

**ENVIRONMENTAL PROTECTION AGENCY****40 CFR Part 60****[EPA-HQ-OAR-2009-0734; FRL-9920-50-OAR]****RIN 2060-AP93****Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces****AGENCY:** Environmental Protection Agency.**ACTION:** Final rule.

**SUMMARY:** The Environmental Protection Agency (EPA) is taking final action to revise the Standards of Performance for New Residential Wood Heaters and to add a new subpart: Standards of Performance for New Residential Hydronic Heaters and Forced-Air Furnaces. Today's rule is authorized by section 111(b) and section 114 of the Clean Air Act (CAA). The EPA is not finalizing, at this time, the proposed Standards of Performance for New Residential Masonry Heaters in order to allow additional time for the Masonry Heater Association to finish their efforts to develop revised test methods, an emissions calculation program and an alternative dimensioning standard. This final rule achieves several objectives for new residential wood heaters, including applying updated emission limits that reflect the current best systems of emission reduction; eliminating exemptions over a broad suite of residential wood combustion devices; strengthening test methods as appropriate; and streamlining the certification process. Residential wood smoke emissions are a significant national air pollution problem and human health issue. These emissions occur in many neighborhoods across the country, including minority and low-income neighborhoods, and impact people in their homes. To the extent that children and other sensitive populations are particularly susceptible to asthma, and that minority populations and low-income populations are more vulnerable, this rule will significantly reduce the pollutants that adversely affect their health. On an economic basis, the public benefits of this rule vastly outweigh the costs, with every dollar in additional cost producing more than \$100 in public benefit. This final action does not include any requirements for heaters solely fired by gas, oil or coal. In addition, it does not include any new requirements associated with appliances

that are already in use. The EPA continues to strongly encourage state, local, tribal, industry and consumer efforts to change out (replace) older heaters with newer, cleaner, more efficient heaters. Additional information is on the EPA Burn Wise Web site at [www.epa.gov/burnwise](http://www.epa.gov/burnwise). Also, we encourage state, local, and tribal authorities to develop site-specific installation and operating requirements to help ensure healthy air for all.

**DATES:** This final action is effective on May 15, 2015. The incorporation by reference of certain publications listed in this rule is approved by the Director of the Federal Register as of May 15, 2015.

**ADDRESSES:** The EPA has established a docket for this action under Docket ID Number EPA-HQ-OAR-2009-0734. All documents in the docket are listed in the <http://www.regulations.gov> index. Although listed in the index, some information is not publicly available (e.g., confidential business information or other information whose disclosure is restricted by statute). Certain other material, such as copyrighted material, will be publicly available only in hard copy form. Publicly available docket materials are available either electronically at <http://www.regulations.gov> or in hard copy at the EPA Docket Center, Public Reading Room, EPA WJC West, Room 3334, 1301 Constitution Ave. NW., Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the Air Docket is (202) 566-1742.

**FOR FURTHER INFORMATION CONTACT:** For questions about this final rule for new residential wood heaters, hydronic heaters, and forced-air furnaces, contact Ms. Amanda Aldridge, Office of Air Quality Planning and Standards, Outreach and Information Division (C304-05), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number (919) 541-5268; fax number (919) 541-2664; email address: [aldridge.amanda@epa.gov](mailto:aldridge.amanda@epa.gov).

**SUPPLEMENTARY INFORMATION:**

*Acronyms and Abbreviations.* The following acronyms and abbreviations are used in this document:

µg/m<sup>3</sup> Micrograms per cubic meter  
 ASTM American Society for Testing and Materials (now ASTM International)  
 BSER Best System of Emissions Reduction  
 BTU British Thermal Unit  
 CAA Clean Air Act  
 CBI Confidential Business Information

CDX Central Data Exchange  
 CEDRI Compliance and Emissions Data Reporting Interface  
 CFR Code of Federal Regulations  
 CO Carbon Monoxide  
 CO<sub>2</sub> Carbon Dioxide  
 CSA Canadian Standards Association  
 EPA U.S. Environmental Protection Agency  
 ERT Electronic Reporting Tool  
 EJ Environmental Justice  
 FR Federal Register  
 g/hr Grams per hour  
 HAP Hazardous Air Pollutant(s)  
 HPBA Hearth, Patio and Barbecue Association  
 IBR Incorporation by Reference  
 ICR Information Collection Request  
 ISO International Organization for Standardization  
 lb Pound(s)  
 lb/hr Pound(s) per hour  
 lb/mmBtu Pound(s) per million British Thermal Units  
 NAAQS National Ambient Air Quality Standards  
 NAICS North American Industry Classification System  
 NESCAUM Northeast States for Coordinated Air Use Management  
 NESHAP National Emission Standards for Hazardous Air Pollutants  
 NO<sub>x</sub> Nitrogen Oxides  
 NSPS New Source Performance Standards  
 NTTAA National Technology Transfer and Advancement Act of 1995  
 NYSERDA New York State Energy Research and Development Authority  
 OAQPS Office of Air Quality Planning and Standards (U.S. EPA)  
 OECA Office of Enforcement and Compliance Assurance (U.S. EPA)  
 OMB Office of Management and Budget  
 PAH Polycyclic Aromatic Hydrocarbon  
 PFI Pellet Fuels Institute  
 POM Polycyclic Organic Matter  
 PM Particulate Matter  
 PM<sub>2.5</sub> Particulate Matter with an aerodynamic diameter of 2.5 micrometers or less ("fine particles")  
 ppm Parts per million  
 R&D Research and Development  
 RIA Regulatory Impact Analysis  
 RTC Response to Comments  
 U.S. United States  
 U.S.C. United States Code  
 UMRA Unfunded Mandates Reform Act  
 vs. Versus  
 VCS Voluntary Consensus Standard(s)  
 VOC Volatile Organic Compound  
 yr Year(s)

*Response to Comments (RTC) Document.* On February 3, 2014 (79 FR 6330), the EPA proposed revisions to the Standards of Performance for New Residential Wood Heaters based on the EPA's review of these standards. On July 1, 2014 (79 FR 37259), the EPA published a Notice of Data Availability (NODA) that solicited comment on additional information regarding residential wood heater testing using cord wood and emissions by burn rate excerpted from EPA certification test reports. In this action, we are finalizing

revisions to the rule, as well as Standards of Performance for New Residential Hydronic Heaters and Forced-Air Furnaces. A document summarizing the public comments on the proposal and the NODA and the EPA responses to the significant comments is available in Docket ID Number EPA-HQ-OAR-2009-0734. A summary of responses to the major comments is in section V.

*Organization of this Document.* The following outline is provided to aid in locating information in this preamble.

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## I. General Information

### A. Executive Summary

The purpose of this action is to finalize amendments to the Standards of Performance for New Residential Wood Heaters (40 CFR part 60, subpart AAA) and to add one new subpart: Standards of Performance for New Residential Hydronic Heaters and Forced-Air Furnaces (40 CFR part 60, subpart QQQQ). This final action was developed following a CAA section 111(b)(1)(B) review of the 1988 promulgated subpart AAA (53 FR 5860, February 26, 1988), *i.e.*, the 1988 New Source Performance Standards (NSPS). Section 111 requires the EPA to establish standards based on best systems of emission reduction (BSER). Section 111(b) requires emission standards for affected sources and section 111(h)(2)(B) allows the EPA to establish work practices and operational standards or combinations of standards in certain cases, such as when testing is impractical due to technological or economic limitations. The current body of evidence strongly supports revision of the 1988 NSPS to capture the technology improvements and enhanced performance of such units since 1988 and to expand the applicability of these standards to include additional wood-burning residential heating devices that are available today. Section 111 requires the EPA to consider costs and economic impacts. The potential impact on this industry that is comprised of over 90 percent small businesses was a concern to the EPA, and we have minimized these potential impacts to the degree possible while still achieving significant emission reductions. For example, we have incorporated stepped (phased) emission limits and streamlined certification procedures to ease the transition. The health benefits associated with these regulations are substantially greater than the cost to manufacture cleaner, lower-emitting appliances. In fact, the public health

benefits of this rule outweigh the costs by more than 100 times.

As discussed in the preamble to the February 3, 2014, proposed rule, particulate pollution from wood heaters is a significant national air pollution problem and human health issue. Residential wood smoke contains fine particles with an aerodynamic diameter of 2.5 micrometers or less (PM<sub>2.5</sub>), carbon monoxide (CO), volatile organic compounds (VOC), toxic air pollutants (*e.g.*, benzene and formaldehyde), and climate-forcing emissions (*e.g.*, methane and black carbon). Residential wood smoke can contribute to unhealthy levels of PM<sub>2.5</sub> in many neighborhoods nationwide, including in minority and low-income neighborhoods, and impact people in their homes. To the extent that children and other sensitive populations are particularly susceptible to asthma, and that minority populations and low-income populations are more vulnerable to the effects of air pollution, this rule will significantly reduce the pollutants that adversely affect their health.

Populations that are at greater risk for experiencing health effects related to fine particle exposures include older adults, children and individuals with pre-existing heart or lung disease. Each year, smoke from wood heaters produces hundreds of thousands of tons of fine particles throughout the country—mostly during the winter months. Nationally, residential wood combustion accounts for 44 percent of total stationary and mobile polycyclic organic matter (POM) emissions, which account for nearly 25 percent of all area source air toxics cancer risks and 15 percent of noncancer respiratory effects.<sup>1</sup> Residential wood smoke causes many counties in the U.S. to either exceed the EPA's health-based national ambient air quality standards (NAAQS) for fine particles or places them on the cusp of exceeding those standards.<sup>2</sup> To the degree that older, higher emitting, less efficient wood heaters are replaced by newer heaters that meet the requirements of this rule, these requirements for cleaner new stoves will result in substantial reductions in emissions, and thus in exposure, producing reduced health impacts. A summary of the estimated health

<sup>1</sup> *Strategies for Reducing Residential Wood Smoke*. EPA-456/B-13-001, March 2013. Prepared by Outreach and Information Division, Air Quality Planning Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. pp. 4–5.

<sup>2</sup> Air Quality and Emissions Data; Supporting Information for the Residential Wood Heater New Source Performance Standard, August 14, 2013.

benefits is shown in Table 1 below. More details are in the final Regulatory Impact Analysis (RIA) in the docket for this rule.

Consistent with Executive Order 13563, “Improving Regulation and Regulatory Review,” we have estimated the cost and benefits of the final rule. The estimated annual net benefits at a 3-percent discount rate are \$3.4 billion to \$7.6 billion, and \$3.1 billion to \$6.9 billion at a 7-percent discount rate in 2013 dollars. The net benefits estimate reflects 8,269 tons of PM<sub>2.5</sub> emission reductions per year, and a total

annualized cost of \$45.7 million, producing an unusually large net benefit for this rule of more than 100 times the costs, and even greater net benefits coming from the new rule applied to single burn rate stoves. We estimate that this rule will result in 360 (Krewski, *et al.*, 2009) or 810 (Lepeule, *et al.*, 2012) avoided premature deaths per year. The non-monetized benefits include 46,000 tons of CO reductions per year; 9,300 tons of VOC reductions per year; reduced exposure to hazardous air pollutants (HAP), including

formaldehyde, benzene, and polycyclic organic matter (POM); reduced climate effects due to reduced black carbon emissions and reduced greenhouse gases emissions; reduced ecosystem effects; and reduced visibility impairments. Table 1 is a summary of the results of the analysis per type of residential wood heater. We have provided estimates reflecting average annual impacts for the 2015 to 2020 timeframe, which are the implementation years analyzed in the RIA for this final rule.

**TABLE 1—SUMMARY OF COMPLIANCE COSTS, MONETIZED BENEFITS, AND MONETIZED NET BENEFITS (2013 DOLLARS) BY TYPE OF HEATER IN THE 2015–2020 TIME FRAME FOR THE FINAL RULE**

Type of heater	Total annualized costs (\$ millions)	Monetized benefits (\$ millions) <sup>a b</sup>	Monetized net benefits (\$ millions)
Wood stoves .....	\$3.02	\$14 to \$31	\$11 to \$28
Single burn rate stoves .....	0.87	280 to 630	280 to 630
Pellet stoves .....	1.52	2 to 5	0 to 3
Forced-air furnaces .....	15.36	1,700 to 3,700	1,700 to 3,700
Hydronic heating systems .....	24.88	1,400 to 3,200	1,400 to 3,200

<sup>a</sup> All estimates are for the time frame from 2015 to 2020 inclusive. These results include units anticipated to come online and the lowest cost disposal assumption. Total annualized costs shown in this table are estimated at a 7-percent interest rate to be consistent with guidance from the Office of Management and Budget (OMB). Total annualized costs are also estimated at a 3 percent interest rate for each source category to be consistent with OMB guidance, and these costs are about 13 percent less than the total annualized costs presented in this table. These costs are presented in the RIA and in the cost memoranda for this final rule. The monetized net benefits with total annualized costs at a 3 percent interest rate are minimally different than those calculated with total annualized costs at a 7 percent interest rate.

<sup>b</sup> Total monetized benefits are estimated at a 3-percent discount rate. The total monetized benefits reflect the human health benefits associated with reducing exposure to PM<sub>2.5</sub> through reductions of directly emitted PM<sub>2.5</sub>. It is important to note that the monetized benefits include many but not all health effects associated with PM<sub>2.5</sub> exposure. Benefits are shown as a range from Krewski *et al.* (2009) to Lepeule *et al.* (2012). These models assume that all fine particles, regardless of their chemical composition, are equally potent in causing premature mortality because the scientific evidence is not yet sufficient to allow differentiation of effect estimates by particle type. Because these estimates were generated using benefit-per-ton estimates, we do not break down the total monetized benefits into specific components.

#### *B. Does this action apply to me?*

Table 2 of this preamble lists categories and entities that will be regulated by this action. Table 2 is not intended to be exhaustive, but rather

provides a guide for readers regarding entities likely to be affected by this final action. These standards, and any changes considered in this rulemaking, are directly applicable to sources as a federal program. Other federal, state,

local and tribal government entities are not directly affected by this final action. States may decide to request partial delegation of enforcement of some parts of this rule, *e.g.*, ensuring permanent labels are on new heaters in retail stores.

**TABLE 2—REGULATED ENTITIES**

Category	NAICS <sup>a</sup> code	Examples of regulated entities
Residential Wood Heating .....	333414—Heating Equipment (except Warm Air Furnaces) Manufacturing. 333415—Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.	Manufacturers, owners and operators of wood heaters, pellet heaters/stoves and hydronic heaters. Manufacturers, owners and operators of forced-air furnaces.
Testing Laboratories .....	541380—Testing Laboratories (except Medical, Veterinary).	Testers of wood heaters, pellet heaters/stoves and hydronic heaters.

<sup>a</sup> North American Industry Classification System

#### *C. Where can I get a copy of this document?*

In addition to being available in the docket, an electronic copy of this final rule, is posted at the following address: <http://www2.epa.gov/residential-wood-heaters>.

#### *D. Judicial Review*

Under section 307(b)(1) of the Clean Air Act (CAA), judicial review of these final rules is available only by filing a petition for review in the United States Court of Appeals for the District of Columbia Circuit by May 15, 2015. Under section 307(b)(2) of the CAA, the

requirements established by these final rules may not be challenged separately in any civil or criminal proceedings brought by the EPA to enforce these requirements. Section 307(d)(7)(B) of the CAA further provides that “[o]nly an objection to a rule or procedure which was raised with reasonable specificity

during the period for public comment (including any public hearing) may be raised during judicial review.” This section also provides a mechanism for us to convene a proceeding for reconsideration, “[i]f the person raising an objection can demonstrate to the EPA that it was impracticable to raise such objection within [the period for public comment] or if the grounds for such objection arose after the period for public comment (but within the time specified for judicial review) and if such objection is of central relevance to the outcome of the rule.” Any person seeking to make such a demonstration to us should submit a Petition for Reconsideration to the Office of the Administrator, U.S. EPA, Room 3000, 1200 Pennsylvania Ave. NW., Washington, DC 20460, with a copy to both the person(s) listed in the preceding **FOR FURTHER INFORMATION CONTACT** section, and the Associate General Counsel for the Air and Radiation Law Office, Office of General Counsel (Mail Code 2344A), U.S. EPA, 1200 Pennsylvania Ave. NW., Washington, DC 20460.

## II. Background Information for This Final Rule

### A. What is the NSPS program?

Under section 111 of the CAA, “Standards of Performance for New Stationary Sources,” the EPA lists categories of sources that, in the EPA’s judgment, cause or contribute significantly to air pollution, which may reasonably be anticipated to endanger public health or welfare pursuant to section 111(b)(1)(A). Section 111(b)(1)(B) requires the EPA to promulgate federal standards of performance for new sources within those categories. At the time the EPA establishes standards for a source category, the EPA prepares an analysis of the potential costs and benefits associated with the NSPS, which also includes the benefits from reductions in pollutants for which the standards do not set limits. For example, emission reductions associated with the requirements of this final rule will generate health benefits by reducing emissions of PM<sub>2.5</sub>, other criteria pollutants, such as CO, and non-criteria HAP. In addition, section 111(h) authorizes the EPA to promulgate design, equipment, work practice, operational, or combinations of standards to reflect the best systems of continuous emission reduction. The NSPS established under section 111(b)(1)(B) do not establish standards of performance for existing sources. However, numerous states have acted

independently of this rule to address new and existing sources as part of state implementation plan (SIP) measures necessary to ensure attainment and maintenance of the NAAQS.

The level of control prescribed by section 111 of the CAA is BSER. In analyzing BSER, the EPA uses available information and considers the emissions reductions and incremental costs for different systems available at reasonable cost. The residential wood heaters source category is different from most NSPS source categories in that it is for mass-produced residential consumer products. Thus, important elements in determining BSER include the significant costs and environmental impacts of delaying production while models with those systems are designed, tested, field evaluated and certified. Section 111(b)(1)(B) of the CAA requires that the standards be effective upon the effective date of the NSPS. As noted earlier and discussed more fully later in this preamble, the stepped (phased) approach for residential wood stoves/heaters, hydronic heaters and forced-air furnaces that the EPA is promulgating considers these factors. That is, for this rulemaking, the EPA has determined the appropriate emission limits and compliance deadlines that together are representative of BSER.

Section 111(b)(1)(B) of the CAA requires the EPA to periodically (every 8 years) review an NSPS unless it determines “that such review is not appropriate in light of readily available information on the efficacy of such standard.” In making revisions to an NSPS, the EPA will revise the standards of performance to reflect improvements in methods for reducing emissions, including consideration of what emissions limitation is achieved in practice. Numerous stakeholders have stated that the current body of evidence strongly justifies the revision of the current residential wood heaters NSPS to capture the improvements in performance of such units since 1988 and to expand the applicability of this NSPS to include additional residential wood-burning heating devices that are available today. Some stakeholders have suggested that the EPA also develop additional NSPS to regulate residential heating devices that burn fuels other than or in addition to wood, e.g., coal, corn or grass. This final rule does not include any new federal requirements for heaters that solely burn fuels other than wood. However, the EPA may consider the need for such requirements during the next review.

### B. Why is residential wood smoke a concern?

There is widespread recognition of the health impacts of particle pollution, to which wood smoke is a contributing factor in many areas. Wood smoke contains a mixture of fine particles and toxic air pollutants (e.g., benzene and formaldehyde) that can cause burning eyes, runny nose, and bronchitis. Exposure to fine particles has been associated with a range of health effects, including aggravation of heart or respiratory problems, changes in lung function and increased respiratory symptoms, as well as premature death. Populations that are at greater risk for experiencing health effects related to fine particle exposures include older adults, children and individuals with pre-existing heart or lung disease. Each year smoke from wood heaters contributes hundreds of thousands of tons of fine particles throughout the country—mostly during the winter months. Nationally, residential wood combustion accounts for 44 percent of total stationary and mobile polycyclic organic matter (POM) emissions, which accounts for nearly 25 percent of all area source air toxics cancer risks and 15 percent of noncancer respiratory effects.<sup>3</sup> Residential wood smoke causes many counties in the U.S. to either exceed the EPA’s health-based NAAQS for fine particles or places them on the cusp of exceeding those standards. For example, in places such as Keene, New Hampshire; Sacramento, California; Tacoma, Washington; and Fairbanks, Alaska; wood combustion can contribute over 50 percent of daily wintertime fine particle emissions.<sup>4</sup> The concerns are heightened because wood stoves, hydronic heaters, and other heaters are often used around the clock in many residential areas. To the degree that older, dirtier, less efficient wood heaters are replaced by newer heaters that meet or exceed the requirements of this rule, the emissions would be reduced, and thus exposure as well, and fewer health impacts should occur. The health and air quality concerns associated with particle pollution and the effects of wood smoke are discussed in detail in the original listing of residential wood heaters under section 111(b) in the February 18, 1987, **Federal**

<sup>3</sup> *Strategies for Reducing Residential Wood Smoke*. EPA-456/B-13-001, March 2013. Prepared by Outreach and Information Division, Air Quality Planning Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. pp. 4–5.

<sup>4</sup> Air Quality and Emissions Data; Supporting Information for the Residential Wood Heater New Source Performance Standard, August 14, 2013.

**Register**, the original subpart AAA proposal in the February 18, 1987, **Federal Register**, the original subpart AAA promulgation in the February 26, 1988, **Federal Register**, the February 3, 2014 proposal of revisions to subpart AAA and the addition of subpart QQQQ and numerous other documents in the docket.

As discussed in the preamble to the February 3, 2014, proposed rule, and, in the Executive Summary (section I.A) of this preamble, particulate pollution from wood heaters is a significant national air pollution problem and human health issue. To the degree that older, higher emitting, less efficient wood heaters are replaced by newer heaters that meet the requirements of this rule, setting these requirements for cleaner new stoves will result in substantial reductions in exposure and reduced health impacts.

### III. Summary of the Final Rule

#### A. General

In response to the results of the review of the 1988 NSPS and in response to comments on the proposed rule and the NODA, the EPA is amending 40 CFR part 60, subpart AAA, Standards of Performance for New Residential Wood Heaters, and adding a new subpart QQQQ, Standards of Performance for New Hydronic Heaters and Forced-Air Furnaces. Subpart AAA applies to room heaters. This final rule broadens the applicability of wood heaters subject to the 1988 NSPS beyond adjustable burn rate wood heaters (the focus of the 1988 regulation) to specifically include all single burn rate wood heaters/stoves/appliances and pellet heaters/stoves/appliances and all other residential wood heaters except those specifically exempt in the rule, *e.g.*, hydronic heaters and forced air furnaces regulated by subpart QQQQ. (Some pellet heaters/stoves/appliances were not affected by the 1988 regulation.) This preamble uses the following terms interchangeably for appliances subject to subpart AAA: wood heaters, stoves and heaters/stoves/appliances. Subpart QQQQ applies to two specific types of wood heaters: hydronic heaters and forced-air furnaces plus any other wood-burning affected appliance that meets the definition of central heater. This preamble uses the terms forced-air furnaces and warm-air furnaces interchangeably for such heaters/furnaces/appliances affected by subpart QQQQ. Wood heaters, hydronic heaters and forced-air furnaces manufactured after the effective date of this final rule will be required to meet PM emission limits.

This final rule does not include any federal emission limitations that would apply to heaters fueled solely by gas, oil or coal. In addition, this final rule does not include any new federal requirements associated with wood heaters or other wood-burning appliances that are already in use in people's homes. The EPA continues to encourage state, local, tribal, manufacturer, retailer and consumer efforts to change out (replace) older heaters with newer, cleaner, more efficient heaters. Also, we continue to encourage state, local, and tribal authorities to develop site-specific installation and operating requirements and oversight to help ensure healthy air for all.

For this final action, the effective date is May 15, 2015 to allow for Congressional Review under the Congressional Review Act (CRA). Under the CRA, 5 U.S.C. 801(a)(3), the effective dates of all "major" rules are delayed for 60 calendar days after they are submitted to Congress or after they are published in the **Federal Register**, whichever date is later. This final action is a "major" rule within the meaning of the CRA.

Section IV summarizes the changes to the proposed rule reflected in the final rule, and section V provides a summary of the major comments received and our responses.

#### 1. Certification Testing and Compliance

As with the 1988 NSPS, because of concern regarding potential negative impacts on small businesses and potential certification delays, this revised subpart AAA for wood heaters/stoves and new subpart QQQQ for hydronic heaters and forced-air furnaces require manufacturers to participate in a certification program that tests a representative heater per model line rather than testing every heater. If the representative heater meets the applicable emission limits contained in this rule, the entire model line may be certified. Individual heaters within the model line are still subject to all other requirements, including labeling and operational requirements. Manufacturers are required to have quality assurance programs to ensure that all heaters within the model line conform to the certified design and meet the applicable emission limits. The EPA will continue to have the authority to conduct audits to ensure compliance.

Additional requirements apply to entities other than the manufacturer. Wholesalers and retailers are also subject to the limits on sales of non-certified affected heaters. Wood heater test laboratories and certifying entities

are subject to quality assurance and reporting requirements. This final rule for subpart AAA and subpart QQQQ requires the proper burn practices that have applied to the owner or operator of a wood heating appliance regulated under subpart AAA since 1988. In addition, new pellet heater/stove owners and operators will be required to use only the grades of pellet fuels and wood chips that are included in the owner's manual based on the heater/stove certification tests. In this final rule, we are revising the original 1988 enforcement and audit provisions to reflect changes in industry practices and development of new tools and procedures. We are also taking final action to improve the previous test methods as well as adding new test methods. More details are in sections IV.D and V.

#### 2. Stepped Compliance Approach

The 1988 NSPS addressed some of the specific characteristics of this source category by developing a stepped compliance approach that provided manufacturers a two-phased implementation of emission limits. Considering that over 90 percent of the manufacturers and retailers are small businesses, we have included this approach in the revised subpart AAA and new subpart QQQQ in order to allow manufacturers lead time to develop, test, field evaluate and certify current technologies across their consumer product lines to meet Step 2 emission limits and in most cases to allow retailers to sell-through inventory. Upon the effective date of this final rule, all new residential wood heaters subject to subparts AAA and QQQQ will be required to meet the NSPS standards. The standards are phased from immediate requirements on the effective date to Step 2 emission limits five years later. The specific emission limits and dates for subparts AAA and QQQQ are shown in Table 3 and Table 4, respectively. To further ease the transition on small businesses, the EPA will not require new testing of heaters that have current certificates of compliance under the 1988 NSPS that show they meet the Step 1 emission levels. Those certificates are automatically extended beyond their current expiration date until the compliance deadline for the Step 2 emission limits. Also, this final rule automatically deems certified hydronic heaters that have been qualified at the Step 1 emission level (or better) under the EPA voluntary partnership program for hydronic heaters or forced-air furnaces that have been independently certified at the Step 1 emission level (or

better) or under Canadian Standards Association B415.1–10.

### 3. NSPS Labels

The final rule requires that each room heater under subpart AAA and central heater under subpart QQQQ be equipped with a permanent label meeting the applicable requirements in § 60.536 and § 60.5478, respectively. The permanent label must include identifying information for the unit and its compliance certification status. The permanent label must be installed so that it is readily visible both before and after the unit is installed. This requirement is needed to assist state, local and tribal officials in determining if a unit complies with state, local and tribal rules and in determining eligibility for any future change out (replacement) programs. Note that “readily visible” does not mean under the body of freestanding stove but it does allow an easily removable decorative façade to cover the label.

In the 1988 NSPS, temporary labels (*e.g.*, hangtags) were required for wood heaters that are subject to the standards, as well as ones that are not (*e.g.*, coal heaters/stoves). These temporary labels were intended to assist consumers in comparing different appliance models and to inform the consumer about the importance of proper operation and maintenance. We proposed to remove the requirement for temporary labels, and we requested comment. After reviewing the comments received, the EPA now concludes that these temporary labels are most valuable if they assist purchasers in identifying the cleanest and most efficient heaters. Therefore, in this final rule the EPA is allowing (voluntary) a temporary NSPS label (hangtag) for each adjustable burn rate heater, single-burn rate heater, pellet heater/stove, hydronic heater and forced-air furnace sold at retail that meets the Step 2 emission limits before the Step 2 compliance date. This temporary label option will end upon the Step 2 compliance date.

In addition, we are providing an alternative compliance option for manufacturers who choose to demonstrate compliance with Step 2 emission limits using cord wood testing rather than the standardized crib wood testing, currently used for the primary compliance option for appliances regulated under subpart AAA and for hydronic heaters under subpart QQQQ. As discussed in the preamble to the February 3, 2014, proposed rule, crib wood is a specified configuration and quality of dimensional lumber and spacers that improves the repeatability of the test method. Cord wood is a

different specified configuration and quality of wood that more closely resembles what a typical homeowner would use. Cord wood testing is a better measure of how the heaters will perform on the type of fuel commonly used in homes.

Each of these models would be equipped with both a permanent label and the voluntary option of a special temporary label (hangtag) informing consumers that these wood heaters were tested and certified when burning cord wood. The specific emission limits are discussed in sections III.B and III.C.

### 4. New Residential Masonry Heaters (Proposed Subpart RRRR)

The EPA is not taking final action at this time on proposed subpart RRRR for new residential masonry heaters. Our reason for taking no action at this time is to allow additional time for the Masonry Heater Association (MHA) to finish their efforts to develop revised test methods, an emissions calculation program and an alternative dimensioning standard. The MHA believes these efforts are critical because most masonry heaters are custom built on-site and testing each custom model would be difficult. The nationwide emission impacts of delaying regulating subpart RRRR are small relative to the impacts of regulating subparts AAA and QQQQ. Fewer than approximately 1,000 masonry heaters are manufactured each year and a total of less than 10 tons per year of PM<sub>2.5</sub> are currently emitted. In comparison, new wood burning appliances covered by subparts AAA and QQQQ are estimated to number more than 200,000 (2015) and currently emit more than 11,000 tons per year of PM<sub>2.5</sub>.<sup>5</sup>

### B. Room Heaters (Revised Subpart AAA)

#### 1. Applicability

After the effective date, new heaters will be required to meet the updated standards. The new standards apply not only to adjustable burn rate wood heaters (the focus of the original regulation), but also to single burn rate wood heaters/stoves, pellet heaters/stoves, and any other affected appliance as defined in revised subpart AAA as a “room heater.” Subpart AAA, as amended, does not apply to new residential hydronic heaters or new residential forced-air furnaces because they are subject to their own subpart. The revised subpart AAA does not apply to fireplaces as defined in Subpart AAA. This final rule tightens the definition for “cook stoves” and adds

definitions for “camp stoves” and “traditional Native American bake ovens” to clarify that they are not subject to the standard other than appropriate labeling for cook stoves and camp stoves and no requirements for traditional Native American bake ovens. Finally, the revised subpart AAA clarifies that the emission limits apply only to wood-burning devices (*i.e.*, not to devices that only burn fuels other than wood, *e.g.*, gas, oil or coal).

#### 2. Automatic EPA Certification for Currently Certified Heaters/Stoves That Meet the Step 1 Emission Levels

In this final rule we make clear that those heaters/stoves with EPA certifications under the 1988 NSPS that show compliance with the Step 1 emission levels will be automatically deemed as certified to meet the Step 1 emission limits under this final rule until the Step 2 compliance date. No separate certification will be required. Over 85 percent of heaters/stoves being sold today already meet the Step 1 emission limit. This automatic certification will avoid unnecessary economic impacts on those manufacturers (over 90 percent are small businesses) who can then focus their efforts on developing a full range of cleaner models that meet Step 2 emission levels. This measure should also help avoid potential delays at laboratories conducting certification testing for heaters newly subject to the NSPS.

#### 3. Two-Step Compliance Approach

We are promulgating a two-step compliance approach that will apply to all new adjustable burn rate wood heaters, single burn rate wood heaters and pellet heaters/stoves. Under this approach, Step 1 emission limits for these sources will apply to each source manufactured on or after the effective date of the final rule or sold at retail on or after December 31, 2015. The approximately 8-month additional time for the retail sale requirement will allow retailers to sell their inventories of heaters that do not comply with the Step 1 emission limits. Step 2 emission limits for these sources will apply to each heater manufactured or sold at retail on or after the date 5 years after the effective date of the final rule. We are not including the alternative three-step emission limit compliance approach for which we also requested comment in the proposal. The comments overwhelmingly indicated that the three-step emission limit approach was inferior not only environmentally but also economically because it would, in effect, require

<sup>5</sup> Memo to USEPA from EC/R, Inc. Estimated Emissions from Wood Heaters. January 2015.

many small manufacturers to engage in two rounds of research and development (R&D) rather than one in order to obtain the same eventual endpoint.

Table 3 summarizes the PM emissions limits that apply to each wood heater under this two-step approach. Note that the emissions standards are “as measured” by the test methods specified in the rule and are labeled as PM although the PM is essentially all PM<sub>2.5</sub>. This avoids the potential extra testing costs of measuring PM<sub>2.5</sub> specifically.

TABLE 3—SUBPART AAA PM EMISSIONS LIMITS

Phases/steps	PM emissions limit
Step 1: Upon the effective date of final rule.	4.5 g/hr.
Step 2: 5 years after the effective date of the final rule.	2.0 g/hr.
Step 2: Cord wood alternative compliance option.	2.5 g/hr.

We are allowing an alternative compliance option for manufacturers who choose to certify using cord wood (rather than crib wood) to meet the Step 2 limits. (As discussed earlier in this preamble, crib wood is a specified configuration and quality of dimensional lumber and spacers that improves the repeatability of the test method. Cord wood is a different specified configuration and quality of wood that more closely resembles what a typical homeowner would use.) Special permanent and temporary labels for room heaters certified with cord wood would specify that they meet a PM emissions limit of 2.5 g/hr. The bases for the crib wood primary emission limit of 2.0 g/hr and the cord wood alternative compliance option emission level of 2.5 g/hr for wood stoves, as well as the limited environmental impact of the differences in these levels, are discussed in section V.A BSER and Particulate Emission Limits for Room Heaters (revised subpart AAA).

The proposal would have required cord wood testing for all Step 2 compliance certifications. Cord wood testing is a better measure of how stoves actually perform in home use; however, we are concerned that many manufacturers (over 90 percent are small businesses) do not yet have experience with designing their stoves to perform well with cord wood testing. Some manufacturers may not be ready for cord wood testing by the Step 2 compliance date and that would result in unreasonable economic impacts. Allowing the cord wood alternative

compliance option acknowledges the efforts of the industry leaders and encourages others to follow their example.

The revised subpart AAA does not include a compliance extension for small volume manufacturers. An extension for manufacture of adjustable burn rate heaters is not necessary because over 85 percent of these appliances already comply with Step 1 emission levels.

We are making a single determination of BSER for catalytic, noncatalytic and hybrid heater systems so as not to restrict open market competition. As in the 1988 NSPS, we are requiring manufacturers to provide warranties on the catalysts, prohibit the operation of catalytic heaters/stoves without a catalyst and require operation according to the owner’s manual. In addition, we are requiring manufacturers to provide warranties for noncatalytic and hybrid heaters/stoves and require operation according to the owner’s manual.

As discussed at proposal, we considered requiring efficiency standards (heat output divided by fuel input) to ensure that stoves are efficient and burn no more wood than necessary for the heat demand so that the consumers can save money on fuel and so that the emissions are lower. We did not propose an efficiency standard because we did not have sufficient data, but the final rule uses our authority under section 114 to require the manufacturer to submit third-party efficiency test data, submit the test data report to the EPA and post the results on the manufacturer’s Web site. Also, we will include this submitted information on the EPA Web site. This will help consumers to make informed choices to reduce fuel costs and emissions now and provide data for us to consider for future rulemaking.

#### 4. Emission Testing, Reporting and Certification

We are requiring emission testing, reporting and certification based on crib wood to demonstrate compliance with Step 1 and Step 2 emissions limits. As discussed in the preamble to the February 3, 2014, proposed rule, “crib wood” is a specified configuration and quality of dimensional lumber and spacers that improves the repeatability of the test method. In this final rule, we are also establishing an alternative compliance option that allows manufacturers to use cord wood for the certification tests. “Cord wood” is a different specified configuration and quality of wood that more closely resembles what a typical homeowner would use.

Commenters overwhelmingly agreed that tuning heaters for crib wood certification tests often results in poorer performance in homes. Based on the existence of a viable draft cord wood test method and the expectation at proposal that the ASTM International (formerly known as American Society of Testing and Materials) test methods for cord wood would be complete soon after the NSPS proposal and that significant testing of wood heaters re-tuned to perform well on cord wood would occur before promulgation of this final rule, the EPA proposed to require testing only with cord wood for compliance with Step 2 emissions limits. We still encourage manufacturers to design wood heaters that best represent in-home performance on cord wood that consumers use as soon as possible. However, the ASTM cord wood test methods have not been completed and only limited testing using the draft methods has occurred.

We received numerous comments from noncatalytic stove manufacturers and laboratories and some states with concerns about when the cord wood test methods would be ready and how quickly noncatalytic stoves could be redesigned to perform well with cord wood certification testing that we proposed for Step 2, *i.e.*, 5 years after the effective date. As discussed in the NODA, as of May 2014, we had test data for three catalytic or hybrid wood heaters/stoves that performed very well on cord wood. However, considering all of the above, we have determined that we do not have sufficient data at this time to support a regulatory requirement for cord wood testing.

We expect that many manufacturers will choose the alternative cord wood compliance testing option so that consumers will have more opportunities to purchase stoves that are tuned for in-home use. We will consider alternative cord wood test method requests on a case-by-case basis until we are convinced that improved test methods have been sufficiently demonstrated that they can be relied upon for regulatory purposes. For now, we will be receptive to alternative test method requests that use the current ASTM draft method. Also, we will be receptive to other requests that are sufficiently demonstrated, ideally using the EPA Method 301 validation procedures. Additionally, we expect that within the next few years we will receive enough cord wood test data for the EPA to establish revised certification requirements based on cord wood testing.

The final rule requires that pellets for the certification tests be only those that



have been graded under a licensing agreement with a third-party organization and meet the minimum quality specifications in § 60.532. Commenters indicated that several organizations are currently available and others are planned, for example, the Pellet Fuels Institute (PFI), ENplus and CANplus. Details of the PFI program are available at <http://pelletheat.org/pfi-standards/pfi-standards-program/>. Details of the ENplus program are at <http://www.enplus-pellets.eu/wp-content/uploads/2012/01/ENplus-Handbook-2.0.pdf>. Details of the CANplus program are at [http://controlunion.ca/fileupload/CA/Certifications/ENplusCANplus/CANplus\\_handbook\\_v2-0.pdf](http://controlunion.ca/fileupload/CA/Certifications/ENplusCANplus/CANplus_handbook_v2-0.pdf). Manufacturers' data show that pellet fuel quality assurance is necessary to ensure that the appliances operate properly and meet the certified emission limits.

At this time, we lack sufficient data to issue a CO emissions limit in today's final rule. However, this final rule uses our authority under section 114 to require manufacturers to determine CO emissions during the compliance tests (as is typically done already), report those results to the EPA and include those results on the manufacturer's Web site, so that data will be available to consumers, and to the EPA and states for CO NAAQS compliance implementation plan considerations and future wood heater rulemakings. We intend to include context and consumer-friendly summaries of the submitted CO emissions data on the EPA Burn Wise Web site also.

Like the 1988 subpart AAA, this final rule uses the EPA authority under section 114 of the CAA to require each manufacturer to submit applications for certifications of compliance for all new models. We are revising the certification process to include third-party certifiers in order to reduce the potential for certification delays that could result from insufficient capacity. However, commenters expressed concern, which we share, that there may not be sufficient third-party certifier capacity and review and approval capacity by the EPA, especially in the first year. Therefore, to avoid unfairly restricting the production and sales of manufacturers who do all the things they should do and then potentially have to wait on EPA approval, we have added a conditional, temporary approval by the EPA based on the manufacturer's submittal of a complete certification application. The application must include the full test report by an EPA-accredited laboratory and all required compliance statements by the manufacturer. The conditional

approval would allow manufacture and sales for 1 year or until EPA review of the application, whichever is earlier. Within that year, the manufacturer must submit a certificate of conformity by a third-party certifier. (In this preamble, we use the terms "third-party certifier," "certifying body," "certifying entity" and "certifying body/entity" interchangeably.)

The EPA is revising the definition of "Accredited Test Laboratory," from only EPA-accredited laboratories to include laboratories accredited by a nationally recognized accrediting body/entity to perform testing for each of the test methods specified in this NSPS under ISO-IEC<sup>6</sup> Standard 17025. Laboratories must be approved by the EPA before beginning certification testing. Current EPA-accredited laboratories may retain their accreditation until 3 years after the effective date of this final rule. Laboratories that are not currently EPA-accredited must achieve ISO-accreditation and register with the EPA within 6 months of the effective date of this rule. Laboratories must report any changes in their accreditation and any deficiencies found under ISO 17025 to the EPA, and the EPA may revoke approval if warranted.

The EPA is requiring a "Certifying-Body-Based Certification Process" beginning 6 months after the effective date of this final rule for all heaters/stoves except hydronic heaters. For hydronic heaters, the "Certifying-Body-Based Certification Process" is required upon the effective date of this final rule because this certification process has already been required under EPA's Hydronic Heater Partnership Program since October 2008. Under this process for all heaters/stoves subject to subparts AAA and QQQQ, after testing is complete, a certification of conformity with the PM emissions limits must be issued by a certifying body with whom the manufacturer has entered into contract for certification services. The certifying body must be accredited under ISO-IEC Standard 17065 and register their credentials with the EPA and receive EPA approval prior to conducting any certifications or related work used as a basis for compliance with this rule and report any changes in their accreditation and any deficiencies found under ISO 17065. Any certifying body that is approved by the EPA and is ISO-accredited is required to act in such a way that will not create a conflict of interest and work with integrity and

honesty. The EPA will oversee the certifying body's work and retain the right to revoke the EPA approvals if appropriate. Upon review of the test report and quality control plan submitted by the manufacturer, the certifying body may certify initial compliance and submit the required documentation on behalf of the manufacturer to the EPA's Office of Enforcement and Compliance Assurance for review, approval and listing of the certified appliance.

The rule continues to require the owner or operator of a wood heating appliance to operate the heater consistent with the owner's manual and not burn improper fuel. Owners and operators must operate pellet fuel appliances with the grades of pellet fuels that are included in the owner's manual. Manufacturers are required to void their warranties in cases of improper operation. Numerous states expressed their support for the continuation of these requirements. Some states and local jurisdictions have enforced similar requirements, and this final rule will allow the EPA to approve state requests for delegation of enforcement authority for these NSPS requirements. In addition, we expect many state, local and tribal authorities will adopt some of the important and very successful strategies in *Strategies for Reducing Wood Smoke*,<sup>7</sup> including changing out (replacing) older heaters with newer, cleaner, more efficient heaters and developing site-specific installation and operating requirements to ensure heaters are not over-sized, avoid nuisance conditions, and ensure proper operation, e.g., using EPA Method 22 observations of visible emissions as an indicator of potential poor or improper operation to help ensure healthy air for all.

The rule continues to contain the crucial quality assurance provisions in the 1988 NSPS. For example, manufacturers must request EPA approval of model line re-certifications or new certifications whenever any change is made in the original design that could potentially affect the emissions rate for that model line or when any of several specified tolerances of key components are changed. The 1988 requirements for manufacturer quality assurance programs are strengthened in the revised rule by requiring the manufacturer within 6 months after the effective date to

<sup>6</sup> The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) prepare and publish international standards.

<sup>7</sup> *Strategies for Reducing Residential Wood Smoke*. EPA-456/B-13-001, March 2013. Prepared by Outreach and Information Division, Air Quality Planning Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711.



contract for a certifying-body to conduct quality assurance audits within 12 months. The certifying body will conduct regular, unannounced audits to ensure that the manufacturer's quality control plan is implemented properly.

The EPA audit testing programs of the 1988 NSPS are retained under the revised rule, although they are streamlined and simplified to better ensure compliance and to clarify that audits can be based on any information the EPA has available and that audits do not need to be statistically random. Also, the rule clarifies that the EPA and states are allowed to be present during the audits and that states (and other entities, including the public) may provide the EPA with information that may ultimately be used in any EPA enforcement and compliance assurance efforts.

### *C. Central Heaters: Hydronic Heaters and Forced-Air Furnaces (Subpart QQQQ)*

#### 1. Applicability

After the effective date, new heaters will be required to meet the new standards. In this final rule, the EPA is adding 40 CFR part 60, subpart QQQQ, which applies to all new wood-fired residential hydronic heaters, wood-fired forced-air furnaces and any other wood-fired affected appliance defined in subpart QQQQ as a "central heater." Wood-fired means designed or marketed to be capable of burning wood or used to burn wood. For example, a coal-fired heater cannot be marketed as capable of wood-burning unless it meet the requirements of this rulemaking and the marketing brochures and owner's manuals must be clearly specific to coal rather than wood. Hydronic heater means a fuel-burning device designed to burn wood or wood pellet fuel for the purpose of heating building space and/or water through the distribution, typically through pipes, of a fluid heated in the device, typically water or a water and antifreeze mixture. Forced-air furnace means a fuel burning device designed to burn wood or wood pellet fuel that warms spaces other than the space where the furnace is located, by the distribution of air heated by the furnace through ducts.

This new "central heater" categorization better ensures that all appliances affected under this new subpart are included in this final action. Adding subpart QQQQ addresses heater appliance types in the 1987 residential wood heater source category listing that were not regulated by the 1988 NSPS. This new subpart is designed similar to subpart AAA, *i.e.*, certification testing of

a representative unit in a model line, label requirements, associated quality assurance requirements and stepped (phased) implementation.

The provisions of subpart QQQQ apply to each affected unit that is manufactured or sold at retail on or after May 15, 2015.

#### 2. Automatic EPA Certification for Currently Certified or Qualified Central Heaters That Meet the Step 1 Emission Levels

In this final rule we make clear that those hydronic heaters with valid EPA Phase 2 qualifications under the voluntary EPA Hydronic Heater Partnership Agreement of October 12, 2011, or hydronic heaters certified by the New York State Department of Environmental Conservation (NYSDEC) that show compliance with the Step 1 emission limits will be automatically deemed EPA certified to meet the Step 1 emission limits under this final rule until the Step 2 compliance date. Also, residential pellet hydronic heaters/boilers that have been qualified under the Renewable Heat New York (RHNY) program will be automatically deemed EPA certified to meet Step 1. (Note that the RHNY program requires pellet heating systems to include installation of thermal storage to maintain high-efficiency and low emissions performance throughout daily and annual cycles. The minimum size thermal storage for boilers less than 85,000 BTU/hr is 119 gallons or 2.0 gallons per 1,000 BTU/hr, whichever is less. For boilers greater than 85,000 BTU/hr, the minimum heat storage is 2.0 gallons per 1,000 BTU/hr.) No separate EPA certification will be required. Similarly, forced-air furnaces independently certified (*i.e.*, not self-tested) under Canadian Standards Association (CSA) B415.1–10 as well as forced-air furnaces certified by the NYSDCE that show compliance with the Step 1 emission limits will be deemed EPA certified to meet the Step 1 emission limits under this final rule until the Step 2 compliance date. This automatic EPA certification will avoid unnecessary economic impacts on those manufacturers (over 90 percent are small businesses) who can then focus their efforts on developing a full range of cleaner models that meet Step 2 emission levels. This measure should also help avoid potential delays at laboratories conducting certification testing for heaters newly subject to the NSPS.

#### 3. Stepped Compliance Approach

We are promulgating a stepped compliance approach that will apply to all new central heaters.

For hydronic heaters, standards will apply to each hydronic heater manufactured after May 15, 2015 and each hydronic heater sold after December 31, 2015. Step 1 p.m. emission limits will apply to each hydronic heaters manufactured on or after May 15, 2015 or sold at retail after December 31, 2015. Step 2 p.m. emission limits will apply to each hydronic heater manufactured or sold at retail on or after May 15, 2020.

For hydronic heaters, we are not promulgating the alternative three-step emission limit approach for which we requested comment in the proposal. The comments overwhelmingly indicated that the three-step emission limit approach was inferior not only environmentally but also economically because it would, in effect, require many small manufacturers to engage in two rounds of R&D rather than one in order to obtain the same eventual endpoint.

For forced-air furnaces, standards will apply to each forced-air furnace manufactured or sold after May 15, 2015. Work practice and operational standards will apply to each forced-air furnace manufactured or sold at retail after May 15, 2015. Step 1 PM emission limits will apply to small (less than 65,000 BTU/hr heat output) forced-air furnaces manufactured or sold on or after May 16, 2016. Step 1 PM emission limits will apply to large (65,000 BTU/hr heat output or larger) forced-air furnaces manufactured or sold on or after May 15, 2017. Step 2 PM emission limits will apply to each forced-air furnace manufactured or sold at retail on or after May 15, 2020.

For forced-air furnaces, we are not promulgating the alternative three-step emission limit approach for which we requested comment in the proposal. The comments overwhelmingly indicated that the three-step emission limit approach was inferior not only environmentally but also economically because it would, in effect, require many small manufacturers to engage in two rounds of R&D rather than one in order to obtain the same eventual endpoint. However, commenters were very concerned about the infeasibility of enforcing an emission limits for forced-air furnaces due to the technical and economic impracticability of testing and certifying approximately 50 forced-air furnaces in the 60 days between publication of this rule and the effective date. For example, a typical forced-air

furnace certification test takes approximately 1 week in the laboratory after the furnace is shipped to the laboratory and a time is scheduled to begin testing. Typically, the laboratory takes approximately 3 or 4 weeks to prepare a complete test report for the manufacturer to submit to the EPA. A reasonable overall estimate is approximately 1.25 months, not counting potential conflicts with other testing in the laboratories. Currently, there are only 4 laboratories that can test forced-air furnaces. We estimate that approximately 12 small forced-air furnaces and 38 large forced-air furnaces would need to be tested as soon as possible. If those tests were to be divided equally among the 4 laboratories, it would take a minimum of approximately 4 months to submit the 12 certification test reports for the small furnaces and an additional year to submit the 38 certification test reports for the large furnaces to the EPA, far longer than the 60 days between the publication date and the effective date. Thus, as noted above, we are requiring work practice and operational standards on the effective date as allowed under section 111(h)(2)(B) of the CAA, and requiring Step 1 PM emission limits for small forced-air furnaces 1 year after the effective date and Step 1 PM emission limits for large forced-air furnaces 2 years after the effective date. Specifically, the manufacturers must develop model-specific descriptions of proper operation and best practices; include them in their owner's manuals;

provide training on them to their distributors; and provide them in written and video format to purchasers/operators/users of their heaters. The specific details that must be included in owner's manuals are in § 60.5474 and Appendix I of this rulemaking.

The following are excerpts of the operational standards required in this rule that must be included in the owner's manuals. Operators must not burn unseasoned wood.

The use of properly split, stored and seasoned wood has much lower PM emission than high-moisture wood, *i.e.*, green wood or wet wood. Operators must not burn improper fuels such as (1) residential or commercial garbage; (2) lawn clippings or yard waste; (3) materials containing rubber, including tires; (4) materials containing plastic; (5) waste petroleum products, paints or paint thinners, or asphalt products; (6) materials containing asbestos; (7) construction or demolition debris; and (8) paper products; cardboard, plywood or particleboard (Note that best practices do allow the use of fire starters made from paper, cardboard, saw dust, wax and similar substances for the purpose of starting a fire in an affected heater); (9) railroad ties or pressure treated lumber; (10) manure or animal remains; (11) salt water driftwood or other or other previously salt water saturated materials; (12) unseasoned wood; and (13) any materials that are not included in the warranty and owner's manual for the subject heater or furnace.

The owner's manual and training materials must also educate operators

on the use of proper operating practices, including correct positioning of bypasses and air dampers during startup, normal operation and reloading. Proper practices also include checking air tubes, catalysts (if so equipped), heat exchangers and other critical parts of the heater to ensure they are working properly and are maintained as needed. Best burn operational practices are already highlighted in many manufacturers' owner's manuals, educational materials from HPBA and Burn Tips on EPA's Burn Wise Web site. Numerous comments noted that best work practices and proper operation and maintenance can significantly reduce emissions at reasonable costs. Thus, considering all of the above, the EPA has determined that these work practice and operational standards represent the best systems of emission reduction as required by section 111(h)(1) for the immediate time frame from the effective date until the Step 1 PM emissions limits apply. More discussion of comments on stepped compliance and the EPA's responses are in section V. Summary of Major Comments and Responses.

Table 4 summarizes the PM emissions limits for hydronic heaters and forced-air furnaces that will apply at each step. Note that the emissions standards are "as measured" by the test methods specified in the rule and are labeled as PM although the PM is essentially all PM<sub>2.5</sub>. This avoids the potential extra testing costs of measuring PM<sub>2.5</sub> specifically.

TABLE 4—SUBPART QQQQ PM EMISSIONS LIMITS

Appliance	Steps	Particulate matter emissions limits
Residential Hydronic Heater .....	Step 1: on or after May 15, 2015 .....	0.32 lb/mmBtu heat output (weighted average) and a cap of 18 g/hr for each individual test run.
	Step 2: on or after May 15, 2020 .....	0.10 lb/mmBtu heat output for each individual burn rate.
	Step 2: cord wood alternative compliance option .....	0.15 lb/mmBtu heat output for each individual burn rate.
Forced-Air Furnace .....	Work practice and operational standards: on or after May 15, 2015.	No specific PM limit.
	Step 1 for small furnaces: on or after May 16, 2016	0.93 lb/mmBtu heat output (weighted average).
	Step 1 for large furnaces: on or after May 15, 2017	0.93 lb/mmBtu heat output (weighted average).
	Step 2 for small or large furnaces: on or after May 15, 2020 (using cord wood as specified in CSA B415.1–10).	0.15 lb/mmBtu heat output for each individual burn rate.

We are allowing an alternative compliance option for manufacturers who choose to certify using cord wood (rather than crib wood) to meet the Step 2 limits for hydronic heaters. The proposal would have required cord wood testing for all Step 2 compliance certifications. Cord wood testing is a better measure of how stoves actually

perform in home use; however, we are concerned that many manufacturers (over 90 percent are small businesses) do not yet have experience with designing their stoves to perform well with cord wood testing. Numerous hydronic heater manufacturers may not be ready by the Step 2 compliance date and that could result in unreasonable

economic impacts. Allowing this option acknowledges the efforts of the industry leaders and encourages others to follow their example. Special (required) permanent and (voluntary) temporary labels for heaters certified with cord wood would specify that they meet a PM emissions limit of 0.15 lb/mmBtu heat output. The Step 2 PM emission

limit for forced-air furnaces matches the hydronic heater alternate cord wood option emission level of 0.15 lb/mmBtu because CSA B415.1–10 already specifies cord wood for the certification tests. The bases for the emission levels are discussed in section V.B BSER and Particulate Emission Limits for Central Heaters (subpart QQQQ).

We are making a single determination of BSER for catalytic, noncatalytic, hybrid, cord wood and pellet heaters and furnaces in order to not restrict open market competition. We are requiring manufacturers to provide warranties on the catalysts, prohibit the operation of catalytic heaters and furnaces without a catalyst and require operation according to the owner's manual. In addition, we are requiring manufacturers to provide warranties for noncatalytic and hybrid heaters and furnaces and require operation according to the owner's manual.

As discussed at proposal, we considered requiring efficiency standards (heat output divided by fuel input) to ensure that heaters are efficient and burn no more wood than necessary for the heat demand so that the consumers can save money on fuel and so that the emissions are lower. We did not propose an efficiency standard because we concluded we do not yet have sufficient data, but the final rule uses our section 114 authority to require efficiency testing and reporting to the EPA. We will include context and summaries of this information on the EPA Burn Wise Web site. This will help better inform consumers so they can choose the best-performing heaters now that will also save them money on fuel costs and also reduce PM emissions by burning less wood. This will also provide data to states and the EPA as we consider future wood heater rulemaking.

At this time, we lack sufficient data to issue a CO emissions limit in today's final rule. However, this rule uses our section 114 authority to require manufacturers to determine CO emissions during the compliance tests (as typically conducted), report those results to the EPA and include those results on the manufacturer's Web site. This will help better inform consumers so they can choose the best-performing heaters that have less CO emissions and less health concerns for themselves and their neighbors. This will also provide data to states and the EPA as we consider future rulemaking. We intend to include context and summaries of the submitted CO emissions data on the EPA Burn Wise Web site also.

In this final rule, we are not setting limits on visible emissions, and we are

not prohibiting use in non-heating seasons. However, operators should note that some state, local and tribal jurisdictions have limits, prohibitions and other requirements that must be followed.

Like the subpart AAA requirements, the subpart QQQQ requirements provide additional time for the sale of unsold hydronic heaters manufactured before the compliance date. This additional sell-through time does not include forced-air furnaces because EPA has determined that it is reasonable for forced-air furnace manufacturers to revise their owner's manuals, training and marketing materials to comply with the work practice and operational standards by the effective date.

As in subpart AAA, subpart QQQQ includes a list of prohibited fuels because their use would cause poor combustion or even hazardous conditions. As in subpart AAA, subpart QQQQ requires that the owner or operator must operate the hydronic heater or forced-air furnace in a manner that is consistent with the owner's manual and the rule requires the manufacturer to discuss the best operating practices in the owner's manual. For pellet-fueled appliances, operation according to the owner's manual includes operation only with pellet fuels that are specified in the owner's manual. As in subpart AAA, manufacturers must only specify graded and licensed pellets that meet certain minimum requirements. Data show that pellet quality is important to ensure that the appliances operate properly such that emissions are within the appliance certification limits.

The permanent labeling requirements and owner's manual requirements in subpart QQQQ are similar to the guidelines in the EPA's current voluntary hydronic heater program with some improvements. Like in subpart AAA, the temporary labels (hangtags) are voluntary and are only for models that meet Step 2 levels before the compliance date and these hangtags end upon the Step 2 compliance date. Subpart QQQQ also has a cord wood alternative compliance option with a special permanent label and a voluntary temporary label (hangtag) for models that meet Step 2 using cord wood. The structure of the rest of subpart QQQQ is similar to the subpart AAA certification and quality assurance process.

#### 4. Emission Testing, Reporting and Certification

The final rule requires that before manufacture and sale at retail, all affected hydronic heaters and forced-air furnaces subject to subpart QQQQ must

conduct certification compliance testing, submit a certificate of compliance and receive EPA approval for the Step 1 and Step 2 PM emission limits by the dates shown in Table 4.

For hydronic heaters, we are requiring emission testing, reporting and certification based on crib wood to demonstrate compliance with Step 1 and Step 2 emissions limits. The final rule requires crib wood emission testing of hydronic heaters by one of the following methods: EPA Method 28WHH in its entirety or EPA Method 28WHH-PTS (with approved adjustment for crib wood versus cord wood) or ASTM E2618–13 with conditions or European National (EN) test method EN 303–5 with conditions. We note that EPA's current NSPS general provisions provide that affected sources may request EPA approval of alternative test methods on a case-by-case basis as appropriate. See 40 CFR 60.8(b).

Commenters overwhelmingly agreed that tuning heaters for crib wood certification tests often results in poorer performance in homes. Based on the existence of viable draft cord wood test methods and the expectation that the ASTM test methods would be final soon after the NSPS proposal and that significant testing of heaters re-tuned to perform well on cord wood would occur before promulgation of this final rule, the EPA proposed to require testing with cord wood for the Step 2 emissions limits. We still encourage manufacturers to design wood heaters that best represent in-home performance on cord wood that consumers use as soon as possible. However, the ASTM cord wood test methods have not been completed and only limited testing using the draft methods has occurred.

We received numerous comments with concerns about when the cord wood test methods would be ready and how quickly heaters could be redesigned to perform well with cord wood certification testing that we proposed for Step 2, *i.e.*, 5 years after the effective date. At proposal, we had limited test data for heaters using cord wood. Considering all of the above, we have determined that we do not have sufficient data at this time to adequately support a regulatory requirement for cord wood testing.

We expect that many manufacturers will choose the alternative cord wood compliance testing option so that consumers will have more opportunities to purchase stoves that are tuned for in-home use. We will consider alternative cord wood test method requests on a case-by-case basis until we are convinced that improved test methods

have been sufficiently demonstrated that they can be relied upon for regulatory purposes. For now, we will be receptive to alternative test methods requests that use the current ASTM draft methods. We will also be receptive to other alternative test method requests that are adequately demonstrated, ideally according to the EPA Method 301 validation procedures.

Additionally, we expect that within the next few years we will receive enough cord wood test data for the EPA to establish revised certification requirements based on cord wood testing.

In this final rule, the EPA is relying on the cord wood test method that has been developed by the CSA for forced-air furnaces. The current version of CSA B415.1–10 was published in March 2010, and it includes not only the forced-air furnace test method but also Canadian emission performance specifications for indoor and outdoor central heating appliances.

In this final rule, we are relying on efficiency test methods that have been developed by the CSA. The current version of CSA B415.1–10 was published in March 2010.

As discussed earlier in section III.B.4 of this preamble, regarding the certification process for room heaters (revised subpart AAA), we are also requiring third-party certifiers for hydronic heaters and forced-air furnaces so as to reduce the potential for certification delays that could result from errors in testing. However, for forced-air furnaces, we are concerned that there may not be sufficient third-party certifier capacity specific to forced-air furnace testing according to the CSA B415.1–10 test method and review and approval capacity by the EPA, especially in the first year. We do not want to unfairly restrict the production and sales of forced-air furnace manufacturers who do all the things they should do and then potentially have to wait on EPA approval. Thus, we have added a conditional, temporary approval by the EPA for forced-air furnaces based on the manufacturer's submittal of a complete certification application. The application must include the full test report by an EPA-approved laboratory and all required compliance statements by the manufacturer. The conditional approval would allow forced-air furnace manufacture and sales for 1 year or until EPA review of the application, whichever is earlier. Within that year, the manufacturer must submit a certificate of conformity by a third-party certifier.

The 1-year conditional, temporary approval by the EPA does not apply to hydronic heaters because they have been required to submit third-party certifications for the EPA hydronic heater voluntary partnership program since 2008 and will continue to do so under this NSPS.

#### **IV. Summary of Significant Changes Following Proposal**

This section is a summary of the significant changes from the proposed rule based on the comments and additional material we received and have carefully considered. The reasons for these changes and their potential impacts are in the Response to Comments (RTC) document and are summarized in section V Summary of Major Comments and Responses.

##### *A. Best Systems of Emission Reduction/Particulate Emission Limits*

We received considerable comment on the proposed PM emission limits that is relevant to our determination of BSER. As explained in more detail in section V, these final emission limits represent significant advances in stove technology and substantial reductions in emissions, both collectively and from individual units.

##### **1. Room Heaters**

The EPA is changing the proposed Step 2 PM emissions limit for new residential room heaters, including catalytic and noncatalytic adjustable rate wood heaters, single burn rate wood heaters and pellet heaters/stoves from 1.3 g/hr to 2.0 g/hr using crib wood. Compliance for room heaters will be determined using the weighted average of burn rates rather than requiring each individual burn rate to meet the limit. To reduce potential certification delays and unnecessary costs for small businesses, we are adding an automatic Step 1 EPA approval for models with valid EPA certifications under the 1988 NSPS that show that the models achieve the Step 1 emission levels. Manufacturers may choose to test using either crib wood or cord wood. If the manufacturers choose the cord wood alternative compliance option, the PM emission limit for cord wood is 2.5 g/hr. Although the number is higher, the cord wood test method is more reflective of fuel that is used in homes and the data available to the EPA indicate that this PM emission level is at least as stringent as the 2.0 g/hr primary crib wood testing emission limit. More details on this are in section V.A Summary of Major Comments and Responses.

For wood heater/stove certification tests using cord wood, the EPA is allowing (voluntary) manufacturers to use a special EPA label which recognizes that cord wood testing more closely reflects actual in-home use.

##### **2. Central Heaters: Hydronic Heaters and Forced-Air Furnaces**

For new residential hydronic heaters, the final rule keeps the proposed Step 1 weighted average PM emission rate of 0.32 lb/mmBTU heat output, establishes a Step 1 PM emissions cap of 18 g/hr for any individual test run and adds automatic Step 1 EPA certification for hydronic heater models if they are already qualified as meeting the Phase 2 emissions level of the EPA's voluntary program. The change from the proposed Step 1 cap of 7.5 g/hr to the final rule Step 1 cap of 18 g/hr was to match the Phase 2 emission levels of the EPA voluntary program and reduce potential certification delays. To further reduce potential certification delays and unnecessary costs for small businesses, we are also adding automatic Step 1 EPA certification for hydronic heater models certified by NYSDEC that demonstrate the models achieve the Step 1 levels and RHHY-qualified pellet hydronic heaters. Similarly, we are adding automatic Step 1 EPA certification for new forced-air furnaces that are independently certified (*i.e.*, not self-tested) under CSA B415.1–10 to meet the Step 1 emission level or that are certified by NYSDEC and meet the Step 1 emission level. For forced-air furnaces for Step 1, we deleted the 7.5 g/hr particulate emission limit per individual burn rate because the CSA B415.1–10 certifications are based on the weighted average, not the g/hr limit, and because the manufacturers do not have experience with meeting g/hr limits for these furnaces.

For hydronic heaters, we are changing the proposed Step 2 PM emissions limit of 0.06 lb/mmBtu heat output to 0.10 lb/mmBtu heat output for each individual burn rate, tested on crib wood. Manufacturers may choose to test using either crib wood or cord wood. If the manufacturer chooses the cord wood alternative compliance option, the Step 2 PM emission limit for cord wood is 0.15 lb/mmBtu heat output. Although the number is higher, the cord wood test method is more reflective of the fuel that is used in homes and the limited cord wood data available to the EPA indicate that this PM emission level is at least as stringent as the 0.10 lb/mmBtu heat output crib wood testing emission limit. For forced-air furnaces, the Step 2 PM emission level matches the hydronic heater cord wood

alternative option because forced-air furnaces are certified using CSA B415.1–10, which already specifies cord wood as the test fuel. Details on the bases of the emission levels are in section V, Summary of Responses to Major Comments.

For hydronic heaters and forced-air furnaces tested with cord wood, the EPA is allowing (voluntary) manufacturers to use special permanent labels and EPA temporary labels (hangtags) which recognize that cord wood testing more closely reflects actual operation under in-home-use conditions.

### 3. Masonry Heaters

As stated in section III of this preamble, the EPA is not taking final action on proposed subpart RRRR for new residential masonry heaters at this time. Comments indicated that the Masonry Heater Association (MHA) needs more time to finish their efforts to develop revised test methods, alternative compliance calculation procedures and dimensioning procedures. The MHA comments stated that the cost of testing masonry heaters is high and impractical because almost all are custom-built onsite. After we receive additional information from MHA and others, we will consider if we should take final action for new residential masonry heaters in a future rulemaking.

The potential emission impact of this delay is small. Fewer than 1,000 masonry heaters are built each year. Most manufacturers build fewer than 15 heaters per year. The total nationwide annual emissions are estimated to be less than 10 tons of PM<sub>2.5</sub>.

### B. Appliance Certification, Laboratory Accreditation and Third-Party Certification

In section III.D of the preamble to the proposed rule, we described the proposed approach for a third-party certification program by an ISO-accredited certifying body and testing by ISO-accredited testing laboratories. This approach requires manufacturers to use third-party, independent ISO-accredited and EPA-approved test labs and certifying entities to demonstrate compliance with a representative appliance for a model line.

Under the Administrator Approval Process (see § 60.533(c) of the proposed rule), we proposed a transition period of 1 year from the effective date of the final rule for test labs to receive ISO accreditation through an EPA-recognized accreditation body. In this final rule, we are increasing the transition period for test laboratories

that are currently EPA-accredited from 1 year to 3 years from the effective date of this final rule (*i.e.*, until May 15, 2018). This additional time for test laboratory accreditation will reduce concerns about costs for these small laboratories and potential testing delays.

We proposed that certifying entities be required to receive ISO accreditation upon the effective date of the final rule; however, commenters stated that ISO accreditations can take 6 months. Requiring use of ISO-accredited certifying bodies/entities on the effective date of the final rule can be difficult for small manufacturers of wood stoves/heaters and forced-air furnaces, which previously have not been required to obtain certifications from ISO-accredited certifying bodies/entities; therefore, we are allowing a 6-month transition for models other than hydronic heaters. The 6-month transition period does not apply to hydronic heaters because the use of ISO-accredited certifying bodies/entities has been part of the EPA's voluntary partnership program for hydronic heaters since 2008.

### C. Cost and Economic Impacts

Cost and economic impacts of the proposed rule have been revised to reflect changes to the standards and improved estimates of costs and emissions for room heaters and central heaters. See section VI of this preamble for a discussion of these revised impacts, as well as the RIA and the RTC document for this final rule for more detailed information.

### D. Test Methods and Compliance Certification Calculation Procedures

The EPA proposed a number of changes to test methods established under the 1988 rule to improve their precision and to better reflect real-world conditions.

#### 1. Burn Rates in Compliance Certification Calculations

For Step 2 emission limits, we proposed to require certification compliance at the lowest burn rate (Category 1) and the maximum burn rate (Category 4) rather than the weighted average of the four burn rates, which was required in the 1988 rule.

Many comments on the proposal and the data in the NODA strongly supported the proposed compliance determinations per individual burn rates. Many other comments strongly opposed the proposal. Considering all of the comments and focusing on the available test data, especially the EPA wood stove certification test data by burn rate that we included in the July

1, 2014, NODA, we are requiring certification calculations based on the weighted average of the four burn rates for subpart AAA. More detail is presented in section V.A, BSER and Particulate Emission Limits for Room Heaters (revised subpart AAA), and section V.F, Test Methods.

For subpart QQQQ, the final rule uses the weighted average with a cap for each test run for Step 1 (for hydronic heaters), but retains the proposed requirement for compliance at each burn rate for Step 2 (for both hydronic heaters and forced-air furnaces), given concerns about the sometimes very large emissions at individual burn rates. The emission limits reflect the data available. For a more detailed discussion of these comments and responses, see the RTC document in the docket for this rule.

### 2. Cord Wood Test Method

Based on the existence of viable draft cord wood test methods and the expectation at proposal that the ASTM "real world" test methods for cord wood would be complete soon after the NSPS proposal and that significant testing of wood heaters re-tuned to perform well on cord wood would occur before promulgation of this final rule, the EPA proposed to require testing only with cord wood for compliance with Step 2 emissions limits. We still encourage manufacturers to design wood heaters that perform best on cord wood that consumers use. However, the ASTM cord wood test methods have not been completed and only limited testing using the draft methods has occurred. We received numerous comments from noncatalytic stove manufacturers and laboratories and some states with concerns about when the cord wood test methods would be ready and how quickly noncatalytic stoves could be redesigned to perform well with cord wood certification testing that we proposed for Step 2, *i.e.*, 5 years after the effective date. (We had test data for three catalytic or hybrid wood heaters/stoves that performed very well on cord wood at the time of proposal.) However, considering all of the above, we have determined that we do not have sufficient data at this time to support a regulatory requirement for cord wood testing (other than for forced-air furnaces), but rather will allow an alternative compliance option for cord wood testing. (Note that forced-air furnace certification tests are conducted according to CSA B415.1–10 which has specified cord wood as the test fuel since 2010.)

We expect that many manufacturers will choose the alternative cord wood

compliance testing option so that consumers will have more opportunities to purchase stoves that are tuned for use in the “real world.” We will consider alternative cord wood test method requests on a case-by-case basis until we are convinced that improved test methods have been sufficiently demonstrated that they can be relied upon for regulatory purposes. For now, we will be receptive to alternative test methods requests that use the current ASTM draft methods. Also, we will be receptive to other alternative test method requests that are adequately demonstrated, ideally according to the EPA Method 301 validation procedures. Additionally, we expect that within the next few years we will receive enough cord wood test data for the EPA to establish revised certification requirements based on cord wood testing.

See section III of this preamble for the specific alternative compliance emissions limit options we are allowing under subparts AAA and QQQQ for manufacturers of heaters who choose to certify compliance with cord wood instead of crib wood. The bases for the options are discussed in section V, Summary of Responses to Major Comments.

### 3. Additional Test Methods

Based on comments and the need to minimize potential testing and certification delays for Step 1, the final rule includes additional test methods for hydronic heaters. In addition to the proposed use of EPA Method 28WHH and EPA Method 28WHH-PTS, the final rule allows manufacturers to use ASTM E2618–13 and EN303–05 with specified conditions/adjustments (e.g., burn rate categories to better match EPA Method 28WHH and use of thermal storage) for determining compliance with the Step 1 emission limits. As with all NSPS, manufacturers may request EPA approval of alternative test methods on a case-by-case basis. See 40 CFR 60.8.

#### E. Sell-Through of Inventory

Based on numerous comments from small business manufacturers and small business retailers and some states, we are lengthening the retail sell-through period for subpart AAA from 6 months from the effective date of the final rule to December 31, 2015, approximately 8 months from the expected effective date. That is, no manufacturer, distributor, wholesaler or retailer may sell or offer to sell new stoves after December 31, 2015, that do not meet the Step 1 emission limit. Eight months will better cover the primary selling period after the rule is final and will affect a very

small number of appliances. We are also providing a retail sell-through period for subpart QQQQ hydronic heaters to also cover the primary selling period. We are not allowing a retail sell-through period for forced-air furnaces because the manufacturers and retailers can quickly revise the owner’s manuals to add best burn practices to comply with the work practice and operational standards. These sell-through provisions do not affect resale of used stoves/heaters; such resale is not restricted by this rule.

#### F. Appeals and Administrative Hearing Procedures

Based on the public comments and our additional review of the history of the 1988 rule, we have determined that there is no need to make the proposed change to a streamlined Petition for Review process. Therefore, we are retaining the Appeals and Administrative Hearing Procedures outlined in the 1988 rule.

### V. Summary of Responses to Major Comments

Detailed summaries are in the RTC document in the docket.

#### A. BSER and Particulate Emission Limits for Room Heaters (Revised Subpart AAA)

We received a full range of comments on the proposed BSER and emission limits for room heaters and the data in the July 1, 2014, NODA. Many comments agreed completely with our proposal and that approximately 10,000 tons/yr of PM<sub>2.5</sub> emission reduction is very important and would lead to significant improvement in public health protection.

Some comments indicated that bans of wood burning would be more appropriate. The EPA is not banning wood burning in this rule because section 111(a)(1) of the CAA requires that the emission standards reflect the degree of emission limitation achievable by the application of BSER.

Some comments suggested that we develop less stringent standards for rural areas than other areas or no standards in rural areas at all. The EPA is not setting different emission standards for rural areas because section 111 of the CAA does not provide legal authority for differentiated standards based on where the devices are used.

#### 1. Stringency of Step 2 Level Using Cord Wood for Room Heaters

Many noncatalytic stove manufacturers and laboratories and some other manufacturers were concerned especially about the stringency of the Step 2 level using cord

wood 5 years after the effective date. We considered all comments and focused on those that discussed the emission data in detail.

Numerous small business manufacturer comments suggested that (1) current stove designs are focused on burning crib wood well at the expense of burning “real world” cord wood well, and stoves cannot just be tweaked to burn both well; (2) experience in homes is that some crib wood-certified stoves smolder if the homeowner does not operate them at high burn for at least 30 minutes before dampening down to the low burn rate settings; (3) a cord wood test method more representative of in-home use should be developed as soon as possible; and (4) a voluntary option should be used to establish a cord wood database to determine BSER.

As discussed in the NODA, limited cord wood testing by Brookhaven National Laboratory (BNL), under contract to the EPA, showed that repeatability of the cord wood test method results can sometimes be very good (i.e., within 15 percent). However, the results of the BNL cord wood tests also showed that emissions from a popular, inexpensive, current-model noncatalytic stove that was not adjusted by the manufacturer for burning cord wood instead of crib wood during the certification test can be much higher than (in several cases, over twice as high) the crib wood emission test results.

Other comments suggested that we stay with the proposed cord wood testing requirement and proposed Step 2 emission level that some heaters can already meet. For example, Washington State Department of Ecology (WSDOE) stated that (1) the data show that hybrid stoves are the best technology capable of meeting Step 2, better than noncatalytic stoves; and (2) the extensive lack of Category 1 burn rate data in the certification tests indicates a “serious flaw” and that EPA needs to develop test methods more representative of in-home use that include start-up and the lowest burn rate at which a device may be commonly operated. We agree with WSDOE that it appears that hybrid stoves may be the best technology capable of meeting Step 2, better than noncatalytic stoves; however, we are concerned about setting required emission levels that may have potential impacts on a large number of small businesses that may not yet have much experience with that technology, and we do not want to prematurely restrict their choices. As discussed in section IV.D, we agree that test methods are needed that better reflect in-home use and include start-up and the lowest burn

rate at which a device may be commonly operated.

As discussed earlier in this preamble, based on the data and comments, we have determined that it is premature to require a cord wood-based Step 2 emission limit at this time. Rather, we are basing the Step 2 requirements on crib wood testing and including an alternative compliance *option* to encourage manufacturers to certify with cord wood as soon as possible to provide consumers with better information regarding in-home use.

In support of the cord wood alternative compliance option, there are three stove model lines that meet Step 2 using cord wood testing. As discussed in section IV.D of this preamble, we expect additional manufacturers will choose the alternative cord wood compliance testing option so that consumers will have more opportunities to purchase stoves that are tuned for in-home use. We will consider alternative cord wood test method requests on a case-by-case basis until we are convinced that improved test methods have been sufficiently demonstrated that they can be relied upon for regulatory purposes. For now, we will be receptive to alternative test method requests that use the current ASTM draft methods. We will also be receptive to other alternative test method requests that are adequately demonstrated, ideally according to EPA Method 301 validation procedures. We expect that within the next few years we will receive enough cord wood test data for the EPA to establish revised certification requirements based on cord wood testing.

Commenters overwhelmingly agree that cord wood testing is a better representation of “real world” conditions, provides better information for consumers to choose the cleanest and most efficient heaters and that the EPA should encourage cord wood testing. Thus, the final rule includes a cord wood alternative compliance option for Step 2 and special permanent labels and allows (voluntary) temporary EPA labels (hangtags) for units tested with cord wood. As discussed earlier in this section, the proposal reasonably anticipated that all manufacturers would iteratively adjust the combustion air flows, directions and proportions to better match the change in hydrocarbon volatilization rate due to the difference in surface-area-to-volume ratio and spacing for crib wood versus cord wood. The proposal also reasonably anticipated that manufacturers would have a full complement of cord wood tested heaters available by Step 2, *i.e.*, 5 years after the effective date. Some

stoves already perform well on cord wood. However, comments from some small business noncatalytic stove manufacturers, small business laboratories and some states have questioned whether most small business manufacturers could comply with the Step 2 emission limits based on cord wood by that date. As discussed in the NODA, the cord wood test data submitted to us for three catalytic or hybrid wood stoves manufactured by two small businesses show that their EPA-certified wood stoves (when tested using cord wood and making no design changes to adjust for testing using cord wood versus crib wood) have similar emissions as their stoves do when tested using crib wood. The cord wood results show that they can achieve an emission limit of 1.3 g/hr, as proposed. Several comments stated that they did not believe these results are representative of most EPA-certified stoves and that typical cord wood values are likely to be higher than the 1.3 gr/hr level, as well as the 2.0 g/hr level of the final crib wood Step 2 emission level or any other crib wood level.

Recognizing that the cord wood alternative compliance option is an option rather than a requirement, we have set the cord wood Step 2 emission level at 2.5 g/hr as the alternative compliance option for room heaters for the following reasons:

- Test data show that at least three wood stoves meet a limit of 1.3 g/hr, which (coupled with some commenters’ claims that the test precision is no better than 1.0 g/hr) would suggest an achievable limit on the order of 2.3 g/hr.

- The State of Washington DOE has required catalytic stoves since 1995 to meet a limit of 2.5 g/hr.

- The Step 2 emission level does not take effect until 5 years after the effective date of this final rule.

The cord wood alternative compliance option provides appropriate opportunities to small manufacturers who have been leaders in optimizing for cord wood performance and encourages other manufacturers to follow their example. More discussion is in the RTC document in the docket for this final rule.

## 2. Stringency of Step 2 Level Using Crib Wood for Room Heaters

We have set the crib wood Step 2 emission limit at 2.0 g/hr for the following reasons:

- Focusing on the comments that discussed the details of the crib wood certification test data for Step 2, nearly 90 percent of current catalytic/hybrid stoves and over 18 percent of current

noncatalytic stoves would meet the Step 2 emission limit of 2.0 g/hr in the final rule. This compares to 20 percent of catalytic/hybrid wood heaters/stoves and only 3 percent of noncatalytic wood heaters/stoves for the proposed 1.3 g/hr Step 2 emission limit.

- Considering that current stove sales are approximately 20 percent catalytic/hybrid stoves and 80 percent noncatalytic stoves, the estimated impact of adjusting the Step 2 emission level from 1.3 g/hr to 2.0 g/hr will be to decrease the emission reduction estimated for this rule by approximately 36 tons per year, which is relatively small compared to the rule’s total estimated emission reduction of 8,269 tons per year. Furthermore, the impact for any individual stove is only on the order of 2 pounds per year.

- The final Step 2 emission limit of 2.0 g/hr is more stringent than any current state requirement.

Thus, considering the significant emission reductions for this final rule and the potential significant cost impacts for this industry that is comprised of over 90 percent small businesses, and considering that the difference between the proposal and this final rulemaking is less than approximately 36 tons per year compared to the 8,269 tons per year for this final rulemaking, we judge that a final Step 2 emission level of 2.0 g/hr within 5 years as BSER for room heaters is a reasonable balance of environmental impacts and costs.

## 3. Determination of BSER for Room Heaters

Some comments questioned that BSER is adequately demonstrated. The data in the paragraph above show that not only are the emission levels demonstrated, the percentages of current heaters that already meet Step 2 demonstrate the reasonableness of the Step 2 emission limit, especially considering that the Step 2 emission limit becomes applicable 5 years after the effective date.

Some comments recommended that the final rule be as stringent as the cleanest stoves on the market and some comments suggested numbers that reflect the top 5 percentile. Section 111 of the CAA does not specify any particular floor for BSER determinations but does require consideration of costs. As discussed above, considering that the emission reduction difference between the proposal and this final rulemaking is approximately 36 tons per year (compared to the 8,269 tons per year for this final rulemaking), we judge that a final Step 2 BSER of 2.0 g/hr within 5



years is a reasonable balance of environmental impacts and costs.

Some comments suggested that the precision of the test method is not good enough to set emission limits more stringent than the 1988 NSPS. In response, we note that the State of Washington DOE has successfully required a 2.5 g/hr emission limit for catalytic stoves since 1995, and several stoves have been EPA-certified at 1.0 g/hr, which is well under the final Step 2 emission limit of 2.0 g/hr. Even if the commenters' claims were correct that the precision is no better than 1.0 g/hr, the final emission limit of 2.0 g/hr would still cover these stoves, *i.e.*, 1.0 g/hr plus 1.0 g/hr equals 2.0 g/hr, the step 2 emission limit. Further, we note that the final rule deletes the previously required upward adjustment for Method 5G to 5H, which was sometimes over a 30 percent increase for certification values (under the 1988 NSPS and the State of Washington DOE) that were tested using Method 5G.

#### *B. BSER and Particulate Emission Limits for Central Heaters (Subpart QQQQ)*

Comments of many small business manufacturers of hydronic heaters and forced-air furnaces questioned the demonstrations of BSER for hydronic heaters and forced-air furnaces, especially the proposed cord wood Step 2 limit of 0.06 lb/mmBtu. As discussed earlier in sections III.B and III.C of this preamble, considering the numerous comments expressing concern about whether most small business manufacturers will be ready in time, reviewing the data currently available, and acknowledging that the expected ASTM cord wood test methods are not yet completed at this time, we have determined that it is premature to require cord wood certification tests for hydronic heaters at this time. Rather, we are allowing a cord wood alternative compliance option.

##### 1. Stringency of Step 1 Level Using Crib Wood for Central Heaters

Focusing on the crib wood test primary requirement and crib wood test data, we see that there are already 50 hydronic heater models Phase 2 qualified under the EPA hydronic heater voluntary partnership program, which also meet the Step 1 emission levels of this final NSPS. These models will be automatically deemed EPA-certified for Step 1 of this final NSPS. (There are also 19 voluntary program qualification tests recently submitted to the EPA that, if valid, will result in 19 additional Phase 2 model qualifications.) Similarly, models certified by the NYSDEC that comply with Step 1 will also be

automatically deemed EPA certified until Step 2. Also, over 20 pellet heaters/boilers are already qualified under the RHNY program, and they will be automatically deemed to be EPA-certified for Step 1 provided they comply with the RHNY requirements for installation and operation with adequate thermal storage. That is, no additional certification will be necessary for these three groups for Step 1.

For forced-air furnaces, commenters indicated that the Step 1 p.m. emission limit was achievable but small furnaces needed 1 year and large furnaces needed 2 years to complete the certification testing. As discussed earlier, the final rule incorporates the necessary additional time for testing.

##### 2. Stringency of Step 2 Level Using Crib Wood for Central Heaters

For new residential hydronic heaters, we have set the crib wood Step 2 emission level at 0.10 lb/mmBtu based on the following:

- Looking at the crib wood test primary requirement for Step 2 (0.10 lb/mmBtu), 9 of the 50 (18 percent) EPA-qualified hydronic heater models currently achieve Step 2 on crib wood (per run); and all 20 of the RHNY-qualified models achieve 0.10 lb/mmBtu.
- The proposed Step 2 level (0.06 lb/mmBtu) currently is achieved only by 3 of the 49 (6 percent) EPA-qualified models (per run).
- The emission reduction difference between the proposed Step 2 hydronic heater emission level (0.06 lb/mmBtu) and the final Step 2 hydronic heater emission level (0.10 lb/mmBtu) is approximately only 15 tons per year (compared to the 8,269 tons per year for this final rulemaking).

Considering the potential significant cost impacts for this industry that is comprised of over 90 percent small businesses, and that the relatively small difference in emission reductions between the proposal and this final rulemaking, we judge that a final hydronic heater Step 2 emission level of 0.10 lb/mmBtu within 5 years as BSER is a reasonable balance of environmental impacts and costs.

##### 3. Stringency of Step 2 Level Using Cord Wood for Central Heaters

As with room heaters (subpart AAA) and for the same reasons, hydronic heaters (subpart QQQQ) have a cord wood alternative compliance option. Considering that it is an option designed to encourage leadership for others to follow, that it is an option rather than a requirement and that many European models already achieve levels better

than 0.06 lb/mmBtu, we have determined that 0.15 lb/mmBtu within 5 years as the cord wood alternative compliance option is a reasonable balance of environmental impacts and costs. We note that the RHNY emission qualification requirement is 0.08 lb/mmBtu. Further, we note that even if there were to be method uncertainty on the order of approximately four times the expected precision of 35 percent, models at 0.06 lb/mmBtu would still be included.

We have set the same final Step 2 emission level for forced-air furnaces as BSER as we have for hydronic heaters based on the following:

- The emission reduction difference between the proposed forced-air furnace Step 2 emission limit of 0.06 lb/mmBtu and this final rulemaking (0.15 lb/mmBtu) is approximately 40 tons per year (compared to 8,269 tons per year emission reduction for this final rulemaking). The difference is slightly larger for forced-air furnaces compared to hydronic heaters because the annual sales of forced-air furnaces are much larger (*i.e.*, 41,000 versus 13,000).

- We considered the potential significant cost impacts for this industry that is comprised of over 90 percent small businesses, as well as the modest difference between the environmental impacts of the proposal and this final rulemaking. Therefore, for forced-air furnaces, we judge that a final Step 2 emission level of 0.15 lb/mmBtu within 5 years as BSER is a reasonable balance of environmental impacts and costs.

Since forced-air furnaces and indoor hydronic heaters compete in the same market, wise consumers expect similar performance. We expect most forced-air furnace manufacturers to transfer technology and knowledge from wood stoves and hydronic heaters. Some small forced-air furnaces have already transferred technology from wood heaters to achieve good performance. Several industry comments questioned their ability to transfer technology from hydronic heaters because of their concerns about size limitations in order to install forced-air furnaces indoors going through doorways and other entrances to basements. They were especially concerned that the space limitations may affect their ability to adequately insulate the models that may be installed in close proximity to combustibles. We acknowledge their concerns but note that coal, oil and natural gas forced-air furnaces and indoor hydronic heaters that have similar space limitations and proximity to combustibles conditions have successfully handled those concerns for many years. For example, numerous

cord-wood-fired indoor hydronic heaters have been safely installed without large volumes of thermal insulation around the firebox

#### C. Appliance Certification

Many comments stressed the importance of easy public availability of certification test reports (especially electronically), limited CBI claims, more details on the EPA Web sites, better labels and more outreach to encourage change outs to cleaner stoves. We agree with these comments and the final rule incorporates this transparency and consumer-friendliness. Some comments suggested wording clarifications that we have incorporated in the final rule. More details are in the RTC document included in the docket for this rule.

#### D. Laboratory Accreditation, Third-Party Certification and Administrative Approval Process

Many comments stressed the importance of credible data for the certifications and the value of close EPA oversight, notwithstanding the addition of ISO-accredited laboratories and ISO-accredited certifying entities. Some comments suggested that the EPA should allow the ISO-accredited certifying entities to issue NSPS certificates directly and that the EPA's role should be solely to review the certifications and only question their certificates upon cause. The small business laboratories requested more time for the transition to ISO-accreditation because of the cost. As discussed earlier in this preamble, the final rule allows a 3-year extension of current EPA accreditations of laboratories and allows 6 months for ISO accreditation of certifying entities, except for hydronic heaters, which have used ISO-accredited certifying entities since October 2008 for the EPA voluntary program. The EPA will retain its approval and oversight functions for this final rule. As also discussed earlier in this preamble, to address the possibility that there may not be sufficient third-party certifier capacity and review and approval capacity by the EPA, especially in the first year, and so as to avoid unfairly restricting the production and sales of manufacturers who do all the things they should do and then potentially have to wait on the EPA approval, we have added a conditional, temporary approval by the EPA for room heaters subject to revised subpart AAA, as well as forced-air furnaces subject to subpart QQQQ, based on the manufacturer's submittal of a complete certification application. The application must include the full test report by an EPA-accredited

laboratory and all required compliance statements by the manufacturer. The conditional approval would allow manufacture and sales for 1 year or until EPA review of the application, whichever is earlier. Within 1 year, the manufacturer must submit a certificate of conformity by a third-party certifier.

The 1-year conditional, temporary approval by the EPA does not apply to hydronic heaters because they have used third-party certifications for the voluntary program since 2008 and will continue to do so under the NSPS.

#### E. Costs and Economic Impacts

##### 1. Costs

Comments received on the proposed rule included information and opinions regarding the EPA wood heater cost estimates.<sup>8</sup> Comments ranged from criticism that the EPA overestimated costs to criticism that the EPA underestimated costs. The comments that provided data and/or analysis explaining why the commenter thought EPA had not accurately estimated the costs were most persuasive, and we have revised our cost estimates based on those detailed comments. Details of our responses to cost comments are in the RTC document and the technical cost memoranda in the docket for this final rule.

##### a. Room Heaters

For example, Washington State Department of Ecology stated that the proposal cost estimates were overestimates and that our estimates did not address input from Woodstock Soapstone Stoves, winner of the 2013 Wood Stove Decathlon, which estimates that the cost of new product development is approximately \$200,000, and furthermore that the proposal cost estimates did not address the economies manufacturers realize when they develop functionally identical models from the originally certified model.<sup>9</sup> Some other commenters generally stated that EPA's breakdown of cost estimates faced by manufacturers is inaccurately low. We have considered all the comments and have revised our cost estimates based on comments that provided additional detailed cost data.

Prior to proposal, we heard various estimates of the costs to bring a wood heater from concept to completion, from

\$200,000 for a single model to \$1,360,000 for a 4-firebox model line. For example, a *Hearth and Home* article estimated the total cost to bring a model from conception to market as \$645,000 to \$750,000 for steel stoves and over \$1 million for cast-iron, enameled wood stoves. The authors indicated that costs would decrease for separate models in the same line by up to 25 percent. Based on this information, we estimated that a 4-model steel line would cost up to \$328,125 per model to develop. These costs include marketing, design, developing first generation, second generation and prototype units; NSPS and safety testing, equipment tooling, etc.<sup>10</sup> Two other manufacturers also provided estimated development costs for a 4-box model line, and based on that information at proposal we estimated average costs to develop a new model line, including testing with both crib wood and cord wood and reporting and recordkeeping, of \$356,250 for certified wood stoves and pellet stoves. We also estimated \$356,250 for single burn rate stoves, forced-air furnaces and hydronic heaters.

The Hearth Patio and Barbecue Association (HPBA) provided detailed estimates of adjustable burn rate wood stoves and hydronic heater model development costs. According to HPBA, the proposal cost estimates are deficient because they do not reflect specific emission rates or emission performances. Their detailed wood stove cost estimates are located in Attachment 2 of the HPBA comments and were prepared by National Economic Research Associates (NERA) Economic Consulting (May 2014).<sup>11</sup> Appendix A of the document, Woodstove Cost Modeling (prepared by Ferguson, Andors & Company) contains the detailed cost estimates we reviewed and adapted for this analysis.<sup>12</sup>

The Ferguson analysis provides cost estimates for four categories of emission reductions based on the proposed emission levels, consisting of modifying 7.5 g/hr stoves to comply with a new 4.5 g/hr emission limit, modifying the 4.5 g/hr stoves to comply with new emission limits of 2.5 g/hr or 1.3 g/hr stoves, and

<sup>10</sup> James E. Houck and Paul Tiegs. *There's a Freight Train Comin'*. *Hearth and Home*. December 2009.

<sup>11</sup> Comment on the proposed rule to Docket EPA-HQ-OAR-2009-0734 from the Hearth, Patio and Barbecue Association available at <http://www.regulations.gov/#/documentDetail;D=EPA-HQ-OAR-2009-0734-1643>.

<sup>12</sup> Ferguson, Robert (Ferguson, Andors & Company), prepared for the Hearth, Patio & Barbecue Association. Proposed Wood Heater NSPS Incremental Cost Effectiveness Analyses, Appendix A: Woodstove Cost Modeling. May 2014. p.1.

<sup>8</sup> Comments on the proposed NSPS are available electronically through <http://www.regulations.gov> by searching Docket ID EPA-HQ-OAR-2009-0734.

<sup>9</sup> Comment on the proposed rule to Docket EPA-HQ-OAR-2009-0734 from the Washington State Department of Ecology; available at <http://www.regulations.gov/#/documentDetail;D=EPA-HQ-OAR-2009-0734-1397>.

modifying a 2.5 g/hr stove to a new emission limit of 1.3 g/hr. The resulting cost components consisted of capital costs per model (R&D, engineering labor, tooling, equipment integration, preliminary testing, and other costs to design and manufacture the modified wood stove model) and other fixed costs per model (certification testing and safety testing, roll-out of the modified products including store display models and burn programs, brochures, user manuals, training and product discounts). The mid-point capital costs presented by Ferguson range from \$281,725 to \$532,050 depending on the emission reduction range.<sup>13</sup>

As discussed earlier in section III.A, unlike the proposed rule, the final subpart AAA rule only contains a Step 1 PM emission limit of 4.5 g/hr and a Step 2 PM emission limit of 2.0 g/hr, with no alternative, three-step emission limits. The comments overwhelmingly indicated that the three-step emission limit approach was inferior not only environmentally but also economically because it would, in effect, require many small manufacturers to engage in two rounds of R&D rather than one in order to obtain the same eventual endpoint.

The Step 1 cost for 7.5 to 4.5 g/hr is a reasonable representation of model development costs for all models subject to subpart AAA, with some exceptions, described below. The Ferguson analysis shows that several of the cost components are identical across scenarios. The analysis claims, however, that other cost components vary according to the specified emission reduction scenario. These differences were not supported in the comments. For purposes of this analysis, we used the 7.5 to 4.5 g/hr scenario as a baseline case and modified it to reflect the deletion of cost categories that were inappropriate for the NSPS analyses, *e.g.*, costs for trips to industry trade shows that would occur for all products regardless of the NSPS.

We did accept the assumptions and logic related to evaluating the tooling cost difference between steel stoves and cast iron stoves, as both are commonly manufactured. Like Ferguson, we used an average of their tooling costs to reflect product differences, even though this may overestimate the number of cast iron stoves in the market place. While we recognize the range in capital cost estimates provided both prior to and after proposal of the draft standards

leave room for additional cost scenarios, especially the much lower cost scenario for Woodstock Soapstone Stoves, the Ferguson costs represent the best documented cost ranges and cost categories available at this time.

For the final cost analysis, we used the mean wood stove costs. For our analyses, these model development costs represent feasible costs for adjustable burn rate stoves and pellet stoves. For single burn rate stoves, as we did at proposal, the analyses reflect that additional R&D may be required to bring these stoves to qualifying levels. Rather than doubling the total model development costs during the first 2 years as we did at proposal, the new costs for the R&D/Engineering cost portion of the total costs are doubled in the first 2 years, with “normal” model development proceeding thereafter.

Details of our responses to cost comments are in the RTC document and the technical and cost memoranda in the docket for this final rule.

#### b. Central Heaters

At proposal, our analyses reflected that hydronic heaters and forced-air furnaces would face the same model development costs as room heaters. Some commenters objected to this characterization, particularly based on the detailed hydronic heater cost estimates located in Attachment 3 of the HPBA comments as prepared by NERA Economic Consulting (May 2014).<sup>14</sup> Appendix A of that document, Hydronic Heater Cost Modeling (prepared by Ferguson, Andors & Company) contains the detailed cost estimates we reviewed and adapted for this analysis.

The HPBA costs for hydronic heaters were prepared with the same methodology and overall assumptions as they used in development of the wood heater costs. The Ferguson analysis provides cost estimates for four categories of hydronic heater emission reductions, based on the proposed emission levels consisting of modifying uncontrolled heaters to comply with a new 0.32 lb/mmBtu emission limit, modifying the 0.32 lb/mmBtu heaters to comply with new emission limits of 0.15 or 0.06 lb/mmBtu, and modifying a 0.15 lb/mmBtu heater to a new emission limit of 0.06 lb/mmBtu. The resulting cost components consisted of capital costs per model (R&D, engineering labor, tooling, equipment integration, preliminary testing, and other costs to design and manufacture

the modified wood stove model) and other fixed costs per model (certification testing and safety testing, roll-out of the modified products including store display models and burn programs, brochures, user manuals, training and product discounts). The mid-point capital costs presented by Ferguson range from \$1,743,750 to \$2,162,300 depending on the emission reduction range.<sup>15</sup> We used these cost estimates in our analysis.

As discussed earlier in section III.A, unlike the proposed rule, the final rule contains a Step 1 PM emission limit of 0.32 lb/mmBtu and a Step 2 PM emission limit of 0.10 lb/mmBtu, with no alternative three-step PM emission limits. The comments overwhelmingly indicated that the three-step PM emission limit approach was inferior not only environmentally but also economically because it would, in effect, require many small manufacturers to engage in two rounds of R&D rather than one in order to obtain the same eventual endpoint.

The Step 1 PM emission limit cost for modifying uncontrolled heaters to comply with 0.32 lb/mmBtu is a reasonable representation of model development costs for all models subject to subpart QQQQ, with some exceptions, described below. The Ferguson analysis shows that several of the cost components are identical across scenarios. The analysis claims that other cost components vary according to the specified emission reduction scenario; however, no support was provided for these claims in the Ferguson analysis. For purposes of our analysis, we used the scenario of uncontrolled to 0.32 lb/mmBtu as a baseline case and modified it to reflect the deletion of cost categories that were inappropriate for the NSPS impact analyses, *e.g.*, costs for trips to industry trade shows that would occur for all products regardless of the NSPS.

For our final rule cost analysis, we used the mean hydronic heater costs estimated in Table 5–2 of the final RIA. These model development costs represent feasible costs for hydronic heaters. For forced-air furnaces, as we did at proposal, our analysis included the additional R&D that may be required to bring these heaters to qualifying levels. Rather than doubling total model development costs during the first 2 years as we did at proposal, for the final rule analysis the R&D/Engineering cost portion of the total costs are doubled in

<sup>13</sup> Ferguson, Robert (Ferguson, Andors & Company), prepared for the Hearth, Patio & Barbecue Association. Proposed Wood Heater NSPS Incremental Cost Effectiveness Analyses, Appendix A: Woodstove Cost Modeling. May 2014. pp. 4–5.

<sup>14</sup> Comment on the proposed rule to Docket EPA–HQ–OAR–2009–0734 from the HPBA available at <http://www.regulations.gov/#/documentDetail;D=EPA-HQ-OAR-2009-0734-1643>.

<sup>15</sup> Ferguson, Robert (Ferguson, Andors & Company), prepared for HPBA. Proposed Wood Heater NSPS Incremental Cost Effectiveness Analyses, Appendix A: Hydronic Heater Cost Modeling. May 2014. p. 4.

the first 2 years, with “normal” model development proceeding thereafter.

Details of our responses to cost comments are in the RTC document and the technical and cost memoranda in the docket for this final rule.

## 2. Economic Impacts

As discussed in detail in the RIA and summarized in section D.1 above, we received numerous comments on the costs, and we have adjusted our cost estimates as appropriate. Since the economic impacts are based on the costs and other factors, we have adjusted the economic impacts accordingly. The details of the adjustments are in the RIA, and a summary is in sections IV.C and VI of this preamble.

## F. Test Methods

### 1. Crib Wood vs. Cord Wood

We received a full range of comments on this issue, from complete support for the proposed cord wood testing requirements to complete opposition to requiring cord wood testing at this time. We considered all comments and focused on those that discussed the data in detail. As discussed earlier in section IV, based on the data and comments submitted, we have determined that it is premature to require a cord wood-based Step 2 PM emission limit at this time (except for forced-air furnaces for which CSA B415.1–10 already specifies cord wood as the test fuel). Rather, we are basing the Step 2 PM emission limit on crib wood testing and including an alternative compliance option to meet an emission limit based on cord wood testing, to encourage manufacturers to certify with cord wood as soon as possible to provide consumers with better information for their actual in-home-use performance. There are some manufacturers that already achieve the cord wood emission level and we expect that many more manufacturers will take this option and submit data that will inform development of a required cord wood certification test in a future rulemaking.

Based on the existence of a viable draft cord wood test method and the expectation at proposal that the ASTM test methods for cord wood would be complete soon after proposal and that significant testing of wood heaters returned to perform well on cord wood would occur before promulgation of this final rule, the EPA proposed to require testing only with cord wood for compliance with Step 2 emissions limits. We still encourage manufacturers to design wood heaters that best represent actual in-home-use performance on cord wood. However,

the ASTM cord wood test methods have not been completed and only limited testing using the draft methods has occurred. For the cord wood alternative compliance option, we will consider approval of requested test methods on a case-by-case basis. We believe the current draft ASTM test methods are sufficient to be used, upon request, for the cord wood alternative compliance option until better test methods can be developed. We will also be receptive to other alternative test method requests that are adequately demonstrated, ideally according to the EPA Method 301 validation procedures. (Note that forced-air furnaces are tested according to the cord wood test method already specified in CSA B415.1–10.

### 2. Compliance for Individual Burn Rates Versus Weighted Averages

We received a full range of comments on this issue, from complete support for the proposed Step 2 compliance for individual burn rates to using only the weighted averages similar to the 1988 NSPS. We considered all comments and focused on those that discussed the data in detail. As mentioned earlier in section IV, based on the data and comments submitted, we have determined that the final rule will require weighted averages for Step 2 in subpart AAA and individual burn rates for Step 2 in subpart QQQQ.

For subpart AAA Step 2 emission limits, we proposed to require certification compliance at the lowest burn rate (Category 1) and the maximum burn rate (Category 4) rather than the weighted average of the four burn rates, which was required in the 1988 rule. Many comments on the proposal and the data in the NODA strongly supported the proposed compliance determinations per individual burn rates. Many other comments strongly opposed the proposal. Considering all of the comments and focusing on the available test data, especially the EPA wood stove certification test data by burn rate that we included in the July 1, 2014 NODA, we are requiring certification calculations based on the weighted average of the four burn rates for subpart AAA. As discussed earlier in section V.A, the data show that for weighted averages, 18 percent of noncatalytic stoves (that represent over 80 percent of the market) achieve 2.0 g/hr. However, on an individual burn rate basis, only 6 percent (7 of 110 stoves) achieve 2.0 g/hr, a relatively small percentage of wood stoves manufactured today. This supports our decision that a Step 2 limit of 2.0 g/hr, based on a weighted average of the multiple burn rates, better represents

BSER for wood stoves/heaters subject to revised subpart AAA, compared to a Step 2 limit based on individual burn rates.

For subpart QQQQ, the final rule retains the proposed Step 1 g/hr emission cap for all burn rates (for hydronic heaters) and the Step 2 requirement for lb/mmBtu compliance at each burn rate (for both hydronic heaters and forced-air furnaces) given concerns about the sometimes very large emissions at individual burn rates. The emission limits reflect the data available. For a more detailed discussion of these comments and responses, see the RTC document in the docket for this rule.

### 3. National Technology Transfer and Advancement Act (NTTAA)

We received a full range of comments on this issue, from complete support to adamant disagreement with our determinations under the NTTAA at proposal that some portions of some of the ASTM test methods were not applicable or impractical for this rule because they did not achieve the Agency’s mission, goals and objectives. (The NTTAA directs agencies to use voluntary consensus standards whenever applicable methods are available unless they are impractical.) As discussed in the proposal preamble in section VI.I, the rule incorporates some voluntary consensus standards (VCS) by reference, including some ASTM methods and CSA B415.1–10. We could not use some ASTM test methods and other VCS because they were not applicable. That is, the inapplicable VCS did not fully achieve the intent of this rule or the primary mission of the Agency and many tribes, states and local agencies to protect human health and the environment.

Some comments claimed that the EPA cannot take portions of VCS but rather must only use the whole VCS. That position is inconsistent with the intent of the NTTAA goal for reducing duplication of effort. That is, using valuable portions of VCS helps reduce potential duplicative efforts.

Some comments suggested that because the EPA unofficial participants (the EPA employees who were not ASTM members but participated in some of the calls) in certain ASTM test method development efforts did not submit official negatives on the standard, that somehow that meant that the EPA approved all of the details of the draft ASTM test methods. The EPA participants often expressed that the draft test methods were not fully applicable to the needs of the EPA and states; but since the draft test methods

may meet some of the immediate needs of the industry participants, the EPA did not want to stop the ASTM efforts to develop improved drafts. Further, the NTTAA guidance explicitly states that Agency participation does not indicate Agency approval or endorsement.

#### 4. Real World, Cold Starts, Cycling, Moisture, Heat Demand

Many comments indicated a critical need for test methods that reflect the “real world” with cord wood, cold starts, cycling, moisture, heat demand and shorter averaging periods.

We strongly agree, and we will consider alternative cord wood test method requests on a case-by-case basis until we are convinced that improved test methods have been sufficiently demonstrated that they can be relied upon for regulatory purposes. Additionally, we expect that within the next few years we will receive enough “real world” cord wood test data for the EPA to establish revised certification requirements based on those test data.

#### G. Health Effects and Benefits

A more detailed summary of the comments is in the RTC document in the docket.

##### 1. Additional Health Outcomes

Several comments suggested that the EPA should expand its assessment of health benefits.

The RIA includes all possible health impacts related to exposure to wood combustion-related PM<sub>2.5</sub>. Table 7–1 of the RIA on human health effects of ambient PM<sub>2.5</sub> has an extensive list of the above mentioned health endpoints that were considered and monetized, including exacerbation of asthma among children. However, several were assessed qualitatively due to time and resource limitations. Table 7–2 of the RIA shows the results of the assessed health incidence reductions and related benefits from reduced PM<sub>2.5</sub> exposure associated with the proposed option.

##### 2. Additional Pollutants and Outcomes

Comments suggested that the EPA should expand its assessment to include benefits of reductions in CO and VOC and certain non-human health-related benefits including: environmental degradation; accelerated depreciation of capital; haze; contribution to anthropogenic climate change; and harm to pets and livestock.

The EPA understands that the benefits assessment in the RIA reflects only a subset of the benefits attributable to the health effects reductions associated with ambient fine particles. Limitations in data, time and resources prevented the

EPA from quantifying the impacts to, or monetizing the benefits from, several important benefits categories, including benefits associated with the potential exposure to ozone formation due to VOC emissions as a precursor, VOC emissions as a PM<sub>2.5</sub> precursor, CO, as well as ecosystem effects, and visibility impairment due to the absence of air quality modeling data for these pollutants among others in this analysis. However, the EPA provided an extensive qualitative assessment of those benefits. The EPA realizes that the benefits presented are an underestimate of the overall benefits resulting from this rule and that these reductions will help with ozone and PM planning.

##### 3. Additional Benefits of Reducing Greenhouse Gases

Comments suggested that we expand the benefits analyses to include the benefits of reducing greenhouse gases.

The EPA agrees that there will be added benefits from assessing impacts of emission reductions of carbon dioxide (CO<sub>2</sub>), methane and black carbon. While we know that these emissions will be reduced along with the reductions of PM emission and the increases in efficiency of the affected heaters, we do not have robust emissions test data to make quantitative benefits analysis on climate change at this time.

One commenter referred to the interagency Social Cost of Carbon (SCC) estimates. The comment suggested that (1) EPA should use SCC to reflect the monetized CO<sub>2</sub> impacts of the proposed rule in the RIA; and (2) EPA should use the SCC estimates published in 2010 instead of the updated SCC estimates published in 2013 because the updated estimates have not been subject to public comment. The SCC represents the monetized net damages of incremental changes in the amount of CO<sub>2</sub> emissions in a given year. Given that CO<sub>2</sub> impacts of the proposed rule were not analyzed, the SCC estimates were not used in the RIA.

##### 4. Uncertainty of “Value per Statistical Life”

Commenters stated that the EPA’s use of the Value per Statistical Life (VSL)—that is, the monetized value attributable to mortality reduction—is a source of uncertainty.

While the Agency is updating its guidance by incorporating the most up-to-date literature and recent recommendations from the Science Advisory Board Environmental Economics Advisory Committee (SAB–EEAC), it has determined that a single, peer-reviewed estimate applied

consistently best reflects the SAB–EEAC advice until updated guidance is available. Therefore, the EPA, after consulting with the Office of Management and Budget (OMB), has decided to use the value established in the 2000 Guidelines for all the EPA actions until a revised estimate can be fully vetted.

The EPA will continue to look into approaches based on the best available science as appropriate. The EPA will continue to recommend the central estimate of \$7.4 million (\$2006), updated to the year of the analysis, be used in all benefits analyses that seek to quantify mortality risk reduction benefits regardless of the age, income, or other population characteristics of the affected population until revised guidance becomes available. This approach was vetted and endorsed by the Agency when the 2000 “Guidelines for Preparing Economic Analyses” were drafted. Although \$7.4 million (\$2006) remains EPA’s default guidance for valuing mortality risk changes, the Agency has considered and presented others and may well consider the commenter recommendation in future assessments.

We agree that there is uncertainty. Recent analyses have estimated substantial increases in life expectancy and the number of life years gained due to improved PM<sub>2.5</sub> air quality. For example, Hubbell (2006) estimated that reducing exposure to PM<sub>2.5</sub> from air pollution regulations may result in an average gain of 15 years of life for those adults prematurely dying from PM<sub>2.5</sub> exposure. In contrast, Pope et al. (2009) estimated changes in average life expectancy at birth over a 20-year period, suggesting that reducing exposure to air pollution may increase average life expectancy at birth by approximately 7 months, which was 15 percent of the overall increase in life expectancy at birth from 1980 through 2000.

##### 5. Uncertainty in the EPA Analyses Regarding the Constant Benefits-per-Ton Simplifying Assumption, Dose-Response Relationship, and Benefits Transfer Approach

Comments suggested that the relationship between pollution and human health is more complex than the EPA’s simplifying assumptions and thus more uncertain.

The EPA’s methods for quantifying health benefits of emission reductions are based on the best available peer-reviewed science and methods that have withstood scrutiny from the EPA’s independent Science Advisory Board (SAB), the National Academy of

Sciences (NRC, 2002), and continuous interagency review.

The RIA references a peer-reviewed manuscript and technical support document (TSD) that each describe the methods EPA employed to quantify the per-ton benefit of reducing fine particle levels from various sources. The air quality modeling attributed fine particle levels to residential wood heaters, holding all other sectors constant—giving us greater confidence that we have correctly characterized the air quality and health impacts attributable to this sector.

With respect to the incidence of benefits among populations living in locations already attaining the primary NAAQS, the EPA acknowledges that primary NAAQS are set at a level deemed by the EPA Administrator to be protective of public health with an adequate margin of safety. At the same time, primary NAAQS are not set at a level of zero risk and there is no known threshold below which PM<sub>2.5</sub> does not cause adverse health effects. Thus, the EPA recognizes that reducing the emissions level in those areas could still have health benefits.

Additional detail of our responses is included in the final RIA.

## VI. Summary of Environmental, Cost, Economic, and Non-Air Health and Energy Impacts

The EPA estimates the total annualized average nationwide costs associated with this rule would be \$45.7 million (\$2013) over the timeframe of 2015 through 2020. The economic impacts for industries affected by this rule over this same period, estimated as a percent of annual compliance cost to sales, range from 1.1 percent for manufacture of pellet stove models to 17.1 percent for manufacture of hydronic heater models. These impacts do not presume any pass-through of impacts to consumers. With pass-through to consumers, these impact estimates to manufacturers will decline proportionate to the degree of pass-through.

### A. What are the air quality impacts?

In section IV of the preamble to the proposed rule, we described the procedure we used to determine the air quality impacts on the industries affected by this rule. Following proposal, we revised the standards for room heaters and central heaters based on public comments. Table 6 is a summary of the revised estimated annual average emissions reductions over years 2015 through 2020 resulting from implementing the final NSPS compared to baseline conditions (for the

years analyzed in the final RIA). As in the proposal, we developed emission factors for each appliance type and then applied those emission factors to shipment data for each of the appliance types subject to the final NSPS.<sup>16</sup> We developed the emission factors using the EPA Residential Wood Combustion (RWC) emission estimation tool,<sup>17</sup> which is a Microsoft Access database that compiles nationwide RWC emissions using county-level, process-specific data and calculations. The compilation of such data is a large, important, continually improving effort by the EPA and the states to ensure that we and the states have access to the best information available. For the final rule, we used the updated version of the tool. The updated tool includes the results of a peer-reviewed emission testing study of hydronic heaters conducted by the EPA Office of Research and Development and the New York State Energy Research and Development Agency. (The study was added to the docket prior to proposal but the tool was not updated until after proposal.) The results of that study show much higher emissions for hydronic heaters at baseline than we estimated at proposal. We have used the updated emission factors because they are based on the best available scientific information. We summed the estimated nationwide number of appliances and the estimated total tons of wood burned for each of the relevant product categories in the inventory and then made some adjustments/assumptions to the baseline RWC inventory to reflect emission characteristics specific to new units. As described below, to avoid any potential for overstating baseline emissions, we went a step further and assumed that all new shipments will meet the current State of Washington Department of Ecology limits, which are approximately 40 percent less than the 1988 NSPS.

Single burn rate stoves are not included in the RWC database as separate identifiable units. For our analysis, we used the same baseline emission factor as freestanding non-certified wood stoves. We used the average tons burned per appliance factor as representative of these stoves as well.

After calculating a baseline average emission rate/appliance (or “emission inventory category”), we multiplied the total tons of wood burned for the

appliance by the RWC emission factor (adjusted as appropriate) to calculate the total tons of PM<sub>2.5</sub> emissions. We divided this value by the number of appliances in the category to calculate the baseline average PM<sub>2.5</sub> emissions per individual appliance. The next step was to develop emission factors representing the final NSPS. The timing of the NSPS emission limits used in this analysis matches the phased-in compliance dates.

For the subpart AAA analysis, we used HPBA data from their 2010 analysis that indicated that at least 90 percent (130 out of 145 catalytic, non-catalytic and pellet stoves combined) already meet the Step 1 PM emission limit. Manufacturers are expected to focus on existing models that already meet the Washington State DOE limits in order to comply with the Step 1 PM emission limit. Furthermore, certification data<sup>18</sup> indicate that 26 percent of non-catalytic and catalytic stoves combined and 70 percent of pellet stoves already meet the Step 2 PM emission limit. For our analysis, we used 26 percent of adjustable burn rate stoves and 70 percent of pellet stoves for the percentages that can already meet the Step 2 PM emission limit without intensive R&D efforts. Although previously unregulated and a less developed technology than adjustable burn rate stoves, single burn rate stove designs have been undergoing R&D in anticipation of the proposed NSPS and cleaner designs are in progress.

For the subpart QQQQ analysis for hydronic heaters, we note that the Step 1 PM emission limit is the EPA “Phase 2” voluntary program lb/mmBtu weighted average emission limit is already met by 50 hydronic heater models built by U.S. manufacturers participating in the voluntary program. We also note that 19 additional qualification tests have been recently submitted to EPA and, if valid, all 19 will be added as Phase 2 qualified models and Step 1 NSPS certified models. The NSPS Step 2 PM emission limit is already met by 9 hydronic heater models built by U.S. manufacturers participating in the voluntary program, as well as over 100 European models per test method EN 303–05 and over 20 pellet boilers (U.S. and European) that have been qualified in the RHNY program. Data indicate that at least 18 percent of current hydronic heater model designs can meet the Step 2 emission limit without intensive R&D efforts.

<sup>16</sup> Memo to USEPA from EC/R, Inc. Estimated Emissions from Wood Heaters. January 2015.

<sup>17</sup> Emission factors are based on EPA’s Residential Wood Combustion Tool version 4.1 with updates from the 2012 EPA report (Gullett et al. Environmental, Energy Market, and Health Characterization of Wood-Fired Hydronic Heater, Final Report, June 2012).

<sup>18</sup> Memo to USEPA from EC/R, Inc. Derivation of wood heater model percentages meeting Step 2 standards. November 2014.

For the subpart QQQQ analysis for forced-air furnaces, we note that the Step 1 PM emission limit is based on test data from certifications under the Canadian standard B415.1–10 (circa 2010) and conversations with industry regarding cleaner forced-air furnace models currently being tested in R&D. As discussed earlier in this preamble, forced-air furnace designs able to meet the Step 2 limit are based on technology transferred from hydronic heater designs and/or wood stove designs.

Next we used data in the Frost & Sullivan Market (F&S) report<sup>19</sup> on 2008 shipments by product category, and F&S revenue forecasts which incorporated the weak economy in years 2009 and 2010, to calculate the reduced number of shipments in years 2009 and 2010. Forced-air furnaces were outside the scope of the F&S report. Instead, we used manufacturer estimates of total industry sales in 2008 and applied the F&S market factors to estimate shipments through 2010. The F&S wood stove numbers included both certified and non-certified stoves, so we estimated numbers of non-certified stove shipments out of the total reported wood stove category (*i.e.*, 40,000 single burn rate stoves shipped in 2008). These shipments were deleted from the total wood stove category shipments. We expanded the 2008 single burn rate estimate using the F&S factors.

For years 2011 through 2029, estimated shipments are generally based on a forecasted revenue growth rate of 2.0 percent, in keeping with the average annual growth in real U.S. GDP predicted by the Conference Board.<sup>20</sup> Historically wood heater shipments have most closely corresponded to GDP, housing starts, and price of wood relative to natural gas. The overall trend in the projection is reasonable in the absence of additional specific shipment projections. We did not change the relative percentages of one type of residential wood heater versus other types of residential wood heaters over this time period. The only exceptions to the use of a 2.0 percent U.S. GDP-based growth rate are for years 2012 and 2018, in which we used industry estimates for hydronic heater and wood stove shipments, respectively. For year 2012, an HPBA consultant estimated there were 13,100 baseline hydronic heater sales.<sup>21</sup> For year 2018, the same HPBA consultant projected there to be 100,000 wood stove sales.<sup>22</sup> We adjusted our estimated shipment data accordingly.

Our cost effectiveness analysis (CE) is based on industry data that show that a given model design will often be sold for approximately 10 years before being redesigned (a 10-year “model design lifespan”) and that each individual stove will be used for 20 years before it is replaced in a residence (a 20-year

“use/emitting appliance lifespan”). These time periods were used to best characterize the actual model design and use lifespans. For proposal, we used a 20-year model design lifespan because many models developed for the 1988 NSPS are still being sold (after 25 years), with many “new” models retaining the same internal working parts with merely exterior cosmetic changes. In response to comments on the proposed rule,<sup>23</sup> however, in which some industry representatives commented that a shorter model lifespan is more typical, and provided data for models for several manufacturers, we reduced the model design lifespan to 10 years for this analysis. Regarding the emitting lifespan of the appliance, most wood heaters in consumer homes emit for at least 20 years and often much longer. Therefore, our CE analysis tracks shipments through year 2029 (using a 10-year design life for a model meeting the Step 2 emission limit in year 2020) and emissions through year 2048 (using a 20-year emitting life for an appliance shipped in year 2029).

Table 6 is a summary of the average emissions reductions over years 2015 through 2020 resulting from implementing the NSPS compared to baseline conditions (for the years analyzed in the RIA).

TABLE 6—ESTIMATED ANNUAL AVERAGE (2015–2020) AIR QUALITY IMPACTS<sup>24</sup>

Appliance type	PM <sub>2.5</sub> (tons)			VOC (tons)			CO (tons)		
	Baseline	Revised NSPS	Emission reduction	Baseline	Revised NSPS	Emission reduction	Baseline	Revised NSPS	Emission reduction
Wood Heaters .....	422	388	34	601	554	47	6,048	5,528	520
Single Burn Rate Heaters .....	922	238	684	1,597	326	1,271	6,954	3,830	3,124
Pellet Heaters/Stoves .....	59	53	6	1	1	0	307	277	30
Furnace: Indoor, Cord Wood .....	6,984	2,944	4,040	7,355	3,101	4,254	39,285	16,561	22,724
Hydronic Heating Systems .....	3,844	338	3,506	4,048	356	3,692	21,623	1,902	19,721
Total .....	12,231	3,962	8,269	13,602	4,337	9,265	74,218	28,099	46,119

**Note:** This table only includes the emissions during the first year of the life of each wood heater. That is, this table does not include the emissions that continue for the duration of the lifetime of each appliance's use, typically greater than 20 years. The EPA acknowledges that this is an underestimate of the actual total emission impacts but this table is provided to allow comparisons on a first year basis.

Minor discrepancies are due to rounding.

<sup>19</sup> Market Research and Report on North American Residential Wood Heaters, Fireplaces, and Hearth Heating Products Market. Prepared by Frost & Sullivan. April 26, 2010. P. 31–32.

<sup>20</sup> Global Economic Outlook 2014, projections prepared by the Conference Board, May 2014 update; <http://www.conference-board.org/data/globaloutlook.cfm>.

<sup>21</sup> Cost-Effectiveness Analysis of Alternative Hydronic Heater New Source Performance Standards, prepared for the Hearth, Patio, and Barbecue Association by NERA Economic Consulting, May 2014. (Attachment 3 of HPBA's comment to the Docket EPA–HQ–OAR–2009–0734).

<sup>22</sup> Cost-Effectiveness Analysis of Alternative Woodstove New Source Performance Standards,

prepared for the HPBA by NERA Economic Consulting, May 2014. (Attachment 2 of HPBA's comment to Docket EPA–HQ–OAR–2009–0734).

<sup>23</sup> Comments on the proposed NSPS are available electronically through <http://www.regulations.gov> by searching Docket IDs EPA–HQ–OAR–2009–0734.



### B. What are the benefits?

Emission reductions associated with the requirements of this rule will generate substantial health benefits by reducing emissions of PM<sub>2.5</sub>, HAPs, as well as criteria pollutants and their precursors, including CO and VOC. VOC are precursors to PM<sub>2.5</sub> and ozone. For this rule, we were only able to quantify the monetized health co-benefits associated with reduced exposure from directly emitted PM<sub>2.5</sub>.

Our benefits reflect the average of annual PM<sub>2.5</sub> emission reductions occurring between 2015 and 2020 (inclusive). We estimate the monetized PM<sub>2.5</sub>-related health benefits of the residential wood heaters NSPS in the 2015–2020 timeframe to be \$3.4 billion to \$7.6 billion (2013 dollars) at a 3-percent discount rate and \$3.1 billion to \$6.9 billion (2013 dollars) at a 7-percent discount rate. (These estimates are greater than the estimates at proposal because the emission reduction

estimates are greater, as discussed in section VI.A of this preamble and the RIA.) Using alternate relationships between PM<sub>2.5</sub> and premature mortality supplied by experts, higher and lower benefits estimates are plausible, but most of the expert-based estimates fall between these two estimates.<sup>25</sup> A summary of the emission reduction and monetized benefits estimates for this rule at discount rates of 3 percent and 7 percent is in Table 7 of this preamble.

TABLE 7—SUMMARY OF MONETIZED PM<sub>2.5</sub>-RELATED HEALTH BENEFITS FOR PROPOSED RESIDENTIAL WOOD HEATERS NSPS IN 2015–2020 TIMEFRAME

[millions of 2013 dollars]<sup>a b c</sup>

Pollutant	Estimated emission reductions (tpy)	Total monetized benefits (3% discount rate)	Total monetized benefits (7% discount rate)
Directly emitted PM <sub>2.5</sub> .....	8,269	\$3,400 to \$7,600	\$3,100 to \$6,900
<b>PM<sub>2.5</sub> Precursors</b>			
VOC .....	9,265		

<sup>a</sup> All estimates are for the 2015–2020 timeframe (inclusive) and are rounded to two significant figures so numbers may not sum across rows. The total monetized benefits reflect the human health benefits associated with reducing exposure to PM<sub>2.5</sub> through reductions of PM<sub>2.5</sub> precursors, such as NO<sub>x</sub>, and directly emitted PM<sub>2.5</sub>. It is important to note that the monetized benefits do not include reduced health effects from exposure to HAP, direct exposure to NO<sub>2</sub>, exposure to ozone, VOC, ecosystem effects, effects from black carbon or visibility impairment.

<sup>b</sup> PM benefits are shown as a range from Krewski, *et al.* (2009) to Lepeule, *et al.* (2012).

<sup>c</sup> These models assume that all fine particles, regardless of their chemical composition, are equally potent in causing premature mortality because the scientific evidence is not yet sufficient to allow differentiation of effects estimates by particle type.

These benefit estimates represent the monetized human health benefits for populations exposed to less PM<sub>2.5</sub> from emission limits established to reduce air pollutants in order to meet this rule. Due to analytical limitations, it was not possible to conduct air quality modeling for this rule. Instead, we used a “benefit-per-ton” approach to estimate the benefits of this rulemaking. To create the benefit-per-ton estimates, this approach uses a model to convert emissions of PM<sub>2.5</sub> precursors into changes in ambient PM<sub>2.5</sub> levels and another model to estimate the changes in human health associated with that change in air quality, which are then divided by the emissions in specific sectors. These benefit-per-ton estimates were derived using the approach published in Fann, *et al.*, (2012),<sup>26</sup> but they have since been updated to reflect these studies and population data in the

2012 p.m. NAAQS RIA.<sup>27</sup> Specifically, we multiplied the benefit-per-ton estimates from the “Residential Wood Heaters” category by the corresponding emission reductions.<sup>28</sup> All national-average benefit-per-ton estimates reflect the geographic distribution of the modeled air quality. The air quality modeling may not reflect the local variability in population density, meteorology, exposure, baseline health incidence rates, or other local factors for any specific location. More information regarding the derivation of the benefit-per-ton estimates for this category is available in the technical support document, which is referenced in footnote 26 and is available in the docket.

These models assume that all fine particles, regardless of their chemical composition, are equally potent in causing premature mortality because the

scientific evidence is not yet sufficient to allow differentiation of effects estimates by particle type. Even though we assume that all fine particles have equivalent health effects, the benefit-per-ton estimates vary between precursors depending on the location and magnitude of their impact on PM<sub>2.5</sub> levels, which drive population exposure.

It is important to note that the magnitude of the PM<sub>2.5</sub> benefits is largely driven by the concentration response function for premature mortality. We cite two key empirical studies, one based on the American Cancer Society cohort study<sup>29</sup> and the extended Six Cities cohort study.<sup>30</sup> In the RIA for this rule, which is available in the docket, we also include benefits estimates derived from expert judgments (Roman *et al.*, 2008) as a characterization of uncertainty

<sup>24</sup> Memo to USEPA from EC/R, Inc. Estimated Emissions from Wood Heaters. January 2015.

<sup>25</sup> Roman, *et al.*, 2008. “Expert Judgment Assessment of the Mortality Impact of Changes in Ambient Fine Particulate Matter in the U.S.,” *Environ. Sci. Technol.*, 42, 7, 2268–2274.

<sup>26</sup> Fann, N., K.R. Baker, and C.M. Fulcher. 2012. “Characterizing the PM<sub>2.5</sub>-related health benefits of emission reductions for 17 industrial, area and mobile emission sectors across the U.S.” *Environment International* 49 41–151.

<sup>27</sup> U.S. Environmental Protection Agency (U.S. EPA). *Regulatory Impact Analysis for the Final Revisions to the National Ambient Air Quality Standards for Particulate Matter*. EPA-452/R-12-003. Office of Air Quality Planning and Standards, Health and Environmental Impacts Division. December 2012. Available at <http://www.epa.gov/pm/2012/finalria.pdf>.

<sup>28</sup> U.S. Environmental Protection Agency. Technical support document: Estimating the benefit per ton of reducing PM<sub>2.5</sub> precursors from 17 sectors. Research Triangle Park, NC. January 2013.

<sup>29</sup> Krewski, C.A., III, R.T. Burnett, M.J. Thun, E.E. Calle, D. Krewski, K. Ito, and G.D. Thurston. 2002. “Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution.” *Journal of the American Medical Association* 287:1132–1141.

<sup>30</sup> Lepeule J, Laden F, Dockery D, Schwartz J. 2012. “Chronic Exposure to Fine Particles and Mortality: An Extended Follow-Up of the Harvard Six Cities Study from 1974 to 2009.” *Environ Health Perspect.* Jul;120(7):965–70.

regarding the PM<sub>2.5</sub>-mortality relationship.

Considering a substantial body of published scientific literature, reflecting thousands of epidemiology, toxicology, and clinical studies, the EPA's Integrated Science Assessment for Particulate Matter<sup>31</sup> documents the association between elevated PM<sub>2.5</sub> concentrations and adverse health effects, including increased premature mortality. This assessment, which was reviewed twice by the EPA's independent Clean Air Scientific Advisory Committee, concluded that the scientific literature consistently finds that a no-threshold model most adequately portrays the PM-mortality concentration-response relationship. Therefore, in this analysis, the EPA assumes that the health impact function for fine particles is without a threshold.

In general, we are more confident in the magnitude of the risks we estimate from simulated PM<sub>2.5</sub> concentrations that coincide with the bulk of the observed PM concentrations in the epidemiological studies that are used to estimate the benefits. Likewise, we are less confident in the risk we estimate from simulated PM<sub>2.5</sub> concentrations that fall below the bulk of the observed data in these studies. Concentration benchmark analyses [e.g., lowest measured level (LML) or one standard deviation below the mean of the air quality data in the study] allow readers to determine the portion of population exposed to annual mean PM<sub>2.5</sub> levels at or above different concentrations, which provides some insight into the level of uncertainty in the estimated PM<sub>2.5</sub> mortality benefits. There are uncertainties inherent in identifying any particular point at which our confidence in reported associations becomes appreciably less, and the scientific evidence provides no clear dividing line. However, the EPA does not view these concentration benchmarks as a concentration threshold below which we would not quantify health benefits of air quality improvements.

For this analysis, policy-specific air quality data are not available. Thus, we are unable to estimate the percentage of premature mortality associated with this specific rule's emission reductions at each PM<sub>2.5</sub> level. As a surrogate measure of mortality impacts, we provide the percentage of the population exposed at each PM<sub>2.5</sub> level using the source

apportionment modeling used to calculate the benefit-per-ton estimates for this sector. Using the Krewski, *et al.*, (2009) study, 93 percent of the population is exposed to annual mean PM<sub>2.5</sub> levels at or above the LML of 5.8 µg/m<sup>3</sup>. Using the Lepeule, *et al.*, (2012) study, 67 percent of the population is exposed above the LML of 8 µg/m<sup>3</sup>. It is important to note that baseline exposure is only one parameter in the health impact function, along with baseline incidence rates, population, and change in air quality. Therefore, caution is warranted when interpreting the LML assessment for this rule.

Every benefit analysis examining the potential effects of a change in environmental protection requirements is limited, to some extent, by data gaps, model capabilities (such as geographic coverage) and uncertainties in the underlying scientific and economic studies used to configure the benefit and cost models. Despite these uncertainties, the benefit analysis for this rule provides a reasonable indication of the expected health benefits of the rulemaking under a set of reasonable estimations.

One should note that the monetized benefits estimates provided above do not include benefits from several important benefit categories, including exposure to HAP, VOC and ozone exposure, as well as ecosystem effects, visibility impairment and greenhouse gas impacts. Although we do not have sufficient information or modeling available to provide monetized estimates for these benefits in this rule, we include a qualitative assessment of these unquantified benefits in the RIA<sup>32</sup> for this final rule.

For more information on the benefits analysis, please refer to the RIA for this rule, which is available in the docket.

### C. What are the cost impacts?

In analyzing the potential cost impacts of the NSPS, we considered two types of impacts. The first was the impact to the manufacturer to comply with the proposed standards. The second was the increase in price of the affected unit. In both of these cases, we considered the same input variables: Research and development (R&D) cost to develop and certify complying model lines, certification costs (where these are separate from R&D), reporting and recordkeeping costs, numbers of shipments of each appliance category (modified, from Frost & Sullivan report), number of manufacturers, and number of models per manufacturer. This

section of the preamble contains a summary of these costs. For more detailed information, see the manufacturer cost impact memo<sup>33</sup> and unit cost memo<sup>34</sup> in the docket. Unless otherwise specified, all costs are in 2013 dollars.

As discussed in detail in section IV.C, we reviewed information provided by HPBA and manufacturers. Based on this information, we estimated<sup>35</sup> average costs to develop a new model line. The estimates of the cost of R&D are crucial to our estimates of overall costs and economic impacts and greatly influence our decisions on BSER and implementation lead times. We annualized the R&D costs over 6 years, applied the NSPS implementation assumptions, and estimated the average manufacturing cost per model line per manufacturer.

The estimate of the number of model types was derived from information provided by HPBA, individual manufacturers, and Internet searches of product offerings. For numbers of manufacturers, we started with HPBA data and modified the dataset based on Internet searches of manufacturers of the major appliance types. Table 8 is a summary of the nationwide average annual NSPS-related cost increases to manufacturers. The average annual cost increases are presented over the 2015 to 2020 period consistent with the years analyzed in the RIA,<sup>36</sup> but were also analyzed over the 2015 to 2029 period. The 2015 to 2029 period encompasses the 2015 NSPS compliance year through the life span of models designed to meet the NSPS, as explained further below and in our background analyses.<sup>37</sup>

TABLE 8—SUMMARY OF NATIONWIDE AVERAGE ANNUAL COST INCREASES [2013\$]

Appliance type	2015–2020 Period
Wood Heaters .....	\$3,020,000
Single Burn Rate Heaters .....	870,000
Pellet Heaters/Stoves .....	1,520,000
Forced-Air Furnaces .....	15,360,000

<sup>33</sup> Memo to USEPA from EC/R, Inc. Residential Heater Manufacturer Cost Impacts. January 2015.

<sup>34</sup> Memo to USEPA from EC/R, Inc. Unit Cost Estimates of Residential Wood Heating Appliances. January 2015.

<sup>35</sup> In developing average R&D costs, we used the highest industry R&D estimates supplied for cost components we deemed attributable to the NSPS, in order to avoid under-estimating potential costs per model line. We also assumed no model consolidation to avoid understating the number of model lines that would undergo R&D nationwide.

<sup>36</sup> RIA for the Final Residential Wood Heaters NSPS.

<sup>37</sup> Memo to USEPA from EC/R, Inc. Residential Heater Cost Effectiveness Analysis. January 2015.

<sup>31</sup> U.S. Environmental Protection Agency (U.S. EPA). 2009. *Integrated Science Assessment for Particulate Matter (Final Report)*. EPA-600-R-08-139F. National Center for Environmental Assessment—RTP Division. December. Available on the Internet at <http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=216546>.

<sup>32</sup> RIA for the Final Residential Wood Heaters NSPS.

TABLE 8—SUMMARY OF NATIONWIDE AVERAGE ANNUAL COST INCREASES—Continued  
[2013\$]

Appliance type	2015–2020 Period
Hydronic Heating Systems .....	24,880,000
Total Average Annual Cost ...	45,660,000

To develop estimates of potential unit cost increases, we used major variables including the estimated number of units shipped per year, the costs to develop new models, baseline costs of models, and the schedule by which the revised NSPS would be implemented. Both the number of shipped units and the baseline costs of models (manufacturers' cost not retail price) were initially based on data from the Frost & Sullivan report with modifications to address additional appliances or subsets of appliances and industry comments as discussed in our background analyses.<sup>38</sup> We also estimated the potential additional manufacturing costs to make NSPS complying models. These expenses result from the use of more expensive structural materials, components to enhance good combustion, etc. We estimated the following additional manufacturing costs per unit based on appliance type:

- Certified wood stoves and pellet stoves represent a well-developed

technology and we could not identify price differences between models with lower emission levels compared to models with higher emission levels. Some stoves with lower emission sell for less than some stoves with higher emissions and vice versa. Therefore, we have assumed no additional manufacturing costs.

- One manufacturer estimated that it will cost an average of \$100 more to manufacture a lower emitting single burn rate product (exclusive of recovering R&D cost), which we updated to 2013 (\$), approximately \$110.<sup>39</sup>

- We have limited information that indicates the cost to produce a forced-air furnace that complies with a Step 1 emission limit is approximately 75 percent more, or \$1,700 (exclusive of recovering R&D cost).<sup>40</sup>

- As can be seen in hydronic heater market survey results, the prices of qualified model hydronic heaters range from \$6,995 to \$15,395, with the average retail price of \$10,193. We adjusted this value to exclude the 25 percent retail markup, resulting in a manufacturers' cost estimate of \$8,154.<sup>41</sup> We estimated an approximate increase of \$3,200 to manufacture a qualified unit compared to an unqualified unit.

Our next step was to develop the following incremental cost formula: Cost of amortized R&D multiplied by number of models divided by number of units shipped per year equals the

incremental cost of developing a new unit, spread over the number of units expected to be sold during a given year in the 6-year model development period. In developing this calculation, we included the concept that the R&D costs per model line are recovered in the sales price of future models, which means that the more units that are sold, the lower the incremental cost per unit. For our unit cost analysis, we used a flat rate in shipments—that is, future shipments over the 6-year model development period would be equal to the shipments estimated in the first year of the 6-year model development period (2015). The flat rate was used because we had no basis for concluding that sales of a given model line would increase or decrease over time due to market competition with other wood heaters or non-wood heaters, changes in consumer demand, changes in the relative price for that model compared to other models or any other factors. Where there are additional manufacturing costs as discussed above, we added these to the unit cost number. Table 9 shows the change in cost to develop and manufacture a stove from baseline (before the NSPS revisions) to after the NSPS revisions are implemented. The economic impacts of these costs are discussed in section C, “*What are the economic impacts?*” More information on both the costs and economic impacts is available in the RIA.

TABLE 9—SUMMARY OF UNIT COSTS  
[Appliance prices in 2013\$]

Appliance type	Cost at baseline (2014)	Total cost during NSPS model development (2015–2020)	Incremental cost increase (to recover amortized costs)
Certified Wood Heaters .....	\$1,259	\$1,307	\$48
Single Burn Rate Heaters .....	271	410	139
Pellet Heaters/Stoves .....	1,384	1,430	46
Forced-Air Furnaces .....	974	3,225	2,251
Hydronic Heating Systems .....	4,923	10,287	5,364

More information is available in the RIA.

#### D. What are the economic impacts?

The economic impacts of the rule are estimated using industry-level estimates of annualized compliance cost to value of shipments (receipts) for affected industries. In this case, cost-to-receipts ratios approximate the maximum price increase needed for a producer to fully

recover the annualized compliance costs associated with a regulation. Essentially, the revenues to producers will likely fully cover the annualized compliance cost incurred by producers at this maximum price increase. Any price increase above the cost-to-receipts ratio provides revenues that exceed the

compliance costs. These industry level cost-to-receipts ratios can be interpreted as an average impact on potentially affected firms in these industries. Cost-to-receipts ratios for the affected product types range from 1.1 percent for pellet heaters/stoves to up to 17.1 percent for hydronic heaters. More

<sup>38</sup> Memo to USEPA from EC/R, Inc. Unit Cost Estimates of Residential Wood Heating Appliances. January 2015.

<sup>39</sup> NSPS Review and Comments. Confidential Business Information. September 2010.

<sup>40</sup> Confidential Business Information.

<sup>41</sup> Cost-Effectiveness Analysis of Alternative Hydronic Heater New Source Performance Standards. Prepared by NERA Consulting for the

Hearth, Patio and Barbecue Association. May 2014. p. 10.

information on how these impacts are estimated can be found in Chapters 5 and 6 of the RIA.

In estimating the net benefits of regulation, the appropriate cost measure is “social costs.” Social costs represent the welfare costs of the rule to society and fully represent the cost impacts regardless of whether they are ultimately borne by manufacturers or consumers. Social costs are best approximated by the compliance costs estimated for this rule. Thus, the annualized social costs are best estimated to be \$45.7 million, based on the estimate of costs to manufacturers and assuming no cost pass-through to consumers. Several comments noted that these potential price increases can often be offset by the homeowner in one or two heating seasons by the reduced cost of fuel due to the increased heating efficiencies. More information on how these social costs are estimated can be found in Chapter 5 of the RIA.

#### *E. What are the non-air quality health and energy impacts?*

These NSPS are anticipated to have no impacts or only negligible impacts on water quality or quantity, waste disposal, radiation or noise. To the extent new NSPS models are more efficient, that would lead to reduced wood consumption, thereby saving timber and preserving woodlands and vegetation for aesthetics, erosion control, carbon sequestration, and ecological needs.

It is difficult to determine the precise energy impacts that might result from this rule. On the one hand, to the extent that the NSPS wood-fueled appliance is more efficient, energy outputs per mass of wood fuel consumed will rise. However, wood-fueled appliances compete with other biomass forms as well as more traditional oil, electricity, and natural gas. Robust data are not available for us to be able to determine the potential for consumers to choose other types of fuels and their associated appliances if the consumer costs of wood-fueled appliances increase and at what level that increase would drive consumer choice. Similarly, robust data are not available for us to determine the degree to which better information on the energy efficiency of the NSPS appliances will encourage consumers to choose new wood-fueled appliances over other new appliances.

## **VII. Statutory and Executive Order Reviews**

### *A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review*

This action is an economically significant regulatory action that was submitted to the Office of Management and Budget (OMB) for review. Any changes made in response to OMB recommendations have been documented in the docket. The EPA prepared an analysis of the potential costs and benefits associated with this action. This analysis, “Regulatory Impact Analysis (RIA) for Residential Wood Heaters NSPS Revision, Final Report” (EPA-452/R-15-001), is available in the docket.

A summary of the monetized benefits and net benefits for the final rule at discount rates of 3 percent and 7 percent is in Table 1 of this preamble, and a more detailed discussion of the benefits is found in section IV.B of this preamble. For more information on the benefits analysis, please refer to the RIA for this rulemaking, which is available in the docket. For more information on the cost analysis, please refer to the RIA or cost memoranda prepared for this rulemaking, all of which is available in the docket.

### *B. Paperwork Reduction Act (PRA)*

The information collection requirements in the rule have been submitted for approval to OMB under the PRA. The Information Collection Request (ICR) documents that the EPA prepared for each subpart have been assigned the EPA ICR number 1176.12 for subpart AAA and ICR number 2442.02 for subpart QQQQ. You can find a copy of the ICR documents in the docket for this rule, and they are briefly summarized here. The new information collection requirements are not enforceable until OMB approves them.

This final rule will require manufacturers of new residential wood heating devices to submit applications for certification of model lines, to submit results of emissions tests conducted to demonstrate that the model lines would comply with the emission limits and produce certified units according to a quality control plan approved by an independent certifying body. Manufacturers must submit a notification of the initial test and biennial reports that each certified model line remains unchanged. They must also maintain records of all certification data, maintain results of quality assurance program inspections

and emissions test data, and seal and store the tested appliance.

Consistent with the current ICR for subpart AAA, we have included costs to manufacture and apply permanent labels on each applicable unit prior to sale. These labels provide important compliance information to enforcement officials and important information to consumers for purchasing appliances. The amended NSPS allows (voluntary) use of EPA temporary labels for the cleanest heaters in order to provide consumers the ability to select wood heaters that meet or exceed the Step 2 standards prior to the 2020 compliance date. This voluntary temporary label option ends upon the 2020 compliance date. Furthermore, the amended NSPS also allows (voluntary) use of temporary EPA labels to indicate wood heaters that meet Step 2 based on cord wood instead of crib wood, allowing consumers to select heaters better tuned to in-home performance. The cost of the voluntary temporary labels are not included because they are not required.

Test laboratories that want to conduct NSPS certification testing will need to apply for approval, conduct proficiency testing and report the results of all such testing. The approved laboratories must maintain records of all certification tests, proficiency tests and compliance audit test data.

The required notifications are used to inform the agency when a new model line is expected to be tested. The EPA and states may then observe the testing, if desired. Emissions test reports are needed as these are the agency’s record of a model line’s initial capability to comply with the emission limit, and serve as a record of the operating conditions under which compliance was achieved. All information submitted to the EPA for which a claim of confidentiality is made (e.g., design drawings) will be safeguarded according to the EPA regulations set forth in 40 CFR 2.201 *et seq.*, Chapter 1, Part 2, Subpart B—Confidentiality of Business Information.

Adequate recordkeeping and reporting are necessary to ensure compliance with these standards as required by the CAA. The information collected from recordkeeping and reporting requirements is also used for prioritizing inspections and is of sufficient quality to be used as evidence in court. We have reviewed all the current requirements and have removed the portions of the recordkeeping that are not necessary.

The EPA considered how to minimize the potential ICR burdens and has incorporated several features that make a major paperwork reduction impact.

For example, the rule allows one representative heater to be tested for a model line rather than requiring every heater to be tested. The revised subpart AAA itself “deems” automatic EPA certification of heaters that have EPA certifications under the 1988 NSPS that show that they would meet the Step 1 emission limits until Step 2. That is, no additional certification is required until Step 2. Also, the new subpart QQQQ deems automatic EPA NSPS Step 1 certification for hydronic heaters with valid EPA Phase 2 qualifications under the EPA Hydronic Heater Partnership Agreement of October 12, 2011 or hydronic heaters or forced-air furnaces certified by the NYSDEC that show compliance with the Step 1 emission levels. That is, no additional certification is required until Step 2. Also, residential pellet hydronic heaters/boilers that have been qualified under the Renewable Heat New York (RHNY) program will be automatically deemed EPA certified to meet the NSPS Step 1 and no additional certification is required until Step 2 provided that they comply with the RHNY requirements for installation and operation with adequate thermal storage.

**Respondents/affected entities:** Manufacturers of new residential wood heaters and laboratories that conduct or plan to conduct wood heater certification tests.

**Respondent's obligation to respond:** Mandatory under section 111 of the CAA.

**Estimated number of respondents:** 72 respondents under subpart AAA (66 manufacturers and 6 testing laboratories); 41 respondents under subpart QQQQ (37 manufacturers and 4 testing laboratories).

**Frequency of responses:** once per model line, annually, biennially, variable and/or infrequent.

**Total estimated burden:** 2,947 labor hours (per year) under subpart AAA; 2,337 labor hours (per year) under subpart QQQQ. Burden is defined at 5 CFR 1320.3(b).

**Total estimated cost:** \$1,716,990 (per year) under subpart AAA, includes \$1,466,440 annualized capital and operation & maintenance costs; \$3,383,100 (per year) under subpart QQQQ, includes \$3,191,200 annualized capital and operation & maintenance costs.

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for the EPA's regulations in 40 CFR are listed in 40 CFR part 9. When OMB approves this ICR, the agency will

announce that approval in the **Federal Register** and publish a technical amendment to 40 CFR part 9 to display the OMB control number for the approved information collection activities contained in this final rule.

### C. Regulatory Flexibility Act (RFA)

Pursuant to sections 603 and 609(b) of the RFA, the EPA prepared an initial regulatory flexibility analysis (IRFA) for the proposed rule and convened a Small Business Advocacy Review (SBAR) Panel to obtain advice and recommendations from small entity representatives that potentially would be subject to the rule's requirements. Summaries of the IRFA and Panel recommendations are presented in the proposed rule at 79 FR 6329.

As required by section 604 of the RFA, the EPA prepared a final regulatory flexibility analysis (FRFA) for this action. The FRFA addresses the issues raised by public comments on the IRFA for the proposed rule. The complete FRFA is available for review in the docket and is summarized here.

- **Reason Why Action Is Being Considered.** As discussed earlier in this preamble, this final rule was developed following CAA section 111(b)(1)(B) review of the existing residential wood heater NSPS, and because emissions from residential wood heaters can be a significant source of air pollution, and thus adverse health effects, in some areas.

- **Statement of Objectives and Legal Basis of Rule.** As discussed earlier in this preamble, the EPA is amending Standards of Performance for New Residential Wood Heaters and adding one new subpart, Standards of Performance for New Residential Hydronic Heaters and Forced-Air Furnaces. This final rule achieves several objectives, including applying updated emission limits that reflect BSER; improving coverage of the broad suite of residential wood heaters; improving the test methods; and streamlining the certification process. This final rule does not include any requirements on heaters solely fired by coal, gas or oil. This final rule does not establish new emissions limits for existing heaters. This rule was developed under the authority of CAA section 111.

- **Response to Any Comments to the Proposed Rule Filed by the Chief Counsel for Advocacy of the SBA.** The SBA's Chief Counsel for Advocacy did not file any comments to the proposed rule.

- **Description and Estimate of the Number of Small Entities.** As discussed earlier in this preamble, small entities

that the EPA anticipates being affected by this rule will include almost all manufacturers of residential wood heaters. We estimate that roughly 250–300 U.S. companies manufacture residential wood heaters.

Approximately 90 percent of these manufacturers meet the SBA small-entity definition of having fewer than 500 employees.

- **Description of reporting, recordkeeping and other compliance requirements.** The reporting and recordkeeping requirements are described in the section immediately above (B. *Paperwork Reduction Act*). As discussed there, the information collection requirements (ICR), including reporting and recordkeeping, in this rule have been submitted for approval to OMB under the *Paperwork Reduction Act*, 44 U.S.C. 3501 *et seq.* For subpart AAA, we estimated the potential annual burden averaged over the first 3 years of the ICR to be a total of 2,947 labor hours per year at a total labor cost of \$250,551 per year and an average annual labor burden per response of 12 hours. For subpart QQQQ, we estimated 2,337 labor hours per year at a total labor cost of \$191,904 per year and an average annual labor burden per response of 12 hours.

- **Description of other compliance requirements.** As described earlier in this preamble, this rule will apply updated emission limits that reflect the current best systems of emission reduction (BSER) and improve the coverage of the expanded variety of types of residential wood heaters. We estimate the NSPS's total annualized average nationwide costs will be \$45.7 million (2013\$) over the 2015 through 2020 period. The economic impacts for industries affected by this rule over this same period range from 1.1 percent for manufacture of pellet stove models to as much as 17.1 percent compliance cost-to-sales estimate for manufacture of hydronic heater models. These impacts do not presume any pass-through of impacts to consumers. With pass-through to consumers, these impact estimates to manufacturers will decline proportionate to the degree of pass-through. We estimate that small entities will have annualized costs of greater than 1 percent of their sales in all affected industries, and NAICS 442299 with receipts less than \$10 million. Those establishments in NAICS 332510, 333414 and 423720 with cost-to-receipt ratios higher than 1 percent account for 90 percent of small entities affected in these industries. Establishments in NAICS 442299 with cost-to-receipt ratios higher than 1 percent account for

99 percent of small entities affected in these industries.

- Relevant federal rules that may overlap or conflict with this rule. There are no other relevant federal rules.
- Significant alternatives. The significant alternatives to this rule, especially those that might minimize potential impacts on small entities, are presented in the remainder of this section.

As required by section 609(b) of the RFA, as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA), the EPA also convened a Small Business Advocacy Review Panel (Panel) to obtain advice and recommendations of representatives of the small entities that potentially would be subject to the rule's requirements. The following paragraphs describe the process, the type of small entity representatives, the outreach efforts and the Panel members.

Well before beginning the formal SBREFA process, the EPA actively engaged in outreach with HPBA, MHA and PFI and many of their member companies to discuss the rule under development and to provide these contacts with an early opportunity to ask questions and discuss their concerns.<sup>42</sup> The EPA provided each small business with general information on the SBREFA process and background information on the NSPS rulemaking process and current schedule.

Based on consultations with the SBA, and resulting from solicited self-nominations, we prepared a list of 30 potential Small Entity Representatives (SERs), from residential wood heating appliance manufacturers (wood heaters, pellet heaters/stoves, hydronic heaters, forced-air furnaces and masonry heaters), other wood-burning appliance manufacturers (fireplaces, cook stoves), equipment suppliers, chimney sweeps, test laboratories, masons and trade associations. Once the official pre-Panel process began and potential SERs were identified, the EPA held an outreach meeting with the potential SERs and invited representatives from the Office of Advocacy of the Small Business Administration (OA/SBA) and the Office of Information and Regulatory Affairs within the Office of Management and Budget (OIRA/OMB) on June 29, 2010, to solicit their feedback on the upcoming proposed rulemaking. Representatives from 26 of the 30

companies and organizations that we selected as potential SERs for this SBREFA process participated in the meeting (in person and by phone). At that meeting, the EPA solicited written comments from the potential SERs, which were later summarized and shared with the Panel as part of the convening document.

The SBAR Panel convened on August 4, 2010. The Panel consisted of representatives of the EPA, OA/SBA and OIRA/OMB. The Panel held a formal outreach meeting/teleconference with the SERs on August 25, 2010. To help the SERs prepare for this meeting, on August 11, 2010, the Panel sent a list of questions, preliminary cost information and other materials to each of the SERs via email. Additional materials were emailed to the SERs on August 19, 2010. The Panel provided the opportunity for questions and comment during the meeting on various aspects of the proposal being developed, including the expanded scope of the rule, changes to the current requirements under consideration, preliminary cost information and follow up from the June 29, 2010, meeting on the SERs' ideas for regulatory flexibility. During the August 25 meeting, SERs voiced general support for the planned proposed rule and shared specific concerns with the Panel members. As a result of this meeting, the EPA received many useful verbal comments, and the EPA received many helpful written comments by September 10, 2010.

Consistent with the RFA/SBREFA requirements, the Panel evaluated the assembled materials and small-entity comments on issues related to elements of the Interim Regulatory Flexibility Analysis. A copy of the Panel final full report is included in the docket for this rule. We have attempted to follow the Panel's recommendations to the degree we can while also ensuring that the options are practicable, enforceable, environmentally sound and consistent with the CAA. For those recommendations not adopted by the EPA, we included an explanation at proposal for why we rejected them.

Further information about the panel is provided in the FRFA and the SBREFA Panel final report that are included in the docket for this rule.

In addition, the EPA is preparing a Small Entity Compliance Guide to help small entities comply with this rule. Small entities can obtain a copy of this guide at <http://www.epa.gov/rfa/compliance-guides.html> or <http://www2.epa.gov/residential-wood-heaters>. We expect the Small Entity Compliance Guide to be available by April 2015.

#### *D. Unfunded Mandates Reform Act (UMRA)*

This action does not contain any unfunded mandates of \$100 million or more as described in UMRA, 2 U.S.C. 1531–1538, and does not significantly or uniquely affect small governments. This action imposes no enforceable duty on any state, local or tribal governments. The nationwide annualized average compliance cost of this rule for directly affected appliances is \$45.7 million/yr in the 2015–2020 timeframe (2013\$). Therefore, this final rule is not be subject to the requirements of sections 202 or 205 of the UMRA.

This final rule is also not subject to the requirements of section 203 of UMRA because it contains no regulatory requirements that might significantly or uniquely affect small governments. The rule does not apply to such governments and will impose no obligations upon them.

#### *E. Executive Order 13132: Federalism*

This action does not have federalism implications. It will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

The rule will not impose any requirements on state and local governments. Thus, Executive Order 13132 does not apply to this final rule. Although section 6 of Executive Order 13132 does not apply to this final action, the EPA did consult with representatives of state and local governments in developing this action. In the spirit of Executive Order 13132 and consistent with the EPA policy to promote communications between the EPA and state and local governments, the EPA solicited comment on the proposed rule from state and local officials. We have responded to their significant comments in this preamble and in the RTC document.

#### *F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments*

This action does not have tribal implications as specified in Executive Order 13175. This rule will not impose any requirements on tribal governments. Thus, Executive Order 13175 does not apply to this action.

Consistent with the EPA Policy on Consultation and Coordination with Indian Tribes, the EPA consulted with tribal officials during the development of this action. A summary of that consultation is provided here. During

<sup>42</sup> Also, as noted in the proposal preamble in the discussion of development of the proposed hydronic heater emission limits, the EPA worked with the hydronic heater industry in 2006 to develop a voluntary partnership program to encourage manufacture of cleaner models, [www.epa.gov/burnwise/participation](http://www.epa.gov/burnwise/participation).

the development of the proposed rulemaking, the EPA conducted outreach with numerous tribal representatives to provide opportunities for input prior to development of the proposed rule. We provided information at the July 2010, National Tribal Forum/ National Tribal Air Association (NTAA) meeting in Albuquerque, New Mexico, and the November 2010, EPA Region 10 Tribal Leaders Summit in Juneau, Alaska. We also presented information on this proposed rulemaking in the April 2010, issue of Tribal Air News and during the EPA/NTAA tribal workgroup conference calls (April 2010, July 2010, August 2010, and May 2013). Specifically, we received input from the EPA/NTAA tribal workgroup members on culturally relevant exclusions from the proposed standards. We agreed with their input, clarified that we do not intend to regulate ceremonial fires, and added a definition to the rule to exclude traditional Native American bake ovens.

On February 18, 2011, the EPA mailed letters to about 600 elected tribal leaders in the U.S. offering an opportunity for consultation on this proposal. We received requests from six tribes. These tribes agreed to discuss this proposal with us in a conference call held on March 22, 2011. The tribes were very supportive of this proposal and provided some helpful clarifications of definitions (e.g., Native American bake ovens) that we have incorporated in this proposal. We continued to provide updates on the rule on the EPA/NTAA conference calls and to offer opportunities to tribal leaders for consultation. On January 30, 2014, and September 25, 2014, we presented updates for tribes at the monthly EPA/NTAA conference calls.

The air quality and public health benefits to be achieved by this rule will benefit tribes. The emissions occur in neighborhoods and affect people in their homes. To the extent that populations are particularly sensitive to asthma, this rule will help.

#### *G. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks*

This action is not subject to Executive Order 13045 because the EPA does not believe the environmental health risks or safety risks addressed by this action present a disproportionate risk to children. This action's health and risk assessments are contained in the RIA as well as the report "Analysis of Exposure to Residential Wood Combustion Emissions for Different Socio-Economic

Groups"<sup>43</sup> which shows that on a nationwide basis, cancer risks due to residential wood smoke emissions among disadvantaged population groups generally are lower than the risks for the general population due to residential wood smoke emissions. One of the demographic variables examined for this report was that of people 18 years and younger. The full report is available in the docket.

This final rule is expected to reduce environmental impacts for everyone, including children. This action promulgates emissions limits at the levels based on BSER, as required by the CAA. Based on our analysis, we believe this rule will not have a disproportionate impact on children, and, in fact, will result in improvements to children's health. These emissions happen in neighborhoods and affect people in their homes. To the extent that children are particularly sensitive to asthma, this rule will help.

#### *H. Executive Order 13211: Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use*

This action is not a "significant energy action" because it is not likely to have a significant adverse effect on the supply, distribution or use of energy. Further, we have concluded that this rule is not likely to have any significant adverse energy effects. In general, we expect the NSPS to improve technology, including energy efficiency. Reducing emissions and increasing efficiency might increase the use of wood fuel, which would relieve pressure on traditional coal or petroleum based energy sources. However, as described in section VI.E, it is difficult to determine the precise energy impacts that might result from this rule. This is because wood-fueled appliances compete with other biomass forms as well as more traditional oil, electricity and natural gas. Robust data are not available to determine the potential conversion to other types of fuels and their associated appliances if the consumer costs of wood-fueled appliances increase and at what level that increase would drive consumer choice.

<sup>43</sup> "Analysis of Exposure to Residential Wood Combustion Emissions for Different Socio-Economic Groups, Revised Draft Report." Prepared for Gil Wood, U.S. EPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC. Prepared by EC/R Inc., EPA Contract No. EP-D-05-085, Work Assignment No. 4-3. April 22, 2010.

#### *I. National Technology Transfer and Advancement Act (NTTAA) and 1 CFR Part 51*

This action involves technical standards. The EPA has decided to use several VCS ASTM International test methods, in full or in part, including the following:

- E2515-11 "Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel." This test method is applicable for the determination of particulate matter emissions from solid-fuel-burning appliances including woodstoves, pellet-burning appliances, factory-built fireplaces, masonry fireplaces, masonry heaters, indoor furnaces, and indoor and outdoor hydronic heaters within a laboratory environment;
- E2779-10 "Standard Test Method for Determining Particulate Matter Emissions from Pellet Heaters." This test method covers the fueling and operating protocol for determining particulate matter emissions from fires in pellet or other granular or particulate biomass burning room heaters and fireplace inserts;
- E2780-10 "Standard Test Method for Determining Particulate Matter Emissions from Wood Heaters." This test method covers the fueling and operating protocol for determining particulate matter emissions from wood fires in wood-burning room heaters and fireplace inserts as well as determining heat output and efficiency; and
- E2618-13 "Standard Test Method for Measurement of Particulate Matter Emissions and Heating Efficiency of Outdoor Solid Fuel-Fired Hydronic Heating Appliances." This test method applies to wood-fired or automatically fed biomass burning hydronic heating appliances. These appliances transfer heat to the indoor environment through circulation of a liquid heat exchange media such as water or a water-antifreeze mixture.

In addition, we determined that the VCS ASTM E871-82 (Reapproved 2013), "Standard Test Method for Moisture Analysis of Particulate Wood Fuels" is acceptable as an alternative to that portion of the EPA Methods 5H and 28. ASTM E871-82 (Reapproved 2013) covers the determination of total weight basis moisture in the analysis sample of particulate wood fuel. These VCS test methods are available for purchase from ASTM International, 100 Barr Harbor Drive, P.O. Box CB700, West Conshohocken, Pennsylvania 19428-2959, (800) 262-1373, <http://www.astm.org>. A hard copy of this material is also available for viewing in



the docket for this rule (Docket ID# EPA-HQ-OAR-2009-0734), the EPA Docket Center, Public Reading Room, EPA WJC West, Room 3334, 1301 Constitution Ave. NW., Washington, DC. The telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the EPA Docket Center is (202) 566-1742.

The EPA will also use, in part, the following test VCS CSA method available at the CSA Web site [http://shop.csa.ca/en/canada/fuel-burning-equipment/b4151-10/inv/27013322010/CSA\\_B415.1-10](http://shop.csa.ca/en/canada/fuel-burning-equipment/b4151-10/inv/27013322010/CSA_B415.1-10) "Performance Testing of Solid-fuel-burning Heating Appliances." This standard specifies requirements for performance testing of solid-fuel-burning heating appliances, including maximum emission rates. This standard also specifies a method for determining heat outputs, appliance efficiencies, emission levels and composition, and flue gas flow rates. A hard copy of this material is also available for viewing in the docket for this rule (Docket ID# EPA-HQ-OAR-2009-0734) at the EPA Docket Center located at the address and telephone numbers above.

Finally, we will use, in part, the following VCS test method, European National (EN) standard prepared by the European Union: EN 303-5 "Heating boilers for solid fuels, hand and automatically stoked nominal heat output of up to 1025 MBtu—Terminology, requirements, testing, and marketing." This EN standard applies to heating boilers including safety devices up to a nominal heat output of 500 kilowatts, which are designed for the burning of solid fuels only and are operated according to the instructions of the boiler manufacturer. This EN standard material is available for purchase at <http://www.en-standard.eu/csn-en-303-5-heating-boilers-part-5-heating-boilers-for-solid-fuels-manually-and-automatically-stoked-nominal-heat-output-of-up-to-500-kw-terminology-requirements-testing-and-marking/?gclid=CMv3wrBfrsACFU4F7Aod3yoAcw>. A hard copy of this material is also available for viewing in the docket for this rule (Docket ID# EPA-HQ-OAR-2009-0734), at the EPA Docket Center located at the address and telephone numbers above. We believe that all the methods listed above have some positive aspects that can help stakeholders determine emissions under various operation conditions. For more details, please refer to section 6 of the RTC document.

The search identified five other VCS that were potentially applicable for this rule in lieu of the EPA reference methods. However, the EPA determined

that the five candidate VCS would not be applicable and practical due to lack of equivalency, documentation, validation data and other important technical and policy considerations. The five VCS and other information and conclusion, including the search and review results, are in the docket for this rule. The EPA solicited comments on this aspect of the proposed rulemaking. Specifically, we invited the public to identify potentially applicable voluntary consensus standards and to explain why such standards, in whole or in part, should or should not be used in this regulation. The EPA's responses to the significant comments are presented in section V of this preamble and in section 6 of the RTC document.

*J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*

The EPA believes the human health or environmental risk addressed by this action will not have potential disproportionately high and adverse human health or environmental effects on minority, low-income or indigenous populations because it does not affect the level of protection provided to human health or the environment. The results of this evaluation are contained in the report "Analysis of Exposure to Residential Wood Combustion Emissions for Different Socio-Economic Groups" which shows that on a nationwide basis, cancer risks due to residential wood smoke emissions among disadvantaged population groups generally are lower than the risks for the general population due to residential wood smoke emissions.<sup>44</sup> Rather, the rule increases the level of environmental protection for all affected populations without having any disproportionately high and adverse human health or environmental effects on any population, including any minority, low-income or indigenous population.

This rule establishes national standards that will reduce primarily PM emissions from new residential wood heaters and, thus, is expected to decrease the amount of these emissions to which all affected populations are exposed. These emissions happen in many neighborhoods nationwide, including in minority and low-income

neighborhoods and affect people in their homes. To the extent that minority populations and low-income populations are more vulnerable, this rule will help.

*K. Congressional Review Act (CRA)*

This action is subject to the CRA, and the EPA will submit a rule report to each House of the Congress and to the Comptroller General of the United States. This action is a "major rule" as defined by 5 U.S.C. 804(2).

**List of Subjects in 40 CFR Part 60**

Environmental protection, Administrative practice and procedure, Air pollution control, Carbon monoxide, Hazardous substances, Incorporation by reference, Intergovernmental relations, Particulate matter, Reporting and recordkeeping requirements.

Dated: February 3, 2015.

**Gina McCarthy,**  
Administrator.

For the reasons stated in the preamble, title 40, chapter I, of the Code of Federal Regulations is amended as set forth below.

**PART 60—STANDARDS OF PERFORMANCE FOR NEW SOURCES**

- 1. The authority citation for part 60 continues to read as follows:

**Authority:** 42 U.S.C. 7401 *et seq.*

**Subpart A—General Provisions**

- 2. Section 60.17 is amended by revising paragraph (a) and the introductory text to paragraph (g); and by adding paragraphs (g)(202) through (206), (s) and (t) to read as follows:

**§ 60.17 Incorporations by reference.**

(a) Certain material is incorporated by reference into this part with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, the EPA must publish notice of change in the **Federal Register** and the material must be available to the public. All approved material is available for inspection at the EPA Docket Center, Public Reading Room, EPA WJC West, Room 3334, 1301 Constitution Ave. NW., Washington, DC, telephone number 202-566-1744, and is available from the sources listed below. It is also available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call (202) 741-6030 or go to [http://www.archives.gov/federal\\_register/](http://www.archives.gov/federal_register/)

<sup>44</sup> "Analysis of Exposure to Residential Wood Combustion Emissions for Different Socio-Economic Groups, Revised Draft Report." Prepared for Gil Wood, U.S. EPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC. Prepared by EC/R Inc., EPA Contract No. EP-D-05-085, Work Assignment No. 4-3. April 22, 2010.

*code\_of\_federal\_regulations/ibr\_locations.html.*

\* \* \* \* \*

(g) The following material is available for purchase from ASTM International, 100 Barr Harbor Drive, P.O. Box CB700, West Conshohocken, Pennsylvania 19428-2959, (800) 262-1373, <http://www.astm.org>.

\* \* \* \* \*

(202) ASTM E871-82 (Reapproved 2013), Standard Test Method for Moisture Analysis of Particulate Wood Fuels, (Approved August 15, 2013), IBR approved for Appendix A-8: Method 28R.

(203) ASTM E2515-11, Standard Test Method for Determination of Particulate Matter Emissions Collected by a Dilution Tunnel, (Approved November 1, 2011), IBR approved for § 60.534 and § 60.5476.

(204) ASTM E2779-10, Standard Test Method for Determining Particulate Matter Emissions from Pellet Heaters, (Approved October 1, 2010), IBR approved for § 60.534.

(205) ASTM E2618-13 Standard Test Method for Measurement of Particulate Matter Emissions and Heating Efficiency of Outdoor Solid Fuel-Fired Hydronic Heating Appliances, (Approved September 1, 2013), IBR approved for § 60.5476.

(206) ASTM E2780-10, Standard Test Method for Determining Particulate Matter Emissions from Wood Heaters, (Approved October 1, 2010), IBR approved for Appendix A: Method 28R.

\* \* \* \* \*

(s) This material is available for purchase from the Canadian Standards Association (CSA), 5060 Spectrum Way, Suite 100, Mississauga, Ontario, Canada L4W 5N6, Telephone: 800-463-6727.

(1) CSA B415.1-10, Performance Testing of Solid-fuel-burning Heating Appliances, (March 2010), IBR approved for § 60.534 and § 60.5476. (The standard is also available at <http://shop.csa.ca/en/canada/fuel-burning-equipment/b4151-10/inv/27013322010>)

(2) [Reserved]

(t) This European National (EN) standards material is available for purchase at European Committee for Standardization, Management Centre, Avenue Marnix 17, B-1000 Brussels, Belgium, Telephone: + 32 2 550 08 11.

(1) DIN EN 303-5:2012E (EN 303-5), Heating boilers—Part 5: Heating boilers for solid fuels, manually and automatically stoked, nominal heat output of up to 500 kW—Terminology, requirements, testing and marking, (October 2012), IBR approved for § 60.5476. (The standard is also available at <http://www.en-standard.eu/>

*csn-en-303-5-heating-boilers-part-5-heating-boilers-for-solid-fuels-manually-and-automatically-stoked-nominal-heat-output-of-up-to-500-kw-terminology-requirements-testing-and-marking/?gclid=CJXI2P97MMCFdcccQodan8ATA)*

(2) [Reserved]

■ 3. Subpart AAA is revised to read as follows:

#### **Subpart AAA—Standards of Performance for New Residential Wood Heaters**

Sec.

60.530 Am I subject to this subpart?

60.531 What definitions must I know?

60.532 What standards and associated requirements must I meet and by when?

60.533 What compliance and certification requirements must I meet and by when?

60.534 What test methods and procedures must I use to determine compliance with the standards and requirements for certification?

60.535 What procedures must I use for EPA approval of a test laboratory or EPA approval of a third-party certifier?

60.536 What requirements must I meet for permanent labels, temporary labels (hangtags), and owner's manuals?

60.537 What records must I keep and what reports must I submit?

60.538 What activities are prohibited under this subpart?

60.539 What hearing and appeal procedures apply to me?

60.539a Who implements and enforces this subpart?

60.539b What parts of the General Provisions do not apply to me?

#### **Subpart AAA—Standards of Performance for New Residential Wood Heaters**

##### **§ 60.530 Am I subject to this subpart?**

(a) You are subject to this subpart if you manufacture, sell, offer for sale, import for sale, distribute, offer to distribute, introduce or deliver for introduction into commerce in the United States, or install or operate an affected wood heater specified in paragraphs (a)(1) or (a)(2) of this section, except as provided in paragraph (c) of this section.

(1) Each adjustable burn rate wood heater, single burn rate wood heater and pellet stove manufactured on or after July 1, 1988, with a current EPA certificate of compliance issued prior to May 15, 2015 according to the certification procedures in effect in this subpart at the time of certification is an affected wood heater.

(2) All other residential wood heaters as defined in § 60.531 manufactured or sold on or after May 15, 2015 are affected wood heaters, except as provided in paragraph (c) of this section.

(b) Each affected wood heater must comply with the provisions of this subpart unless exempted under paragraphs (b)(1) through (b)(6) of this section. These exemptions are determined by rule applicability and do not require EPA notification or public notice.

(1) Affected wood heaters manufactured in the United States for export are exempt from the applicable emission limits of § 60.532 and the requirements of § 60.533.

(2) Affected wood heaters used for research and development purposes that are never offered for sale or sold and that are not used for the purpose of providing heat are exempt from the applicable emission limits of § 60.532 and the requirements of § 60.533. No more than 50 wood heaters manufactured per model line can be exempted for this purpose.

(3) Appliances that do not burn wood or wood pellets (such as coal-only heaters that meet the definition in § 60.531 or corn-only pellet stoves) are exempt from the applicable emission limits of § 60.532 and the requirements of § 60.533 provided that all advertising and warranties exclude wood burning.

(4) Cook stoves as defined in § 60.531 are exempt from the applicable emission limits of § 60.532 and the requirements of § 60.533.

(5) Camp stoves as defined in § 60.531 are exempt from the applicable emission limits of § 60.532 and the requirements of § 60.533.

(6) Modification or reconstruction, as defined in § 60.14 and § 60.15 of subpart A of this part does not, by itself, make a wood heater an affected facility under this subpart.

(c) The following are not affected wood heaters and are not subject to this subpart:

(1) Residential hydronic heaters and residential forced-air furnaces subject to subpart QQQQ of this part.

(2) Residential masonry heaters that meet the definition in § 60.531.

(3) Appliances that are not residential heating devices (for example, manufactured or site-built masonry fireplaces).

(4) Traditional Native American bake ovens that meet the definition in § 60.531.

##### **§ 60.531 What definitions must I know?**

As used in this subpart, all terms not defined herein have the meaning given them in the Clean Air Act and subpart A of this part.

*Adjustable burn rate wood heater* means a wood heater that is equipped with or installed with a damper or other mechanism to allow the operator to vary

burn rate conditions, regardless of whether it is internal or external to the appliance. This definition does not distinguish between heaters that are free standing, built-in or fireplace inserts.

*Approved test laboratory* means a test laboratory that is approved for wood heater certification testing under § 60.535 or is an independent third-party test laboratory that is accredited under ISO-IEC Standard 17025 to perform testing using the test methods specified in § 60.534 by an accreditation body that is a full member signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement and approved by the EPA for conducting testing under this subpart.

*Camp stove* (sometimes also called cylinder stove or wall tent stove) means a portable stove equipped with a pipe or chimney exhaust capable of burning wood or coal intended for use in a tent or other temporary structure used for hunting, camping, fishing or other outdoor recreation. The primary purpose of the stove is to provide space heating, although cooking and heating water may be additional functions.

*Catalytic combustor* means a device coated with a noble metal used in a wood heater to lower the temperature required for combustion.

*Chip wood fuel* means wood chipped into small pieces that are uniform in size, shape, moisture, density and energy content.

*Coal-only heater* means an enclosed, coal-burning appliance capable of space heating or space heating and domestic water heating, which is marketed and warranted solely as a coal-only heater and has all of the following characteristics:

- (1) An opening for emptying ash that is located near the bottom or the side of the appliance;
- (2) A system that admits air primarily up and through the fuel bed;
- (3) A grate or other similar device for shaking or disturbing the fuel bed or a power-driven or mechanical stoker;
- (4) Installation instructions, owner's manual and marketing information that state that the use of wood in the stove, except for coal ignition purposes, is prohibited by law; and
- (5) A safety listing as a coal-only heater, except for coal ignition purposes, under accepted American or Canadian safety codes, as documented by a permanent label from a nationally recognized certification body.

*Commercial owner* means any person who owns or controls a wood heater in the course of the business of the manufacture, importation, distribution

(including shipping and storage), or sale of the wood heater.

*Cook stove* means a wood-fired appliance that is designed, marketed and warranted primarily for cooking food and that has the following characteristics:

- (1) An oven, with volume of 0.028 cubic meters (1 cubic foot) or greater, and an oven rack;
- (2) A device for measuring oven temperatures;
- (3) A flame path that is routed around the oven;
- (4) An ash pan;
- (5) An ash clean-out door below the oven;
- (6) The absence of a fan or heat channels to dissipate heat from the appliance;
- (7) A cooking surface with an area measured in square inches or square feet that is at least 1.5 times greater than the volume of firebox measured in cubic inches or cubic feet. Example: A cook stove with a firebox of 2 cubic feet must have a cooking surface of at least 3 square feet;
- (8) A portion of at least four sides of the oven (which may include the bottom and/or top) is exposed to the flame path during the heating cycle of the oven. A flue gas bypass may exist for temperature control.

*Fireplace* means a wood-burning appliance intended to be used primarily for aesthetic enjoyment and not as a space heater. An appliance is a fireplace if it is in a model line that satisfies the requirements in paragraphs (1), (2) or (3) of this definition.

(1) The model line includes a safety listing under recognized American or Canadian safety standards, as documented by a permanent label from a nationally recognized certification body affixed on each unit sold, and that said safety listing only allows operation of the fireplace with doors fully open. Operation with any required safety screen satisfies this requirement.

(2) The model line has a safety listing that allows operation with doors closed, has no user-operated controls other than flue or outside air dampers that can only be adjusted to either a fully closed or fully opened position, and the requirements in either paragraph (2)(i) or (2)(ii) of this definition are satisfied.

(i) Appliances are sold with tempered glass panel doors only (either as standard or optional equipment), or

(ii) The fire viewing area is equal to or greater than 500 square inches.

(3)(i) A model line that is clearly positioned in the marketplace as intended to be used primarily for aesthetic enjoyment and not as a room heater, as demonstrated by product

literature (including owner's manuals), advertising targeted at the trade or public (including web-based promotional materials) or training materials is presumptively a fireplace model line.

(ii) The presumption in paragraph (3)(i) of this definition can be rebutted by test data from an EPA-approved test laboratory reviewed by an EPA-approved third-party certifier that were generated when operating the appliance with the door(s) closed, and that demonstrate an average stack gas carbon dioxide (CO<sub>2</sub>) concentration over the duration of the test run equal to or less than 5.00 percent and a ratio of the average stack gas CO<sub>2</sub> to the average stack gas carbon monoxide (CO) equal to or greater than 15:1. The stack gas average CO<sub>2</sub> and CO concentrations for the test run shall be determined in accordance with the requirements in CSA B415.1-10 (IBR, see § 60.17), clause 6.3, using a sampling interval no greater than 1 minute. The average stack gas CO<sub>2</sub> and CO concentrations for purposes of this determination shall be the average of the stack gas concentrations from all sampling intervals over the full test run.

*Manufactured* means completed and ready for shipment (whether or not assembled or packaged) for purposes of determining the date of manufacture.

*Manufacturer* means any entity that constructs or imports into the United States a wood heater.

*Model line* means all wood heaters offered for sale by a single manufacturer that are similar in all material respects that would affect emissions as defined in this section.

*Particulate matter (PM)* means total particulate matter including coarse particulate (PM<sub>10</sub>) and fine particulate (PM<sub>2.5</sub>).

*Pellet fuel* means refined and densified fuel shaped into small pellets or briquettes that are uniform in size, shape, moisture, density and energy content.

*Pellet stove* (sometimes called pellet heater or pellet space heater) means an enclosed, pellet or chip fuel-burning device capable of and intended for residential space heating or space heating and domestic water heating. Pellet stoves include a fuel storage hopper or bin and a fuel feed system. Pellet stoves include, but are not limited to:

(1) Free-standing pellet stoves—pellet stoves that are installed on legs or on a pedestal or other supporting base. These stoves generally are safety listed under ASTM E1509, UL-1482, ULC S627 or ULC-ORD C1482.

(2) Pellet stove fireplace inserts—pellet stoves intended to be installed in masonry fireplace cavities or in other enclosures. These stoves generally are safety listed under ASTM E1509, UL-1482, ULC-S628 or ULC-ORD C1482.

(3) Built-in pellet stoves—pellet stoves intended to be recessed into the wall. These stoves generally are safety listed under ASTM E1509, UL-127, ULC-S610 or ULC-ORD C1482.

*Representative affected wood heater* means an individual wood heater that is similar in all material respects that would affect emissions to other wood heaters within the model line it represents.

*Residential masonry heater* means a factory-built or site-built wood-burning device in which the heat from intermittent fires burned rapidly in the firebox is stored in the refractory mass for slow release to building spaces. Masonry heaters are site-built (using local materials or a combination of local materials and manufactured components) or site-assembled (using factory-built components), solid fuel-burning heating appliances constructed mainly of refractory materials (e.g., masonry materials or soapstone). They typically have an interior construction consisting of a firebox and heat exchange channels built from refractory components, through which flue gases are routed. ASTM E-1602 “Standard Guide for Construction of Solid Fuel Burning Masonry Heaters” provides design and construction information for the range of masonry heaters most commonly built in the United States. The site-assembled models are generally listed to UL-1482.

*Sale* means the transfer of ownership or control, except that a transfer of control of an affected wood heater for research and development purposes within the scope of § 60.530(b)(2) is not a sale.

*Similar in all material respects that would affect emissions* means that the construction materials, exhaust and inlet air systems and other design features are within the allowed tolerances for components identified in § 60.533(k)(2), (3) and (4).

*Single burn rate wood heater* means a wood heater that is not equipped with or installed with a burn control device to allow the operator to vary burn rate conditions. Burn rate control devices include stack dampers that control the outflow of flue gases from the heater to the chimney, whether built into the appliance, sold with it, or recommended for use with the heater by the manufacturer, retailer or installer; and air control slides, gates or any other type

of mechanisms that control combustion air flow into the heater.

*Sold at retail* means the sale by a commercial owner of a wood heater to the ultimate purchaser/user or noncommercial purchaser.

*Third-party certifier* (sometimes called *third-party certifying body* or *product certifying body*) means an independent third party that is accredited under ISO-IEC Standards 17025 and 17065 to perform certifications, inspections and audits by an accreditation body that is a full member signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement and approved by the EPA for conducting certifications, inspections and audits under this subpart.

*Traditional Native American bake oven* means a wood or other solid fuel burning appliance that is designed primarily for use by Native Americans for food preparation, cooking, warming or for instructional, recreational, cultural or ceremonial purposes.

*Unseasoned wood* means wood with an average moisture content of 20 percent or more.

*Valid certification test* means a test that meets the following criteria:

(1) The Administrator was notified about the test in accordance with § 60.534(g);

(2) The test was conducted by an approved test laboratory as defined in this section;

(3) The test was conducted on a wood heater similar in all material respects that would affect emissions to other wood heaters of the model line that is to be certified; and

(4) The test was conducted in accordance with the test methods and procedures specified in § 60.534.

*Wood heater* means an enclosed, wood burning-appliance capable of and intended for residential space heating or space heating and domestic water heating. These devices include, but are not limited to, adjustable burn rate wood heaters, single burn rate wood heaters and pellet stoves. Wood heaters may or may not include air ducts to deliver some portion of the heat produced to areas other than the space where the wood heater is located. Wood heaters include, but are not limited to:

(1) Free-standing wood heaters—Wood heaters that are installed on legs, on a pedestal or suspended from the ceiling. These products generally are safety listed under UL-1482, UL-737 or ULC-S627.

(2) Fireplace insert wood heaters—Wood heaters intended to be installed in masonry fireplace cavities or in other enclosures. These appliances generally

are safety listed under UL-1482, UL-737 or ULC-S628.

(3) Built-in wood heaters—Wood heaters that are intended to be recessed into the wall. These appliances generally are safety listed under UL-1482, UL-737, UL-127 or ULC-S610.

#### **§ 60.532 What standards and associated requirements must I meet and by when?**

(a) *2015 particulate matter emission standards.* Unless exempted under § 60.530(b), each affected wood heater manufactured, imported into the United States, and/or sold at retail on or after May 15, 2015 must be certified to not discharge into the atmosphere any gases that contain particulate matter in excess of a weighted average of 4.5 g/hr (0.010 lb/hr), except that a wood heater manufactured before May 15, 2015 may be imported into the United States and/or sold at retail on or before December 31, 2015. Compliance for all heaters must be determined by the test methods and procedures in § 60.534.

(b) *2020 particulate matter emission standards.* Unless exempted under § 60.530(b) or electing to use the cord wood alternative means of compliance option in paragraph (c) of the section, each affected wood heater manufactured or sold at retail for use in the United States on or after May 15, 2020 must not discharge into the atmosphere any gases that contain particulate matter in excess of a weighted average of 2.0 g/hr (0.0044 lb/hr). Compliance for all heaters must be determined by the test methods and procedures in § 60.534.

(c) *2020 cord wood alternative compliance option.* Each affected wood heater manufactured or sold at retail for use in the United States on or after May 15, 2020 must not discharge into the atmosphere any gases that contain particulate matter in excess of a weighted average of 2.5 g/hr (0.0055 lb/hr). Compliance must be determined by a cord wood test method approved by the Administrator and the procedures in § 60.534.

(d) *Chip wood fuel requirements.* Operators of wood heaters that are certified to burn chip wood fuels must only burn chip wood fuels that have been specified in the owner's manual. The chip wood fuel must meet the following minimum requirements:

(1) Moisture content: less than 35 percent;

(2) Inorganic fines: less than or equal to 1 percent;

(3) Chlorides: less than or equal to 300 parts per million by weight;

(4) Ash content: no more than 2 percent;

(5) No demolition or construction waste; and

(6) Trace metals: less than 100 mg/kg.

(e) *Pellet fuel requirements.* Operators of wood heaters that are certified to burn pellet fuels must only burn pellets that have been specified in the owner's manual and graded under a licensing agreement with a third-party organization approved by the EPA. The Pellet Fuels Institute, ENplus and CANplus are initially deemed to be approved third-party organizations for this purpose, and additional organizations may apply to the Administrator for approval. The pellet fuel must meet the following minimum requirements as assured through a quality assurance program licensed by a third-party organization approved by the EPA:

(1) Density: consistent hardness and energy content with a minimum density of 38 pounds/cubic foot;

(2) Dimensions: maximum length of 1.5 inches and diameter between 0.230 and 0.285 inches;

(3) Inorganic fines: less than or equal to 1 percent;

(4) Chlorides: less than or equal to 300 parts per million by weight;

(5) Ash content: no more than 2 percent;

(6) Contains no demolition or construction waste;

(7) Trace metals: less than 100 mg/kg; and

(8) None of the prohibited fuels in paragraph (f) of this section.

(f) *Prohibited fuel types.* No person is permitted to burn any of the following materials in an affected wood heater:

(1) Residential or commercial garbage;

(2) Lawn clippings or yard waste;

(3) Materials containing rubber, including tires;

(4) Materials containing plastic;

(5) Waste petroleum products, paints or paint thinners, or asphalt products;

(6) Materials containing asbestos;

(7) Construction or demolition debris;

(8) Paper products, cardboard, plywood, or particleboard. The prohibition against burning these materials does not prohibit the use of fire starters made from paper, cardboard, sawdust, wax and similar substances for the purpose of starting a fire in an affected wood heater;

(9) Railroad ties, pressure-treated wood or pallets;

(10) Manure or animal remains;

(11) Salt water driftwood or other previously salt water saturated materials;

(12) Unseasoned wood;

(13) Any materials that are not included in the warranty and owner's manual for the subject wood heater; or

(14) Any materials that were not included in the certification tests for the subject wood heater.

(g) *Operation of affected wood heaters.* The user of an affected residential wood heater must operate the heater in a manner consistent with the owner's manual. The owner's manual must clearly specify that operation in a manner inconsistent with the owner's manual would void the warranty.

(h) *Temperature sensor requirement.* An affected wood heater equipped with a catalytic combustor must be equipped with a temperature sensor that can monitor combustor gas stream temperatures within or immediately downstream [within 2.54 centimeters (1 inch)] of the catalytic combustor surface.

#### **§ 60.533 What compliance and certification requirements must I meet and by when?**

(a) *Certification requirement.* Each affected wood heater must be certified to be in compliance with the applicable emission standards and other requirements of this subpart. For each model line manufactured or sold by a single entity (e.g., company or manufacturer), compliance with applicable emission standards of § 60.532 must be determined based on testing of representative affected wood heaters within the model line. If one entity licenses a model line to another entity, each entity's model line must be certified. If an entity intends to change the name of the entity or the name of the model, the manufacturer must apply for a new certification 60 days before the intended name change.

(1) Except for model lines meeting the requirements of paragraph (h)(1) of this section, on or after May 15, 2015, the manufacturer must submit to the Administrator the information required in paragraph (b) of this section and follow either the certification process in paragraphs (c) through (e) of this section or the third-party certifier-based application process specified in paragraph (f) of this section.

(2) On or after May 16, 2016, the manufacturer must submit the information required in paragraph (b) of this section and follow the third-party certifier-based application process specified in paragraph (f) of this section.

(b) *Application for a certificate of compliance.* Any manufacturer of an affected wood heater must apply to the Administrator for a certificate of compliance for each model line. The application must be submitted to: [WoodHeaterReports@epa.gov](mailto:WoodHeaterReports@epa.gov). The application must be signed by a responsible representative of the manufacturer or an authorized representative and must contain the following:

(1) The model name and design number. The model name and design number must clearly distinguish one model from another. The name and design number cannot include the EPA symbol or logo or name or derivatives such as "EPA."

(2) Engineering drawings and specifications of components that may affect emissions (including specifications for each component listed in paragraph (k)(2), (3) and (4) of this section). Manufacturers may use assembly or design drawings that have been prepared for other purposes, but must designate on the drawings the dimensions of each component listed in paragraph (k) of this section. Manufacturers must identify tolerances of components listed in paragraph (k)(2) of this section that are different from those specified in that paragraph, and show that such tolerances cannot reasonably be anticipated to cause wood heaters in the model line to exceed the applicable emission limits. The drawings must identify how the emission-critical parts, such as air tubes and catalyst, can be readily inspected and replaced.

(3) A statement whether the firebox or any firebox component (including the materials listed in paragraph (k)(3) of this section) will be composed of material different from the material used for the firebox or firebox component in the wood heater on which certification testing was performed, a description of any such differences and demonstration that any such differences may not reasonably be anticipated to adversely affect emissions or efficiency.

(4) Clear identification of any claimed confidential business information (CBI). Submit such information under separate cover to the EPA CBI Office; Attn: Residential Wood Heater Compliance Program Lead, 1200 Pennsylvania Ave. NW., Washington, DC 20004. Note that all emissions data, including all information necessary to determine emission rates in the format of the standard, cannot be claimed as CBI.

(5) All documentation pertaining to a valid certification test, including the complete test report and, for all test runs: Raw data sheets, laboratory technician notes, calculations and test results. Documentation must include the items specified in the applicable test methods. Documentation must include discussion of each test run and its appropriateness and validity, and must include detailed discussion of all anomalies, whether all burn rate categories were achieved, any data not used in the calculations and, for any test runs not completed, the data collected during the test run and the reason(s)

that the test run was not completed and why. The burn rate for the low burn rate category must be no greater than the rate that an operator can achieve in home use and no greater than is advertised by the manufacturer or retailer. The test report must include a summary table that clearly presents the individual and overall emission rates, efficiencies and heat outputs. Submit the test report and all associated required information, according to the procedures for electronic reporting specified in § 60.537(f).

(6) A copy of the warranties for the model line, which must include a statement that the warranties are void if the unit is used to burn materials for which the unit is not certified by the EPA and void if not operated according to the owner's manual.

(7) A statement that the manufacturer will conduct a quality assurance program for the model line that satisfies the requirements of paragraph (m) of this section.

(8) A statement describing how the tested unit was sealed by the laboratory after the completion of certification testing and asserting that such unit will be stored by the manufacturer in the sealed state until 5 years after the certification test.

(9) Statements that the wood heaters manufactured under this certificate will be—

(i) Similar in all material respects that would affect emissions as defined in § 60.531 to the wood heater submitted for certification testing, and

(ii) Labeled as prescribed in § 60.536.

(iii) Accompanied by an owner's manual that meets the requirements in § 60.536. In addition, a copy of the owner's manual must be submitted to the Administrator and be available to the public on the manufacturer's Web site.

(10) A statement that the manufacturer has entered into contracts with an approved laboratory and an approved third-party certifier that satisfy the requirements of paragraph (f) of this section.

(11) A statement that the approved laboratory and approved third-party certifier are allowed to submit information on behalf of the manufacturer, including any claimed to be CBI.

(12) A statement that the manufacturer will place a copy of the certification test report and summary on the manufacturer's Web site available to the public within 30 days after the Administrator issues a certificate of compliance.

(13) A statement of acknowledgment that the certificate of compliance cannot

be transferred to another manufacturer or model line without written approval by the Administrator.

(14) A statement acknowledging that it is unlawful to sell, distribute or offer to sell or distribute an affected wood heater without a valid certificate of compliance.

(15) Contact information for the responsible representative of the manufacturer and all authorized representatives, including name, affiliation, physical address, telephone number and email address.

(c) *Administrator approval process.*

(1) The Administrator may issue a certificate of compliance for a model line if the Administrator determines, based on all information submitted by the applicant and any other relevant information available, that:

(i) A valid certification test demonstrates that the representative affected wood heater complies with the applicable emission standards in § 60.532;

(ii) Any tolerances or materials for components listed in paragraph (k)(2) or (3) of this section that are different from those specified in those paragraphs may not reasonably be anticipated to cause wood heaters in the model line to exceed the applicable emission limits; and

(iii) The requirements of paragraph (b) of this section have been met.

(2) The Administrator will deny certification if the Administrator determines that the criteria in paragraph (c)(1) of this section have not been satisfied. Upon denying certification under this paragraph, the Administrator will give written notice to the manufacturer setting forth the basis for this determination.

(d) *Level of compliance certification.* The Administrator will issue the certificate of compliance for the most stringent particulate matter emission standard that the tested representative wood heater meets under § 60.532.

(e) *Conditional, temporary certificate of compliance.* A conditional, temporary certificate of compliance may be granted by the Administrator until May 16, 2016 based on the manufacturer's submittal of a complete certification application meeting all the requirements in § 60.533(b). The application must include the full test report by an EPA-approved laboratory and all required compliance statements by the manufacturer with the exception of a certificate of conformity by an EPA-approved third-party certifier. The conditional, temporary certificate of compliance would allow manufacture and sales of the affected wood heater model line until May 16, 2016 or until

the Administrator completes the review of the application, whichever is earlier. By May 16, 2016, the manufacturer must submit a certificate of conformity by an EPA-approved third-party certifier.

(f) *Third-party certifier-based application process.* (1) Any manufacturer of an affected wood heater must apply to the Administrator for a certificate of compliance for each model line. The manufacturer must meet the following requirements:

(i) The manufacturer must contract with a third-party certifier for certification services. The contract must include regular (at least annual) unannounced audits under ISO-IEC Standard 17065 to ensure that the manufacturer's quality assurance plan is being implemented. The contract must also include a report for each audit under ISO-IEC Standard 17065 that fully documents the results of the audit. The contract must include authorization and requirement for the third-party certifier to submit all such reports to the Administrator and the manufacturer within 30 days of the audit. The audit report must identify deviations from the manufacturer's quality assurance plan and specify the corrective actions that need to be taken to address each identified deficiency.

(ii) The manufacturer must submit the materials specified in paragraph (b) of this section and a quality assurance plan that meets the requirements of paragraph (m) of this section to the third-party certifier. The quality assurance plan must ensure that units within a model line will be similar in all material respects that would affect emissions to the wood heater submitted for certification testing, and it must include design drawings for the model line.

(iii) The manufacturer must apply to the third-party certifier for a certification of conformity with the applicable requirements of this subpart for the model line.

(A) After testing by an approved test laboratory is complete, certification of conformity with the emission standards in § 60.532 must be performed by the manufacturer's contracted third-party certifier.

(B) The third-party certifier may certify conformity if the emission tests have been conducted per the appropriate guidelines; the test report is complete and accurate; the instrumentation used for the test was properly calibrated; the test report shows that the representative affected wood heater meets the applicable emission limits specified in § 60.532; the quality assurance plan is adequate to ensure that units within the model line

will be similar in all material respects that would affect emissions to the wood heater submitted for certification testing; and that the affected heaters would meet all applicable requirements of this subpart.

(iv) The manufacturer must then submit to the Administrator an application for a certificate of compliance that includes the certification of conformity, quality assurance plan, test report and all supporting documentation specified in paragraph (b) of this section.

(v) The submission also must include a statement signed by a responsible official of the manufacturer or authorized representative that the manufacturer has complied with and will continue to comply with all requirements of this subpart for certificate of compliance and that the manufacturer remains responsible for compliance regardless of any error by the test laboratory or third-party certifier.

(2) The Administrator will issue to the manufacturer a certificate of compliance for a model line if it is determined, based on all of the information submitted in the application for certification and any other relevant information, that:

(i) A valid certification of conformity has demonstrated that the representative affected wood heater complies with the applicable emission standards in § 60.532;

(ii) Any tolerances or materials for components listed in paragraph (k)(2) or (3) of this section that are different from those specified in those paragraphs may not be reasonably anticipated to cause wood heaters in the model line to exceed the applicable emission limits;

(iii) The requirements of paragraph (b) of this section have been met; and

(iv) A valid certificate of conformity for the model line has been prepared and submitted.

(3) The Administrator will deny certification if the Administrator determines that the criteria in paragraph (f)(2) of this section have not been satisfied. Upon denying certification under this paragraph, the Administrator will give written notice to the manufacturer setting forth the basis for the determination.

(g) *Waiver from submitting test results.* An applicant for certification may apply for a potential waiver of the requirement to submit the results of a certification test pursuant to paragraph (b)(5) of this section, if the wood heater meets either of the following conditions:

(1) The wood heaters of the model line are similar in all material respects that would affect emissions, as defined

in § 60.531, to another model line that has already been issued a certificate of compliance. A manufacturer that seeks a waiver of certification testing must identify the model line that has been certified, and must submit a copy of an agreement with the owner of the design permitting the applicant to produce wood heaters of that design.

(2) The manufacturer has previously conducted a valid certification test to demonstrate that the wood heaters of the model line meet the applicable standard specified in § 60.532.

(h) *Certification period.* Unless revoked sooner by the Administrator, a certificate of compliance will be valid for the following periods as applicable:

(1) For a model line that was previously certified as meeting the 1990 Phase II emission standards under the 1988 NSPS, in effect prior to May 15, 2015, at an emission level equal to or less than the 2015 emission standards in § 60.532(a), the model line is deemed to have a certificate of compliance for the 2015 emission standards in § 60.532(a), which is valid until the effective date for the 2020 standards in § 60.532(b) (i.e., until May 15, 2020).

(2) For a model line certified as meeting emission standards in § 60.532, a certificate of compliance will be valid for 5 years from the date of issuance or until a more stringent standard comes into effect, whichever is sooner.

(i) *Renewal of certification.* (1) The manufacturer must request renewal of a model line's certificate of compliance or recertify the model line every 5 years, or the manufacturer may choose to no longer manufacture or sell that model line after the expiration date. If the manufacturer chooses to no longer manufacture that model line, then the manufacturer must submit a statement to the Administrator to that effect.

(2) A manufacturer of an affected wood heater model line may apply to the Administrator for potential renewal of its certificate of compliance by submitting the material specified in paragraph (b) and following the procedures specified in paragraph (f) of this section, or by affirming in writing that the wood heaters in the model line continue to be similar in all material respects that would affect emissions to the representative wood heater submitted for testing on which the original certificate of compliance was based and requesting a potential waiver from certification testing. The application must include a copy of the review of the draft application and approval by the third-party certifier.

(3) If the Administrator grants a renewal of certification, the Administrator will give written notice to

the manufacturer setting forth the basis for the determination and issue a certification renewal.

(4) If the Administrator denies the request for a renewal of certification, the Administrator will give written notice to the manufacturer setting forth the basis for the determination.

(5) If the Administrator denies the request for a renewal of certification, the manufacturer and retailer must not manufacture or sell the previously-certified wood heaters after the expiration date of the certificate of compliance.

(j) [Reserved]

(k) *Recertification.* (1) The manufacturer must recertify a model line whenever any change is made in the design submitted pursuant to paragraph (b)(2) of this section that affects or is presumed to affect the particulate matter emission rate for that model line. The manufacturer of an affected wood heater must apply to the Administrator for potential recertification by submitting the material specified in paragraph (b) and following the procedures specified in paragraph (f) of this section, or by affirming in writing that the change will not cause wood heaters in the model line to exceed applicable emission limits and requesting a potential waiver from certification testing. The application for recertification must be reviewed and approved by the contracted third-party certifier and a copy of the review and approval must be included. The Administrator may waive this requirement upon written request by the manufacturer, if the manufacturer presents adequate rationale and the Administrator determines that the change may not reasonably be anticipated to cause wood heaters in the model line to exceed the applicable emission limits. The granting of such a waiver does not relieve the manufacturer of any compliance obligations under this subpart.

(2) Any change in the design tolerances or actual dimensions of any of the following components (where such components are applicable) is presumed to affect particulate matter and carbon monoxide emissions and efficiency if that change exceeds  $\pm 0.64$  cm ( $\pm 1/4$  inch) for any linear dimension and  $\pm 5$  percent for any cross-sectional area relating to air introduction systems and catalyst bypass gaps unless other dimensions and cross-sectional areas are previously approved by the Administrator under paragraph (c)(1)(ii) of this section:

(i) Firebox: Dimensions;



(ii) Air introduction systems: Cross-sectional area of restrictive air inlets and outlets, location and method of control;

(iii) Baffles: Dimensions and locations;

(iv) Refractory/insulation: Dimensions and location;

(v) Catalyst: Dimensions and location;

(vi) Catalyst bypass mechanism and catalyst bypass gap tolerances (when bypass mechanism is in closed position): Dimensions, cross-sectional area, and location;

(vii) Flue gas exit: Dimensions and location;

(viii) Door and catalyst bypass gaskets: Dimensions and fit;

(ix) Outer thermal shielding and thermal coverings: Dimensions and location;

(x) Fuel feed system: For wood heaters that are designed primarily to burn pellet fuel or wood chips and other wood heaters equipped with a fuel feed system, the fuel feed rate, auger motor design and power rating, and the angle of the auger to the firebox; and

(xi) Forced-air combustion system: For wood heaters so equipped, the location and horsepower of blower motors and the fan blade size.

(3) Any change in the materials used for the following components is presumed to affect particulate matter emissions and efficiency:

(i) Refractory/insulation; or

(ii) Door and catalyst bypass gaskets.

(4) A change in the make, model or composition of a catalyst is presumed to affect particulate matter and carbon monoxide emissions and efficiency, unless the change has been requested by the heater manufacturer and has been approved in advance by the Administrator, based on test data that demonstrate that the replacement catalyst is equivalent to or better than the original catalyst in terms of particulate matter emission reduction.

(l) *Criteria for revocation of certification.* (1) The Administrator may revoke certification if it is determined that the wood heaters being manufactured or sold in that model line do not comply with the requirements of this subpart. Such a determination will be based on all available evidence, including but not limited to:

(i) Test data from a retesting of the original unit on which the certification test was conducted or a unit that is similar in all material respects that would affect emissions;

(ii) A finding that the certification test was not valid. The finding will be based on problems or irregularities with the certification test or its documentation, but may be supplemented by other information;

(iii) A finding that the labeling of the wood heater model line, the owner's manual or the associated marketing information does not comply with the requirements of § 60.536;

(iv) Failure by the manufacturer to comply with reporting and recordkeeping requirements under § 60.537;

(v) Physical examination showing that a significant percentage (as defined in the quality assurance plan approved pursuant to paragraph (m) of this section, but no larger than 1 percent) of production units inspected is not similar in all material respects that would affect emissions to the representative affected wood heater submitted for certification testing;

(vi) Failure of the manufacturer to conduct a quality assurance program in conformity with paragraph (m) of this section; or

(vii) Failure of the approved laboratory to test the wood heater using the methods specified in § 60.534.

(2) Revocation of certification under this paragraph (l) will not take effect until the manufacturer concerned has been given written notice by the Administrator setting forth the basis for the proposed determination and an opportunity to request a hearing under § 60.539.

(m) *Quality assurance program.* On or after May 16, 2016, for each certified model line, the manufacturer must conduct a quality assurance program that satisfies the requirements of paragraphs (m)(1) through (5) of this section. The quality assurance program requirements of this paragraph (m) supersede the quality assurance plan requirements previously specified in § 60.533(o) that was in effect prior to May 15, 2015. The manufacturer of a model line with a compliance certification under paragraph (h)(1) of this section must conduct a quality assurance program that satisfies the requirements of this paragraph (m) by May 16, 2016.

(1) The manufacturer must prepare and operate according to a quality assurance plan for each certified model line that includes specific inspection and testing requirements for ensuring that all units within a model line are similar in all material respects that would affect emissions to the wood heater submitted for certification testing and meet the emissions standards in § 60.532.

(2) The quality assurance plan must be approved by the third-party certifier as part of the certification of conformity process specified in paragraph (f) of this section.

(3) The quality assurance plan must include regular (at least annual) unannounced audits by the third-party certifier under ISO-IEC Standard 17065 to ensure that the manufacturer's quality assurance plan is being implemented.

(4) The quality assurance plan must include a report for each audit under ISO-IEC Standard 17065 that fully documents the results of the audit. The third-party certifier must be authorized and required to submit all such reports to the Administrator and the manufacturer within 30 days of the audit. The audit report must identify deviations from the manufacturer's quality assurance plan and specify the corrective actions that need to be taken to address each identified deficiency.

(5) Within 30 days after receiving each audit report, the manufacturer must report to the third-party certifier and to the Administrator its corrective actions and responses to any deficiencies identified in the audit report. No such report is required if an audit report did not identify any deficiencies.

(n) *EPA compliance audit testing.*

(1)(i) The Administrator may select by written notice wood heaters or model lines for compliance audit testing to determine compliance with the emission standards in § 60.532.

(ii) The Administrator will transmit a written notification of the selected wood heaters or model line(s) to the manufacturer, which will include the name and address of the laboratory selected to perform the audit test and the model name and serial number of the wood heater(s) or model line(s) selected to undergo audit testing.

(2)(i) The Administrator may test, or direct the manufacturer to have tested, a wood heater or a wood heater from the model line(s) selected under paragraph (n)(1)(i) of this section in a laboratory approved under § 60.535. The Administrator may select any approved test laboratory or federal laboratory for this audit testing.

(ii) The expense of the compliance audit test is the responsibility of the wood heater manufacturer.

(iii) The test must be conducted using the same test method used to obtain certification. If the certification test consisted of more than one particulate matter sampling test method, the Administrator may direct the manufacturer and test laboratory as to which of these methods to use for the purpose of audit testing. The Administrator will notify the manufacturer at least 30 days prior to any test under this paragraph, and allow the manufacturer and/or his authorized representatives to observe the test.

(3) *Revocation of certification.* (i) If emissions from a wood heater tested under paragraph (n)(2) of this section exceed the applicable emission standard by more than 50 percent using the same test method used to obtain certification, the Administrator will notify the manufacturer that certification for that model line is suspended effective 72 hours from the receipt of the notice, unless the suspension notice is withdrawn by the Administrator. The suspension will remain in effect until withdrawn by the Administrator, or the date 30 days from its effective date if a revocation notice under paragraph (n)(3)(ii) of this section is not issued within that period, or the date of final agency action on revocation, whichever occurs earliest.

(ii)(A) If emissions from a wood heater tested under paragraph (n)(2) of this section exceed the applicable emission limit, the Administrator will notify the manufacturer that certification is revoked for that model line.

(B) A revocation notice under paragraph (n)(3)(ii)(A) of this section will become final and effective 60 days after the date of written notification to the manufacturer, unless it is withdrawn, a hearing is requested under § 60.539(a)(2), or the deadline for requesting a hearing is extended.

(C) The Administrator may extend the deadline for requesting a hearing for up to 60 days for good cause.

(D) A manufacturer may extend the deadline for requesting a hearing for up to 6 months, by agreeing to a voluntary suspension of certification.

(iii) Any notification under paragraph (n)(3)(i) or (n)(3)(ii) of this section will include a copy of a preliminary test report from the approved test laboratory or federal test laboratory. The test laboratory must provide a preliminary test report to the Administrator within 14 days of the completion of testing, if a wood heater exceeds the applicable emission limit in § 60.532. The test laboratory must provide the Administrator and the manufacturer, within 30 days of the completion of testing, all documentation pertaining to the test, including the complete test report and raw data sheets, laboratory technician notes, and test results for all test runs.

(iv) Upon receiving notification of a test failure under paragraph (n)(3)(ii) of this section, the manufacturer may request that up to four additional wood heaters from the same model line be tested at the manufacturer's expense, at the test laboratory that performed the emissions test for the Administrator.

(v) Whether or not the manufacturer proceeds under paragraph (n)(3)(iv) of this section, the manufacturer may submit any relevant information to the Administrator, including any other test data generated pursuant to this subpart. The manufacturer must bear the expense of any additional testing.

(vi) The Administrator will withdraw any notice issued under paragraph (n)(3)(ii) of this section if tests under paragraph (n)(3)(iv) of this section show either—

(A) That exactly four additional wood heaters were tested for the manufacturer and all four met the applicable emission limits; or

(B) That exactly two additional wood heaters were tested for the manufacturer and each of them met the applicable emission limits and the average emissions of all three tested heaters (the original audit heater and the two additional heaters) met the applicable emission limits.

(vii) If the Administrator withdraws a notice pursuant to paragraph (n)(3)(vi) of this section, the Administrator will revise the certification values for the model line based on the test data and other relevant information. The manufacturer must then revise the model line's labels and marketing information accordingly.

(viii) The Administrator may withdraw any proposed revocation, if the Administrator finds that an audit test failure has been rebutted by information submitted by the manufacturer under paragraph (n)(3)(iv) of this section and/or (n)(3)(v) of this section or by any other relevant information available to the Administrator.

**§ 60.534 What test methods and procedures must I use to determine compliance with the standards and requirements for certification?**

Test methods and procedures specified in this section or in appendices of this part, except as provided under § 60.8(b), must be used to determine compliance with the standards and requirements for certification under §§ 60.532 and 60.533 and for reporting carbon monoxide emissions and efficiency as follows:

(a)(1) For affected wood heaters subject to the 2015 and 2020 particulate matter emission standards of §§ 60.532(a) and (b), the manufacturer must have an EPA-approved test laboratory conduct testing according to paragraphs (a)(1)(i) or (ii) of this section. The manufacturer or manufacturer's authorized representative must submit a summary and the full test reports with all supporting information, including

detailed discussion of all anomalies, whether all burn rate categories were properly achieved, any data not used in the calculations and, for any test runs not completed, the data that were collected and the reason that the test run was not completed. The burn rate for the low burn rate category must be no greater than the rate that an operator can achieve in home use and no greater than is advertised by the manufacturer or retailer. The manufacturer has the option of submitting test results obtained pursuant to either paragraph (a)(1)(i) or (ii) of this section to the Administrator as specified under § 60.537 as part of a request for a certification of compliance.

(i) Conduct testing with crib wood using EPA Method 28R of Appendix A–8 of this part or an alternative crib wood test method approved by the Administrator or the ASTM E2779–10 (IBR, see § 60.17) pellet heater test method to establish the certification test conditions and the particulate matter emission values.

(ii) Conduct testing with cord wood using an alternative cord wood test method approved by the Administrator to establish the certification test conditions and the particulate matter emission values.

(2) For the 2020 cord wood alternative means of compliance option specified in § 60.532(c), the manufacturer must have an EPA-approved test laboratory conduct testing with cord wood using an alternative cord wood test method approved by the Administrator to establish the certification test conditions and the particulate matter emission values.

(b) [Reserved]

(c) For affected wood heaters subject to the 2015 and 2020 particulate matter emission standards specified in § 60.532(a), (b) and (c), particulate matter emission concentrations must be measured with ASTM E2515–11 (IBR, see § 60.17). Four-inch filters and Teflon membrane filters or Teflon-coated glass fiber filters may be used in ASTM E2515–11.

(d) For all tests conducted using ASTM E2515–11 (IBR, see § 60.17) pursuant to this section, the manufacturer and approved test laboratory must also measure the first hour of particulate matter emissions for each test run using a separate filter in one of the two parallel trains. The manufacturer and approved test laboratory must report the test results for the first hour separately and also include them in the total particulate matter emissions per run.

(e) The manufacturer must have the approved test laboratory measure the

efficiency, heat output and carbon monoxide emissions of the tested wood heater using Canadian Standards Administration (CSA) Method B415.1–10 (IBR, see § 60.17), section 13.7.

(f) Douglas fir may be used in ASTM E2779–10, ASTM E2780–10 and CSA B415.1–10 (IBR, see § 60.17).

(g) The manufacturer of an affected wood heater model line must notify the Administrator of the date that certification testing is scheduled to begin by email to [WoodHeaterReports@epa.gov](mailto:WoodHeaterReports@epa.gov). This notice must be received by the EPA at least 30 days before the start of testing. The notification of testing must include the manufacturer's name and physical and email addresses, the approved test laboratory's name and physical and email addresses, the third-party certifier name, the model name and number (or, if unavailable, some other way to distinguish between models), and the dates of testing. The laboratory may substitute certification testing of another affected wood heater on the original date in order to ensure regular laboratory testing operations.

(h) The approved test laboratory must allow the manufacturer, the manufacturer's approved third-party certifier, the EPA and delegated state regulatory agencies to observe certification testing. However, manufacturers must not involve themselves in the conduct of the test after the pretest burn has begun. Communications between the manufacturer and laboratory or third-party certifier personnel regarding operation of the wood heater must be limited to written communications transmitted prior to the first pretest burn of the certification test series. During certification tests, the manufacturer may communicate with laboratory personnel only in writing and only to notify them that the manufacturer has observed a deviation from proper test procedures. All communications must be included in the test documentation required to be submitted pursuant to § 60.533(b)(5) and must be consistent with instructions provided in the owner's manual required under § 60.536(g), except to the extent that they address details of the certification tests that would not be relevant to owners or regulators.

**§ 60.535 What procedures must I use for EPA approval of a test laboratory or EPA approval of a third-party certifier?**

(a) *Test laboratory approval.* (1) A laboratory must apply to the Administrator for approval to test under this rule by submitting documentation that the laboratory is accredited by a nationally recognized accrediting entity under ISO–IEC Standard 17025 to

perform testing using the test methods specified under § 60.534. Laboratories accredited by EPA prior to May 15, 2015 may have until March 16, 2018 to submit documentation that they have accreditation under ISO–IEC Standard 17025 to perform testing using the test methods specified under § 60.534. ISO accreditation is required for all other laboratories performing testing beginning on November 16, 2015.

(2) As part of the application, the test laboratory must:

(i) Agree to participate biennially in an independently operated proficiency testing program with no direct ties to the participating laboratories;

(ii) Agree to allow the Administrator, regulatory agencies and third-party certifiers access to observe certification testing;

(iii) Agree to comply with calibration, reporting and recordkeeping requirements that affect testing laboratories; and

(iv) Agree to perform a compliance audit test at the manufacturer's expense at the testing cost normally charged to such manufacturer if the laboratory is selected by the Administrator to conduct the compliance audit test of the manufacturer's model line. The test laboratory must provide a preliminary audit test report to the Administrator within 14 days of the completion of testing, if the tested wood heater exceeds the applicable emission limit in § 60.532. The test laboratory must provide the Administrator and the manufacturer, within 30 days of the completion of audit testing, all documentation pertaining to the test, including the complete test report and raw data sheets, laboratory technician notes, and test results for all test runs.

(v) Have no conflict of interest and receive no financial benefit from the outcome of certification testing conducted pursuant to § 60.533.

(vi) Agree to not perform initial certification tests on any models manufactured by a manufacturer for which the laboratory has conducted research and development design services within the last 5 years.

(vii) Agree to seal any wood heater on which it performed certification tests, immediately upon completion or suspension of certification testing, by using a laboratory-specific seal.

(viii) Agree to immediately notify the Administrator of any suspended tests through email and in writing, giving the date suspended, the reason(s) why, and the projected date for restarting. The laboratory must submit the operation and test data obtained, even if the test is not completed.

(3) If the EPA approves the laboratory, the Administrator will provide the test laboratory with a certificate of approval for testing under this rule. If the EPA does not approve the laboratory, the Administrator will give written notice to the laboratory setting forth the basis for the determination.

(b) *Revocation of test laboratory approval.* (1) The Administrator may revoke the EPA laboratory approval if it is determined that the laboratory:

(i) Is no longer accredited by the accreditation body;

(ii) Does not follow required procedures or practices;

(iii) Has falsified data or otherwise misrepresented emission data;

(iv) Has failed to participate in a proficiency testing program, in accordance with its commitment under paragraph (a)(2)(i) of this section; or

(v) Has failed to seal a wood heater in accordance with paragraph (a)(2)(vii) of this section.

(2) Revocation of approval under this paragraph (b) will not take effect until the laboratory concerned has been given written notice by the Administrator setting forth the basis for the proposed determination and an opportunity for a hearing under § 60.539. However, if revocation is ultimately upheld, all tests conducted by the laboratory after written notice was given will, at the discretion of the Administrator, be declared invalid.

(c) *Period of test laboratory approval*

(1) With the exception of laboratories meeting the provisions of paragraph (c)(2) of this section, and unless revoked sooner, a certificate of approval for testing under this rule is valid for 5 years from the date of issuance.

(2) Laboratories accredited by the EPA by May 15, 2015, under the provisions of § 60.535 as in effect prior to that date may continue to be EPA accredited and deemed EPA approved for testing under this subpart until May 15, 2018, at which time the EPA accreditation and approval ends unless the laboratory has obtained accreditation under § 60.535 as in effect on that date.

(d) *Third-party certifier approval.* (1) A third-party certifier may apply to the Administrator for approval to be an EPA-approved third-party certifier by submitting credentials demonstrating that it has been accredited by a nationally recognized accrediting entity to perform certifications and inspections under ISO–IEC Standard 17025, ISO–IEC Standard 17065 and ISO–IEC Standard 17020.

(2) As part of the application, the third-party certifier must:

(i) Agree to offer to contract with wood heater manufacturers to perform

third-party certification activities according to the requirements of this subpart;

(ii) Agree to periodically conduct audits as described in § 60.533(m) and the manufacturer's quality assurance program;

(iii) Agree to comply with reporting and recordkeeping requirements that affect approved wood heater testing laboratories and third-party certifiers;

(iv) Have no conflict of interest and receive no financial benefit from the outcome of certification testing conducted pursuant to § 60.533;

(v) Agree to make available to the Administrator supporting documentation for each wood heater certification and audit; and

(vi) Agree to not perform initial certification reviews on any models manufactured by a manufacturer for which the third-party certifier has conducted research and development design services within the last 5 years.

(3) If approved, the Administrator will provide the third-party certifier with a certificate of approval. The approval will expire 5 years after being issued unless renewed by the third-party certifier. If the EPA denies the approval, the Administrator will give written notice to the third-party certifier for the basis for the determination.

(e) *Revocation of third-party certifier approval.* (1) The Administrator will revoke a third-party certifier's EPA approval if it is determined that the certifier;

(i) Is no longer accredited by the accreditation body;

(ii) Does not follow required procedures or practices; or

(iii) Has falsified certification data or otherwise misrepresented emission data.

(2) Revocation of approval under this paragraph (e) will not take effect until the certifier concerned is given written notice by the Administrator setting forth the basis for the proposed determination and an opportunity for a hearing under § 60.539. However, if revocation is upheld, all certifications by the certifier after written notice was given will, at the discretion of the Administrator, be declared invalid.

**§ 60.536 What requirements must I meet for permanent labels, temporary labels (hangtags) and owner's manuals?**

(a) *General permanent label requirements.* (1) Each affected wood heater manufactured on or after the date the applicable standards come into effect as specified in § 60.532, must have a permanent label affixed to it that meets the requirements of this section.

(2) Except for wood heaters subject to § 60.530(b)(1) through (5), the

permanent label must contain the following information:

(i) Month and year of manufacture of the individual unit;

(ii) Model name or number;

(iii) Certification test emission value, test method and standard met (e.g., 2015, 2020 crib wood, or 2020 cord wood); and

(iv) Serial number.

(3) The permanent label must:

(i) Be affixed in a readily visible or readily accessible location in such a manner that it can be easily viewed before and after the appliance is installed (an easily-removable facade may be used for aesthetic purposes, however the bottom of a free-standing heater is not considered to be readily visible or readily accessible);

(ii) Be at least 8.9 cm long and 5.1 cm wide (3½ inches long and 2 inches wide);

(iii) Be made of a material expected to last the lifetime of the wood heater;

(iv) Present the required information in a manner so that it is likely to remain legible for the lifetime of the wood heater; and

(v) Be affixed in such a manner that it cannot be removed from the appliance without damage to the label.

(4) The permanent label may be combined with any other label, as long as the required information is displayed, the integrity of the permanent label is not compromised, and the permanent label meets the requirements in § 60.536(a)(3).

(5) Any label statement under paragraph (b) or (c) of this section constitutes a representation by the manufacturer as to any wood heater that bears it:

(i) That a certification of compliance was in effect at the time the wood heater left the possession of the manufacturer;

(ii) That the manufacturer was, at the time the label was affixed, conducting a quality assurance program in conformity with § 60.533(m); and

(iii) That all wood heaters individually tested for emissions by the manufacturer under its quality assurance program pursuant to § 60.533(m) met the applicable emissions limits.

(b) *Permanent label requirements for adjustable burn rate wood heaters and pellet stoves.* If an adjustable burn rate wood heater or pellet stove belongs to a model line certified under § 60.533, and no wood heater in the model line has been found to exceed the applicable emission limits or tolerances through quality assurance testing, one of the following statements, as appropriate, must appear on the permanent label:

"U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2015 particulate emission standards. Not approved for sale after May 15, 2020." or

"U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using crib wood." or

"U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards using cord wood."

(c) *Permanent label requirements for single burn rate wood heaters.* If the single burn rate wood heater belongs to a model line certified under § 60.533, and no heater in the model line has been found to exceed the applicable emission limits or tolerances through quality assurance testing, one of the following statements, as appropriate, must appear on the permanent label:

"U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2015 particulate emission standards for single burn rate heaters. Not approved for sale after May 15, 2020. This single burn rate wood heater is not approved for use with a flue damper." or

"U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with 2020 particulate emission standards for single burn rate heaters. This single burn rate wood heater is not approved for use with a flue damper."

(d) *Additional permanent label content.* The permanent label for all certified wood heaters must also contain the following statement:

"This wood heater needs periodic inspection and repair for proper operation. Consult the owner's manual for further information. It is against federal regulations to operate this wood heater in a manner inconsistent with the operating instructions in the owner's manual."

(e) *Permanent label requirements for affected wood heaters with exemptions under § 60.530(b).* (1) If an affected wood heater is manufactured in the United States for export as provided in § 60.530(b)(1), the following statement must appear on the permanent label:

"U.S. ENVIRONMENTAL PROTECTION AGENCY Export stove. May not be sold or operated within the United States."

(2) If an affected wood heater is manufactured for use for research and development purposes as provided in § 60.530(b)(2), the following statement must appear on the permanent label:

"U.S. ENVIRONMENTAL PROTECTION AGENCY Not certified. Research

Stove. Not approved for sale or for operation other than for research.”

(3) If a wood heater is exclusively a non-wood-burning heater as provided § 60.530(b)(3), the following statement must appear on the permanent label:

“U.S. ENVIRONMENTAL PROTECTION AGENCY This heater is not certified for wood burning. Use of any wood fuel is a violation of federal regulations.”

(4) If an affected wood heater is a cook stove that meets the definition in § 60.531, the following statement must appear on the permanent label:

“U.S. ENVIRONMENTAL PROTECTION AGENCY This unit is not a certified residential wood heater. The primary use for this unit is for cooking or baking.”

(5) If an affected wood heater is a camp stove that meets the definition in § 60.531, the following statement must appear on the permanent label:

“U.S. ENVIRONMENTAL PROTECTION AGENCY This unit is not a certified residential wood heater. For portable and temporary use only.”

(f) *Temporary label (hangtag) voluntary option.* (1) Each model certified to meet the 2020 particulate matter emission standards of § 60.532(b) prior May 15, 2020 may display the temporary labels (hangtags) specified in section 3 of Appendix I of this part. The electronic template will be provided by the Administrator upon approval of the certification.

(2) The hangtags in paragraph (f)(1) of this section end on May 15, 2020.

(3) Each model certified to meet the 2020 Cord Wood Alternative Compliance Option of § 60.532(c) may display the cord wood temporary label specified in section 3 of Appendix I of this part. The electronic template will be provided by the Administrator upon approval of the certification.

(g) *Owner's manual requirements.* (1) Each affected wood heater offered for sale by a commercial owner must be accompanied by an owner's manual that must contain the information listed in paragraph (g)(2) of this section (pertaining to installation) and paragraph (g)(3) of this section (pertaining to operation and maintenance). Such information must be adequate to enable consumers to achieve optimal emissions performance. Such information must be consistent with the operating instructions provided by the manufacturer to the approved test laboratory for operating the wood heater during certification testing, except for details of the certification test that would not be relevant to the user. The

commercial owner must also make current and historical owner's manuals available on the company Web site and upon request to the EPA.

(2) Guidance on proper installation, include stack height, location and achieving proper draft.

(3) Proper operation and maintenance information, including minimizing visible emissions:

(i) Fuel loading and re-loading procedures; recommendations on fuel selection and warnings on what fuels not to use, such as unseasoned wood, treated wood, colored paper, cardboard, solvents, trash and garbage;

(ii) Fire starting procedures;

(iii) Proper use of air controls, including how to establish good combustion and how to ensure good combustion at the lowest burn rate for which the heater is warranted;

(iv) Ash removal procedures;

(v) Instructions for replacement of gaskets, air tubes and other parts that are critical to the emissions performance of the unit, and other maintenance and repair instructions;

(vi) For catalytic or hybrid models, information on the following pertaining to the catalytic combustor: Procedures for achieving and maintaining catalyst activity, maintenance procedures, procedures for determining deterioration or failure, procedures for replacement and information on how to exercise warranty rights;

(vii) For catalytic or hybrid models, the following statement—

“This wood heater contains a catalytic combustor, which needs periodic inspection and replacement for proper operation. It is against federal regulations to operate this wood heater in a manner inconsistent with operating instructions in this manual, or if the catalytic element is deactivated or removed.”

(viii) For noncatalytic models, the following statement—

“This wood heater needs periodic inspection and repair for proper operation. It is against federal regulations to operate this wood heater in a manner inconsistent with operating instructions in this manual.”

(4) Any manufacturer using the EPA-recommended language contained in Appendix I of this part to satisfy any requirement of this paragraph (g) will be considered to be in compliance with that requirement, provided that the particular language is printed in full, with only such changes as are necessary to ensure accuracy for the particular wood heater model line.

(h) Wood heaters that are affected by this subpart, but that have been owned

and operated by a noncommercial owner, are not subject to paragraphs (f) and (g) of this section when offered for resale.

#### **§ 60.537 What records must I keep and what reports must I submit?**

(a)(1) Each manufacturer who holds a certificate of compliance pursuant to § 60.533(c), (e) or (f) for a model line must maintain records containing the information required by paragraph (a)(2) through (4) of this section with respect to that model line for at least 5 years.

(2) All documentation pertaining to the certification test used to obtain certification, including the full test report and raw data sheets, laboratory technician notes, calculations, the test results for all test runs, and discussions of the appropriateness and validity of all test runs, including runs attempted but not completed. The retained certification test documentation must include, as applicable, detailed discussion of all anomalies, whether all burn rate categories were properly achieved, any data not used in the calculations and, for any test runs not completed, the data that were collected and the reason that the test run was not completed. The retained certification test also must include documentation that the burn rate for the low burn rate category was no greater than the rate that an operator can achieve in home use and no greater than is advertised by the manufacturer or retailer.

(3) Results of the quality assurance program inspections pursuant to § 60.533(m).

(4) For emissions tests conducted pursuant to the quality assurance program required by § 60.533(m), all test reports, data sheets, laboratory technician notes, calculations, and test results for all test runs, the corrective actions taken, if any, and any follow-up actions such as additional testing.

(b) Each approved test laboratory and third-party certifier must maintain records consisting of all documentation pertaining to each certification test, quality assurance program inspection and audit test, including the full test report and raw data sheets, technician notes, calculations, and the test results for all test runs. Each approved test laboratory must submit accreditation credentials and all proficiency test results to the Administrator. Each third-party certifier must submit each certification test, quality assurance program inspection report and ISO IEC accreditation credentials to the Administrator.

(c) Each manufacturer must retain each wood heater upon which certification tests were performed based

upon which certification was granted under § 60.533(c) or (f) at the manufacturer's facility for a minimum of 5 years after the certification test. Each wood heater must remain sealed and unaltered. Any such wood heater must be made available to the Administrator upon request for inspection and testing.

(d) Each manufacturer of an affected wood heater model line certified under § 60.533(c) or (f) must submit a report to the Administrator every 2 years following issuance of a certificate of compliance for each model line. This report must include the sales for each model by state and certify that no changes in the design or manufacture of this model line have been made that require recertification under § 60.533(k).

(e)(1) Unless otherwise specified, all records required under this section must be maintained by the manufacturer, commercial owner of the affected wood heater, approved test laboratory or third-party certifier for a period of no less than 5 years.

(2) Unless otherwise specified, all reports to the Administrator required under this subpart must be made to: *WoodHeaterReports@epa.gov*.

(f) Within 60 days after the date of completing each performance test, *e.g.*, initial certification test, tests conducted for quality assurance, and tests for renewal or recertification, each manufacturer must submit the performance test data electronically to *WoodHeaterReports@epa.gov*. Owners or operators who claim that some of the information being submitted is CBI (*e.g.*, design drawings) must submit a complete file, including the information claimed to be CBI, on a compact disk or other commonly used electronic storage media (including, but not limited to, flash drives) by mail, and the same file, with the CBI omitted, electronically. The compact disk must be clearly marked as CBI and mailed to U.S. EPA, OECA CBI Office, Attention: Residential Wood Heater Compliance Program Lead, 1200 Pennsylvania Avenue NW., Washington, DC 20004. Emission data, including all information necessary to determine compliance, except sensitive engineering drawings and sensitive detailed material specifications, may not be claimed as CBI.

(g) Within 30 days of receiving a certification of compliance for a model line, the manufacturer must make the full non-CBI test report and the summary of the test report available to the public on the manufacturer's Web site.

(h) Each manufacturer who uses the exemption for R&D heaters under § 60.530(b)(2) must maintain records for

at least 5 years documenting where the heaters were located, that the heaters were never offered for sale or sold and that the heaters were not used for the purpose of heating.

#### **§ 60.538 What activities are prohibited under this subpart?**

(a) No person is permitted to advertise for sale, offer for sale, sell or operate an affected wood heater that does not have affixed to it a permanent label pursuant to § 60.536 (b) through (e), as applicable.

(b) No person is permitted to advertise for sale, offer for sale, or sell an affected wood heater labeled under § 60.536(e)(1) except for export. No person is permitted to operate an affected wood heater in the United States if it is labeled under § 60.536(e)(1).

(c)(1) No commercial owner is permitted to advertise for sale, offer for sale or sell an affected wood heater permanently labeled under § 60.536 (b) through (d), as applicable, unless:

(i) The affected wood heater has been certified to comply with the 2015 or 2020 particulate matter emission standards pursuant to § 60.532, as applicable. This prohibition does not apply to wood heaters affected by this subpart that have been previously owned and operated by a noncommercial owner; and

(ii) The commercial owner provides any purchaser or transferee with an owner's manual that meets the requirements of § 60.536(g) and a copy of the warranty.

(2) No commercial owner is permitted to advertise for sale, offer for sale, or sell an affected wood heater permanently labeled under § 60.536(b) and (c), unless the affected wood heater has been certified to comply with the 2015 or 2020 particulate matter emission standards of § 60.532, as applicable.

(3) A commercial owner other than a manufacturer complies with the requirements of paragraph (c)(1) of this section if the commercial owner—

(i) Receives the required documentation from the manufacturer or a previous commercial owner; and

(ii) Provides that documentation unaltered to any person to whom the wood heater that it covers is sold or transferred.

(d)(1) In any case in which the Administrator revokes a certificate of compliance either for the submission of false or inaccurate information or other fraudulent acts, or based on a finding under § 60.533(l)(1)(ii) that the certification test was not valid, the Administrator may give notice of that revocation and the grounds for it to all commercial owners.

(2) On and after the date of receipt of the notice given under paragraph (d)(1) of this section, no commercial owner is permitted to sell any wood heater covered by the revoked certificate (other than to the manufacturer) unless the model line has been recertified in accordance with this subpart.

(e) No person is permitted to install or operate an affected wood heater except in a manner consistent with the instructions on its permanent label and in the owner's manual pursuant to § 60.536(g), including only using fuels for which the unit is certified.

(f) No person is permitted to operate, sell or offer for sale an affected wood heater that was originally equipped with a catalytic combustor if the catalytic element is deactivated or removed.

(g) No person is permitted to operate, sell or offer for sale an affected wood heater that has been physically altered to exceed the tolerance limits of its certificate of compliance, pursuant to § 60.533(k).

(h) No person is permitted to alter, deface, or remove any permanent label required to be affixed pursuant to § 60.536(a) through (e), as applicable.

(i) If a temporary label is affixed to the wood heater, retailers may not sell or offer for sale that wood heater unless the temporary label affixed is in accordance with § 60.536(f), as applicable.

#### **§ 60.539 What hearing and appeal procedures apply to me?**

(a)(1) The affected manufacturer, laboratory or third-party certifier may request a hearing under this section within 30 days following receipt of the required notification in any case where the Administrator—

(i) Denies an application for a certificate of compliance under § 60.533(c) or § 60.533(f);

(ii) Denies an application for a renewal of certification under § 60.533(i);

(iii) Issues a notice of revocation of certification under § 60.533(1);

(iv) Denies an application for laboratory approval under § 60.535(a);

(v) Issues a notice of revocation of laboratory approval under § 60.535(b);

(vi) Denies an application for third-party certifier approval under § 60.535(d); or

(vii) Issues a notice of revocation of third-party certifier approval under § 60.535(e).

(2) In any case where the Administrator issues a notice of revocation under § 60.533(n)(3)(ii), the manufacturer may request a hearing under this section with the time limits set out in § 60.533(n)(3)(ii).

(b) Any hearing request must be in writing, must be signed by an

authorized representative of the petitioning manufacturer or laboratory and must include a statement setting forth with particularity the petitioner's objection to the Administrator's determination or proposed determination.

(c)(l) Upon receipt of a request for a hearing under paragraph (a) of this section, the Administrator will request the Chief Administrative Law Judge to designate an Administrative Law Judge as Presiding Officer for the hearing. If the Chief Administrative Law Judge replies that no Administrative Law Judge is available to perform this function, the Administrator will designate a Presiding Officer who has not had any prior responsibility for the matter under review, and who is not subject to the direct control or supervision of someone who has had such responsibility.

(2) The hearing will commence as soon as practicable at a time and place fixed by the Presiding Officer.

(3)(i) A motion for leave to intervene in any proceeding conducted under this section must set forth the grounds for the proposed intervention, the position and interest of the movant and the likely impact that intervention will have on the expeditious progress of the proceeding. Any person already a party to the proceeding may file an answer to a motion to intervene, making specific reference to the factors set forth in the foregoing sentence and paragraph (c)(3)(iii) of this section, within 10 days after service of the motion for leave to intervene.

(ii) A motion for leave to intervene in a proceeding must ordinarily be filed before the first prehearing conference or, in the absence of a prehearing conference, prior to the setting of a time and place for a hearing. Any motion filed after that time must include, in addition to the information set forth in paragraph (c)(3)(i) of this section, a statement of good cause for the failure to file in a timely manner. The intervenor shall be bound by any agreements, arrangements and other matters previously made in the proceeding.

(iii) A motion for leave to intervene may be granted only if the movant demonstrates that his presence in the proceeding would not unduly prolong or otherwise prejudice the adjudication of the rights of the original parties, and that movant may be adversely affected by a final order. The intervenor will become a full party to the proceeding upon the granting of leave to intervene.

(iv) Persons not parties to the proceeding may move for leave to file amicus curiae briefs. The movant must

state his interest and the reasons why the proposed amicus brief is desirable. If the motion is granted, the Presiding Officer or Administrator will issue an order setting the time for filing such brief. An amicus curiae may participate in any briefing after his motion is granted, and will be served with all briefs, reply briefs, motions and orders relating to issues to be briefed.

(4) In computing any period of time prescribed or allowed in this subpart, the day of the event from which the designated period begins to run will not be included. Saturdays, Sundays and federal legal holidays will be included. When a stated time expires on a Saturday, Sunday or legal holiday, the stated time period will be extended to include the next business day.

(d)(l) Upon his appointment, the Presiding Officer must establish a hearing file. The file will consist of the notice issued by the Administrator under §§ 60.533(c)(2), 60.533(f)(3), 60.533(i)(4), 60.533(l)(2), 60.533(n)(3)(ii)(A), 60.535(a)(3), 60.535(b)(2), 60.535(d)(3) or 60.535(e)(2) together with any accompanying material, the request for a hearing and the supporting data submitted therewith, and all documents relating to the request for certification or approval or the proposed revocation of either.

(2) The hearing file must be available for inspection by any party, to the extent authorized by law, at the office of the Presiding Officer, or other place designated by him.

(e) Any party may appear in person, or may be represented by counsel or by any other duly authorized representative.

(f)(l) The Presiding Officer upon the request of any party, or at his discretion, may order a prehearing conference at a time and place specified by him to consider the following:

- (i) Simplification of the issues,
- (ii) Stipulations, admissions of fact, and the introduction of documents,
- (iii) Limitation of the number of expert witnesses,
- (iv) Possibility of agreement disposing of all or any of the issues in dispute,
- (v) Such other matters as may aid in the disposition of the hearing, including such additional tests as may be agreed upon by the parties.

(2) The results of the conference must be reduced to writing by the Presiding Officer and made part of the record.

(g)(l) Hearings will be conducted by the Presiding Officer in an informal but orderly and expeditious manner. The parties may offer oral or written evidence, subject to the exclusion by the Presiding Officer of irrelevant, immaterial and repetitious evidence.

(2) Witnesses will not be required to testify under oath. However, the Presiding Officer will call to the attention of witnesses that their statements may be subject to penalties under title 18 U.S.C. 1001 for knowingly making false statements or representations or using false documents in any matter within the jurisdiction of any department or agency of the United States.

(3) Any witness may be examined or cross-examined by the Presiding Officer, the parties or their representatives.

(4) Hearings must be recorded verbatim. Copies of transcripts of proceedings may be purchased by the applicant from the reporter.

(5) All written statements, charts, tabulations and similar data offered in evidence at the hearings must, upon a showing satisfactory to the Presiding Officer of their authenticity, relevancy and materiality, be received in evidence and will constitute a part of the record.

(h)(l) The Presiding Officer will make an initial decision which must include written findings and conclusions and the reasons or basis therefor on all the material issues of fact, law or discretion presented on the record. The findings, conclusions and written decision must be provided to the parties and made a part of the record. The initial decision will become the decision of the Administrator without further proceedings unless there is an appeal to the Administrator or motion for review by the Administrator. Except as provided in paragraph (h)(3) of this section, any such appeal must be taken within 20 days of the date the initial decision was filed.

(2) On appeal from or review of the initial decision, the Administrator will have all the powers which he would have in making the initial decision including the discretion to require or allow briefs, oral argument, the taking of additional evidence or the remanding to the Presiding Officer for additional proceedings. The decision by the Administrator must include written findings and conclusions and the reasons or basis therefor on all the material issues of fact, law or discretion presented on the appeal or considered in the review.

(3) In any hearing requested under paragraph (a)(2) of this section the Presiding Officer must render the initial decision within 60 days of that request. Any appeal to the Administrator must be taken within 10 days of the initial decision, and the Administrator must render a decision in that appeal within 30 days of the filing of the appeal.



**§ 60.539a Who implements and enforces this subpart?**

(a) Under section 111(c) of the Clean Air Act, the Administrator may delegate the following implementation and enforcement authority to a state, local or tribal authority upon request:

(1) Enforcement of prohibitions on the installation and operation of affected wood heaters in a manner inconsistent with the installation and owner's manual;

(2) Enforcement of prohibitions on operation of catalytic wood heaters where the catalyst has been deactivated or removed;

(3) Enforcement of prohibitions on advertisement and/or sale of uncertified model lines;

(4) Enforcement of prohibitions on advertisement and/or sale of affected heaters that do not have required permanent label;

(5) Enforcement of proper labeling of affected wood heaters; and

(6) Enforcement of compliance with other labeling requirements for affected wood heaters.

(7) Enforcement of certification testing procedures;

(8) Enforcement of requirements for sealing of the tested heaters and meeting parameter limits; and

(9) Enforcement of compliance requirements of EPA-approved laboratories.

(b) Delegations shall not include:

(1) Decisions on certification;

(2) Revocation of certification;

(3) Establishment or revision of standards;

(4) Establishment or revision of test methods;

(5) Laboratory and third-party certifier approvals and revocations;

(6) Enforcing provisions governing content of owner's manuals; and

(7) Hearings and appeals procedures.

(c) Nothing in these delegations will prohibit the Administrator from enforcing any applicable requirements.

(d) Nothing in these delegations will limit delegated entities from using their authority under section 116 of the Clean Air Act to adopt or enforce more restrictive requirements.

**§ 60.539b What parts of the General Provisions do not apply to me?**

The following provisions of subpart A of part 60 do not apply to this subpart:

(a) Section 60.7;

(b) Section 60.8(a), (c), (d), (e), (f) and (g);

(c) Section 60.14; and

(c) Section 60.15(d).

**Subpart PPPP—[Reserved]**

■ 4. Subpart PPPP is added and reserved.

■ 5. Subpart QQQQ is added to read as follows:

**Subpart QQQQ—Standards of Performance for New Residential Hydronic Heaters and Forced-Air Furnaces**

Sec.

60.5472 Am I subject to this subpart?

60.5473 What definitions must I know?

60.5474 What standards and requirements must I meet and by when?

60.5475 What compliance and certification requirements must I meet and by when?

60.5476 What test methods and procedures must I use to determine compliance with the standards and requirements for certification?

60.5477 What procedures must I use for EPA approval of a test laboratory or EPA approval of a third-party certifier?

60.5478 What requirements must I meet for permanent labels, temporary labels (hangtags), and owner's manuals?

60.5479 What records must I keep and what reports must I submit?

60.5480 What activities are prohibited under this subpart?

60.5481 What hearing and appeal procedures apply to me?

60.5482 Who implements and enforces this subpart?

60.5483 What parts of the General Provisions do not apply to me?

**Subpart QQQQ—Standards of Performance for New Residential Hydronic Heaters and Forced-Air Furnaces****§ 60.5472 Am I subject to this subpart?**

(a) You are subject to this subpart if you manufacture, sell, offer for sale, import for sale, distribute, offer to distribute, introduce or deliver for introduction into commerce in the United States, or install or operate a residential hydronic heater, forced-air furnace or other central heater manufactured on or after May 15, 2015, except as provided in paragraph (c) of this section.

(b) Each residential hydronic heater, forced-air furnace or other central heater must comply with the provisions of this subpart unless exempted under paragraphs (b)(1) through (b)(3) of this section. These exemptions are determined by rule applicability and do not require additional EPA notification or public notice.

(1) Affected residential hydronic heaters, forced-air furnaces or other central heaters manufactured in the United States for export are exempt from the applicable emission limits of § 60.5474 and the requirements of § 60.5475.

(2) Affected residential hydronic heaters, forced-air furnaces or other central heaters used for research and

development purposes that are never offered for sale or sold and that are not used to provide heat are exempt from the applicable emission limits of § 60.5474 and the requirements of § 60.5475. No more than 12 affected residential central heaters manufactured per model line may be exempted for this purpose.

(3) Appliances that do not burn wood or wood pellets or wood chips (such as coal-only central heaters that meet the definition in § 60.5473 or corn-only central heaters) are exempt from the applicable emission limits of § 60.5474 and the requirements of § 60.5475 provided that all advertising and warranties clearly denote that wood burning is prohibited in these appliances.

(c) The following are not affected central heaters and are not subject to this subpart:

(1) Residential wood heaters subject to subpart AAA of this part.

(2) Residential masonry heaters as defined in § 60.5473.

**§ 60.5473 What definitions must I know?**

As used in this subpart, all terms not defined herein have the same meaning given them in the Clean Air Act and subpart A of this part.

*Approved test laboratory* means a test laboratory that is approved for central heater certification testing under § 60.5477 or is an independent third-party test laboratory that is accredited under ISO-IEC Standard 17025 to perform testing using the test methods specified in § 60.5476 by an accreditation body that is a full member signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement and approved by the EPA for conducting testing under this subpart.

*Catalytic combustor* means a device coated with a noble metal used in a wood heater to lower the temperature required for combustion.

*Central heater* means a fuel-burning device designed to burn wood or wood pellet fuel that warms spaces other than the space where the device is located, by the distribution of air heated by the furnace through ducts or liquid heated in the device and distributed typically through pipes. Unless otherwise specified, these devices include, but are not limited to, residential forced-air furnaces (small and large) and residential hydronic heaters.

*Chip wood fuel* means wood chipped into small pieces that are uniform in size, shape, moisture, density and energy content.

*Coal-only hydronic heater or forced-air furnace* means an enclosed, coal-

burning appliance capable of space heating or domestic water heating that has all of the following characteristics:

(1) Installation instructions, owner's manual and marketing information that state that the use of wood in the appliance, except for coal ignition purposes, is prohibited by law; and

(2) The model is listed by a nationally recognized safety-testing laboratory for coal use only, except for coal ignition purposes.

*Commercial owner* means any person who owns or controls a residential hydronic heater, forced-air furnace or other affected central heater in the course of the business of the manufacture, importation, distribution, or sale of the unit.

*Large residential forced-air furnace* means a residential forced-air furnace that is capable of a heat output of 65,000 BTU per hour or greater.

*Manufactured* means completed and ready for shipment (whether or not assembled or packaged) for purposes of determining the date of manufacture.

*Manufacturer* means any entity that constructs or imports into the United States a central heater.

*Model line* means all central heaters offered for sale by a single manufacturer that are similar in all material respects that would affect emissions as defined in this section.

*Particulate matter (PM)* means total particulate matter including coarse particulate ( $PM_{10}$ ) and fine particulate ( $PM_{2.5}$ ).

*Pellet fuel* means refined and densified solid wood shaped into small pellets or briquettes that are uniform in size, shape, moisture, density and energy content.

*Representative affected wood or central heater* means an individual heater that is similar in all material respects that would affect emissions as defined in this section to other heaters within the model line it represents.

*Residential forced-air furnace* means a fuel burning device designed to burn wood or wood pellet fuel that warms spaces other than the space where the furnace is located, by the distribution of air heated by the furnace through ducts.

*Residential hydronic heater* means a fuel burning device designed to burn wood or wood pellet fuel for the purpose of heating building space and/or water through the distribution, typically through pipes, of a fluid heated in the device, typically water or a water and antifreeze mixture.

*Residential masonry heater* means a factory-built or site-built wood-burning device in which the heat from intermittent fires burned rapidly in the firebox is stored in the refractory mass

for slow release to building spaces. Masonry heaters are site-built (using local materials or a combination of local materials and manufactured components) or site-assembled (using factory-built components), solid fuel-burning heating appliances constructed mainly of refractory materials (e.g., masonry materials or soapstone). They typically have an interior construction consisting of a firebox and heat exchange channels built from refractory components, through which flue gases are routed. ASTM E1602 "Standard Guide for Construction of Solid Fuel Burning Masonry Heaters" provides design and construction information for the range of masonry heaters most commonly built in the United States. The site-assembled models are generally listed to UL-1482.

*Sale* means the transfer of ownership or control, except that a transfer of control of an affected central heater for research and development purposes within the scope of § 60.5472(b)(2) is not a sale.

*Similar in all material respects that would affect emissions* means that the construction materials, exhaust and inlet air system, and other design features are within the allowed tolerances for components identified in § 60.5475(k).

*Small residential forced-air furnace* means a residential forced-air furnace that is only capable of a maximum heat output of less than 65,000 BTU per hour.

*Sold at retail* means the sale by a commercial owner of a central heater to the ultimate purchaser/user or noncommercial purchaser.

*Third-party certifier* (sometimes called third-party certifying body or product certifying body) means an independent third party that is accredited under ISO-IEC Standards 17025 and 17065 to perform certifications, inspections and audits by an accreditation body that is a full member signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement and approved by the EPA for conducting certifications, inspections and audits under this subpart.

*Unseasoned wood* means wood with an average moisture content of 20 percent or more.

*Valid certification test* means a test that meets the following criteria:

(1) The Administrator was notified about the test in accordance with § 60.5476(h);

(2) The test was conducted by an approved test laboratory as defined in this section;

(3) The test was conducted on a central heater similar in all material respects that would affect emissions as defined in this section to other central heaters of the model line that is to be certified; and

(4) The test was conducted in accordance with the test methods and procedures specified in § 60.5476.

*Wood heater* under this subpart means an enclosed, wood burning-appliance capable of and intended for residential central heating or central heating and domestic water heating. Unless otherwise specified, these devices include, but are not limited to, hydronic heaters and forced-air furnaces.

#### **§ 60.5474 What standards and requirements must I meet and by when?**

(a) *Standards.* Unless exempted under § 60.5472, no person is permitted to:

(1) On or after May 15, 2015, manufacture, import into the United States or sell at retail a residential hydronic heater unless it has been certified to meet the 2015 particulate matter emission limits in paragraph (b)(1) of this section, except that a residential hydronic heater that was manufactured on or before May 15, 2015 may be imported into the United States and/or sold at retail on or before December 31, 2015.

(2) On or after May 15, 2020 manufacture or sell at retail a residential hydronic heater unless it has been certified to meet the 2020 particulate matter emission limit in paragraph (b)(2) or (b)(3) of this section.

(3) On or after May 15, 2015, manufacture or sell at retail a residential forced-air furnace unless it complies with the work practice and operating standards in paragraphs (d), (e), (f) and (g) of this section and the owner's manual requirements in Appendix I.

(4) On or after May 16, 2016, manufacture or sell at retail a small residential forced-air furnace unless it has been certified to meet the 2016 particulate matter emission limits in paragraph (b)(4) of this section

(5) On or after May 15, 2017 manufacture or sell at retail a large forced-air furnace unless it has been certified to meet the 2017 particulate matter emission limits in paragraph (b)(5) of this section.

(6) On or after May 15, 2020 manufacture or sell at retail a small or large residential forced-air furnace unless it has been certified to meet the 2020 particulate matter emission limit in paragraph (b)(6) of this section.

(b)(1) 2015 residential hydronic heater particulate matter emission limit: A weighted average of 0.32 lb/mmBtu

(0.137 g/MJ) heat output and a maximum per individual burn rate of 18.0 g/hr (0.041 lb/hr) as determined by the test methods and procedures in § 60.5476 or an alternative crib wood or cord wood test method approved by the Administrator.

(2) 2020 residential hydronic heater particulate matter emission limit: 0.10 lb/mmBtu (0.026 g/MJ) heat output per individual burn rate as determined by the crib wood test methods and procedures in § 60.5476 or an alternative crib wood test method approved by the Administrator.

(3) 2020 residential hydronic heater cord wood alternative compliance option for particulate matter emission limit: 0.15 lb/mmBtu (0.026 g/MJ) heat output per individual burn rate as determined by the cord wood test methods and procedures in § 60.5476 or an alternative cord wood test method approved by the Administrator.

(4) 2016 small forced-air furnace particulate matter emission limit: A weighted average of 0.93 lb/mmBtu (0.40 g/MJ) heat output as determined by the test methods and procedures in § 60.5476.

(5) 2017 large forced-air furnace particulate matter emission limit: A weighted average of 0.93 lb/mmBtu (0.40 g/MJ) heat output as determined by the test methods and procedures in § 60.5476.

(6) 2020 forced-air furnace particulate matter emission limit: 0.15 lb/mmBtu (0.026 g/MJ) heat output per individual burn rate as determined by the cord wood test methods and procedures in § 60.5476 or cord wood test methods approved by the Administrator.

(c) [Reserved]

(d) *Chip wood fuel requirements.* Operators of wood central heaters, including hydronic heaters and forced-air furnaces, that are certified to burn chip wood fuels may only burn wood chips that have been specified in the owner's manual. The chip wood fuel must meet the following minimum requirements:

- (1) Moisture content: Less than 35 percent;
- (2) Inorganic fines: Less than or equal to 1 percent;
- (3) Chlorides: Less than or equal to 300 parts per million by weight;
- (4) Ash content: No more than 2 percent;
- (5) No demolition or construction waste; and
- (6) Trace metals: Less than 100 mg/kg.

(e) *Pellet fuel requirements.* Operators of wood central heaters, including outdoor residential hydronic heaters, indoor residential hydronic heaters, and residential forced-air furnaces, that are

certified to burn pellet fuels may only burn pellets that have been graded under a licensing agreement with a third-party organization approved by the EPA. The Pellet Fuels Institute, ENplus and CANplus are initially deemed to be approved third-party organizations for this purpose, and additional organizations may apply to the Administrator for approval. The pellet fuel must meet the following minimum requirements as assured through a quality assurance program licensed by a third-party organization approved by the EPA:

- (1) Density: Consistent hardness and energy content with a minimum density of 38 pounds/cubic foot;
  - (2) Dimensions: Maximum length of 1.5 inches and diameter between 0.230 and 0.285 inches;
  - (3) Inorganic fines: Less than or equal to 1 percent;
  - (4) Chlorides: Less than or equal to 300 parts per million by weight; and
  - (5) Ash content: No more than 2 percent.
  - (6) Contains no demolition or construction waste;
  - (7) Trace metals: Less than 100 mg/kg; and
  - (8) None of the prohibited fuels in paragraph (f) of this section.
- (f) *Prohibited fuel types.* No person is permitted to burn any of the following materials in an outdoor residential hydronic heater, indoor residential hydronic heater, residential forced-air furnace or other affected central heater:
- (1) Residential or commercial garbage;
  - (2) Lawn clippings or yard waste;
  - (3) Materials containing rubber, including tires;
  - (4) Materials containing plastic;
  - (5) Waste petroleum products, paints or paint thinners, or asphalt products;
  - (6) Materials containing asbestos;
  - (7) Construction or demolition debris;
  - (8) Paper products; cardboard,

plywood or particleboard. The prohibition against burning these materials does not prohibit the use of fire starters made from paper, cardboard, saw dust, wax and similar substances for the purpose of starting a fire in an affected central heater;

- (9) Railroad ties or pressure treated lumber;
- (10) Manure or animal remains;
- (11) Salt water driftwood or other or other previously salt water saturated materials;
- (12) Unseasoned wood;
- (13) Any materials that are not included in the warranty and owner's manual for the subject heater or furnace; or

(14) Any materials that were not included in the certification tests for the subject heater or furnace.

(g) *Operation of affected wood heaters.* A user must operate an outdoor residential hydronic heater, indoor residential hydronic heater, residential forced-air furnace or other affected central heater in a manner consistent with the owner's manual. The owner's manual must clearly specify that operation in a manner inconsistent with the owner's manual would void the warranty.

(h) *Temperature sensor requirement.* An affected wood heater equipped with a catalytic combustor must be equipped with a temperature sensor that can monitor combustor gas stream temperatures within or immediately downstream [within 2.54 centimeters (1 inch)] of the catalytic combustor surface.

#### **§ 60.5475 What compliance and certification requirements must I meet and by when?**

(a) *Certification requirement.* (1) Each affected residential hydronic heater, forced-air furnace and other central heater must be certified to be in compliance with the applicable emission standards and other requirements of this subpart. For each model line manufactured or sold by a single entity, e.g., company or manufacturer, compliance with applicable emission standards of § 60.5474 must be determined based on testing of representative affected central heaters within the model line. If one entity licenses a model line to another entity, each entity's model line must be certified. If an entity intends to change the name of the entity or the name of the model, the manufacturer must apply for a new certification 60 days before making the change.

(2) The manufacturer of each model line must submit the information required in paragraph (b) of this section and follow either the certification process in paragraphs (c) through (e) of this section (for forced-air furnaces) or the certification procedure specified in paragraph (f) of this section.

(3) Models qualified as meeting the Phase 2 emission levels under the 2011 EPA hydronic heater partnership agreement are automatically deemed to have a certificate of compliance for the 2015 particulate matter emission standards and be valid until the effective date for the 2020 particulate matter emission standards.

(4) Models certified by the New York State Department of Environment and Conservation to meet the emission levels in § 60.5474(b) are automatically deemed to have a certificate of compliance for the 2015 particulate matter emission standards and be valid

until the effective date for the 2020 particulate matter emission standards.

(5) Models approved by the New York State Energy Research and Development Authority under the Renewable Heat New York (RHNY) Biomass Boiler Program are automatically deemed to have a certificate of compliance for the 2015 particulate matter emission standards and be valid until the effective date for the 2020 particulate matter emission standards provided that they comply with the thermal storage requirements in the RHNY program.

(6) Small forced-air furnace models that are certified under CSA B415.1–10 (IBR, see § 60.17), by an EPA approved third-party certifier, to meet the 2016 particulate matter emission level will be automatically deemed to have a certificate of compliance for the 2016 particulate matter emission standards and be valid until the effective date for the 2020 particulate matter emission standards.

(7) Large forced-air furnace models that are certified under CSA B415.1–10 (IBR, see § 60.17), by an EPA approved third-party certifier, to meet the 2017 particulate matter emission level will be automatically deemed to have a certificate of compliance for the 2017 particulate matter emission standards and be valid until the effective date of the 2020 particulate matter emission standards.

(b) *Application for a certificate of compliance.* Any manufacturer of an affected residential hydronic heater or forced-air furnace or other central heater must apply to the Administrator for a certificate of compliance for each model line. The application must be submitted to: [WoodHeaterReports@epa.gov](mailto:WoodHeaterReports@epa.gov). The application must be signed by a responsible representative of the manufacturer or an authorized representative and must contain the following:

(1) The model name and/or design number. The model name and/or design number must clearly distinguish one model from another. The name and/or design number cannot include the EPA symbol or logo or name or derivatives such as “EPA.”

(2) Engineering drawings and specifications of components that may affect emissions (including specifications for each component listed in paragraph (k) of this section). Manufacturers may use assembly or design drawings that have been prepared for other purposes, but must designate on the drawings the dimensions of each component listed in paragraph (k) of this section. Manufacturers must identify dimensions of components listed in

paragraph (k)(2) of this section that are different from those specified in that paragraph, and show that such differences cannot reasonably be anticipated to cause central heaters in the model line to exceed the applicable emission limits. The drawings must identify how the emission critical parts, such as air tubes and catalyst, can be readily inspected and replaced.

(3) A statement whether the firebox or any firebox component (including the materials listed in paragraph (k)(3) of this section) will be composed of material different from the material used for the firebox or firebox component in the central heater on which certification testing was performed and a description of any such differences and demonstration that any such differences may not reasonably be anticipated to adversely affect emissions or efficiency.

(4) Clear identification of any claimed confidential business information (CBI). Submit such information under separate cover to the EPA CBI Office; Attn: Residential Wood Heater Compliance Program Lead, 1200 Pennsylvania Ave. NW., Washington, DC 20004. Note that all emissions data, including all information necessary to determine emission rates in the format of the standard, cannot be claimed as CBI.

(5) All documentation pertaining to a valid certification test, including the complete test report and, for all test runs: Raw data sheets, laboratory technician notes, calculations and test results. Documentation must include the items specified in the applicable test methods. Documentation must include discussion of each test run and its appropriateness and validity, and must include detailed discussion of all anomalies, whether all burn rate categories were achieved, any data not used in the calculations and, for any test runs not completed, the data collected during the test run and the reason(s) that the test run was not completed. The documentation must show that the burn rate for the low burn rate category is no greater than the rate that an operator can achieve in home use and no greater than is advertised by the manufacturer or retailer. The test report must include a summary table that clearly presents the individual and overall emission rates, efficiencies and heat outputs. Submit the test report and all associated required information according to the procedures for electronic reporting specified in § 60.5479(f).

(6) A copy of the warranties for the model line, which must include a statement that the warranties are void if the unit is used to burn materials for which the unit is not certified by the

EPA and void if not operated according to the owner's manual.

(7) A statement that the manufacturer will conduct a quality assurance program for the model line that satisfies the requirements of paragraph (m) of this section.

(8) A statement describing how the tested unit was sealed by the laboratory after the completion of certification testing and asserting that such unit will be stored by the manufacturer in the sealed state until 5 years after the certification test.

(9) Statements that the central heater manufactured under this certificate will be—

(i) Similar in all material respects that would affect emissions as defined in this subpart to the central heater submitted for certification testing, and

(ii) Labeled as prescribed in § 60.5478.

(iii) Accompanied by an owner's manual that meets the requirements in § 60.5478. In addition, a copy of the owner's manual must be submitted to the EPA and be available to the public on the manufacturer's Web site.

(10) A statement that the manufacturer has entered into contracts with an approved laboratory and an approved third-party certifier that satisfy the requirements of paragraph (f) of this section.

(11) A statement that the approved laboratory and approved third-party certifier are allowed to submit information on behalf of the manufacturer, including any claimed to be CBI.

(12) A statement that the manufacturer will place a copy of the certification test report and summary on the manufacturer's Web site available to the public within 30 days after the Administrator issues a certificate of compliance.

(13) A statement of acknowledgment that the certificate of compliance cannot be transferred to another manufacturer or model line without written approval by the Administrator.

(14) A statement acknowledging that it is unlawful to sell, distribute, or offer to sell or distribute an affected wood heater without a valid certificate of compliance.

(15) Contact information for the responsible representative of the manufacturer and all authorized representatives, including name, affiliation, physical address, telephone number and email address.

(c) *Administrator approval process.*

(1) The Administrator may issue a certificate of compliance for a model line if the Administrator determines, based on all information submitted by

the applicant and any other relevant information available, that:

(i) A valid certification test demonstrates that the representative affected central heater complies with the applicable emission standards in § 60.5474;

(ii) Any tolerances or materials for components listed in paragraph (k)(2) or (3) of this section that are different from those specified in those paragraphs may not reasonably be anticipated to cause central heaters in the model line to exceed the applicable emission limits; and

(iii) The requirements of paragraph (b) of this section have been met.

(2) The Administrator will deny certification if the Administrator determines that the criteria in paragraph (c)(1) of this section have not been satisfied. Upon denying certification under this paragraph, the Administrator will give written notice to the manufacturer setting forth the basis for this determination.

(d) *Level of compliance certification.* The Administrator will issue the certificate of compliance for the most stringent particulate matter emission standard that the tested representative central heater meets under § 60.5474.

(e) *Conditional, temporary certificate of compliance.* A conditional, temporary certificate of compliance with the Step 1 p.m. emission standards may be granted by the Administrator until May 16, 2016 for small or large forced-air furnaces based on the manufacturer's submittal of a complete certification application meeting all requirements in § 60.5475(b). The application must include the full test report by an EPA-approved laboratory and all required compliance statements by the manufacturer with the exception of a certificate of conformity by an EPA approved third-party certifier. The conditional, temporary approval would allow early marketing of forced-air furnaces as having a conditional, temporary certificate of compliance with the Step 1 p.m. emission standards until May 16, 2016 or until the Administrator completes the review of the application, whichever is earlier.

(f) *Third-party certifier-based application process.* (1) Any manufacturer of an affected central heater must apply to the Administrator for a certificate of compliance for each model line. The manufacturer must meet the following requirements:

(i) The manufacturer must contract with a third-party certifier for certification services. The contract must include regular (at least annual) unannounced audits under ISO-IEC Standard 17065 to ensure that the

manufacturer's quality assurance plan is being implemented. The contract must also include a report for each audit under ISO-IEC Standard 17065 that fully documents the results of the audit. The contract must include authorization and requirement for the third-party certifier to submit all such reports to the Administrator and the manufacturer within 30 days of the audit. The audit report must identify deviations from the manufacturer's quality assurance plan and specify the corrective actions that need to be taken to address each identified deficiency.

(ii) The manufacturer must submit the materials specified in paragraph (b) of this section and a quality assurance plan that meets the requirements of paragraph (m) of this section to the third-party certifier. The quality assurance plan must ensure that units within a model line will be similar in all material respects that would affect emissions to the wood heater submitted for certification testing, and it must include design drawings for the model line.

(iii) The manufacturer must apply to the third-party certifier for a certification of conformity with the applicable requirements of this subpart for the model line.

(A) After testing by an approved test laboratory is complete, certification of conformity with the emission standards in § 60.5474 must be performed by the manufacturer's contracted third-party certifier.

(B) The third-party certifier may certify conformity if the emission tests have been conducted per the appropriate guidelines: The test report is complete and accurate; the instrumentation used for the test was properly calibrated; the test report shows that the representative affected central heater meets the applicable emission limits specified in § 60.5474; and the quality assurance plan is adequate to ensure that units within the model line will be similar in all material respects that would affect emissions to the central heater submitted for certification testing, and that the affected heaters would meet all applicable requirements of this subpart.

(iv) The manufacturer must then submit to the Administrator an application for a certificate of compliance that includes the certification of conformity, quality assurance plan, test report and all supporting documentation specified in paragraph (b) of this section.

(v) The submission also must include a statement signed by a responsible official of the manufacturer or authorized representative that the

manufacturer has complied with and will continue to comply with all requirements of this subpart for certificate of compliance and that the manufacturer remains responsible for compliance regardless of any error by the test laboratory or third-party certifier.

(2) The Administrator will issue to the manufacturer a certificate of compliance for a model line if it is determined, based on all of the information submitted in the application for certification and any other relevant information, that:

(i) A valid certification of conformity has demonstrated that the representative affected central heater complies with the applicable emission standards in § 60.5474;

(ii) Any tolerances or materials for components listed in paragraph (k)(2) or (3) of this section that are different from those specified in those paragraphs may not be reasonably anticipated to cause central heaters in the model line to exceed the applicable emission limits;

(iii) The requirements of paragraphs (b) of this section have been met; and

(iv) A valid certificate of conformity for the model line has been prepared and submitted.

(3) The Administrator will deny certification if the Administrator determines that the criteria in paragraph (f)(2) of this section have not been satisfied. Upon denying certification under this paragraph, the Administrator will give written notice to the manufacturer setting forth the basis for the determination.

(g) *Waiver from submitting test results.* An applicant for certification may apply for a potential waiver of the requirement to submit the results of a certification test pursuant to paragraph (b) of this section, if the central heater meets either of the following conditions:

(1) The central heaters of the model line are similar in all material respects that would affect emissions, as defined in § 60.5473 and paragraph (k) of this section, to another model line that has already been issued a certificate of compliance. A manufacturer that seeks a waiver of certification testing must identify the model line that has been certified, and must submit a copy of an agreement with the owner of the design permitting the applicant to produce central heaters of that design.

(2) The manufacturer has previously conducted a valid certification test to demonstrate that the central heaters of the model line meet the applicable standard specified in § 60.5474.

(h) *Certification period.* Unless revoked sooner by the Administrator, a certificate of compliance will be valid

for 5 years from the date of issuance or until a more stringent standard comes into effect, whichever is sooner.

(i) *Renewal of certification.* (1) The manufacturer must renew a model line's certificate of compliance or recertify the model line every 5 years, or the manufacturer may choose to no longer manufacture or sell that model line after the expiration date. If the manufacturer chooses to no longer manufacture that model line, then the manufacturer must submit a statement to the Administrator to that effect.

(2) A manufacturer of an affected residential hydronic heater or forced-air furnace or other central heater may apply to the Administrator for potential renewal of its certificate of compliance by submitting the material specified in paragraph (b) and following the procedures specified in paragraph (f) of this section, or by affirming in writing that the central heaters in the model line continue to be similar in all material respects that would affect emissions to the representative central heater submitted for testing on which the original certificate of compliance was based and requesting a potential waiver from certification testing. The application must include a copy of the review of the draft application and approval by the third-party certifier.

(3) If the Administrator grants a renewal of certification, the Administrator will give written notice to the manufacturer setting forth the basis for the determination and issue a certification renewal.

(4) If the Administrator denies the request for a renewal of certification, the Administrator will give written notice to the manufacturer setting forth the basis for the determination.

(5) If the Administrator denies the request for a renewal of certification, the manufacturer and retailer must not manufacture or sell the previously-certified central heaters after the expiration date of the certificate of compliance.

(j) [Reserved]

(k) *Recertification.* (1) The manufacturer must recertify a model line whenever any change is made in the design submitted pursuant to paragraph (k)(2) of this section that affects or is presumed to affect the particulate matter emission rate for that model line. The manufacturer of an affected central heater must apply to the Administrator for potential recertification by submitting the material specified in paragraph (b) of this section and following the procedures specified in paragraph (f) of this section or by affirming in writing that the change will not cause the

central heaters in the model line to exceed applicable emission limits and requesting a waiver from certification testing. The application for recertification must be reviewed and approved by the contracted third-party certifier and a copy of the review and approval must be included. The Administrator may waive this requirement upon written request by the manufacturer, if the manufacturer presents adequate rationale and the Administrator determines that the change may not reasonably be anticipated to cause central heaters in the model line to exceed the applicable emission limits. The granting of such a waiver does not relieve the manufacturer of any compliance obligations under this subpart.

(2) Any change in the design tolerances of any of the following components (where such components are applicable) is presumed to affect particulate matter and carbon monoxide emissions and efficiency if that change exceeds  $\pm 0.64$  cm ( $\pm 1/4$  inch) for any linear dimension and  $\pm 5$  percent for any cross-sectional area relating to air introduction systems and catalyst bypass gaps unless other dimensions and cross-sectional areas are previously approved by the Administrator under paragraph (c)(1)(ii) of this section:

- (i) Firebox: Dimensions;
- (ii) Air introduction systems: Cross-sectional area of restrictive air inlets and outlets, location and method of control;
- (iii) Baffles: Dimensions and locations;
- (iv) Refractory/insulation: Dimensions and location;
- (v) Catalyst: Dimensions and location;
- (vi) Catalyst bypass mechanism and catalyst bypass gap tolerances (when bypass mechanism is in closed position): Dimensions, cross-sectional area, and location;
- (vii) Flue gas exit: Dimensions and location;
- (viii) Door and catalyst bypass gaskets: Dimensions and fit;
- (ix) Outer thermal shielding and thermal coverings: Dimensions and location;
- (x) Fuel feed system: For central heaters that are designed primarily to burn wood pellet fuel or wood chips and other central heaters equipped with a fuel feed system, the fuel feed rate, auger motor design and power rating, and the angle of the auger to the firebox; and

(xi) Forced air combustion system: For central heaters so equipped, the location and horsepower of blower motors and the fan blade size.

(3) Any change in the materials used for the following components is

presumed to affect particulate matter emissions and efficiency:

- (i) Refractory/insulation; or
- (ii) Door and catalyst bypass gaskets.

(4) A change in the make, model, or composition of a catalyst is presumed to affect particulate matter and carbon monoxide emissions and efficiency, unless the change has been requested by the central heater manufacturer and has been approved in advance by the Administrator, based on test data that demonstrate that the replacement catalyst is equivalent to or better than the original catalyst in terms of particulate matter emission reduction.

(l) *Criteria for revocation of certification.* (1) The Administrator may revoke certification of a product line if it is determined that the central heaters being manufactured or sold in that model line do not comply with the requirements of this subpart. Such a determination will be based on all available evidence, including but not limited to:

(i) Test data from retesting of the original unit on which the certification test was conducted on a unit that is similar in all material respects that would affect emissions;

(ii) A finding that the certification test was not valid. The finding will be based on problems or irregularities with the certification test or its documentation, but may be supplemented by other information;

(iii) A finding that the labeling of the central heater model line or the owner's manual or the associated marketing information does not comply with the requirements of § 60.5478;

(iv) Failure by the manufacturer to comply with the reporting and recordkeeping requirements of § 60.5479;

(v) Physical examination showing that a significant percentage (as defined in the quality assurance plan approved pursuant to paragraph (m) of this section, but no larger than 1 percent) of production units inspected is not similar in all material respects that would affect emissions to the representative affected central heater submitted for certification testing; or

(vi) Failure of the manufacturer to conduct a quality assurance program in conformity with paragraph (m).

(vii) Failure of the approved laboratory to test the central heater using the methods specified in § 60.5476.

(2) Revocation of certification under this paragraph (l) of this section will not take effect until the manufacturer concerned has been given written notice by the Administrator setting forth the basis for the proposed determination

and an opportunity to request a hearing under § 60.5481.

(m) *Quality assurance program.* On or after May 16, 2016, for each certified model line, the manufacturer must conduct a quality assurance program that satisfies the requirements of paragraphs (m)(1) through (5) of this section.

(1) The manufacturer must prepare and operate according to a quality assurance plan for each certified model line that includes specific inspection and testing requirements for ensuring that all units within a model line are similar in all material respects that would affect emissions to the central heater submitted for certification testing and meet the emissions standards in § 60.5474.

(2) The quality assurance plan must be approved by the third-party certifier as part of the certification of conformity process specified in paragraph (f) of this section.

(3) The quality assurance plan must include regular (at least annual) unannounced audits by the third-party certifier under ISO-IEC Standard 17065 to ensure that the manufacturer's quality assurance plan is being implemented.

(4) The quality assurance plan must include a report for each audit under ISO-IEC Standard 17065 that fully documents the results of the audit. The third-party certifier must be authorized and required to submit all such reports to the Administrator within 30 days of the audit. The audit report must identify deviations from the manufacturer's quality assurance plan and specify the corrective actions that need to be taken to address each identified deficiency.

(5) Within 30 days after receiving each audit report, the manufacturer must report to the third-party certifier and to the Administrator its corrective actions and responses to any deficiencies identified in the audit report. No such report is required if an audit report did not identify any deficiencies.

(n) *EPA compliance audit testing.*

(1)(i) The Administrator may select by written notice central heaters or model lines for compliance audit testing to determine compliance with the emission standards in § 60.5474.

(ii) The Administrator will transmit a written notification of the selected central heaters or model line(s) to the manufacturer, which will include the name and address of the laboratory selected to perform the audit test and the model name and serial number of the central heater(s) or central heater model line(s) selected to undergo audit testing.

(2)(i) The Administrator may test, or direct the manufacturer to have tested, the central heater(s) from the model line(s) selected under paragraph (n)(1)(i) of this section in a laboratory approved under § 60.5477. The Administrator may select any approved test laboratory or federal laboratory for this audit testing.

(ii) The expense of the compliance audit test is the responsibility of the central heater manufacturer.

(iii) The test must be conducted using the same test method used to obtain certification. If the certification test consisted of more than one particulate matter sampling test method, the Administrator may direct the manufacturer and test laboratory as to which of these methods to use for the purpose of audit testing. The Administrator will notify the manufacturer at least 30 days prior to any test under this paragraph, and allow the manufacturer and/or his authorized representatives to observe the test.

(3) *Revocation of certification.* (i) If emissions from a central heater tested under paragraph (n)(2) of this section exceed the applicable emission standard by more than 50 percent using the same test method used to obtain certification, the Administrator will notify the manufacturer that certification for that model line is suspended effective 72 hours from the receipt of the notice, unless the suspension notice is withdrawn by the Administrator. The suspension will remain in effect until withdrawn by the Administrator, or the date 30 days from its effective date if a revocation notice under paragraph (n)(3)(ii) of this section is not issued within that period, or the date of final agency action on revocation, whichever occurs earliest.

(ii)(A) If emissions from a central heater tested under paragraph (n)(2) of this section exceed the applicable emission limit, the Administrator will notify the manufacturer that certification is revoked for that model line.

(B) A notice under paragraph (n)(3)(ii)(A) of this section will become final and effective 60 days after the date of written notification to the manufacturer, unless it is withdrawn, a hearing is requested under § 60.5481(a)(2), or the deadline for requesting a hearing is extended.

(C) The Administrator may extend the deadline for requesting a hearing for up to 60 days for good cause.

(D) A manufacturer may extend the deadline for requesting a hearing for up to 6 months, by agreeing to a voluntary suspension of certification.

(iii) Any notification under paragraph (n)(3)(i) or (ii) of this section will

include a copy of a preliminary test report from the approved test laboratory or federal test laboratory. The test laboratory must provide a preliminary test report to the Administrator within 14 days of the completion of testing, if a central heater exceeds the applicable emission limit in § 60.5474. The test laboratory must provide the Administrator and the manufacturer, within 30 days of the completion of testing, all documentation pertaining to the test, including the complete test report and raw data sheets, laboratory technician notes, and test results for all test runs.

(iv) Upon receiving notification of a test failure under paragraph (n)(3)(ii) of this section, the manufacturer may request that up to four additional central heaters from the same model line be tested at the manufacturer's expense, at the test laboratory that performed the emissions test for the Administrator.

(v) Whether or not the manufacturer proceeds under paragraph (n)(3)(iv) of this section, the manufacturer may submit any relevant information to the Administrator, including any other test data generated pursuant to this subpart. The manufacturer must bear the expense of any additional testing.

(vi) The Administrator will withdraw any notice issued under paragraph (n)(3)(ii) of this section if tests under paragraph (n)(3)(iv) of this section show either—

(A) That exactly four additional central heaters were tested for the manufacturer and all four met the applicable emission limits; or

(B) That exactly two additional central heaters were tested for the manufacturer and each of them met the applicable emission limits and the average emissions of all three tested heaters (the original audit heater and the two additional heaters) met the applicable emission limits.

(vii) If the Administrator withdraws a notice pursuant to paragraph (n)(3)(vi) of this section, the Administrator will revise the certification values for the model line based on the test data and other relevant information. The manufacturer must then revise the labels and marketing information accordingly.

(viii) The Administrator may withdraw any proposed revocation, if the Administrator finds that an audit test failure has been rebutted by information submitted by the manufacturer under paragraph (n)(3)(iv) of this section and/or (n)(3)(v) of this section or by any other relevant information available to the Administrator.



**§ 60.5476 What test methods and procedures must I use to determine compliance with the standards and requirements for certification?**

Test methods and procedures specified in this section or in appendices of this part, except as provided under § 60.8(b), must be used to determine compliance with the standards and requirements for certification under §§ 60.5474 and 60.5475 and for reporting carbon monoxide emissions and efficiency. The EPA will post all approved alternative test methods on the EPA Web site. The manufacturer or the manufacturer's authorized representative must submit a summary and the full test report with all supporting information, including detailed discussion of all anomalies, whether all burn rate categories were properly achieved, any data not used in the calculations and, for any test runs not completed, the data that were collected and the reason that the test run was not completed. The burn rate for the low burn rate category must be no greater than the rate that an operator can achieve in home use and no greater than is advertised by the manufacturer or retailer.

(a) Canadian Standards Administration (CSA) Method B415.1–10, sections 13.7–13.10 (IBR, see § 60.17), must be used to measure the thermal efficiency and CO emissions of outdoor and indoor residential hydronic heaters and forced-air furnaces, except that the burn rates specified in Method 28WHH must be used for hydronic heaters.

(b) Testing conducted with continuously fed biomass as the fuel(s) must be conducted according to the relevant section of the ASTM E2618–13 (IBR, see § 60.17) or adaptations approved by EPA. The EPA will post all approved alternative test methods on the EPA Web site.

(c)(1) For outdoor and indoor residential hydronic heaters to be tested under the 2015 particulate matter emission standards in § 60.5474(b)(1), the manufacturer must have an EPA-approved test laboratory use:

- (i) Method 28WHH;
- (ii) Method 28WHH PTS;
- (iii) ASTM E2618–13 (IBR, see § 60.17) (using crib wood); or
- (iv) EN 303–5 (IBR, see § 60.17), only for units sold with thermal storage.

(2) For outdoor and indoor residential hydronic heaters to be tested under the 2020 particulate matter emission standards in § 60.5474(b)(2), the manufacturer must have an EPA-approved test laboratory use:

- (i) Method 28WHH;
- (ii) Method 28WHH PTS; or

(iii) ASTM E2618–13 (IBR, see § 60.17) (using crib wood).

(3) If the heater is equipped with full or partial heat storage, the manufacturer, retailer and installer must not sell or install the heater with less heat storage capacity than is used in the certification test.

(4) The manufacturer and approved laboratory must make the following adjustments to the methods listed in paragraphs (a), (c)(1) and (2) of this section:

(i) For ASTM E2618–13 (IBR, see § 60.17), the burn rate categories specified in Method 28WHH must be used;

(ii) For EN 303–5 (IBR, see § 60.17), the organic compounds must be included as part of the PM.

(iii) For ASTM 2618–13 (IBR, see § 60.17) Appendix A1 for full thermal storage certification tests, the test must use the large scale as required in the test method unless the manufacturer requests a variance, in advance of testing, contingent upon measuring flue gas temperature, oxygen and CO, using a simple electronic spreadsheet calculator to estimate efficiency and conducting a comparison to the delivered efficiency to determine if a more detailed examination should be made.

(5) For particulate matter emission concentrations measured with ASTM E2515–11 (IBR, see § 60.17), four-inch filters and Teflon membrane filters or Teflon-coated glass fiber filters may be used.

(6) For all tests conducted using ASTM 2515–11 (IBR, see § 60.17) pursuant to this section, the manufacturer and approved test laboratory must also measure the first hour of particulate matter emissions for each test run using a separate filter in one of the two parallel trains. The manufacturer and approved test laboratory must report the test results for the first hour separately and also include them in the total particulate matter emissions per run.

(d)(1) For hydronic heaters subject to the 2020 cord wood alternative compliance option specified in § 60.5474(b)(3), the manufacturers must have the approved laboratory conduct cord wood testing using the test methods listed below:

- (i) Method 28WHH;
- (ii) Method 28WHH PTS; or
- (iii) ASTM E2618–13 (IBR, see § 60.17) (using cord wood).

(2) If the heater is equipped with full or partial heat storage, the manufacturer, retailer and installer must not sell or install the heater with less heat storage

capacity than is used in the certification test.

(3) The manufacturer and approved laboratory must make the following adjustments to the methods listed in (d)(1) of this section:

(i) For ASTM E2618–13 (IBR, see § 60.17), use the burn rate categories specified in Method 28WHH;

(ii) For all methods, report the results separately per burn rate category.

(e) For forced-air furnaces, use CSA Method B415.1–10 (IBR, see § 60.17) to measure the heat output (mmBtu/hr) and particulate matter emission rate (lb/mmBtu heat output), except use the burn rate categories in Method 28WHH for the 2020 particulate matter emission standards. For the 2020 particulate matter emission standards, report the particulate matter, efficiency and CO emission results separately per burn rate category.

(f) For affected wood heaters subject to the particulate matter emission standards, emission concentrations must be measured with ASTM E2515–11 (IBR, see § 60.17), except for the 2015 certification tests using EN303–5 (IBR, see § 60.17). As required in paragraph (c)(4)(ii) of this section, the manufacturer and approved laboratory must add the organic gases to the PM for EN 303–5. Four-inch filters and Teflon membrane filters or Teflon-coated glass fiber filters may be used in ASTM E2515–11. Method 5H is not allowed for certification testing.

(g) Douglas fir may be used in ASTM E2618–13 and CSA B415.1–10 (IBR, see § 60.17).

(h) The manufacturer of an affected central heater model line must notify the Administrator of the date that certification testing is to begin, by email, to [WoodHeaterReports@epa.gov](mailto:WoodHeaterReports@epa.gov). This notice must be at least 30 days before the start of testing. The notification of testing must include the manufacturer's name and physical and email addresses, the approved test laboratory's name and physical and email addresses, third-party certifier name, the model name and number (or, if unavailable, some other way to distinguish between models), and the dates of testing. The laboratory may substitute certification testing of another affected central heater on the original date in order to ensure regular laboratory testing operations.

(i) The approved test laboratory must allow the manufacturer, the manufacturer's approved third-party certifier, the EPA and delegated state regulatory agencies to observe certification testing. However, manufacturers must not involve themselves in the conduct of the test after the pretest burn has begun.

Communications between the manufacturer and laboratory or third-party certifier personnel regarding operation of the central heater must be limited to written communications transmitted prior to the first pretest burn of the certification series. During certification tests, the manufacturer may communicate with laboratory personnel only in writing and only to notify them that the manufacturer has observed a deviation from proper test procedures. All communications must be included in the test documentation required to be submitted pursuant to § 60.5475(b)(5) and must be consistent with instructions provided in the owner's manual required under § 60.5478(f), except to the extent that they address details of the certification tests that would not be relevant to owners or regulators.

**§ 60.5477 What procedures must I use for EPA approval of a test laboratory or EPA approval of a third-party certifier?**

(a) *Test laboratory approval.* (1) A laboratory must apply to the Administrator for approval to test under this rule by submitting documentation that the laboratory is accredited by a nationally recognized accrediting entity under ISO-IEC Standard 17025 to perform testing using the test methods specified under § 60.5476. Laboratories accredited by EPA prior to May 15, 2015 may have until May 15, 2018 to submit documentation that they have accreditation under ISO-IEC Standard 17025 to perform testing using the test methods specified under § 60.5476. ISO accreditation is required for all other laboratories performing hydronic heater testing beginning on May 15, 2015, and performing forced-air furnace testing beginning on November 16, 2015.

(2) As part of the application, the test laboratory must:

- (i) Agree to participate biennially in an independently operated proficiency testing program with no direct ties to the laboratories participating;
- (ii) Agree to allow the Administrator, regulatory agencies and certifying bodies access to observe certification testing;
- (iii) Agree to comply with calibration, reporting and recordkeeping requirements that affect testing laboratories; and
- (iv) Agree to perform a compliance audit test at the manufacturer's expense at the testing cost normally charged to such manufacturer if the laboratory is selected by the Administrator to conduct the compliance audit test of the manufacturer's model line. The test laboratory must provide a preliminary audit test report to the Administrator

within 14 days of the completion of testing, if a central heater exceeds the applicable emission limit in § 60.5474. The test laboratory must provide the Administrator and the manufacturer, within 30 days of the completion of audit testing, all documentation pertaining to the test, including the complete test report and raw data sheets, laboratory technician notes, and test results for all test runs.

(v) Have no conflict of interest and receive no financial benefit from the outcome of certification testing conducted pursuant to § 60.5475.

(vi) Agree to not perform initial certification tests on any models manufactured by a manufacturer for which the laboratory has conducted research and development design services within the last 5 years.

(vii) Agree to seal any wood heater on which it performed certification tests, immediately upon completion or suspension of certification testing, by using a laboratory-specific seal.

(viii) Agree to immediately notify the Administrator of any suspended tests through email and in writing, giving the date suspended, the reason(s) why, and the projected date for restarting. The laboratory must submit the operation and test data obtained, even if the test is not completed.

(3) If the EPA approves the laboratory, the Administrator will provide the test laboratory with a certificate of approval for testing under this rule. If the EPA does not approve the laboratory, the Administrator will give written notice to the laboratory setting forth the basis for the determination.

(b) *Revocation of test laboratory approval.* (1) The Administrator may revoke the EPA laboratory approval if it is determined that the laboratory:

- (i) Is no longer accredited by the accreditation body;
- (ii) Does not follow required procedures or practices;
- (iii) Has falsified data or otherwise misrepresented emission data;
- (iv) Failed to participate in a proficiency testing program, in accordance with its commitment under paragraph (a)(2)(i) of this section; or
- (v) Failed to seal the central heater in accordance with paragraph (a)(2)(vii) of this section.

(2) Revocation of approval under this paragraph (b) will not take effect until the laboratory concerned has been given written notice by the Administrator setting forth the basis for the proposed determination and an opportunity for a hearing under § 60.5481. However, if revocation is ultimately upheld, all tests conducted by the laboratory after written notice was given will, at the

discretion of the Administrator, be declared invalid.

(c) *Period of test laboratory approval.*

(1) With the exception of laboratories meeting the provisions of paragraph (c)(2) of this section, and unless revoked sooner, a certificate of approval for testing under this rule is valid for 5 years from the date of issuance.

(2) Laboratories accredited by the EPA by May 15, 2015, under the provisions of § 60.535 as in effect prior to that date may continue to be EPA accredited and deemed EPA approved for testing under this subpart until May 15, 2018, at which time the EPA accreditation and approval ends unless the laboratory has obtained accreditation under § 60.5477 as in effect on that date.

(d) *Third-party certifier approval.* (1) A Third-party certifier may apply to the Administrator for approval to be an EPA-approved third-party certifier by submitting credentials demonstrating that it has been accredited by a nationally recognized accrediting entity to perform certifications and inspections under ISO-IEC Standard 17025, ISO-IEC Standard 17065 and ISO-IEC Standard 17020.

(2) As part of the application, the third-party certifier must:

(i) Agree to offer to contract with central heater manufacturers to perform third-party certification activities according to the requirements set out in this subpart.

(ii) Agree to periodically conduct audits as described in § 60.5475(m) and the manufacturer's quality assurance program;

(iii) Agree to comply with reporting and recordkeeping requirements that affect approved central heater testing laboratories and third-party certifiers;

(iv) Have no conflict of interest and receive no financial benefit from the outcome of certification testing conducted pursuant to § 60.5475;

(v) Agree to make available to the Administrator supporting documentation for each central heater certification and audit; and

(vi) Agree to not perform initial certification reviews on any models manufactured by a manufacturer for which the third-party certifier has conducted research and development design services within the last 5 years.

(3) If approved, the Administrator will provide the third-party certifier with a certificate of approval. The approval will expire 5 years after being issued unless renewed by the third-party certifier. If the EPA denies the approval, the Administrator will give written notice to the third-party certifier for the basis for the determination.

(e) *Revocation of third-party certifier approval.* (1) The Administrator will revoke the third-party certifier's EPA approval if it is determined that the certifier:

- (i) Is no longer accredited by the accreditation body;
- (ii) Does not follow required procedures or practices; or
- (iii) Has falsified certification data or otherwise misrepresented emission data.

(2) Revocation of approval under this paragraph (e) will not take effect until the certifier concerned is given written notice by the Administrator setting forth the basis for the proposed determination and an opportunity for a hearing under § 60.5481. However, if revocation is upheld, all certifications by the certifier after written notice was given will, at the discretion of the Administrator, be declared invalid.

**§ 60.5478 What requirements must I meet for permanent labels, temporary labels (hangtags), and owner's manuals?**

(a) *General permanent label requirements.* (1) Each affected central heater manufactured or sold on or after the date the applicable standards come into effect as specified in § 60.5474, must have a permanent label affixed to it that meets the requirements of this section.

(2) The permanent label must contain the following information:

- (i) Month and year of manufacture of the individual unit;
- (ii) Model name and number;
- (iii) Certification test emission value, test method, and standard met; and
- (iv) Serial number.

(3) The permanent label must:

- (i) Be affixed in a readily visible or accessible location in such a manner that it can be easily viewed before and after the appliance is installed (a easily removable façade can be used for aesthetic purposes);
- (ii) Be at least 8.9 cm long and 5.1 cm wide (3 1/2 inches long and 2 inches wide);
- (iii) Be made of a material expected to last the lifetime of the central heater;
- (iv) Present the required information in a manner so that it is likely to remain legible for the lifetime of the central heater; and
- (v) Be affixed in such a manner that it cannot be removed without damage to the label.

(4) The permanent label may be combined with any other label, as long as the required information is displayed, the integrity of the permanent label is not compromised, and the permanent label meets the requirements of § 60.5478(a)(3).

(5) Any label statement under paragraph (b) of this section constitutes a representation by the manufacturer as to any central heater that bears it:

- (i) That a certification of compliance was in effect at the time the central heater left the possession of the manufacturer;
- (ii) That the manufacturer was, at the time the label was affixed, conducting a quality assurance program in conformity with § 60.5475(m); and
- (iii) That all the central heaters individually tested for emissions by the manufacturer under its quality assurance program pursuant to § 60.5475(m) met the applicable emissions limit.

(b) *Permanent label requirements for central heaters.* If a central heater belongs to a model line certified under § 60.5475, and no unit in the model line has been found to exceed the applicable emission limits or tolerances through quality assurance testing, one of the following statements, as appropriate, must appear on the permanent label:

“U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with the 2015 particulate emission standards. Not approved for sale after May 15, 2020” or

“U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with the 2016 particulate emission standards. Not approved for sale after May 15, 2020” or

“U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with the 2017 particulate emission standards. Not approved for sale after May 15, 2020” or

“U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with the 2020 particulate emission standards using crib wood.” or

“U.S. ENVIRONMENTAL PROTECTION AGENCY Certified to comply with the 2020 particulate emission standards using cord wood.”

(c) *Additional permanent label content.* The permanent label for all certified central heaters must also contain the following statement on the permanent label:

“This appliance needs periodic inspection and repair for proper operation. Consult owner's manual for further information. It is against federal regulations to operate this appliance in a manner inconsistent with operating instructions in the owner's manual.”

(d) *Permanent label requirements for affected wood heaters with exemptions under § 60.5472(b).* (1) If an affected central heater is manufactured in the United States for export as provided in

§ 60.5472(b)(1), the following statement must appear on the permanent label:

“U.S. ENVIRONMENTAL PROTECTION AGENCY Export appliance. May not be sold or operated in the United States.”

(2) If an affected central heater is manufactured for use for research and development purposes as provided in § 60.5472(b)(2), the following statement must appear on the permanent label:

“U.S. ENVIRONMENTAL PROTECTION AGENCY Not certified. Research Appliance. Not approved for sale or for operation other than for research.”

(3) If an affected central heater is a non wood-burning central heater exclusively as provided in § 60.5472(b)(3), the following statement must appear on the permanent label:

“U.S. ENVIRONMENTAL PROTECTION AGENCY This appliance is not certified for wood burning. Use of any wood fuel is a violation of federal regulations.”

(e) *Temporary label (hangtag) voluntary options.* (1) Each model line certified to meet the 2020 particulate emission standards prior to May 15, 2020 may display the hangtags specified in section 3 of Appendix I of this part. The electronic template will be provided by the Administrator upon approval of the certification.

(2) The hangtags in paragraph (e)(1) of this section end upon May 15, 2020.

(3) Each model certified to meet the 2020 Cord Wood Alternative Compliance Option may display the cord wood temporary label specified in section 3 of Appendix I of this part. The electronic template will be provided by the Administrator upon approval of the certification.

(f) *Owner's manual requirements.* (1) Each affected central heater offered for sale by a commercial owner must be accompanied by an owner's manual that must contain the information listed in paragraph (f)(2) of this section (pertaining to installation), and paragraph (f)(3) of this section (pertaining to operation and maintenance). Such information must be adequate to enable consumers to achieve optimal emissions performance. Such information must be consistent with the operating instructions provided by the manufacturer to the approved test laboratory for operating the central heater during certification testing, except for details of the certification test that would not be relevant to the ultimate user. The commercial owner must also make current and historical owner's manuals available on the company Web site and upon request to the EPA.

(2) Guidance on proper installation information, including stack height, heater location and achieving proper draft.

(3) Proper operation and maintenance information, including minimizing visible emissions.

(i) Fuel loading and re-loading procedures, recommendations on fuel selection and warnings on what fuels not to use, such as unseasoned wood, treated wood, colored paper, cardboard, solvents, trash and garbage;

(ii) Fire starting procedures;

(iii) Proper use of air controls, including how to establish good combustion and how to ensure good combustion at the lowest burn rate for which the heater is warranted;

(iv) Ash removal procedures;

(v) Instructions for replacement of gaskets and other parts that are critical to the emissions performance of the unit and other maintenance and repair instructions;

(vi) For catalytic models, information on the following pertaining to the catalytic combustor: Procedures for achieving and maintaining catalyst activity, maintenance procedures, procedures for determining deterioration or failure, procedures for replacement and information on how to exercise warranty rights;

(vii) For catalytic models, the following statement—

“This wood heater contains a catalytic combustor, which needs periodic inspection and replacement for proper operation. It is against federal regulations to operate this wood heater in a manner inconsistent with operating instructions in this manual, or if the catalytic element is deactivated or removed”; and

(viii) For noncatalytic models, the following statement—

“This wood heater needs periodic inspection and repair for proper operation. It is against federal regulations to operate this wood heater in a manner inconsistent with operating instructions in this manual.”

(4) Any manufacturer using the EPA-recommended language contained in Appendix I of this part to satisfy any requirement of this paragraph (f) will be considered to be in compliance with that requirement, provided that the particular model language is printed in full, with only such changes as are necessary to ensure accuracy for the particular model line.

(g) Central heaters that are affected by this subpart, but that have been owned and operated by a noncommercial owner, are not subject to paragraphs (e)

and (f) of this section when offered for resale.

**§ 60.5479 What records must I keep and what reports must I submit?**

(a)(1) Each manufacturer who holds a certificate of compliance pursuant to § 60.5475(a)(2) for a model line must maintain records containing the information required by paragraphs (a)(2) through (4) of this section with respect to that model line for at least 5 years.

(2) All documentation pertaining to the certification test used to obtain certification, including the full test report and raw data sheets, laboratory technician notes, calculations, and the test results for all test runs, and discussions of the appropriateness and validity of all test runs, including runs attempted but not completed. The retained certification test documentation must include, as applicable, detailed discussions of all anomalies, whether all burn rate categories were properly achieved, any data not used in the calculations and, for any test runs not completed, the data that were collected and the reason that the test run was not completed. The retained certification test also must include documentation that the burn rate for the low burn category was no greater than the rate that an operator can achieve in home use and no greater than is advertised by the manufacturer or retailer.

(3) Results of the quality assurance program inspections required pursuant to § 60.5475(m).

(4) For emissions tests conducted pursuant to the quality assurance program required by § 60.5475(m), all test reports, data sheets, laboratory technician notes, calculations, and test results for all test runs, the corrective actions taken, if any, and any follow-up actions such as additional testing.

(b) Each approved test laboratory and third-party certifier must maintain records consisting of all documentation pertaining to each certification test, quality assurance program inspection and audit test, including the full test report and raw data sheets, technician notes, calculations, the test results for all test runs. Each approved test laboratory must submit accreditation credentials and all proficiency test results to the Administrator. Each third-party certifier must submit each certification test, quality assurance program inspection report and ISO-IEC accreditation credentials to the Administrator.

(c) Each manufacturer must retain each central heater upon which certification tests were performed and

certification granted under § 60.5475(a)(2) at the manufacturer's facility for 5 years after the certification test. Each central heater must remain sealed and unaltered. Any such central heater must be made available upon request to the Administrator for inspection and testing.

(d) Each manufacturer of an affected central heater model line certified pursuant to § 60.5475(a)(2) must submit a report to the Administrator every 2 years following issuance of a certificate of compliance for each model line. This report must include the sales for each model by state and certify that no changes in the design or manufacture of the model line have been made that require recertification pursuant to § 60.5475(k).

(e)(1) Unless otherwise specified, all records required under this section must be maintained by the manufacturer, commercial owner of the affected central heater, approved test laboratory or third-party certifier for a period of no less than 5 years.

(2) Unless otherwise specified, all reports to the Administrator required under this subpart must be made to: *WoodHeaterReports@epa.gov*.

(f) Within 60 days after the date of completing each performance test (e.g., initial certification test, tests conducted for quality assurance and tests for renewal or recertification), each manufacturer must submit performance test data electronically to *WoodHeaterReports@epa.gov*. Owners or operators who claim that some of the information being submitted for performance tests is CBI (e.g., design drawings) must submit a complete file, including information claimed to be CBI on a compact disk or other commonly used electronic storage media (including, but not limited to, flash drives), by mail, and the same file with the CBI omitted, electronically. The compact disk must be clearly marked as CBI and mailed to U.S. EPA, OECA CBI Office, Attention: Residential Wood Heater Compliance Program, Washington, DC 20004. Emission data and all information necessary to determine compliance, except sensitive engineering drawings and sensitive detailed material specifications, cannot be claimed as CBI.

(g) Within 30 days of receiving a certification of compliance for a model line, the manufacturer must make the full non-CBI test report and the summary of the test report available on the manufacturer's Web site.

(h) Each manufacturer who uses the exemption for R&D heaters under § 60.5472(b)(2) must maintain records for at least 5 years documenting where

the heaters were located, that the heaters were never offered for sale or sold and that the heaters were not used for the purpose of heating.

**§ 60.5480 What activities are prohibited under this subpart?**

(a) No person is permitted to advertise for sale, offer for sale, sell or operate an affected residential hydronic heater or forced-air furnace or other central heater that does not have affixed to it a permanent label pursuant to § 60.5478(b) through (d), as applicable.

(b) No person is permitted to advertise for sale, offer for sale, or sell an affected central heater labeled under § 60.5478(d)(1) except for export. No person is permitted to operate an affected central heater in the United States if it is labeled under § 60.5478(d)(1).

(c)(1) No commercial owner is permitted to advertise for sale, offer for sale, or sell an affected central heater permanently labeled under § 60.5478(b) unless:

(i) The affected appliance has been certified to comply with the particulate emission standards pursuant to § 60.5474 as applicable; and

(ii) The commercial owner provides any purchaser or transferee with an owner's manual that meets the requirements of § 60.5478(f), a copy of the warranty and a moisture meter.

(2) A commercial owner other than a manufacturer complies with the requirements of paragraph (c)(1) of this section if the commercial owner:

(i) Receives the required documentation from the manufacturer or a previous commercial owner; and

(ii) Provides that documentation unaltered to any person to whom the central heater that it covers is sold or transferred.

(d)(1) In any case in which the Administrator revokes a certificate of compliance either for the knowing submission of false or inaccurate information or other fraudulent acts, or based on a finding under § 60.5475(l)(1)(ii) that the certification test was not valid, the Administrator may give notice of that revocation and the grounds for it to all commercial owners.

(2) On and after the date of receipt of the notice given under paragraph (d)(1) of this section, no commercial owner is permitted to sell any central heater covered by the revoked certificate (other than to the manufacturer) unless the model line has been recertified in accordance with this subpart.

(e) No person is permitted to install or operate an affected central heater except in a manner consistent with the

instructions on its permanent label and in the owner's manual pursuant to § 60.5478(f), including only using fuels for which the unit is certified.

(f) No person is permitted to operate, sell or offer for sale an affected central heater that was originally equipped with a catalytic combustor if the catalytic element is deactivated or removed.

(g) No person is permitted to operate, sell or offer for sale an affected central heater that has been physically altered to exceed the tolerance limits of its certificate of compliance, pursuant to § 60.5475(k).

(h) No person is permitted to alter, deface, or remove any permanent label required to be affixed pursuant to § 60.5478(a) through (d), as applicable.

(i) If a temporary label is affixed to the central heater, retailers may not sell or offer for sale that central heater unless the temporary label affixed is in accordance with § 60.5478(e), as applicable.

**§ 60.5481 What hearing and appeal procedures apply to me?**

(a)(1) The affected manufacturer, laboratory or third-party certifier may request a hearing under this section within 30 days following receipt of the required notification in any case where the Administrator—

(i) Denies an application for a certificate of compliance under § 60.5475 (a)(2);

(ii) Denies an application for a renewal of certification under § 60.5475(i);

(iii) Issues a notice of revocation of certification under § 60.5475(l);

(iv) Denies an application for laboratory approval under § 60.5477(a);

(v) Issues a notice of revocation of laboratory approval under § 60.5477(b).

(vi) Denies an application for third-party certifier approval under § 60.5477(d); or

(vii) Issues a notice of revocation of third-party certifier approval under § 60.5477(e).

(2) In any case where the Administrator issues a notice of revocation under § 60.5475(n)(3)(ii), the manufacturer may request a hearing under this section with the time limits set out in § 60.5475(n)(3)(ii).

(b) Any hearing request must be in writing, must be signed by an authorized representative of the petitioning manufacturer or laboratory, and must include a statement setting forth with particularity the petitioner's objection to the Administrator's determination or proposed determination.

(c)(1) Upon receipt of a request for a hearing under paragraph (a) of this

section, the Administrator will request the Chief Administrative Law Judge to designate an Administrative Law Judge as Presiding Officer for the hearing. If the Chief Administrative Law Judge replies that no Administrative Law Judge is available to perform this function, the Administrator will designate a Presiding Officer who has not had any prior responsibility for the matter under review, and who is not subject to the direct control or supervision of someone who has had such responsibility.

(2) The hearing will commence as soon as practicable at a time and place fixed by the Presiding Officer.

(3)(i) A motion for leave to intervene in any proceeding conducted under this section must set forth the grounds for the proposed intervention, the position and interest of the movant and the likely impact that intervention will have on the expeditious progress of the proceeding. Any person already a party to the proceeding may file an answer to a motion to intervene, making specific reference to the factors set forth in the foregoing sentence and paragraph (c)(3)(iii) of this section within 10 days after service of the motion for leave to intervene.

(ii) A motion for leave to intervene in a proceeding must ordinarily be filed before the first prehearing conference or, in the absence of a prehearing conference, prior to the setting of a time and place for a hearing. Any motion filed after that time must include, in addition to the information set forth in paragraph (c)(3)(i) of this section, a statement of good cause for the failure to file in a timely manner. The intervenor shall be bound by any agreements, arrangements and other matters previously made in the proceeding.

(iii) A motion for leave to intervene may be granted only if the movant demonstrates that his presence in the proceeding would not unduly prolong or otherwise prejudice the adjudication of the rights of the original parties, and that movant may be adversely affected by a final order. The intervenor will become a full party to the proceeding upon the granting of leave to intervene.

(iv) Persons not parties to the proceeding may move for leave to file *amicus curiae* briefs. The movant must state his interest and the reasons why the proposed *amicus* brief is desirable. If the motion is granted, the Presiding Officer or Administrator will issue an order setting the time for filing such brief. An *amicus curia* may participate in any briefing after his motion is granted, and will be served with all

briefs, reply briefs, motions, and orders relating to issues to be briefed.

(4) In computing any period of time prescribed or allowed in this subpart, the day of the event from which the designated period begins to run will not be included. Saturdays, Sundays, and federal legal holidays will be included. When a stated time expires on a Saturday, Sunday or legal holiday, the stated time period will be extended to include the next business day.

(d)(1) Upon his appointment the Presiding Officer must establish a hearing file. The file will consist of the notice issued by the Administrator under §§ 60.5475(c)(2), 60.5475(f)(3), 60.5475(i)(4), 60.5475(l)(2), 60.5475(n)(3)(ii)(A), 60.5477(a)(3), 60.5477(b)(2), 60.5477(d)(3) or 60.5477(e)(2), together with any accompanying material, the request for a hearing and the supporting data submitted therewith, and all documents relating to the request for certification or approval, or the proposed revocation of either.

(2) The hearing file must be available for inspection by any party, to the extent authorized by law, at the office of the Presiding Officer, or other place designated by him.

(e) Any party may appear in person, or may be represented by counsel or by any other duly authorized representative.

(f)(1) The Presiding Officer, upon the request of any party, or at his discretion, may order a prehearing conference at a time and place specified by him to consider the following:

- (i) Simplification of the issues;
- (ii) Stipulations, admissions of fact, and the introduction of documents;
- (iii) Limitation of the number of expert witnesses;
- (iv) Possibility of agreement disposing of all or any of the issues in dispute; and
- (v) Such other matters as may aid in the disposition of the hearing, including such additional tests as may be agreed upon by the parties.

(2) The results of the conference must be reduced to writing by the Presiding Officer and made part of the record.

(g)(1) Hearings shall be conducted by the Presiding Officer in an informal but orderly and expeditious manner. The parties may offer oral or written evidence, subject to the exclusion by the Presiding Officer of irrelevant, immaterial and repetitious evidence.

(2) Witnesses will not be required to testify under oath. However, the Presiding Officer will call to the attention of witnesses that their statements may be subject to penalties under title 18 U.S.C. 1001 for knowingly making false statements or

representations or using false documents in any matter within the jurisdiction of any department or agency of the United States.

(3) Any witness may be examined or cross-examined by the Presiding Officer, the parties, or their representatives.

(4) Hearings must be recorded verbatim. Copies of transcripts of proceedings may be purchased by the applicant from the reporter.

(5) All written statements, charts, tabulations and similar data offered in evidence at the hearings must, upon a showing satisfactory to the Presiding Officer of their authenticity, relevancy and materiality, be received in evidence and will constitute a part of the record.

(h)(1) The Presiding Officer will make an initial decision which must include written findings and conclusions and the reasons or basis therefor on all the material issues of fact, law, or discretion presented on the record. The findings, conclusions and written decision must be provided to the parties and made a part of the record. The initial decision will become the decision of the Administrator without further proceedings unless there is an appeal to the Administrator or motion for review by the Administrator. Except as provided in paragraph (h)(3) of this section, any such appeal must be taken within 20 days of the date the initial decision was filed.

(2) On appeal from or review of the initial decision the Administrator will have all the powers which he would have in making the initial decision including the discretion to require or allow briefs, oral argument, the taking of additional evidence or the remanding to the Presiding Officer for additional proceedings. The decision by the Administrator must include written findings and conclusions and the reasons or basis therefor on all the material issues of fact, law, or discretion presented on the appeal or considered in the review.

(3) In any hearing requested under paragraph (a)(2) of this section the Presiding Officer must render the initial decision within 60 days of that request. Any appeal to the Administrator must be taken within 10 days of the initial decision, and the Administrator must render a decision in that appeal within 30 days of the filing of the appeal.

#### **§ 60.5482 Who implements and enforces this subpart?**

(a) Under section 111(c) of the Clean Air Act, the Administrator may delegate the following implementation and enforcement authority to a state, local or tribal authority upon request:

(1) Enforcement of prohibitions on the installation and operation of affected central heaters in a manner inconsistent with the installation and owner's manual;

(2) Enforcement of prohibitions on operation of catalytic central heaters where the catalyst has been deactivated or removed;

(3) Enforcement of prohibitions on advertisement and/or sale of uncertified model lines;

(4) Enforcement of prohibitions on advertisement and/or sale of affected central heaters that do not have required permanent label;

(5) Enforcement of proper labeling of affected central heaters;

(6) Enforcement of compliance with other labeling requirements for affected central heaters.

(7) Enforcement of certification testing procedures;

(8) Enforcement of requirements for sealing of the tested central heaters and meeting parameter limits; and

(9) Enforcement of compliance requirements of EPA-approved laboratories.

(b) Delegations shall not include:

- (1) Decisions on certification;
- (2) Revocation of certification;
- (3) Establishment or revision of standards;
- (4) Establishment or revision of test methods;

(5) Laboratory and third-party certifier approvals and revocations;

(6) Enforcing provisions governing content of owner's manuals; and

(7) Hearings and appeals procedures.

(c) Nothing in these delegations will prohibit the Administrator from enforcing any applicable requirements.

(d) Nothing in these delegations will limit delegated entities from using their authority under section 116 of the Clean Air Act to adopt or enforce more restrictive requirements.

#### **§ 60.5483 What parts of the General Provisions do not apply to me?**

The following provisions of subpart A of part 60 do not apply to this subpart:

- (a) Section 60.7;
- (b) Section 60.8(a), (c), (d), (e), (f) and (g); and
- (c) Section 60.15(d).

■ 6. Part 60 Appendix A-8 is amended by adding Test Methods 28R, 28WHH, and 28WHH-PTS to follow Test Method 28A to read as follows:

#### **Appendix A-8 to Part 60—Test Methods 26 through 30B**

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## Test Method 28R for Certification and Auditing of Wood Heaters

### 1.0 Scope and Application

1.1 This test method applies to certification and auditing of wood-fired room heaters and fireplace inserts.

1.2 The test method covers the fueling and operating protocol for measuring particulate emissions, as well as determining burn rates, heat output and efficiency.

1.3 Particulate emissions are measured by the dilution tunnel method as specified in ASTM E2515-11 *Standard Test Method for Determination of Particulate Matter Emissions Collected in a Dilution Tunnel* (IBR, see § 60.17). Upon request, four-inch filters may be used. Upon request, Teflon membrane filters or Teflon-coated glass fiber filters may be used.

### 2.0 Procedures

2.1 This method incorporates the provisions of ASTM E2780-10 (IBR, see § 60.17) except as follows:

2.1.1 The burn rate categories, low burn rate requirement, and weightings in Method 28 shall be used.

2.1.2 The startup procedures shall be the same as in Method 28.

2.1.3 Manufacturers shall not specify a smaller volume of the firebox for testing than the full usable firebox.

2.1.4 Prior to testing, the heater must be operated for a minimum of 50 hours using a medium burn rate. The conditioning may be at the manufacturer's facility prior to the certification test. If the conditioning is at the certification test laboratory, the pre-burn for the first test can be included as part of the conditioning requirement.

2.2 Manufacturers may use ASTM E871-82 (reapproved 2013) (IBR, see § 60.17) as an alternative to the procedures in Method 5H or Method 28 for determining total weight basis moisture in the analysis sample of particulate wood fuel.

## Test Method 28WHH for Measurement of Particulate Emissions and Heating Efficiency of Wood-Fired Hydronic Heating Appliances

### 1.0 Scope and Application

1.1 This test method applies to wood-fired hydronic heating appliances. The units typically transfer heat through circulation of a liquid heat exchange media such as water or a water-antifreeze mixture.

1.2 The test method measures particulate emissions and delivered heating efficiency at specified heat output rates based on the appliance's rated heating capacity.

1.3 Particulate emissions are measured by the dilution tunnel method as specified in ASTM E2515-11 *Standard Test Method for Determination of Particulate Matter Emissions Collected in a Dilution Tunnel* (IBR, see § 60.17). Upon request, four-inch filters may be used. Upon request, Teflon membrane filters or Teflon-coated glass fiber filters may be used. Delivered efficiency is measured by determining the heat output through measurement of the flow rate and temperature change of water circulated through a heat exchanger external to the appliance and determining the input from the mass of dry wood fuel and its higher

heating value. Delivered efficiency does not attempt to account for pipeline loss.

1.4 Products covered by this test method include both pressurized and non-pressurized heating appliances intended to be fired with wood. These products are wood-fired hydronic heating appliances that the manufacturer specifies for indoor or outdoor installation. They are often connected to a heat exchanger by insulated pipes and normally include a pump to circulate heated liquid. They are used to heat structures such as homes, barns and greenhouses and can heat domestic hot water, spas or swimming pools.

1.5 Distinguishing features of products covered by this standard include:

1.5.1 Manufacturer specifies for indoor or outdoor installation.

1.5.2 A firebox with an access door for hand loading of fuel.

1.5.3 Typically, an aquastat that controls combustion air supply to maintain the liquid in the appliance within a predetermined temperature range provided sufficient fuel is available in the firebox.

1.5.4 A chimney or vent that exhausts combustion products from the appliance.

1.6 The values stated are to be regarded as the standard whether in I-P or SI units. The values given in parentheses are for information only.

### 2.0 Summary of Method and References

2.1 Particulate matter emissions are measured from a wood-fired hydronic heating appliance burning a prepared test fuel crib in a test facility maintained at a set of prescribed conditions. Procedures for determining burn rates, and particulate emissions rates and for reducing data are provided.

2.2 Referenced Documents

2.2.1 EPA Standards

2.2.1.1 Method 28 Certification and Auditing of Wood Heaters

2.2.2 Other Standards

2.2.2.1 ASTM E2515-11—*Standard Test Method for Determination of Particulate Matter Emissions Collected in a Dilution Tunnel* (IBR, see § 60.17).

2.2.2.2 CSA-B415.1-10 *Performance Testing of Solid-Fuel-Burning Heating Appliances* (IBR, see § 60.17).

### 3.0 Terminology

3.1 Definitions.

3.1.1 Hydronic Heating—A heating system in which a heat source supplies energy to a liquid heat exchange media such as water that is circulated to a heating load and returned to the heat source through pipes.

3.1.2 Aquastat—A control device that opens or closes a circuit to control the rate of fuel consumption in response to the temperature of the heating media in the heating appliance.

3.1.3 Delivered Efficiency—The percentage of heat available in a test fuel charge that is delivered to a simulated heating load as specified in this test method.

3.1.4 Manufacturer's Rated Heat Output Capacity—The value in Btu/hr (MJ/hr) that the manufacturer specifies that a particular model of hydronic heating appliance is

capable of supplying at its design capacity as verified by testing, in accordance with Section 13.

3.1.5 Burn Rate—The rate at which test fuel is consumed in an appliance. Measured in pounds (lbs) or kilograms of wood (dry basis) per hour (lb/hr or kg/hr).

3.1.6 Firebox—The chamber in the appliance in which the test fuel charge is placed and combusted.

3.1.7 Test Fuel Charge—The collection of test fuel layers placed in the appliance at the start of the emission test run.

3.1.8 Test Fuel Layer—Horizontal arrangement of test fuel units.

3.1.9 Test Fuel Unit—One or more test fuel pieces with ¾ inch (19 mm) spacers attached to the bottom and to one side. If composed of multiple test fuel pieces, the bottom spacer may be one continuous piece.

3.1.10 Test Fuel Piece—A single 4 x 4 (4 ± 0.25 inches by 4 ± 0.25 inches) [100 ± 6 mm by 100 ± 6 mm] white or red oak wood piece cut to the length required.

3.1.11 Test Run—An individual emission test that encompasses the time required to consume the mass of the test fuel charge.

3.1.12 Overall Efficiency (SLM)—The efficiency for each test run as determined using the CSA B415.1-10 (IBR, see § 60.17) stack loss method.

3.1.13 Thermopile—A device consisting of a number of thermocouples connected in series, used for measuring differential temperature.

### 4.0 Summary of Test Method

4.1 Dilution Tunnel. Emissions are determined using the "dilution tunnel" method specified in ASTM E2515-11 *Standard Test Method for Determination of Particulate Matter Emissions Collected in a Dilution Tunnel* (IBR, see § 60.17). The flow rate in the dilution tunnel is maintained at a constant level throughout the test cycle and accurately measured. Samples of the dilution tunnel flow stream are extracted at a constant flow rate and drawn through high efficiency filters. The filters are dried and weighed before and after the test to determine the emissions catch and this value is multiplied by the ratio of tunnel flow to filter flow to determine the total particulate emissions produced in the test cycle.

4.2 Efficiency. The efficiency test procedure takes advantage of the fact that this type of appliance delivers heat through circulation of the heated liquid (water) from the appliance to a remote heat exchanger and back to the appliance. Measurements of the water temperature difference as it enters and exits the heat exchanger along with the measured flow rate allow for an accurate determination of the useful heat output of the appliance. The input is determined by weight of the test fuel charge, adjusted for moisture content, multiplied by the higher heating value. Additional measurements of the appliance weight and temperature at the beginning and end of a test cycle are used to correct for heat stored in the appliance. Overall efficiency (SLM) is determined using the CSA B415.1-10 (IBR, see § 60.17) stack loss method for data quality assurance purposes.

4.3 Operation. Appliance operation is conducted on a hot-to-hot test cycle meaning



that the appliance is brought to operating temperature and a coal bed is established prior to the addition of the test fuel charge and measurements are made for each test fuel charge cycle. The measurements are made under constant heat draw conditions within predetermined ranges. No attempt is made to modulate the heat demand to simulate an indoor thermostat cycling on and off in response to changes in the indoor environment. Four test categories are used. These are:

4.3.1 Category I: A heat output of 15 percent or less of manufacturer's rated heat output capacity.

4.3.2 Category II: A heat output of 16 percent to 24 percent of manufacturer's rated heat output capacity.

4.3.3 Category III: A heat output of 25 percent to 50 percent of manufacturer's rated heat output capacity.

4.3.4 Category IV: Manufacturer's rated heat output capacity.

## 5.0 Significance and Use

5.1 The measurement of particulate matter emission rates is an important test method widely used in the practice of air pollution control.

5.1.1 These measurements, when approved by state or federal agencies, are often required for the purpose of determining compliance with regulations and statutes.

5.1.2 The measurements made before and after design modifications are necessary to demonstrate the effectiveness of design changes in reducing emissions and make this standard an important tool in manufacturers' research and development programs.

5.2 Measurement of heating efficiency provides a uniform basis for comparison of product performance that is useful to the consumer. It is also required to relate emissions produced to the useful heat production.

5.3 This is a laboratory method and is not intended to be fully representative of all actual field use. It is recognized that users of hand-fired, wood-burning equipment have a great deal of influence over the performance of any wood-burning appliance. Some compromises in realism have been made in the interest of providing a reliable and repeatable test method.

## 6.0 Test Equipment

6.1 Scale. A platform scale capable of weighing the appliance under test and associated parts and accessories when completely filled with water to an accuracy of  $\pm 1.0$  pound ( $\pm 0.5$  kg).

6.2 Heat Exchanger. A water-to-water heat exchanger capable of dissipating the expected heat output from the system under test.

6.3 Water Temperature Difference Measurement. A Type—T 'special limits' thermopile with a minimum of 5 pairs of junctions shall be used to measure the temperature difference in water entering and leaving the heat exchanger. The temperature difference measurement uncertainty of this type of thermopile is equal to or less than  $\pm 0.50$  °F ( $\pm 0.25$  °C). Other temperature measurement methods may be used if the temperature difference measurement

uncertainty is equal to or less than  $\pm 0.50$  °F ( $\pm 0.25$  °C).

6.4 Water Flow Meter. A water flow meter shall be installed in the inlet to the load side of the heat exchanger. The flow meter shall have an accuracy of  $\pm 1$  percent of measured flow.

6.4.1 Optional—Appliance Side Water Flow Meter. A water flow meter with an accuracy of  $\pm 1$  percent of the flow rate is recommended to monitor supply side water flow rate.

6.5 Optional Recirculation Pump. Circulating pump used during test to prevent stratification of liquid being heated.

6.6 Water Temperature Measurement—Thermocouples or other temperature sensors to measure the water temperature at the inlet and outlet of the load side of the heat exchanger. Must meet the calibration requirements specified in section 10.1.

6.7 Wood Moisture Meter—Calibrated electrical resistance meter capable of measuring test fuel moisture to within 1 percent moisture content. Must meet the calibration requirements specified in section 10.4.

6.8 Flue Gas Temperature Measurement—Must meet the requirements of CSA B415.1–10 (IBR, see § 60.17), clause 6.2.2.

6.9 Test Room Temperature Measurement—Must meet the requirements of CSA B415.1–10 (IBR, see § 60.17), clause 6.2.1.

6.10 Flue Gas Composition Measurement—Must meet the requirements of CSA B415.1–10 (IBR, see § 60.17), clauses 6.3.1 through 6.3.3.

## 7.0 Safety

7.1 These tests involve combustion of wood fuel and substantial release of heat and products of combustion. The heating system also produces large quantities of very hot water and the potential for steam production and system pressurization. Appropriate precautions must be taken to protect personnel from burn hazards and respiration of products of combustion.

## 8.0 Sampling, Test Specimens and Test Appliances

8.1 Test specimens shall be supplied as complete appliances including all controls and accessories necessary for installation in the test facility. A full set of specifications and design and assembly drawings shall be provided when the product is to be placed under certification of a third-party agency. The manufacturer's written installation and operating instructions are to be used as a guide in the set-up and testing of the appliance.

## 9.0 Preparation of Test Equipment

9.1 The appliance is to be placed on a scale capable of weighing the appliance fully loaded with a resolution of  $\pm 1.0$  lb (0.5 kg).

9.2 The appliance shall be fitted with the type of chimney recommended or provided by the manufacturer and extending to  $15 \pm 0.5$  feet ( $4.6 \pm 0.15$  m) from the upper surface of the scale. If no flue or chimney system is recommended or provided by the manufacturer, connect the appliance to a flue of a diameter equal to the flue outlet of the

appliance. The flue section from the appliance flue collar to  $8 \pm 0.5$  feet above the scale shall be single wall stove pipe and the remainder of the flue shall be double wall insulated class A chimney.

## 9.3 Optional Equipment Use

9.3.1 A recirculation pump may be installed between connections at the top and bottom of the appliance to minimize thermal stratification if specified by the manufacturer. The pump shall not be installed in such a way as to change or affect the flow rate between the appliance and the heat exchanger.

9.3.2 If the manufacturer specifies that a thermal control valve or other device be installed and set to control the return water temperature to a specific set point, the valve or other device shall be installed and set per the manufacturer's written instructions.

9.4 Prior to filling the tank, weigh and record the appliance mass.

## 9.5 Heat Exchanger

9.5.1 Plumb the unit to a water-to-water heat exchanger with sufficient capacity to draw off heat at the maximum rate anticipated. Route hoses, electrical cables, and instrument wires in a manner that does not influence the weighing accuracy of the scale as indicated by placing dead weights on the platform and verifying the scale's accuracy.

9.5.2 Locate thermocouples to measure the water temperature at the inlet and outlet of the load side of the heat exchanger.

9.5.3 Install a thermopile meeting the requirements of section 6.3 to measure the water temperature difference between the inlet and outlet of the load side of the heat exchanger.

9.5.4 Install a calibrated water flow meter in the heat exchanger load side supply line. The water flow meter is to be installed on the cooling water inlet side of the heat exchanger so that it will operate at the temperature at which it is calibrated.

9.5.5 Place the heat exchanger in a box with 2 in. (50 mm) of expanded polystyrene (EPS) foam insulation surrounding it to minimize heat losses from the heat exchanger.

9.5.6 The reported efficiency and heat output rate shall be based on measurements made on the load side of the heat exchanger.

9.5.7 Temperature instrumentation per section 6.6 shall be installed in the appliance outlet and return lines. The average of the outlet and return water temperature on the supply side of the system shall be considered the average appliance temperature for calculation of heat storage in the appliance ( $TF_{avg}$  and  $TI_{avg}$ ). Installation of a water flow meter in the supply side of the system is optional.

9.6 Fill the system with water. Determine the total weight of the water in the appliance when the water is circulating. Verify that the scale indicates a stable weight under operating conditions. Make sure air is purged properly.

## 10.0 Calibration and Standardization

10.1 Water Temperature Sensors. Temperature measuring equipment shall be calibrated before initial use and at least semi-annually thereafter. Calibrations shall be in

compliance with National Institute of Standards and Technology (NIST) Monograph 175, Standard Limits of Error.

#### 10.2 Heat Exchanger Load Side Water Flow Meter.

10.2.1 The heat exchanger load side water flow meter shall be calibrated within the flow range used for the test run using NIST traceable methods. Verify the calibration of the water flow meter before and after each test run and at least once during each test run by comparing the water flow rate indicated by the flow meter to the mass of water collected from the outlet of the heat exchanger over a timed interval. Volume of the collected water shall be determined based on the water density calculated from section 13, Eq. 8, using the water temperature measured at the flow meter. The uncertainty in the verification procedure used shall be 1 percent or less. The water flow rate determined by the collection and weighing method shall be within 1 percent of the flow rate indicated by the water flow meter.

10.3 Scales. The scales used to weigh the appliance and test fuel charge shall be calibrated using NIST traceable methods at least once every 6 months.

10.4 Moisture Meter. The moisture meter shall be calibrated per the manufacturer's instructions and checked before each use.

10.5 Flue Gas Analyzers—In accordance with CSA B415.1–10 (IBR, see § 60.17), clause 6.8.

### 11.0 Conditioning

11.1 Prior to testing, the appliance is to be operated for a minimum of 50 hours using a medium heat draw rate. The conditioning may be at the manufacturer's facility prior to the certification test. If the conditioning is at the certification test laboratory, the pre-burn for the first test can be included as part of the conditioning requirement. If conditioning is included in pre-burn, then the appliance shall be aged with fuel meeting the specifications outlined in sections 12.2 with a moisture content between 19 and 25 percent on a dry basis. Operate the appliance at a medium burn rate (Category II or III) for at least 10 hours for noncatalytic appliances and 50 hours for catalytic appliances. Record and report hourly flue gas exit temperature data and the hours of operation. The aging procedure shall be conducted and documented by a testing laboratory.

### 12.0 Procedure

12.1 Appliance Installation. Assemble the appliance and parts in conformance with the manufacturer's written installation instructions. Clean the flue with an appropriately sized, wire chimney brush before each certification test series.

12.2 Fuel. Test fuel charge fuel shall be red (*Quercus ruba L.*) or white (*Quercus alba*) oak 19 to 25 percent moisture content on a dry basis. Piece length shall be 80 percent of the firebox depth rounded down to the nearest 1 inch (25mm) increment. For example, if the firebox depth is 46 inches (1168mm) the 4 x 4 piece length would be 36 inches (46 inches x 0.8 = 36.8 inches rounded down to 36 inches). Pieces are to be placed in the firebox parallel to the longest firebox dimension. For fireboxes with sloped

surfaces that create a non-uniform firebox length, the piece length shall be adjusted for each layer based on 80 percent of the length at the level where the layer is placed. Pieces are to be spaced  $\frac{3}{4}$  inches (19 mm) apart on all faces. The first fuel layer may be assembled using fuel units consisting of multiple 4 x 4s consisting of single pieces with bottom and side spacers of 3 or more pieces if needed for a stable layer. The second layer may consist of fuel units consisting of no more than two pieces with spacers attached on the bottom and side. The top two layers of the fuel charge must consist of single pieces unless the fuel charge is only three layers. In that instance only the top layer must consist of single units. Three-quarter inch (19 mm) by 1.5 inch (38 mm) spacers shall be attached to the bottom of piece to maintain a  $\frac{3}{4}$  inch (19 mm) separation. When a layer consists of two or more units of 4 x 4s an additional  $\frac{3}{4}$  inch (19 mm) thick by 1.5 inch (38 mm) wide spacer shall be attached to the vertical face of each end of one 4 x 4, such that the  $\frac{3}{4}$  inch (19 mm) space will be maintained when two 4 x 4 units or pieces are loaded side by side. In cases where a layer contains an odd number of 4 x 4s one piece shall not be attached, but shall have spacers attached in a manner that will provide for the  $\frac{3}{4}$  inch (19 mm) space to be maintained (See Figure 1). Spacers shall be attached perpendicular to the length of the 4 x 4s such that the edge of the spacer is  $1 \pm 0.25$  inch from the end of the 4 x 4s in the previous layers. Spacers shall be red or white oak and will be attached with either nails (non-galvanized), brads or oak dowels. The use of kiln-dried wood is not allowed.

12.2.1 Using a fuel moisture meter as specified in section 6.7 of the test method, determine the fuel moisture for each test fuel piece used for the test fuel load by averaging at least five fuel moisture meter readings measured parallel to the wood grain. Penetration of the moisture meter insulated electrodes for all readings shall be  $\frac{1}{4}$  the thickness of the fuel piece or 19 mm ( $\frac{3}{4}$  in.), whichever is lesser. One measurement from each of three sides shall be made at approximately 3 inches from each end and the center. Two additional measurements shall be made centered between the other three locations. Each individual moisture content reading shall be in the range of 18 to 28 percent on a dry basis. The average moisture content of each piece of test fuel shall be in the range of 19 to 25 percent. It is not required to measure the moisture content of the spacers. Moisture shall not be added to previously dried fuel pieces except by storage under high humidity conditions and temperature up to 100 °F. Fuel moisture shall be measured within 4 hours of using the fuel for a test.

12.2.2 Firebox Volume. Determine the firebox volume in cubic feet. Firebox volume shall include all areas accessible through the fuel loading door where firewood could reasonably be placed up to the horizontal plane defined by the top of the loading door. A drawing of the firebox showing front, side and plan views or an isometric view with interior dimensions shall be provided by the manufacturer and verified by the laboratory.

Calculations for firebox volume from computer aided design (CAD) software programs are acceptable and shall be included in the test report if used. If the firebox volume is calculated by the laboratory the firebox drawings and calculations shall be included in the test report.

12.2.3 Test Fuel Charge. Test fuel charges shall be determined by multiplying the firebox volume by 10 pounds (4.54 kg) per ft<sup>3</sup> (28L), or a higher load density as recommended by the manufacturer's printed operating instructions, of wood (as used wet weight). Select the number of pieces of standard fuel that most nearly match this target weight. This is the standard fuel charge for all tests. For example, if the firebox loading area volume is 10 ft<sup>3</sup> (280L) and the firebox depth is 46 inches (1168 mm), test fuel charge target is 100 lbs (45 kg) minimum and the piece length is 36 inches (914 mm). If eight 4 x 4s, 36 inches long weigh 105 lbs (48 kg), use 8 pieces for each test fuel charge. All test fuel charges will be of the same configuration.

12.3 Sampling Equipment. Prepare the particulate emission sampling equipment as defined by ASTM E2515–11 *Standard Test Method for Determination of Particulate Matter Emissions Collected in a Dilution Tunnel* (IBR, see § 60.17). Upon request, four-inch filters may be used. Upon request, Teflon membrane filters or Teflon-coated glass fiber filters may be used.

12.4 Appliance Startup. The appliance shall be fired with wood fuel of any species, size and moisture content at the laboratories' discretion to bring it up to operating temperature. Operate the appliance until the water is heated to the upper operating control limit and has cycled at least two times. Then remove all unburned fuel, zero the scale and verify the scales accuracy using dead weights.

12.4.1 Pretest Burn Cycle. Reload appliance with oak wood and allow it to burn down to the specified coal bed weight. The pretest burn cycle fuel charge weight shall be within  $\pm 10$  percent of the test fuel charge weight. Piece size and length shall be selected such that charcoalization is achieved by the time the fuel charge has burned down to the required coal bed weight. Pieces with a maximum thickness of approximately 2 inches have been found to be suitable. Charcoalization is a general condition of the test fuel bed evidenced by an absence of large pieces of burning wood in the coal bed and the remaining fuel pieces being brittle enough to be broken into smaller charcoal pieces with a metal poker. Manipulations to the fuel bed prior to the start of the test run are to be done to achieve charcoalization while maintaining the desired heat output rate. During the pre-test burn cycle and at least one hour prior to starting the test run, adjust water flow to the heat exchanger to establish the target heat draw for the test. For the first test run the heat draw rate shall be equal to the manufacturer's rated heat output capacity.

12.4.1.1 Allowable Adjustments. Fuel addition or subtractions, and coal bed raking shall be kept to a minimum but are allowed up to 15 minutes prior to the start of the test

run. For the purposes of this method, coal bed raking is the use of a metal tool (poker) to stir coals, break burning fuel into smaller pieces, dislodge fuel pieces from positions of poor combustion, and check for the condition of charcoalization. Record all adjustments to and additions or subtractions of fuel, and any other changes to the appliance operations that occur during pretest ignition period. During the 15-minute period prior to the start of the test run, the wood heater loading door shall not be open more than a total of 1 minute. Coal bed raking is the only adjustment allowed during this period.

**12.4.2 Coal Bed Weight.** The appliance is to be loaded with the test fuel charge when the coal bed weight is between 10 percent and 20 percent of the test fuel charge weight. Coals may be raked as necessary to level the coal bed but may only be raked and stirred once between 15 to 20 minutes prior to the addition of the test fuel charge.

**12.5 Test Runs.** For all test runs, the return water temperature to the hydronic heater must be equal to or greater than 120 °F. Aquastat or other heater output control device settings that are adjustable shall be set using manufacturer specifications, either as factory set or in accordance with the owner's manual, and shall remain the same for all burn categories.

Complete a test run in each heat output rate category, as follows:

**12.5.1 Test Run Start.** Once the appliance is operating normally and the pretest coal bed weight has reached the target value per section 12.4.2, tare the scale and load the full test charge into the appliance. Time for loading shall not exceed 5 minutes. The actual weight of the test fuel charge shall be measured and recorded within 30 minutes prior to loading. Start all sampling systems.

**12.5.1.1** Record all water temperatures, differential water temperatures and water flow rates at time intervals of one minute or less.

**12.5.1.2** Record particulate emissions data per the requirements of ASTM E2515 (IBR, see § 60.17).

**12.5.1.3** Record data needed to determine overall efficiency (SLM) per the requirements of CSA B415.1–10 (IBR, see § 60.17), clauses 6.2.1, 6.2.2, 6.3, 8.5.7, 10.4.3 (a), 10.4.3(f), and 13.7.9.3

**12.5.1.3.1** Measure and record the test room air temperature in accordance with the requirements of CSA B415.1–10 (IBR, see § 60.17), clauses 6.2.1, 8.5.7 and 10.4.3 (g).

**12.5.1.3.2** Measure and record the flue gas temperature in accordance with the requirements of CSA B415.1–10 (IBR, see § 60.17), clauses 6.2.2, 8.5.7 and 10.4.3 (f).

**12.5.1.3.3** Determine and record the carbon monoxide (CO) and carbon dioxide (CO<sub>2</sub>) concentrations in the flue gas in accordance with CSA B415.1–10 (IBR, see § 60.17), clauses 6.3, 8.5.7 and 10.4.3 (i) and (j).

**12.5.1.3.4** Measure and record the test fuel weight per the requirements of CSA B415.1–10 (IBR, see § 60.17), clauses 8.5.7 and 10.4.3 (h).

**12.5.1.3.5** Record the test run time per the requirements of CSA B415.1–10 (IBR, see § 60.17), clauses 10.4.3 (a).

**12.5.1.4** Monitor the average heat output rate on the load side of the heat exchanger.

If the heat output rate gets close to the upper or lower limit of the target range ( $\pm 5$  percent) adjust the water flow through the heat exchanger to compensate. Make changes as infrequently as possible while maintaining the target heat output rate. The first test run shall be conducted at the Category IV heat output rate to validate that the appliance is capable of producing the manufacturer's rated heat output capacity.

**12.5.2 Test Fuel Charge Adjustment.** It is acceptable to adjust the test fuel charge (*i.e.*, reposition) once during a test run if more than 60 percent of the initial test fuel charge weight has been consumed and more than 10 minutes have elapsed without a measurable (1 lb or 0.5 kg) weight change while the operating control is in the demand mode. The time used to make this adjustment shall be less than 60 seconds.

**12.5.3 Test Run Completion.** The test run is completed when the remaining weight of the test fuel charge is 0.0 lb (0.0 kg). End the test run when the scale has indicated a test fuel charge weight of 0.0 lb (0.0 kg) or less for 30 seconds.

**12.5.3.1** At the end of the test run, stop the particulate sampling train and overall efficiency (SLM) measurements, and record the run time, and all final measurement values.

**12.5.4 Heat Output Capacity Validation.** The first test run must produce a heat output rate that is within 10 percent of the manufacturer's rated heat output capacity (Category IV) throughout the test run and an average heat output rate within 5 percent of the manufacturer's rated heat output capacity. If the appliance is not capable of producing a heat output within these limits, the manufacturer's rated heat output capacity is considered not validated and testing is to be terminated. In such cases, the tests may be restarted using a lower heat output capacity if requested by the manufacturer.

**12.5.5 Additional Test Runs.** Using the manufacturer's rated heat output capacity as a basis, conduct a test for additional heat output categories as specified in section 4.3. It is not required to run these tests in any particular order.

**12.5.6 Alternative Heat Output Rate for Category I.** If an appliance cannot be operated in the Category I heat output range due to stopped combustion, two test runs shall be conducted at heat output rates within Category II, provided that the completed test run burn rate is no greater than the burn rate expected in home use. If this rate cannot be achieved, the test is not valid.

When the alternative heat output rate is used, the weightings for the weighted averages indicated in Table 2 shall be the average of the Category I and II weightings and shall be applied to both Category II results. The two completed runs in Category II will be deemed to meet the requirement for runs completed in both Category I and Category II. Appliances that are not capable of operation within Category II (<25 percent of maximum) cannot be evaluated by this test method. The test report must include full documentation and discussion of the attempted runs, completed runs and calculations.

**12.5.6.1 Stopped Fuel Combustion.** Evidence that an appliance cannot be

operated at a Category I heat output rate due to stopped fuel combustion shall include documentation of two or more attempts to operate the appliance in burn rate Category I and fuel combustion has stopped prior to complete consumption of the test fuel charge. Stopped fuel combustion is evidenced when an elapsed time of 60 minutes or more has occurred without a measurable (1 lb or 0.5 kg) weight change in the test fuel charge while the appliance operating control is in the demand mode. Report the evidence and the reasoning used to determine that a test in burn rate Category I cannot be achieved. For example, two unsuccessful attempts to operate at an output rate of 10 percent of the rated output capacity are not sufficient evidence that burn rate Category I cannot be achieved. Note that section 12.5.6 requires that the completed test run burn rate can be no greater than the burn rate expected in home use. If this rate cannot be achieved, the test is not valid.

**12.5.7 Appliance Overheating.** Appliances shall be capable of operating in all heat output categories without overheating to be rated by this test method. Appliance overheating occurs when the rate of heat withdrawal from the appliance is lower than the rate of heat production when the unit control is in the idle mode. This condition results in the water in the appliance continuing to increase in temperature well above the upper limit setting of the operating control. Evidence of overheating includes: 1 hour or more of appliance water temperature increase above the upper temperature set-point of the operating control, exceeding the temperature limit of a safety control device (independent from the operating control), boiling water in a non-pressurized system or activation of a pressure or temperature relief valve in a pressurized system.

**12.6 Additional Test Runs.** The testing laboratory may conduct more than one test run in each of the heat output categories specified in section 4.3.1. If more than one test run is conducted at a specified heat output rate, the results from at least two-thirds of the test runs in that heat output rate category shall be used in calculating the weighted average emission rate (See section 14.1.14). The measurement data and results of all test runs shall be reported regardless of which values are used in calculating the weighted average emission rate.

### 13.0 Calculation of Results

#### 13.1 Nomenclature

$E_T$ —Total particulate emissions for the full test run as determined per ASTM E2515–11 (IBR, see § 60.17) in grams  
 $E_{g/MJ}$ —Emissions rate in grams per megajoule of heat output  
 $E_{lb/MMBtu}$ —Emissions rate in pounds per million Btu of heat output  
 $E_{g/kg}$ —Emissions factor in grams per kilogram of dry fuel burned  
 $E_{g/hr}$ —Emissions factor in grams per hour  
 HHV—Higher heating value of fuel = 8600 Btu/lb (19.990 MJ/kg)  
 LHV—Lower heating value of fuel = 7988 Btu/lb (18.567 MJ/kg)  
 $\Delta T$ —Temperature difference between water entering and exiting the heat exchanger

$Q_{out}$ —Total heat output in BTU's (megajoules)

$Q_{in}$ —Total heat input available in test fuel charge in BTU (megajoules)

$M$ —Mass flow rate of water in lb/min (kg/min)

$V_i$ —Volume of water indicated by a totalizing flow meter at the  $i$ th reading in gallons (liters)

$V_f$ —Volumetric flow rate of water in heat exchange system in gallons per minute (liters/min)

$\Theta$ —Total length of test run in hours

$t_i$ —Data sampling interval in minutes

$\eta_{del}$ —Delivered heating efficiency in percent

$F_i$ —Weighting factor for heat output category  $i$  (See Table 2)

$T_1$ —Temperature of water at the inlet on the supply side of the heat exchanger

$T_2$ —Temperature of the water at the outlet on the supply side of the heat exchanger

$T_3$ —Temperature of water at the inlet to the load side of the heat exchanger

$T_{avg}$ —Average temperature of the appliance and water at start of the test

$$T_{I_{avg}} = (T_1 + T_2)/2 \text{ at the start of the test, } ^\circ\text{F} \quad \text{Eq. 1}$$

$T_{F_{avg}}$ —Average temperature of the appliance and water at the end of the test

$$T_{F_{avg}} = (T_1 + T_2)/2 \text{ at the end of the test, } ^\circ\text{F} \quad \text{Eq. 2}$$

$MC$ —Fuel moisture content in percent dry basis

$MC_i$ —Average moisture content of individual 4 x 4 fuel pieces in percent dry basis

$MC_{sp}$ —Moisture content of spacers assumed to be 10 percent dry basis

$\sigma$ —Density of water in pounds per gallon

$C_p$ —Specific heat of water in Btu/lb,  $^\circ\text{F}$

$C_{steel}$ —Specific heat of steel (0.1 Btu/lb,  $^\circ\text{F}$ )

$W_{fuel}$ —Fuel charge weight in pounds (kg)

$W_i$ —Weight of individual fuel 4 x 4 pieces in pounds (kg)

$W_{sp}$ —Weight of all spacers used in a fuel load in pounds (kg)

$W_{app}$ —Weight of empty appliance in pounds

$W_{wa}$ —Weight of water in supply side of the system in pounds

13.2 After the test is completed, determine the particulate emissions  $E_T$  in accordance with ASTM E2515–11 (IBR, see § 60.17).

13.3 Determine Average Fuel Load Moisture Content

$$MC_{Ave} = [(\sum W_i \times MC_i) + (W_{sp} \times MC_{sp})] \div W_{fuel}, \% \quad \text{Eq. 3}$$

#### 13.4 Determine heat input

$$Q_{in} = (W_{fuel}/(1+(MC/100))) \times HHV, \text{ BTU} \quad \text{Eq. 4}$$

$$Q_{in \text{ LHV}} = (W_{fuel}/(1+(MC/100))) \times LHV, \text{ BTU} \quad \text{Eq. 5}$$

#### 13.5 Determine Heat Output and Efficiency

##### 13.5.1 Determine heat output as:

$Q_{out} = \sum [\text{Heat output determined for each sampling time interval}] + \text{Change in heat stored in the appliance.}$

$$Q_{out} = \left[ \sum (C_{pi} \cdot \Delta T_i \cdot \dot{M}_i \cdot t_i) \right] + (W_{app} \cdot C_{Steel} + C_{pa} W_{water}) \cdot (T_{F_{avg}} - T_{I_{avg}}), \text{ BTU} \quad \text{Eq. 6}$$

**Note:** The subscript (i) indicates the parameter value for sampling time interval  $t_i$ .

$M_i$  = Mass flow rate = gal/min x density of water (lb/gal) = lb/min

$$M_i = V_{fi} \cdot \sigma_i, \text{ lb/min} \quad \text{Eq. 7}$$

$$\Sigma_i = (62.56 + (-.0003413 \times T_{3i}) + (-.00006225 \times T_{3i}^2)) 0.1337, \text{ lbs/gal} \quad \text{Eq. 8}$$

$$C_p = 1.0014 + (-.000003485 \times T_{3i}) \text{ Btu/lb, } ^\circ\text{F} \quad \text{Eq. 9}$$

$C_{steel} = 0.1 \text{ Btu/lb, } ^\circ\text{F}$

$$C_{pa} = 1.0014 + (-.000003485 \times (T_{I_{avg}} + T_{F_{avg}})/2), \text{ Btu/lb-}^\circ\text{F} \quad \text{Eq. 10}$$

$$V_{fi} = (V_i - V_{i-1})/(t_i - t_{i-1}), \text{ gal/min} \quad \text{Eq. 11}$$

**Note:**  $V_i$  is the total water volume at the end of interval  $i$  and  $V_{i-1}$  is the total water volume at the beginning of the time interval.

This calculation is necessary when a totalizing type water meter is used.

13.5.2 Determine heat output rate as:

$$\text{Heat Output Rate} = Q_{\text{out}}/\Theta, \text{ BTU/hr} \quad \text{Eq. 12}$$

13.5.3 Determine emission rates and emission factors as:

$$E_{\text{g/MJ}} = E_T/(Q_{\text{out}} \times 0.001055), \text{ g/MJ} \quad \text{Eq. 13}$$

$$E_{\text{lb/MM BTU output}} = (E_T/453.59)/(Q_{\text{output}} \times 10^{-6}), \text{ lb/mmBtu Out} \quad \text{Eq. 14}$$

$$E_{\text{g/kg}} = E_T/(W_{\text{fuel}}/(1+MC/100)), \text{ g/dry kg} \quad \text{Eq. 15}$$

$$E_{\text{g/hr}} = E_T/\Theta, \text{ g/hr} \quad \text{Eq. 16}$$

13.5.4 Determine delivered efficiency as:

$$\eta_{\text{del}} = (Q_{\text{out}}/Q_{\text{in}}) \times 100, \% \quad \text{Eq. 17}$$

$$\eta_{\text{del LHV}} = (Q_{\text{out}}/Q_{\text{in LHV}}) \times 100, \% \quad \text{Eq. 18}$$

13.5.5 Determine  $\eta_{\text{SLM}}$ —Overall Efficiency (SLM) using Stack Loss

For determination of the average overall thermal efficiency ( $\eta_{\text{SLM}}$ ) for the test run, use the data collected over the full test run and the calculations in accordance with CSA B415.1–10 (IBR, see § 60.17), clause 13.7 except for 13.7.2 (e), (f), (g), and (h), use the following average fuel properties for oak: percent C = 50.0, percent H = 6.6, percent O = 43.2, percent ash = 0.2 percent. The averaging period for determination of efficiency by the stack loss method allows averaging over 10 minute time periods for flue gas temperature, flue gas  $\text{CO}_2$ , and flue gas CO for the determination of the efficiency. However, under some cycling conditions the “on” period may be short

relative to this 10 minute period. For this reason, during cycling operation the averaging period for these parameters may not be longer than the burner on period divided by 10. The averaging period need not be shorter than one minute. During the off period, under cycling operation, the averaging periods specified may be used. Where short averaging times are used, however, the averaging period for fuel consumption may still be at 10 minutes. This average wood consumption rate shall be applied to all of the smaller time intervals included.

13.5.5.1 Whenever the CSA B415.1–10 (IBR, see § 60.17) overall efficiency is found to be lower than the overall efficiency based on load side measurements, as determined by Eq. 16 of this method, section 14.1.7 of the

test report must include a discussion of the reasons for this result.

13.6 Weighted Average Emissions and Efficiency

13.6.1 Determine the weighted average emission rate and delivered efficiency from the individual tests in the specified heat output categories. The weighting factors ( $F_i$ ) are derived from an analysis of ASHRAE bin data which provides details of normal building heating requirements in terms of percent of design capacity and time in a particular capacity range—or “bin”—over the course of a heating season. The values used in this method represent an average of data from several cities located in the northern United States.

$$\text{Weighted average delivered efficiency: } \eta_{\text{avg}} = \sum \eta_i \times F_i, \% \quad \text{Eq. 19}$$

$$\text{Weighted average emissions: } E_{\text{avg}} = \sum E_i \times F_i, \% \quad \text{Eq. 20}$$

13.7 Average Heat Output ( $Q_{\text{out-8hr}}$ ) and Efficiency ( $\eta_{\text{avg-8hr}}$ ) for 8 hour burn time.

13.7.1 Units tested under this standard typically require infrequent fuelling, 8 to 12

hours intervals being typical. Rating unit's based on an average output sustainable over an 8 hour duration will assist consumers in

appropriately sizing units to match the theoretical heat demand of their application.

13.7.2 Calculations:

$$Q_{\text{out-8hr}} = X1 + \{ (8 - Y1) \times [ (X2 - X1) / (Y2 - Y1) ] \}, \% \quad \text{Eq. 21}$$

$$\eta_{\text{avg-8hr}} = \eta_{\text{del1}} + \{ (8 - Y1) \times [ (\eta_{\text{del2}} - \eta_{\text{del1}}) / (Y2 - Y1) ] \}, \% \quad \text{Eq. 22}$$

Where:

Y1 = Test duration just above 8 hrs

Y2 = Test duration just below 8 hrs

X1 = Actual load for duration Y1

X2 = Actual load for duration Y2

$\eta_{del1}$  = Average delivered efficiency for duration Y1

$\eta_{del2}$  = Average delivered efficiency for duration Y2

13.7.2.1 Determine the test durations and actual load for each category as recorded in Table 1A.

13.7.2.2 Determine the data point that has the nearest duration greater than 8 hrs.

X1 = Actual load,

Y1 = Test duration, and

$\eta_{del1}$  = Average delivered efficiency for this data point

13.7.2.3 Determine the data point that has the nearest duration less than 8 hours.

X2 = Actual load,

Y2 = Test duration, and

$\eta_{del2}$  = Average delivered efficiency for this data point

13.7.2.4 Example:

#### CATEGORY ACTUAL LOAD DURATION [Category Actual Load Duration $\eta_{del}$ ]

	(Btu/Hr)	(Hr)	(%)
1	15,000 .....	10.2	70.0
2	26,000 .....	8.4	75.5
3	50,000 .....	6.4	80.1
4	100,000 .....	4.7	80.9

Category 2 duration is just above 8 hours, therefore: X1 = 26,000 Btu/hr,  $\eta_{del1}$  = 75.5% and Y1 = 8.4 hrs

Category 3 duration is just below 8 hours, therefore: X2 = 50,000 Btu/hr,  $\eta_{del2}$  = 80.1% and Y2 = 6.4 hrs

$Q_{out-8hr} = 26,000 + \{(8-8.4) \times [(50,000-26,000)/(6.4-8.4)]\} = 30,800$  BTU/hr

$\eta_{avg-8hr} = 75.5 + \{(8-8.4) \times [(80.1-75.5)/(6.4-8.4)]\} = 76.4\%$

#### 13.8 Carbon Monoxide Emissions

For each minute of the test period, the carbon monoxide emission rate shall be calculated as:

$$CO_{g/min} = Q_{std} \cdot CO_s \cdot 3.30 \times 10^{-5} \quad \text{Eq. 23}$$

Total CO emissions for each of the three test periods (CO<sub>1</sub>, CO<sub>2</sub>, CO<sub>3</sub>) shall be calculated as the sum of the emission rates for each of the 1 minute intervals.

Total CO emission for the test run, CO<sub>T</sub>, shall be calculated as the sum of CO<sub>1</sub>, CO<sub>2</sub>, and CO<sub>3</sub>.

#### 14.0 Report

14.1.1 The report shall include the following.

14.1.2 Name and location of the laboratory conducting the test.

14.1.3 A description of the appliance tested and its condition, date of receipt and dates of tests.

14.1.4 A statement that the test results apply only to the specific appliance tested.

14.1.5 A statement that the test report shall not be reproduced except in full, without the written approval of the laboratory.

14.1.6 A description of the test procedures and test equipment including a schematic or other drawing showing the location of all required test equipment. Also, a description of test fuel sourcing, handling and storage practices shall be included.

14.1.7 Details of deviations from, additions to or exclusions from the test

method, and their data quality implications on the test results (if any), as well as information on specific test conditions, such as environmental conditions.

14.1.8 A list of participants and observers present for the tests.

14.1.9 Data and drawings indicating the fire box size and location of the fuel charge.

14.1.10 Drawings and calculations used to determine firebox volume.

14.1.11 Information for each test run fuel charge including piece size, moisture content, and weight.

14.1.12 All required data for each test run shall be provided in spreadsheet format. Formulae used for all calculations shall be accessible for review.

14.1.13 Test run duration for each test.

14.1.14 Calculated results for delivered efficiency at each burn rate and the weighted average emissions reported as total emissions in grams, pounds per mm Btu of delivered heat, grams per MJ of delivered heat, grams per kilogram of dry fuel and grams per hour. Results shall be reported for each heat output category and the weighted average.

14.1.15 Tables 1A, 1B, 1C and Table 2 must be used for presentation of results in test reports.

14.1.16 A statement of the estimated uncertainty of measurement of the emissions and efficiency test results.

14.1.17 Raw data, calibration records, and other relevant documentation shall be retained by the laboratory for a minimum of 7 years.

#### 15.0 Precision and Bias

15.1 Precision—It is not possible to specify the precision of the procedure in Method 28WHH because the appliance operation and fueling protocols and the appliances themselves produce variable amounts of emissions and cannot be used to determine reproducibility or repeatability of this measurement method.

15.2 Bias—No definitive information can be presented on the bias of the procedure in Method 28WHH for measuring solid fuel burning hydronic heater emissions because no material having an accepted reference value is available.

#### 16.0 Keywords

16.1 Solid fuel, hydronic heating appliances, wood-burning hydronic heaters.

**Table 1A. Data Summary Part A**

						$\Theta$	$W_{fuel}$	$MC_{ave}$	$Q_{in}$	$Q_{out}$
Category	Run No	Load % Capacity	Target Load	Actual Load	Act Load	Test Duration	Wood Wt	Wood Moisture	Heat Input	Heat Output
			BTU/hr	BTU/hr	% of max	hrs	lb	% DB	BTU	BTU
I		< 15% of max								
II		16-24% of max								
III		25-50% of max								
IV		Max capacity								

**Table 1B. Data Summary Part B**

			T2 Min	$E_T$	E	E	$E_{g/hr}$	$E_{g/kg}$	$\eta_{del}$	$\eta_{SLM}$
Category	Run No	Load % Capacity	Min Return Water Temp.	Total PM Emissions	PM Output Based	PM Output Based	PM Rate	PM Factor	Delivered Efficiency	Stack Loss Efficiency
			°F	g	lb <sub>MMBTU</sub> Out	g/MJ	g/hr	g/kg	%	%
I		< 15% of max								
II		16-24% of max								
III		25-50% of max								
IV		Max capacity								

**Table 1C: Hangtag Information (optional)**

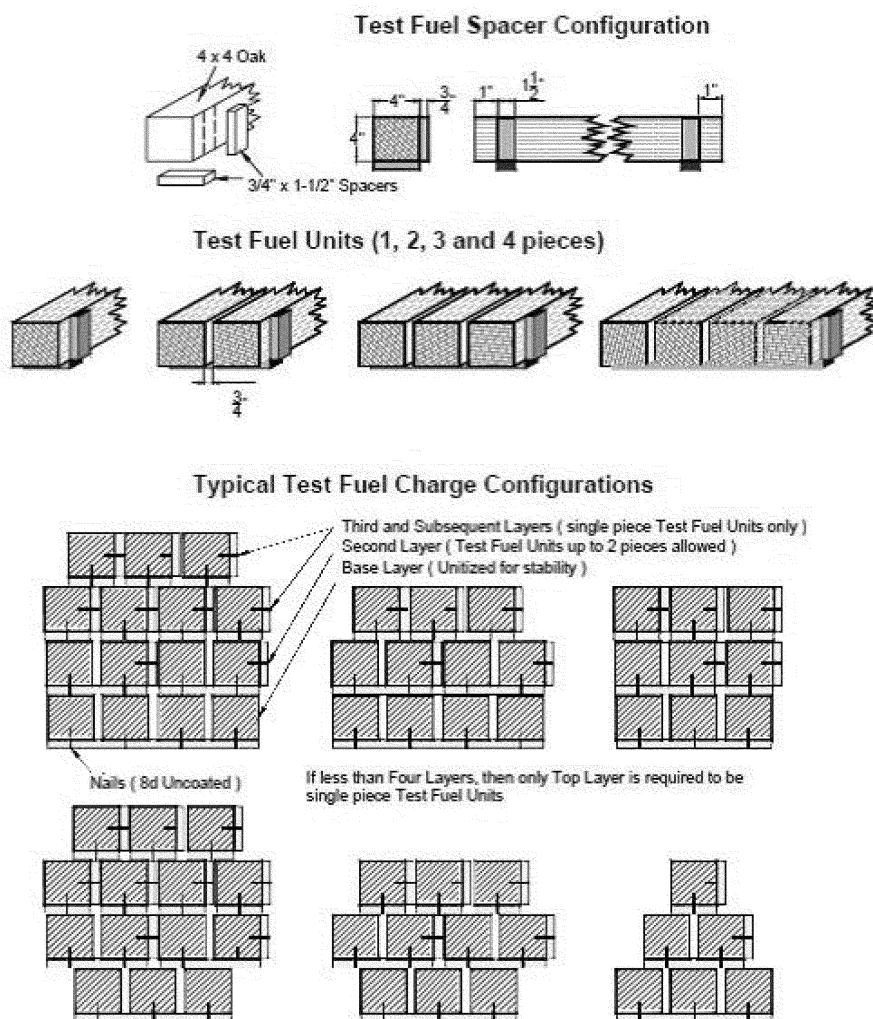
MANUFACTURER:			
MODEL NUMBER:			
MAXIMUM OUTPUT RATING:	$Q_{max}$		BTU/HR
ANNUAL EFFICIENCY RATING:	$N_{avg}$		(Using higher heating value)
PARTICLE EMISSIONS:	$E_{avg}$		GRAMS/HR (average)
			LBS/MILLION BTU OUTPUT
CARBON MONOXIDE:	COg/MIN		GRAMS/MINUTE



Table 2. Annual Weighting

Category	Weighting Factor (F <sub>i</sub> )	$\eta_{del,i} \times F_i$	$E_{g/MJ,i} \times F_i$	$E_{g/kg,i} \times F_i$	$E_{lb/mmBtu\ Out,i} \times F_i$	$E_{g/hr,i} \times F_i$
I	0.437					
II	0.238					
III	0.275					
IV	0.050					
Totals	1.000					

Figure 1. Typical Test Fuel Piece



**Test Method 28WHH for Certification of Cord Wood-Fired Hydronic Heating Appliances With Partial Thermal Storage: Measurement of Particulate Matter (PM) and Carbon Monoxide (CO) Emissions and Heating Efficiency of Wood-Fired Hydronic Heating Appliances With Partial Thermal Storage**

**1.0 Scope and Application**

1.1 This test method applies to wood-fired hydronic heating appliances with heat storage external to the appliance. The units typically transfer heat through circulation of a liquid heat exchange media such as water or a water-antifreeze mixture. Throughout this document, the term "water" will be used to denote any of the heat transfer liquids approved for use by the manufacturer.

1.2 The test method measures PM and CO emissions and delivered heating efficiency at specified heat output rates referenced against the appliance's rated heating capacity as specified by the manufacturer and verified under this test method.

1.3 PM emissions are measured by the dilution tunnel method as specified in the EPA Method 28WHH and the standards

referenced therein with the exceptions noted in section 12.5.9. Delivered efficiency is measured by determining the fuel energy input and appliance output. Heat output is determined through measurement of the flow rate and temperature change of water circulated through a heat exchanger external to the appliance and the increase in energy of the external storage. Heat input is determined from the mass of dry wood fuel and its higher heating value (HHV). Delivered efficiency does not attempt to account for pipeline loss.

1.4 Products covered by this test method include both pressurized and non-pressurized hydronic heating appliances intended to be fired with wood and for which the manufacturer specifies for indoor or outdoor installation. The system, which includes the heating appliance and external storage, is commonly connected to a heat exchanger by insulated pipes and normally includes a pump to circulate heated liquid. These systems are used to heat structures such as homes, barns and greenhouses. They also provide heat for domestic hot water, spas and swimming pools.

1.5 Distinguishing features of products covered by this standard include:

1.5.1 The manufacturer specifies the application for either indoor or outdoor installation.

1.5.2 A firebox with an access door for hand loading of fuel.

1.5.3 Typically an aquastat mounted as part of the appliance that controls combustion air supply to maintain the liquid in the appliance within a predetermined temperature range provided sufficient fuel is available in the firebox. The appliance may be equipped with other devices to control combustion.

1.5.4 A chimney or vent that exhausts combustion products from the appliance.

1.5.5 A liquid storage system, typically water, which is not large enough to accept all of the heat produced when a full load of wood is burned and the storage system starts a burn cycle at 125 °F.

1.5.6 The heating appliances require external thermal storage and these units will only be installed as part of a system which includes thermal storage. The manufacturer specifies the minimum amount of thermal storage required. However, the storage system

shall be large enough to ensure that the boiler (heater) does not cycle, slumber, or go into an off-mode when operated in a Category III load condition (See section 4.3).

1.6 The values stated are to be regarded as the standard whether in I-P or SI units. The values given in parentheses are for information only.

## 2.0 Summary of Method and References

2.1 PM and CO emissions are measured from a wood-fired hydronic heating appliance burning a prepared test fuel charge in a test facility maintained at a set of prescribed conditions. Procedures for determining heat output rates, PM and CO emissions, and efficiency and for reducing data are provided.

### 2.2 Referenced Documents

#### 2.2.1 EPA Standards

##### 2.2.1.1 Method 28 Certification and Auditing of Wood Heaters

##### 2.2.1.2 Method 28WHH Measurement of Particulate Emissions and Heating Efficiency of Wood-Fired Hydronic Heating Appliances and the Standards Referenced therein.

#### 2.2.2 Other Standards

##### 2.2.2.1 CSA-B415.1-10 *Performance Testing of Solid-Fuel-Burning Heating Appliances*

## 3.0 Terminology

### 3.1 Definitions

3.1.1 Hydronic Heating—A heating system in which a heat source supplies energy to a liquid heat exchange media such as water that is circulated to a heating load and returned to the heat source through pipes.

3.1.2 Aquastat—A control device that opens or closes a circuit to control the rate of fuel consumption in response to the temperature of the heating media in the heating appliance.

3.1.3 Delivered Efficiency—The percentage of heat available in a test fuel charge that is delivered to a simulated heating load or the storage system as specified in this test method.

3.1.4 Emission Factor—The emission of a pollutant expressed in mass per unit of energy (typically) output from the boiler/heater.

3.1.5 Emission Index—The emission of a pollutant expressed in mass per unit mass of fuel used.

3.1.6 Emission Rate—The emission of a pollutant expressed in mass per unit time

3.1.7 Manufacturer's Rated Heat Output Capacity—The value in Btu/hr (MJ/hr) that the manufacturer specifies that a particular model of hydronic heating appliance is capable of supplying at its design capacity as verified by testing, in accordance with section 12.5.4.

3.1.8 Heat Output Rate—The average rate of energy output from the appliance during a specific test period in Btu/hr (MJ/hr).

3.1.9 Firebox—The chamber in the appliance in which the test fuel charge is placed and combusted.

3.1.10 NIST—National Institute of Standards and Technology.

3.1.11 Test Fuel Charge—The collection of test fuel placed in the appliance at the start of the emission test run.

3.1.12 Test Run—An individual emission test which encompasses the time required to consume the mass of the test fuel charge. The time of the test run also considers the time for the energy to be drawn from the thermal storage.

3.1.13 Test Run Under "Cold-to-Cold" Condition—Under this test condition the test fuel is added into an empty chamber along with kindling and ignition materials (paper). The boiler/heater at the start of this test is typically 125° to 130 °F.

3.1.14 Test Run Under "Hot-to-Hot" Condition—Under this test condition the test fuel is added onto a still-burning bed of charcoals produced in a pre-burn period. The boiler/heater water is near its operating control limit at the start of the test.

3.1.15 Overall Efficiency, also known as Stack Loss Efficiency—The efficiency for each test run as determined using the CSA B415.1-10 (IBR, see § 60.17) stack loss method (SLM).

3.1.16 Phases of a Burn Cycle—The "startup phase" is defined as the period from the start of the test until 15 percent of the test fuel charge is consumed. The "steady-state phase" is defined as the period from the end of the startup phase to a point at which 80 percent of the test fuel charge is consumed. The "end phase" is defined as the time from the end of the steady-state period to the end of the test.

3.1.17 Thermopile—A device consisting of a number of thermocouples connected in series, used for measuring differential temperature.

3.1.18 Slumber Mode—This is a mode in which the temperature of the water in the boiler/heater has exceeded the operating control limit and the control has changed the boiler/heater fan speed, dampers, and/or other operating parameters to minimize the heat output of the boiler/heater.

## 4.0 Summary of Test Method

4.1 Dilution Tunnel. Emissions are determined using the "dilution tunnel" method specified in EPA Method 28WHH and the standards referenced therein. The flow rate in the dilution tunnel is maintained at a constant level throughout the test cycle and accurately measured. Samples of the dilution tunnel flow stream are extracted at a constant flow rate and drawn through high efficiency filters. The filters are dried and weighed before and after the test to determine the emissions collected and this value is multiplied by the ratio of tunnel flow to filter flow to determine the total particulate emissions produced in the test cycle.

4.2 Efficiency. The efficiency test procedure takes advantage of the fact that this type of system delivers heat through circulation of the heated liquid (water) from the system to a remote heat exchanger (e.g. baseboard radiators in a room) and back to the system. Measurements of the cooling water temperature difference as it enters and exits the test system heat exchanger along with the measured flow rate allow for an accurate determination of the useful heat output of the appliance. Also included in the heat output is the change in the energy content in the storage system during a test

run. Energy input to the appliance during the test run is determined by weight of the test fuel charge, adjusted for moisture content, multiplied by the higher heating value. Additional measurements of the appliance weight and temperature at the beginning and end of a test cycle are used to correct for heat stored in the appliance. Overall efficiency (SLM) is determined using the CSA B415.1-10 (IBR, see § 60.17) stack loss method for data quality assurance purposes.

4.3 Operation. Four test categories are defined for use in this method. These are:

4.3.1 Category I: A heat output of 15 percent or less of manufacturer's rated heat output capacity.

4.3.2 Category II: A heat output of 16 percent to 24 percent of manufacturer's rated heat output capacity.

4.3.3 Category III: A heat output of 25 percent to 50 percent of manufacturer's rated heat output capacity.

4.3.4 Category IV: Manufacturer's Rated Heat Output Capacity. These heat output categories refer to the output from the system by way of the load heat exchanger installed for the test. The output from just the boiler/heater part of the system may be higher for all or part of a test, as part of this boiler/heater output goes to storage.

For the Category III and IV runs, appliance operation is conducted on a hot-to-hot test cycle meaning that the appliance is brought to operating temperature and a coal bed is established prior to the addition of the test fuel charge and measurements are made for each test fuel charge cycle. The measurements are made under constant heat draw conditions within pre-determined ranges. No attempt is made to modulate the heat demand to simulate an indoor thermostat cycling on and off in response to changes in the indoor environment.

For the Category I and II runs, the unit is tested with a "cold start." At the manufacturer's option, the Category II and III runs may be waived and it may be assumed that the particulate emission values and efficiency values determined in the startup, steady-state, and end phases of Category I are applicable in Categories II and III for the purpose of determining the annual averages in lb/mmBtu and g/MJ (See section 13). For the annual average in g/hr, the length of time for stored heat to be drawn from thermal storage shall be determined for the test load requirements of the respective category.

All test operations and measurements shall be conducted by personnel of the laboratory responsible for the submission of the test report.

## 5.0 Significance and Use

5.1 The measurement of particulate matter emission and CO rates is an important test method widely used in the practice of air pollution control.

5.1.1 These measurements, when approved by state or federal agencies, are often required for the purpose of determining compliance with regulations and statutes.

5.1.2 The measurements made before and after design modifications are necessary to demonstrate the effectiveness of design changes in reducing emissions and make this standard an important tool in manufacturers' research and development programs.

5.2 Measurement of heating efficiency provides a uniform basis for comparison of product performance that is useful to the consumer. It is also required to relate emissions produced to the useful heat production.

5.3 This is a laboratory method and is not intended to be fully representative of all actual field use. It is recognized that users of hand-fired, wood-burning equipment have a great deal of influence over the performance of any wood-burning appliance. Some compromises in realism have been made in the interest of providing a reliable and repeatable test method.

## 6.0 Test Equipment

6.1 Scale. A platform scale capable of weighing the boiler/heater under test and associated parts and accessories when completely filled with water to an accuracy of  $\pm 1.0$  pound ( $\pm 0.5$  kg) and a readout resolution of  $\pm 0.2$  pound ( $\pm 0.1$  kg).

6.2 Heat Exchanger. A water-to-water heat exchanger capable of dissipating the expected heat output from the system under test.

6.3 Water Temperature Difference Measurement. A Type—T 'special limits' thermopile with a minimum of 5 pairs of junctions shall be used to measure the temperature difference in water entering and leaving the heat exchanger. The temperature difference measurement uncertainty of this type of thermopile is equal to or less than  $\pm 0.50$  °F ( $\pm 0.25$  °C). Other temperature measurement methods may be used if the temperature difference measurement uncertainty is equal to or less than  $\pm 0.50$  °F ( $\pm 0.25$  °C). This measurement uncertainty shall include the temperature sensor, sensor well arrangement, piping arrangements, lead wire, and measurement/recording system. The response time of the temperature measurement system shall be less than half of the time interval at which temperature measurements are recorded.

6.4 Water Flow Meter. A water flow meter shall be installed in the inlet to the load side of the heat exchanger. The flow meter shall have an accuracy of  $\pm 1$  percent of measured flow.

6.4.1 Optional—Appliance Side Water Flow Meter. A water flow meter with an accuracy of  $\pm 1$  percent of the flow rate is recommended to monitor supply side water flow rate.

6.5 Optional Recirculation Pump. Circulating pump used during test to prevent stratification, in the boiler/heater, of liquid being heated.

6.6 Water Temperature Measurement. Thermocouples or other temperature sensors to measure the water temperature at the inlet and outlet of the load side of the heat exchanger must meet the calibration requirements specified in 10.1 of this method.

6.7 Lab Scale. For measuring the moisture content of wood slices as part of the overall wood moisture determination. Accuracy of  $\pm 0.01$  pounds.

6.8 Flue Gas Temperature Measurement. Must meet the requirements of CSA B415.1–10 (IBR, see § 60.17), clause 6.2.2.

6.9 Test Room Temperature Measurement. Must meet the requirements of

CSA B415.1–10 (IBR, see § 60.17), clause 6.2.1.

6.10 Flue Gas Composition Measurement. Must meet the requirements of CSA B415.1–10 (IBR, see § 60.17), clauses 6.3.1 through 6.3.3.

6.11 Dilution Tunnel CO Measurement. In parallel with the flue gas composition measurements, the CO concentration in the dilution tunnel shall also be measured and reported at time intervals not to exceed one minute. This analyzer shall meet the zero and span drift requirements of CSA B415.1–10 (IBR, see § 60.17). In addition the measurement repeatability shall be better than  $\pm 15$  ppm over the range of CO levels observed in the dilution tunnel.

## 7.0 Safety

7.1 These tests involve combustion of wood fuel and substantial release of heat and products of combustion. The heating system also produces large quantities of very hot water and the potential for steam production and system pressurization. Appropriate precautions must be taken to protect personnel from burn hazards and respiration of products of combustion.

## 8.0 Sampling, Test Specimens and Test Appliances

8.1 Test specimens shall be supplied as complete appliances, as described in marketing materials, including all controls and accessories necessary for installation in the test facility. A full set of specifications, installation and operating instructions, and design and assembly drawings shall be provided when the product is to be placed under certification of a third-party agency. The manufacturer's written installation and operating instructions are to be used as a guide in the set-up and testing of the appliance and shall be part of the test record.

8.2 The size, connection arrangement, and control arrangement for the thermal storage shall be as specified in the manufacturer's documentation. It is not necessary to use the specific storage system that the boiler/heater will be marketed with. However, the capacity of the system used in the test cannot be greater than that specified as the minimum allowable for the boiler/heater.

8.3 All system control settings shall be the as-shipped, default settings. These default settings shall be the same as those communicated in a document to the installer or end user. These control settings and the documentation of the control settings as to be provided to the installer or end user shall be part of the test record.

8.4 Where the manufacturer defines several alternatives for the connection and loading arrangement, one shall be defined in the appliance documentation as the default or standard installation. It is expected that this will be the configuration for use with a simple baseboard heating system. This is the configuration to be followed for these tests. The manufacturer's documentation shall define the other arrangements as optional or alternative arrangements.

## 9.0 Preparation of Test Equipment

9.1 The appliance is to be placed on a scale capable of weighing the appliance fully loaded with a resolution of  $\pm 0.2$  lb (0.1 kg).

9.2 The appliance shall be fitted with the type of chimney recommended or provided by the manufacturer and extending to  $15 \pm 0.5$  feet ( $4.6 \pm 0.15$  m) from the upper surface of the scale. If no flue or chimney system is recommended or provided by the manufacturer, connect the appliance to a flue of a diameter equal to the flue outlet of the appliance. The flue section from the appliance flue collar to  $8 \pm 0.5$  feet above the scale shall be single wall stove pipe and the remainder of the flue shall be double wall insulated class A chimney.

### 9.3 Optional Equipment Use

9.3.1 A recirculation pump may be installed between connections at the top and bottom of the appliance to minimize thermal stratification if specified by the manufacturer. The pump shall not be installed in such a way as to change or affect the flow rate between the appliance and the heat exchanger.

9.3.2 If the manufacturer specifies that a thermal control valve or other device be installed and set to control the return water temperature to a specific set point, the valve or other device shall be installed and set per the manufacturer's written instructions.

9.4 Prior to filling the boiler/heater with water, weigh and record the appliance mass.

### 9.5 Heat Exchanger

9.5.1 Plumb the unit to a water-to-water heat exchanger with sufficient capacity to draw off heat at the maximum rate anticipated. Route hoses and electrical cables and instrument wires in a manner that does not influence the weighing accuracy of the scale as indicated by placing dead weights on the platform and verifying the scale's accuracy.

9.5.2 Locate thermocouples to measure the water temperature at the inlet and outlet of the load side of the heat exchanger.

9.5.3 Install a thermopile (or equivalent instrumentation) meeting the requirements of section 6.3 to measure the water temperature difference between the inlet and outlet of the load side of the heat exchanger.

9.5.4 Install a calibrated water flow meter in the heat exchanger load side supply line. The water flow meter is to be installed on the cooling water inlet side of the heat exchanger so that it will operate at the temperature at which it is calibrated.

9.5.5 Place the heat exchanger in a box with 2 in. (50 mm) of expanded polystyrene (EPS) foam insulation surrounding it to minimize heat losses from the heat exchanger.

9.5.6 The reported efficiency and heat output rate shall be based on measurements made on the load side of the heat exchanger.

9.5.7 Temperature instrumentation per section 6.6 shall be installed in the appliance outlet and return lines. The average of the outlet and return water temperature on the supply side of the system shall be considered the average appliance temperature for calculation of heat storage in the appliance ( $TF_{avg}$  and  $TI_{avg}$ ). Installation of a water flow meter in the supply side of the system is optional.

9.6 Storage Tank. The storage tank shall include a destratification pump as illustrated in Figure 1. The pump will draw from the bottom of the tank and return to the top as illustrated. Temperature sensors (TS1 and TS2 in Figure 1) shall be included to measure the temperature in the recirculation loop. The valve plan in Figure 1 allows the tank recirculation loop to operate and the boiler/heater-to-heat exchanger loop to operate at the same time but in isolation. This would typically be done before the start of a test or following completion of a test to determine the end of test average tank temperature. The nominal flow rate in the storage tank recirculation loop can be estimated based on pump manufacturers' performance curves and any significant restriction in the recirculation loop.

9.7 Fill the system with water. Determine the total weight of the water in the appliance when the water is circulating. Verify that the scale indicates a stable weight under operating conditions. Make sure air is purged properly.

#### 10.0 Calibration and Standardization

10.1 Water Temperature Sensors. Temperature measuring equipment shall be calibrated before initial use and at least semi-annually thereafter. Calibrations shall be in compliance with National Institute of Standards and Technology (NIST) Monograph 175, Standard Limits of Error.

10.2 Heat Exchanger Load Side Water Flow Meter.

10.2.1 The heat exchanger load side water flow meter shall be calibrated within the flow range used for the test run using NIST-traceable methods. Verify the calibration of the water flow meter before and after each test run and at least once during each test run by comparing the water flow rate indicated by the flow meter to the mass of water collected from the outlet of the heat

exchanger over a timed interval. Volume of the collected water shall be determined based on the water density calculated from section 13, Eq. 12, using the water temperature measured at the flow meter. The uncertainty in the verification procedure used shall be 1 percent or less. The water flow rate determined by the collection and weighing method shall be within 1 percent of the flow rate indicated by the water flow meter.

10.3 Scales. The scales used to weigh the appliance and test fuel charge shall be calibrated using NIST-traceable methods at least once every 6 months.

10.4 Flue Gas Analyzers—In accordance with CSA B415.1–10 (IBR, see § 60.17), clause 6.8.

#### 11.0 Conditioning

11.1 Prior to testing, an appliance is to be operated for a minimum of 50 hours using a medium heat draw rate. The conditioning may be at the manufacturer's facility prior to the certification test. If the conditioning is at the certification test laboratory, the pre-burn for the first test can be included as part of the conditioning requirement. If conditioning is included in pre-burn, then the appliance shall be aged with fuel meeting the specifications outlined in section 12.2 with a moisture content between 19 and 25 percent on a dry basis. Operate the appliance at a medium heat output rate (Category II or III) for at least 10 hours for non-catalytic appliances and 50 hours for catalytic appliances. Record and report hourly flue gas exit temperature data and the hours of operation. The aging procedure shall be conducted and documented by a testing laboratory.

#### 12.0 Procedure

12.1 Appliance Installation. Assemble the appliance and parts in conformance with the manufacturer's written installation

instructions. Clean the flue with an appropriately sized, wire chimney brush before each certification test series.

12.2 Fuel. Test fuel charge fuel shall be red (*Quercus rubra* L.) or white (*Quercus Alba*) oak 19 to 25 percent moisture content on a dry basis. Piece length shall be 80 percent of the firebox depth rounded down to the nearest 1 inch (25mm) increment. For example, if the firebox depth is 46 inches (1168mm) the piece length would be 36 inches (46 inches x 0.8 = 36.8 inches, rounded down to 36 inches). Pieces are to be placed in the firebox parallel to the longest firebox dimension. For fireboxes with sloped surfaces that create a non-uniform firebox length, the piece length shall be adjusted for each layer based on 80 percent of the length at the level where the layer is placed. The test fuel shall be cord wood with cross section dimensions and weight limits as defined in CSA B415.1–10 (IBR, see § 60.17), section 8.3, Table 4. The use of dimensional lumber is not allowed.

12.2.1 Select three pieces of cord wood from the same batch of wood as the test fuel and the same weight as the average weight of the pieces in the test load  $\pm 1.0$  lb. From each of these three pieces, cut three slices. Each slice shall be  $\frac{1}{2}$  inch to  $\frac{3}{4}$  inch thick. One slice shall be cut across the center of the length of the piece. The other two slices shall be cut half way between the center and the end. Immediately measure the mass of each piece in pounds. Dry each slice in an oven at 220 °F for 24 hours or until no further weight change occurs. The slices shall be arranged in the oven so as to provide separation between faces. Remove from the oven and measure the mass of each piece again as soon as practical, in pounds.

The moisture content of each slice, on a dry basis, shall be calculated as:

$$MC_{\text{slice}} = 100 \cdot \frac{(W_{\text{SliceWet}} - W_{\text{SliceDry}})}{W_{\text{SliceDry}}}$$

Where:

$W_{\text{SliceWet}}$  = weight of the slice before drying in pounds

$W_{\text{SliceDry}}$  = weight of the slice after drying in pounds

$MC_{\text{slice}}$  = moisture content of the slice in % dry basis

The average moisture content of the entire test load (MC) shall be determined using Eq. 6. Each individual slice shall have a moisture content in the range of 18 percent to 28 percent on a dry basis. The average moisture content for the test fuel load shall be in the range of 19 percent to 25 percent. Moisture shall not be added to previously dried fuel pieces except by storage under high humidity conditions and temperature up to 100 °F. Fuel moisture measurement shall begin within 4 hours of using the fuel batch for a test. Use of a pin-type meter to estimate the moisture content prior to a test is recommended.

12.2.2 Firebox Volume. Determine the firebox volume in cubic feet. Firebox volume

shall include all areas accessible through the fuel loading door where firewood could reasonably be placed up to the horizontal plane defined by the top of the loading door. A drawing of the firebox showing front, side and plan views or an isometric view with interior dimensions shall be provided by the manufacturer and verified by the laboratory. Calculations for firebox volume from computer aided design (CAD) software programs are acceptable and shall be included in the test report if used. If the firebox volume is calculated by the laboratory the firebox drawings and calculations shall be included in the test report.

12.2.3 Test Fuel charge. Test fuel charges shall be determined by multiplying the firebox volume by 10 pounds (4.54 kg) per ft<sup>3</sup> (28L), or a higher load density as recommended by the manufacturer's printed operating instructions, of wood (as used wet weight). Select the number of pieces of cord wood that most nearly match this target

weight. However, the test fuel charge cannot be less than the target of 10 pounds (4.54 kg) per ft<sup>3</sup> (28L).

12.3 Sampling Equipment. Prepare the particulate emission sampling equipment as defined by EPA Method 28WHH and the standards referenced therein.

12.4 Appliance Startup. The appliance shall be fired with wood fuel of any species, size and moisture content, at the laboratory's discretion, to bring it up to operating temperature. Operate the appliance until the water is heated to the upper operating control limit and has cycled at least two times. Then remove all unburned fuel, zero the scale and verify the scales accuracy using dead weights.

12.4.1 Startup Procedure for Category III and IV Test Runs, "Hot-to-Hot."

12.4.1.1 Pretest t Burn Cycle. Following appliance startup (section 12.4), reload appliance with oak cord wood and allow it to burn down to the specified coal bed weight. The pre-test burn cycle fuel charge

weight shall be within  $\pm 10$  percent of the test fuel charge weight. Piece size and length shall be selected such that charcoalization is achieved by the time the fuel charge has burned down to the required coal bed weight. Pieces with a maximum thickness of approximately 2 inches have been found to be suitable. Charcoalization is a general condition of the test fuel bed evidenced by an absence of large pieces of burning wood in the coal bed and the remaining fuel pieces being brittle enough to be broken into smaller charcoal pieces with a metal poker. Manipulations to the fuel bed prior to the start of the test run are to be done to achieve charcoalization while maintaining the desired heat output rate. During the pre-test burn cycle and at least one hour prior to starting the test run, adjust water flow to the heat exchanger to establish the target heat draw for the test. For the first test run the heat draw rate shall be equal to the manufacturer's rated heat output capacity.

12.4.1.2 Allowable Adjustments. Fuel addition or subtractions, and coal bed raking shall be kept to a minimum but are allowed up to 15 minutes prior to the start of the test run. For the purposes of this method, coal bed raking is the use of a metal tool (poker) to stir coals, break burning fuel into smaller pieces, dislodge fuel pieces from positions of poor combustion, and check for the condition of charcoalization. Record all adjustments to and additions or subtractions of fuel, and any other changes to the appliance operations that occur during pretest ignition period. During the 15-minute period prior to the start of the test run, the wood heater loading door shall not be open more than a total of 1 minute. Coal bed raking is the only adjustment allowed during this period.

12.4.1.3 Coal Bed Weight. The appliance is to be loaded with the test fuel charge when the coal bed weight is between 10 percent and 20 percent of the test fuel charge weight. Coals may be raked as necessary to level the coal bed but may only be raked and stirred once between 15 to 20 minutes prior to the addition of the test fuel charge.

12.4.1.4 Storage. The Category III and IV test runs may be done either with or without the thermal storage. If thermal storage is used, the initial temperature of the storage must be 125 °F or greater at the start of the test. The storage may be heated during the pre-test burn cycle or it may be heated by external means. If thermal storage is used, prior to the start of the test run, the storage tank destratification pump, shown in Figure 1, shall be operated until the total volume pumped exceeds 1.5 times the tank volume and the difference between the temperature at the top and bottom of the storage tank (TS<sub>1</sub> and TS<sub>2</sub>) is less than 1 °F. These two temperatures shall then be recorded to determine the starting average tank temperature. The total volume pumped may be based on the nominal flow rate of the destratification pump (See section 9.6). If the Category III and IV runs are done with storage, it is recognized that during the last hour of the pre-burn cycle the storage tank must be mixed to achieve a uniform starting temperature and cannot receive heat from the boiler/heater during this time. During this time period, the boiler/heater might cycle or

go into a steady reduced output mode. (Note—this would happen, for example, in a Category IV run if the actual maximum output of the boiler/heater exceed the manufacturer's rated output.) A second storage tank may be used temporarily to enable the boiler/heater to operate during this last hour of the pre-burn period as it will during the test period. The temperature of this second storage tank is not used in the calculations but the return water to the boiler/heater (after mixing device if used) must be 125 °F or greater.

12.4.2 Startup Procedure for Category I and II Test Runs, "Cold-to-Cold."

12.4.2.1 Initial Temperatures. This test shall be started with both the boiler/heater and the storage at a minimum temperature of 125 °F. The boiler/heater maximum temperature at the start of this test shall be 135 °F. The boiler/heater and storage may be heated through a pre-burn or it may be heated by external means.

12.4.2.2 Firebox Condition at Test Start. Prior to the start of this test remove all ash and charcoal from the combustion chamber(s). The loading of the test fuel and kindling should follow the manufacturer's recommendations, subject to the following constraints: Up to 10 percent kindling and paper may be used which is in addition to the fuel load. Further, up to 10 percent of the fuel load (*i.e.*, included in the 10 lb/ft<sup>3</sup>) may be smaller than the main fuel. This startup fuel shall still be larger than 2 inches.

12.4.2.3 Storage. The Category I and II test runs shall be done with thermal storage. The initial temperature of the storage must be 125 °F or greater at the start of the test. The storage may be heated during the pre-test burn cycle or it may be heated by external means. Prior to the start of the test run, the storage tank destratification pump, shown in Figure 1, shall be operated until the total volume pumped exceeds 1.5 times the tank volume and the difference between the temperature at the top and bottom of the storage tank (TS<sub>1</sub> and TS<sub>2</sub>) is less than 1 °F. These two temperatures shall then be recorded to determine the starting average tank temperature. The total volume pumped may be based on the nominal flow rate of the destratification pump (See section 9.6).

12.5 Test Runs. For all test runs, the return water temperature to the hydronic heater must be equal to or greater than 120 °F (this is lower than the initial tank temperature to allow for any pipeline losses). Where the storage system is used, flow of water from the boiler/heater shall be divided between the storage tank and the heat exchanger such that the temperature change of the circulating water across the heat exchanger shall be 30  $\pm$  5 °F, averaged over the entire test run. This is typically adjusted using the system valves.

Complete a test run in each heat output rate category, as follows:

12.5.1 Test Run Start. For Category III and IV runs: Once the appliance is operating normally and the pretest coal bed weight has reached the target value per section 12.4.1, tare the scale and load the full test charge into the appliance. Time for loading shall not exceed 5 minutes. The actual weight of the test fuel charge shall be measured and

recorded within 30 minutes prior to loading. Start all sampling systems.

For Category I and II runs: Once the appliance has reached the starting temperature, tare the scale and load the full test charge, including kindling into the appliance. The actual weight of the test fuel charge shall be measured and recorded within 30 minutes prior to loading. Light the fire following the manufacturer's written normal startup procedure. Start all sampling systems.

12.5.1.1 Record all water temperatures, differential water temperatures and water flow rates at time intervals of one minute or less.

12.5.1.2 Record particulate emissions data per the requirements of EPA Method 28WHH and the standards referenced therein.

12.5.1.3 Record data needed to determine overall efficiency (SLM) per the requirements of CSA B415.1–10 (IBR, see § 60.17) clauses 6.2.1, 6.2.2, 6.3, 8.5.7, 10.4.3(a), 10.4.3(f), and 13.7.9.3

12.5.1.3.1 Measure and record the test room air temperature in accordance with the requirements of CSA B415.1–10 (IBR, see § 60.17), clauses 6.2.1, 8.5.7 and 10.4.3(g).

12.5.1.3.2 Measure and record the flue gas temperature in accordance with the requirements of CSA B415.1–10 (IBR, see § 60.17), clauses 6.2.2, 8.5.7 and 10.4.3(f).

12.5.1.3.3 Determine and record the carbon monoxide (CO) and carbon dioxide (CO<sub>2</sub>) concentrations in the flue gas in accordance with CSA B415.1–10 (IBR, see § 60.17), clauses 6.3, 8.5.7 and 10.4.3(i) and (j).

12.5.1.3.4 Measure and record the test fuel weight per the requirements of CSA B415.1–10 (IBR, see § 60.17), clauses 8.5.7 and 10.4.3(h).

12.5.1.3.5 Record the test run time per the requirements of CSA B415.1–10 (IBR, see § 60.17), clause 10.4.3(a).

12.5.1.3.6 Record and document all settings and adjustments, if any, made to the boiler/heater as recommended/required by manufacturer's instruction manual for different combustion conditions or heat loads. These may include temperature setpoints, under and over-fire air adjustment, or other adjustments that could be made by an operator to optimize or alter combustion. All such settings shall be included in the report for each test run.

12.5.1.4 Monitor the average heat output rate on the load side of the heat exchanger based on water temperatures and flow. If the heat output rate over a 10 minute averaging period gets close to the upper or lower limit of the target range ( $\pm 5$  percent), adjust the water flow through the heat exchanger to compensate. Make changes as infrequently as possible while maintaining the target heat output rate. The first test run shall be conducted at the Category IV heat output rate to validate that the appliance is capable of producing the manufacturer's rated heat output capacity.

12.5.2 Test Fuel Charge Adjustment. It is acceptable to adjust the test fuel charge (*i.e.*, reposition) once during a test run if more than 60 percent of the initial test fuel charge weight has been consumed and more than 10

minutes have elapsed without a measurable (1 lb or 0.5 kg) weight change while the operating control is in the demand mode. The time used to make this adjustment shall be less than 60 seconds.

12.5.3 Test Run Completion. For the Category III and IV, "hot-to-hot" test runs, the test run is completed when the remaining weight of the test fuel charge is 0.0 lb (0.0 kg). ( $W_{FuelBurned} = W_{fuel}$ ) End the test run when the scale has indicated a test fuel charge weight of 0.0 lb (0.0 kg) or less for 30 seconds.

For the Category I and II "cold-to-cold" test runs, the test run is completed; and the end of a test is defined at the first occurrence of any one of the following:

(a) The remaining weight of the test fuel charge is less than 1 percent of the total test fuel weight ( $W_{FuelBurned} > 0.99 \cdot W_{fuel}$ );

(b) The automatic control system on the boiler/heater switches to an off mode. In this case, the boiler/heater fan (if used) is typically stopped and all air flow dampers are closed by the control system. Note that this off mode cannot be an "overheat" or emergency shutdown which typically requires a manual reset; or

(c) If the boiler/heater does not have an automatic off mode: After 90 percent of the fuel load has been consumed and the scale has indicated a rate of change of the test fuel charge of less than 1.0 lb/hr for a period of 10 minutes or longer. Note—this is not considered "stopped fuel combustion." See section 12.5.6.1.

12.5.3.1 At the end of the test run, stop the particulate sampling train and overall efficiency (SLM) measurements, and record the run time, and all final measurement values.

12.5.3.2 At the end of the test run, continue to operate the storage tank destratification pump until the total volume pumped exceeds 1.5 times the tank volume. The maximum average of the top and bottom temperatures measured after this time may be taken as the average tank temperature at the end of the tests (TFSavg, See section 13.1). The total volume pumped may be based on the nominal flow rate of the destratification pump (See section 9.6).

12.5.3.3 For the Category I and II test runs, there is a need to determine the energy content of the unburned fuel remaining in the chamber if the remaining mass in the chamber is greater than 1 percent of the test fuel weight. Following the completion of the test, as soon as safely practical, this remaining fuel is removed from the chamber, separated from the remaining ash and weighed. This separation could be implemented with a slotted "scoop" or similar tool. A ¼ inch opening size in the separation tool shall be used to separate the ash and charcoal. This separated char is assigned a heating value of 12,500 Btu/lb.

12.5.4 Heat Output Capacity Validation. The first test run must produce a heat output rate that is within 10 percent of the manufacturer's rated heat output capacity (Category IV) throughout the test run and an average heat output rate within 5 percent of the manufacturer's rated heat output capacity. If the appliance is not capable of producing a heat output within these limits,

the manufacturer's rated heat output capacity is considered not validated and testing is to be terminated. In such cases, the tests may be restarted using a lower heat output capacity if requested by the manufacturer. Alternatively, during the Category IV run, if the rated output cannot be maintained for a 15 minute interval, the manufacturer may elect to reduce the rated output to match the test and complete the Category IV run on this basis. The target outputs for Categories I, II, and III shall then be recalculated based on this change in rated output capacity.

12.5.5 Additional Test Runs. Using the manufacturer's rated heat output capacity as a basis, conduct a test for additional heat output categories as specified in section 4.3. It is not required to run these tests in any particular order.

12.5.6 Alternative Heat Output Rate for Category I. If an appliance cannot be operated in the Category I heat output range due to stopped combustion, two test runs shall be conducted at heat output rates within Category II. When this is the case, the weightings for the weighted averages indicated in section 14.1.15 shall be the average of the Category I and II weightings and shall be applied to both Category II results. Appliances that are not capable of operation within Category II (<25 percent of maximum) cannot be evaluated by this test method.

12.5.6.1 Stopped Fuel Combustion. Evidence that an appliance cannot be operated at a Category I heat output rate due to stopped fuel combustion shall include documentation of two or more attempts to operate the appliance in heat output rate Category I and fuel combustion has stopped prior to complete consumption of the test fuel charge. Stopped fuel combustion is evidenced when an elapsed time of 60 minutes or more has occurred without a measurable (1 lb or 0.5 kg) weight change in the test fuel charge while the appliance operating control is in the demand mode. Report the evidence and the reasoning used to determine that a test in heat output rate Category I cannot be achieved. For example, two unsuccessful attempts to operate at an output rate of 10 percent of the rated output capacity are not sufficient evidence that heat output rate Category I cannot be achieved.

12.5.7 Appliance Overheating. Appliances with their associated thermal storage shall be capable of operating in all heat output categories without overheating to be rated by this test method. Appliance overheating occurs when the rate of heat withdrawal from the appliance is lower than the rate of heat production when the unit control is in the idle mode. This condition results in the water in the appliance continuing to increase in temperature well above the upper limit setting of the operating control. Evidence of overheating includes: 1 hour or more of appliance water temperature increase above the upper temperature set-point of the operating control, exceeding the temperature limit of a safety control device (independent from the operating control—typically requires manual reset), boiling water in a non-pressurized system or activation of a pressure or temperature relief valve in a pressurized system.

12.5.8 Option to Eliminate Tests in Category II and III. Following successful completion of a test run in Category I, the manufacturer may eliminate the Category II and III tests. For the purpose of calculating the annual averages for particulates and efficiency, the values obtained in the Category I run shall be assumed to apply also to Category II and Category III. It is envisioned that this option would be applicable to systems which have sufficient thermal storage such that the fuel load in the Category I test can be completely consumed without the system reaching its upper operating temperature limit. In this case, the boiler/heater would likely be operating at maximum thermal output during the entire test and this output rate may be higher than the manufacturer's rated heat output capacity. The Category II and III runs would then be the same as the Category I run. It may be assumed that the particulate emission values and efficiency values determined in the startup, steady-state, and end phases of Category I are applicable in Categories II and III, for the purpose of determining the annual averages in lb/mmBtu and g/MJ (See section 13). For the annual average in g/hr, the length of time for stored heat to be drawn from thermal storage shall be determined for the test load requirements of the respective category.

12.5.9 Modification to Measurement Procedure in EPA Method 28WHH to Determine Emissions Separately During the Startup, Steady-State and End Phases. With one of the two particulate sampling trains used, filter changes shall be made at the end of the startup phase and the steady-state phase (See section 3.0). This shall be done to determine the particulate emission rate and particulate emission index for the startup, steady-state, and end phases individually. For this one train, the particulates measured during each of these three phases shall be added together to also determine the particulate emissions for the whole run.

12.5.10 Modification to Measurement Procedure in EPA Method 28WHH and the Standards Referenced therein on Averaging Period for Determination of Efficiency by the Stack Loss Method. The methods currently defined in Method 28WHH allow averaging over 10-minute time periods for flue gas temperature, flue gas CO<sub>2</sub>, and flue gas CO for the determination of the efficiency with the stack loss method. However, under some cycling conditions the "on" period may be short relative to this 10-minute period. For this reason, during cycling operation the averaging period for these parameters may not be longer than the burner on period divided by 10. The averaging period need not be shorter than one minute. During the off period, under cycling operation, averaging periods as specified in EPA Method 28WHH and the standards referenced therein, may be used. Where short averaging times are used, however, the averaging period for fuel consumption may still be at 10 minutes. This average wood consumption rate shall be applied to all of the smaller time intervals included.

12.6 Additional Test Runs. The testing laboratory may conduct more than one test run in each of the heat output categories



specified in section 4.3. If more than one test run is conducted at a specified heat output rate, the results from at least two-thirds of the test runs in that heat output rate category shall be used in calculating the weighted average emission rate. The measurement data and results of all test runs shall be reported regardless of which values are used in calculating the weighted average emission rate.

### 13.0 Calculation of Results

#### 13.1 Nomenclature

CO<sub>s</sub>—Carbon monoxide measured in the dilution tunnel at arbitrary time in ppm dry basis.

CO<sub>g/min</sub>—Carbon monoxide emission rate in g/min.

CO<sub>T</sub>—Total carbon monoxide emission for the full test run in grams.

CO<sub>1</sub>—Startup period carbon monoxide emissions in grams.

CO<sub>2</sub>—Steady-state period carbon monoxide emission in grams.

CO<sub>3</sub>—End period carbon monoxide emission in grams.

E<sub>T</sub>—Total particulate emissions for the full test run as determined per EPA Method 28WHH and the standards referenced therein in grams.

E<sub>1</sub>—Startup period particulate emissions in grams.

E<sub>2</sub>—Steady-state period particulate emissions in grams.

E<sub>3</sub>—End period particulate emissions in grams.

E<sub>1\_g/kg</sub>—Startup period particulate emission index in grams per kg fuel.

E<sub>2\_g/kg</sub>—Steady-state period particulate emission index in grams per kg fuel.

E<sub>3\_g/kg</sub>—End period particulate emission index in grams per kg fuel.

E<sub>1\_g/hr</sub>—Startup period particulate emission rate in grams per hour.

E<sub>2\_g/hr</sub>—Steady-state period particulate emission rate in grams per hour.

E<sub>3\_g/hr</sub>—End period particulate emission rate in grams per hour.

E<sub>g/MJ</sub>—Emission rate in grams per MJ of heat output.

E<sub>lb/mmBtu output</sub>—Emissions rate in pounds per million Btu of heat output.

E<sub>g/kg</sub>—Emissions factor in grams per kilogram of dry fuel burned.

E<sub>g/hr</sub>—Emission factor in grams per hour.

HHV—Higher heating value of fuel = 8600 Btu/lb (19.990 MJ/kg).

LHV—Lower heating value of fuel = 7988 Btu/lb (18.567 MJ/kg).

ΔT—Temperature difference between cooling water entering and exiting the heat exchanger.

Q<sub>out</sub>—Total heat output in Btu (MJ).

Q<sub>in</sub>—Total heat input available in test fuel charge in Btu's (MJ).

Q<sub>std</sub>—Volumetric flow rate in dilution tunnel in dscfm.

M—Mass flow rate of water in lb/min (kg/min).

V<sub>i</sub>—Volume of water indicated by a totalizing flow meter at the i<sub>th</sub> reading in gallons (liters).

V<sub>i</sub>—Volumetric flow rate of water in heat exchange system in gallons per minute (liters/min).

Θ—Total length of burn period in hours (Θ<sub>1</sub> + Θ<sub>2</sub> + Θ<sub>3</sub>).

Θ<sub>1</sub>—Length of time of the startup period in hours.

Θ<sub>2</sub>—Length of time of the steady-state period in hours.

Θ<sub>3</sub>—Length of time of the end period in hours.

Θ<sub>4</sub>—Length of time for stored heat to be used following a burn period in hours.

t<sub>i</sub>—Data sampling interval in minutes.

η<sub>del</sub>—Delivered heating efficiency in percent.

F<sub>i</sub>—Weighting factor for heat output category i. (See Table 2.)

T<sub>1</sub>—Temperature of water at the inlet on the supply side of the heat exchanger, °F.

T<sub>2</sub>—Temperature of the water at the outlet on the supply side of the heat exchanger, °F.

T<sub>3</sub>—Temperature of cooling water at the inlet to the load side of the heat exchanger, °F.

T<sub>4</sub>—Temperature of cooling water at the outlet of the load side of the heat exchanger, °F.

T<sub>5</sub>—Temperature of the hot water supply as it leaves the boiler/heater, °F.

T<sub>6</sub>—Temperature of return water as it enters the boiler/heater, °F.

T<sub>7</sub>—Temperature in the boiler/heater optional destratification loop at the top of the boiler/heater, °F.

T<sub>8</sub>—Temperature in the boiler/heater optional destratification loop at the bottom of the boiler/heater, °F.

TI<sub>avg</sub>—Average temperature of the appliance and water at start of the test.

$$TI_{avg} - (T5 + T6)/2 \text{ at the start of the test, } ^\circ\text{F.}$$

Eq. 1

TF<sub>avg</sub>—Average temperature of the appliance and water at the end of the test.

$$TF_{avg} - (T5 + T6)/2 \text{ at the end of the test, } ^\circ\text{F.}$$

Eq. 2

TIS<sub>1</sub>—Temperature at the inlet to the storage system at the start of the test.

TIS<sub>2</sub>—Temperature at the outlet from the storage system at the start of the test.

TFS<sub>1</sub>—Temperature at the inlet to the storage system at the end of the test.

TFS<sub>2</sub>—Temperature at the outlet from the storage system at the end of the test.

TIS<sub>avg</sub>—Average temperature of the storage system at the start of the test.

$$TIS_{avg} - (TIS_1 + TIS_2)/2 \text{ at the end of the test.}$$

Eq. 3

TFS<sub>avg</sub>—Average temperature of the storage system at the end of the test.

$$TFS_{avg} - (TFS_1 + TFS_2)/2.$$

Eq. 4

MC—Fuel moisture content in percent dry basis.

σ—Density of water in pounds per gallon.

σ<sub>initial</sub>—Density of water in the boiler/heater system at the start of the test in pounds per gallons.

σ<sub>boiler/heater</sub>—Density of water in the boiler/heater system at an arbitrary time during the test in pounds per gallon.

C<sub>p</sub>—Specific heat of water in Btu/lb, °F.

C<sub>steel</sub>—Specific heat of steel (0.1 Btu/lb, °F).

V<sub>boiler/heater</sub>—total volume of water in the boiler/heater system on the weight scale in gallons.

W<sub>fuel</sub>—Fuel charge weight, as-fired or “wet”, in pounds (kg).

W<sub>fuel\_1</sub>—Fuel consumed during the startup period in pounds (kg).

W<sub>fuel\_2</sub>—Fuel consumed during the steady state period in pounds (kg).

W<sub>fuel\_3</sub>—Fuel consumed during the end period in pounds (kg).

$W_{\text{FuelBurned}}$ —Weight of fuel that has been burned from the start of the test to an arbitrary time, including the needed correction for the change in density and weight of the water in the boiler/heater system on the scale in pounds (kg).

$W_{\text{RemainingFuel}}$ —Weight of unburned fuel separated from the ash at the end of a test. Useful only for Category I and Category II tests.

$W_{\text{app}}$ —Weight of empty appliance in pounds (kg).

$W_{\text{wat}}$ —Weight of water in supply side of the system in pounds (kg).

$W_{\text{ScaleInitial}}$ —Weight reading on the scale at the start of the test, just after the test load has been added in pounds (kg).

$W_{\text{Scale}}$ —Reading of the weight scale at an arbitrary time during the test run in pounds (kg).

$W_{\text{StorageTank}}$ —Weight of the storage tank empty in pounds (kg).

$W_{\text{WaterStorage}}$ —Weight of the water in the storage tank at  $TIS_{\text{avg}}$  in pounds (kg).

13.2 After the test is completed, determine the particulate emissions  $E_T$  in accordance with EPA Method 28WHH and the standards referenced therein.

13.3 Determination of the weight of fuel that has been burned at an arbitrary time.

For the purpose of tracking the consumption of the test fuel load during a test run the following may be used to calculate the weight of fuel that burned since the start of the test:

$$W_{\text{FuelBurned}} = (W_{\text{ScaleInitial}} - W_{\text{Scale}}) + V_{\text{Boiler/heater}} \cdot (\sigma_{\text{Initial}} - \sigma_{\text{boiler/heater}}) \quad \text{Eq. 5}$$

Water density,  $\sigma$ , is calculated using Equation 12.

13.4 Determine Average Fuel Load Moisture Content.

$$MC = \frac{\sum W_{\text{SliceWet}_i} - MC_{\text{Slice}_i}}{\sum W_{\text{SliceWet}_i}} \quad \text{Eq. 6}$$

13.5 Determine Heat Input.

$$Q_{\text{in}} = (W_{\text{fuel}} / (1 + (MC/100))) \times \text{HHV, Btu (MJ)}. \quad \text{Eq. 7}$$

$$Q_{\text{in LHV}} = (W_{\text{fuel}} / (1 + (MC/100))) \times \text{LHV, Btu (MJ)}. \quad \text{Eq. 8}$$

13.5.1 Correction to  $Q_{\text{in}}$  for the Category I and II tests, where there is greater than 1

percent of the test fuel charge in the chamber at the end of the test period.

$$Q_{\text{InCorrected}} = Q_{\text{in}} - W_{\text{Remaining}} \cdot 12,500 \text{ Btu} \quad \text{Eq. 9}$$

13.6 Determine Heat Output, Efficiency, and Emissions.

$Q_{\text{out}} = \Sigma$  [Heat output determined for each sampling time interval] + Change in heat

stored in the appliance + Change in heat in storage tank.

13.6.1 Determine heat output as:

$$Q_{\text{out}} = \Sigma [C_{pi} \cdot \Delta T_i \cdot M_i \cdot t_i] + (W_{\text{app}} \cdot C_{\text{steel}} + W_{\text{water}} \cdot C_{pa}) \cdot (TF_{\text{avg}} - TI_{\text{avg}}) \\ + (W_{\text{StorageTank}} \cdot C_{\text{steel}} + W_{\text{WaterStorage}} \cdot C_{pa}) \cdot (TFS_{\text{avg}} - TIS_{\text{avg}}) \text{ Btu (MJ)} \quad \text{Eq. 10}$$

**Note:** The subscript (i) indicates the parameter value for sampling time interval  $t_i$ .

$M_i$  = Mass flow rate = gal/min  $\times$  density of water (lb/gal) = lb/min.

$$M_i = V_{fi} \cdot \sigma_i, \text{ lb/min.} \quad \text{Eq. 11}$$

$$\sigma_i = (62.56 + (-.0003413 \times T_{3i}) + (-.00006225 \times T_{3i}^2)) \cdot 0.1337, \text{ lb/gal.} \quad \text{Eq. 12}$$

$$C_p = 1.0014 + (-.000003485 \times T_{3i}) \text{ Btu/lb, } ^\circ\text{F.} \quad \text{Eq. 13}$$

$C_{\text{steel}} = 0.1 \text{ Btu/lb, } ^\circ\text{F.}$

$$C_{pa} = 1.0014 + (-.000003485 \times (TI_{\text{avg}} + TF_{\text{avg}})/2), \text{ Btu/lb, } ^\circ\text{F.} \quad \text{Eq. 14}$$

$$V_{fi} = (V_i - V_{i-1}) / (t_i - t_{i-1}), \text{ gal/min.} \quad \text{Eq. 15}$$

**Note:**  $V_i$  is the total water volume at the end of interval  $i$  and  $V_{i-1}$  is the total water volume at the beginning of the time interval.

This calculation is necessary when a totalizing type water meter is used.

13.6.2 Determine Heat Output Rate Over Burn Period ( $\Theta_1 + \Theta_2 + \Theta_3$ ) as:

$$\text{Heat Output Rate} = Q_{\text{out}}/\Theta, \text{ Btu/hr (MJ/hr).} \quad \text{Eq. 16}$$

13.6.3 Determine Emission Rates and Emission Factors as:

$$E_{\text{g/MJ}} = E_T/(Q_{\text{out}} \times 0.001055), \text{ g/MJ.} \quad \text{Eq. 17}$$

$$E_{\text{lb/MM Btu output}} = (E_T/453.59)/(Q_{\text{out}} \times 10^{-6}), \text{ lb/mmBtu out.} \quad \text{Eq. 18}$$

$$E_{\text{g/kg}} = E_T/(W_{\text{fuel}}/(1+MC/100)), \text{ g/dry kg.} \quad \text{Eq. 19}$$

$$E_{\text{g/hr}} = E_T/(\Theta_1 + \Theta_2 + \Theta_3 + \Theta_4), \text{ g/hr.} \quad \text{Eq. 20}$$

$$\Theta_4 = (W_{\text{StorageTank}} \cdot C_{\text{steel}} + W_{\text{WaterStorage}} \cdot C_{\text{pa}}) \cdot (TFS_{\text{avg}} - TIS_{\text{avg}})/(Q_{\text{out}}/\Theta) \quad \text{Eq. 21}$$

If thermal storage is not used in a Category III or IV run, then  $\Theta_4 = 0$ .

$$E_{1\_g/kg} = E_1/(W_{\text{fuel}_1}/(1 + MC/100)), \text{ g/dry kg.}$$

$$E_{2\_g/kg} = E_2/(W_{\text{fuel}_2}/(1 + MC/100)), \text{ g/dry kg.}$$

$$E_{3\_g/kg} = E_3/(W_{\text{fuel}_3}/(1 + MC/100)), \text{ g/dry kg.}$$

$$E_{1\_g/hr} = E_1/\Theta_1, \text{ g/hr.}$$

$$E_{2\_g/hr} = E_2/\Theta_2, \text{ g/hr.}$$

$$E_{3\_g/hr} = E_3/\Theta_3, \text{ g/hr.}$$

13.6.4 Determine delivered efficiency as:

$$\eta_{\text{del}} = (Q_{\text{out}}/Q_{\text{InCorrected}}) \times 100, \% \quad \text{Eq. 22}$$

$$\eta_{\text{del LHV}} = (Q_{\text{out}}/Q_{\text{in LHV}}) \times 100, \% \quad \text{Eq. 23}$$

13.6.5 Determine  $\eta_{\text{SLM}}$ —Overall Efficiency, also known as Stack Loss Efficiency, using stack loss method (SLM).

For determination of the average overall thermal efficiency ( $\eta_{\text{SLM}}$ ) for the test run, use the data collected over the full test run and the calculations in accordance with CSA B415.1–10 (IBR, see § 60.17), clause 13.7 except for 13.7.2(e), (f), (g), and (h), use the following average fuel properties for oak: %C = 50.0, %H = 6.6, %O = 43.2, %Ash = 0.2.

13.6.5.1 Whenever the CSA B415.1–10 (IBR, see § 60.17) overall efficiency is found to be lower than the overall efficiency based

on load side measurements, as determined by Eq. 22 of this method, section 14.1.7 of the test report must include a discussion of the reasons for this result. For a test where the CSA B415.1–10 overall efficiency SLM is less than 2 percentage points lower than the overall efficiency based on load side measurements, the efficiency based on load side measurements shall be considered invalid. [Note on the rationale for the 2 percentage points limit. The SLM method does not include boiler/heater jacket losses and, for this reason, should provide an efficiency which is actually higher than the

efficiency based on the energy input and output measurements or “delivered efficiency.” A delivered efficiency that is higher than the efficiency based on the SLM could be considered suspect. A delivered efficiency greater than 2 percentage points higher than the efficiency based on the SLM, then, clearly indicates a measurement error.]

13.6.6 Carbon Monoxide Emissions

For each minute of the test period, the carbon monoxide emission rate shall be calculated as:

$$CO_{\text{g/min}} = Q_{\text{std}} \cdot CO_s \cdot 3.30 \times 10^{-5} \quad \text{Eq. 24}$$

Total CO emissions for each of the three test periods ( $CO_{-1}$ ,  $CO_{-2}$ ,  $CO_{-3}$ ) shall be calculated as the sum of the emission rates for each of the 1-minute intervals. Total CO emission for the test run,  $CO_T$ , shall be calculated as the sum of  $CO_{-1}$ ,  $CO_{-2}$ , and  $CO_{-3}$ .

13.7 Weighted Average Emissions and Efficiency.

13.7.1 Determine the weighted average emission rate and delivered efficiency from the individual tests in the specified heat output categories. The weighting factors ( $F_i$ ) are derived from an analysis of ASHRAE bin data which provides details of normal

building heating requirements in terms of percent of design capacity and time in a particular capacity range—or “bin”—over the course of a heating season. The values used in this method represent an average of data from several cities located in the northern United States.

$$\text{Weighted average delivered efficiency: } \eta_{\text{avg}} = \sum \eta_i \times F_i, \% \quad \text{Eq. 25}$$

$$\text{Weighted average emissions: } E_{\text{avg}} = \sum E_i \times F_i, \% \quad \text{Eq. 26}$$

If, as discussed in section 12.5.8, the option to eliminate tests in Category II and III is elected, the values of efficiency and particulate emission rate as measured in Category I, shall be assigned also to Category II and III for the purpose of determining the annual averages.

#### 14.0 Report

14.1.1 The report shall include the following:

14.1.2 Name and location of the laboratory conducting the test.

14.1.3 A description of the appliance tested and its condition, date of receipt and dates of tests.

14.1.4 A description of the minimum amount of external thermal storage that is required for use with this system. This shall be specified both in terms of volume in gallons and stored energy content in Btu with a storage temperature ranging from 125 °F to the manufacturer's specified setpoint temperature.

14.1.5 A statement that the test results apply only to the specific appliance tested.

14.1.6 A statement that the test report shall not be reproduced except in full, without the written approval of the laboratory.

14.1.7 A description of the test procedures and test equipment including a schematic or other drawing showing the location of all required test equipment. Also, a description of test fuel sourcing, handling and storage practices shall be included.

14.1.8 Details of deviations from, additions to or exclusions from the test

method, and their data quality implications on the test results (if any), as well as information on specific test conditions, such as environmental conditions.

14.1.9 A list of participants and their roles and observers present for the tests.

14.1.10 Data and drawings indicating the fire box size and location of the fuel charge.

14.1.11 Drawings and calculations used to determine firebox volume.

14.1.12 Information for each test run fuel charge including piece size, moisture content and weight.

14.1.13 All required data and applicable blanks for each test run shall be provided in spreadsheet format both in the printed report and in a computer file such that the data can be easily analyzed and calculations easily verified. Formulas used for all calculations shall be accessible for review.

14.1.14 For each test run,  $\Theta_1, \Theta_2, \Theta_3$ , the total CO and particulate emission for each of these three periods, and  $\Theta_4$ .

14.1.15 Calculated results for delivered efficiency at each heat output rate and the weighted average emissions reported as total emissions in grams, pounds per mm Btu of delivered heat, grams per MJ of delivered heat, grams per kilogram of dry fuel and grams per hour. Results shall be reported for each heat output category and the weighted average.

14.1.16 Tables 1A, 1B, 1C, 1D, 1E and Table 2 must be used for presentation of results in test reports.

14.1.17 A statement of the estimated uncertainty of measurement of the emissions and efficiency test results.

14.1.18 A plot of CO emission rate in grams/minute vs. time, based on 1 minute averages, for the entire test period, for each run.

14.1.19 A plot of estimated boiler/heater energy release rate in Btu/hr based on 10 minute averages, for the entire test period, for each run. This will be calculated from the fuel used, the wood heating value and moisture content, and the SLM efficiency during each 10 minute period.

14.1.20 Raw data, calibration records, and other relevant documentation shall be retained by the laboratory for a minimum of 7 years.

#### 15.0 Precision and Bias

15.1 Precision—It is not possible to specify the precision of the procedure in this test method because the appliance operation and fueling protocols and the appliances themselves produce variable amounts of emissions and cannot be used to determine reproducibility or repeatability of this test method.

15.2 Bias—No definitive information can be presented on the bias of the procedure in this test method for measuring solid fuel burning hydronic heater emissions because no material having an accepted reference value is available.

#### 16.0 Keywords

16.1 Solid fuel, hydronic heating appliances, wood-burning hydronic heaters, partial thermal storage.

**Table 1A. Data Summary Part A**

						$\Theta$	$W_{\text{fuel}}$	$MC_{\text{ave}}$	$Q_{\text{in}}$	$Q_{\text{out}}$
Category	Run No	Load % Capacity	Target Load	Actual Load	Actual Load	Test Duration	Wood Weight as-fired	Wood Moisture	Heat Input	Heat Output
		Btu/hr	Btu/hr	Btu/hr	% of max	hrs	lb	%DB	Btu	Btu
I		< 15% of max								
II		16-24% of max								
III		25-50% of max								
IV		Max capacity								

**Table 1B. Data Summary Part B**

			T2 Min	$E_T$	E	E	$E_{\text{g/hr}}$	$E_{\text{g/kg}}$	$\eta_{\text{del}}$	$H_{\text{SLM}}$
Category	Run No	Load % Capacity	Min Return Water Temp.	Total PM Emissions	PM Output Based	PM Output Based	PM Rate	PM Factor	Delivered Efficiency	Stack Loss Efficiency
			°F	g	lb/mm Btu Out	g/MJ	g/hr	g/kg	%	%
I		< 15% of max								
II		16-24% of max								
III		25-50% of max								
IV		Max capacity								

**Table 1C. Data Summary Part C**

			$\Theta_1$	$\Theta_2$	$\Theta_3$	CO <sub>1</sub>	CO <sub>2</sub>	CO <sub>3</sub>	CO <sub>T</sub>
Category	Run No	Load % Capacity	Startup Time.	Steady State Time	End Time	Startup CO emission	Steady State CO emission	End CO emission	Total CO emission
			min	min	min	g	g	g	g
I		< 15% of max							
II		16-24% of max							
III		25-50% of max							
IV		Max capacity							

**Table 1D. Data Summary Part D**

			E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>	E <sub>1_g/kg</sub>	E <sub>2_g/kg</sub>	E <sub>3_g/kg</sub>
Category	Run No	Load % Capacity	Startup PM	Steady State PM	End PM	Startup PM emission index	Steady State PM emission index	End PM emission index
			g	g	g	g/kg fuel	g/kg fuel	g/kg fuel
I		< 15% of max						
II		16-24% of max						
III		25-50% of max						
IV		Max capacity						

**Table 1E: Label Summary Information**

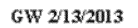
MANUFACTURER:			
MODEL NUMBER:			
ANNUAL EFFICIENCY RATING:	$\eta_{avg}$		(Using higher heating value)
PARTICLE EMISSIONS:	$E_{avg}$		grams/hr (Average)
			lbs/mmBtu/hr Output

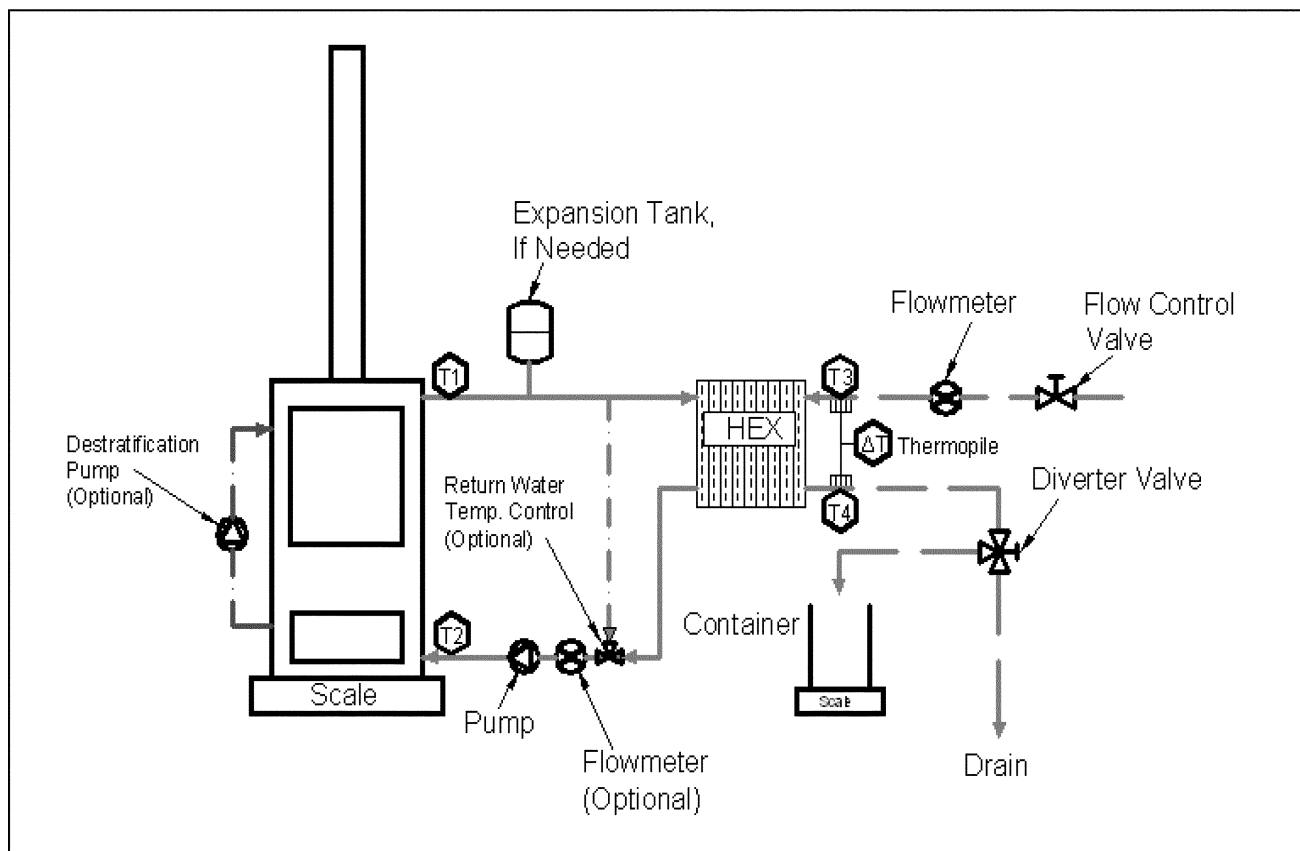
**Table 2. Annual Weighting**

Category	Weighting Factor ( $F_i$ )	$\eta_{del,i} \times F_i$	$E_{g/MJ,i} \times F_i$	$E_{g/kg,i} \times F_i$	$E_{lb/mmBtu Out,i} \times F_i$	$E_{g/hr,i} \times F_i$
I	0.437					
II	0.238					
III	0.275					
IV	0.050					
Totals	1.000					



**Note:**  
**Illustrated appliance pump location and flow path through the appliance are generic and may vary based on the unit being tested.**



**Figure 2. Schematic of Test Equipment Set-up**

**Note:** Illustrated appliance pump location and flow path through the appliance.

■ 7. Appendix I to Part 60 is revised to read as follows:

**Appendix I to Part 60—Owner's Manuals and Temporary Labels for Wood Heaters Subject to Subparts AAA and QQQQ of Part 60**

**1. Introduction**

The purpose of this appendix is to provide specific instructions and examples to manufacturers for compliance with the owner's manual provisions of subparts AAA and QQQQ of this part.

**2. Instructions for Preparation of Wood Heater Owner's Manuals**

**2.1 Introduction**

Although the owner's manuals do not require premarket approval, EPA will monitor the contents to ensure that sufficient information is included to provide heater proper operation and maintenance information affecting emissions to consumers. The manufacturer must make current and historical owner's manuals available on the company Web site and upon request to the EPA. The purpose of this section is to provide instructions to manufacturers for compliance with the owner's manual provisions of § 60.536(g) of subpart AAA that applies to wood heaters and § 60.5478(f) of subpart QQQQ that applies to hydronic heaters and forced-air furnaces. A checklist of topics and

illustrative language is provided as instructions. Owner's manuals should be tailored to specific wood heater models, as appropriate.

**2.2 Topics Required To Be Addressed in Owner's Manual**

- (a) Wood heater description and compliance status;
- (b) Tamper warnings;
- (c) Overall heater warranty information and catalyst information and warranty (if catalyst-equipped);
- (d) Fuel selection;
- (e) Achieving and maintaining catalyst light-off (if catalyst-equipped);
- (f) Catalyst monitoring (if catalyst-equipped);
- (g) Troubleshooting catalytic-equipped heaters (if catalyst-equipped);
- (h) Catalyst replacement (if catalyst-equipped);
- (i) Wood heater proper operation and maintenance, including minimizing visible emissions;
- (j) Wood heater proper installation, including location, stack height and achieving proper draft;
- (k) Use of smoke detectors and carbon monoxide monitors; and
- (l) Efficiency.

**2.3 Sample Text/Descriptions**

- (a) The following are example texts and/or further descriptions illustrating the topics

identified above. Although the regulation requires manufacturers to address (where applicable) the 10 topics identified above, the exact language is not specified. Manuals should be written specific to the model and design of the wood heater. The following instructions are composed of generic descriptions and texts.

(b) If manufacturers choose to use the language provided in the example, the portion in italics should be revised as appropriate. Any manufacturer electing to use the EPA example language will be considered to be in compliance with owner's manual requirements provided that the particular language is printed in full with only such changes as are necessary to ensure accuracy.

Example language is not provided for certain topics, since these areas are generally heater specific. For these topics, manufacturers should develop text that is specific to the proper operation and maintenance of their particular products.

**2.3.1 Wood Heater Description and Compliance Status**

Owner's manuals must include:

- (a) Manufacturer and model;
- (b) Compliance status (2015 standard, 2016 standard, 2017 standard, 2020 standard, crib wood standard or cord wood alternative standard, last allowable sell date, etc.); and
- (c) Heat output range.

Exhibit 1—Example Text covering 2.3.1(a), (b), and (c) of this appendix:

“This manual describes the installation and operation of the Brand X, Model 0 catalytic equipped wood heater. This heater meets the 2015 U.S. Environmental Protection Agency’s crib wood emission limits for wood heaters sold after May 15, 2015. Under specific test conditions this heater has been shown to deliver heat at rates ranging from 8,000 to 35,000 Btu/hr.”

### 2.3.2 Tamper Warnings

(a) The following statement must be included in the owner’s manual for all units:

“This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual.”

(b) The following statement must be included in the owner’s manual for catalyst-equipped units:

“This wood heater contains a catalytic combustor, which needs periodic inspection and replacement for proper operation. It is against federal regulations to operate this wood heater in a manner inconsistent with operating instructions in this manual, or if the catalytic element is deactivated or removed.”

### 2.3.3 Overall Heater Warranty Information and Catalyst Information and Warranty (if catalyst-equipped)

The following information must be included with or supplied in the owner’s and warranty manuals:

(a) Manufacturer and model, including catalyst if catalyst-equipped;

(b) Warranty details, including catalyst if catalyst-equipped; and

(c) Instructions for warranty claims.

Exhibit 2—Example Text covering 2.3.3(a), (b), and (c) of this appendix for catalysts:

“The combustor supplied with this heater is a *Brand Z, Long Life Combustor*. Consult the catalytic combustor warranty also supplied with this wood heater. Warranty claims should be addressed to:

Stove or Catalyst Manufacturer \_\_\_\_\_

Address \_\_\_\_\_

Phone # \_\_\_\_\_

2.3.3.1 This section should also provide clear instructions on how to exercise the warranty (how to package parts for return shipment, etc.).

#### 2.3.4 Fuel Selection

Owner’s manuals must include:

(a) Instructions on acceptable fuels;

(b) Warning against inappropriate fuels; and

(c) How to determine seasoned wood compared to unseasoned wood, how to use moisture meters and other techniques and the importance of seasoned wood.

Exhibit 3—Example Text covering 2.3.4(a) and (b) of this appendix:

“This heater is designed to burn natural wood only. Higher efficiencies and lower emissions generally result when burning air dried seasoned hardwoods, as compared to softwoods or to green or freshly cut hardwoods. DO NOT BURN:

(1) Garbage;  
(2) Lawn clippings or yard waste;  
(3) Materials containing rubber, including tires;

(4) Materials containing plastic;

(5) Waste petroleum products, paints or paint thinners, or asphalt products;

(6) Materials containing asbestos;

(7) Construction or demolition debris;

(8) Railroad ties or pressure-treated wood;

(9) Manure or animal remains;

(10) Salt water driftwood or other previously salt water saturated materials;

(11) Unseasoned wood; or

(12) Paper products, cardboard, plywood, or particleboard. The prohibition against burning these materials does not prohibit the use of fire starters made from paper, cardboard, saw dust, wax and similar substances for the purpose of starting a fire in an affected wood heater.

Burning these materials may result in release of toxic fumes or render the heater ineffective and cause smoke.”

### 2.3.5 Achieving and Maintaining Catalyst Light-Off

Owner’s manuals must describe in detail proper procedures for:

(a) Operation of catalyst bypass (stove specific);

(b) Achieving catalyst light-off from a cold start; and

(c) Achieving catalyst light-off when refueling.

2.3.5.1 No example text is supplied for describing operation of catalyst bypass mechanisms (Item 2.3.5(a) of this appendix) since these are typically stove-specific. Manufacturers must provide instructions specific to their model describing:

(1) Bypass position during startup;

(2) Bypass position during normal operation; and

(3) Bypass position during reloading.

Exhibit 4—Example Text for Item 2.3.5(b) of this appendix:

“The temperature in the stove and the gases entering the combustor must be raised to between 500° to 700 °F for catalytic activity to be initiated. During the startup of a cold stove, a medium to high firing rate must be maintained for about 20 minutes. This ensures that the stove, catalyst, and fuel are all stabilized at proper operating temperatures. Even though it is possible to have gas temperatures reach 600 °F within 2 to 3 minutes after a fire is started, if the fire is allowed to die down immediately, it may go out or the combustor may stop working. Once the combustor starts working, heat generated in it by burning the smoke will keep it working.”

Exhibit 5—Example Text for Item 2.3.5(c) of this appendix:

“REFUELING: During the refueling and rekindling of a cool fire, or a fire that has burned down to the charcoal phase, operate the stove at a medium to high firing rate for about 10 minutes to ensure that the catalyst reaches approximately 600 °F.”

### 2.3.6 Catalyst Monitoring

Owner’s manuals must include:

(a) Recommendation to visually inspect combustor at least three times during the heating season;

(b) Discussion on expected combustor temperatures for monitor-equipped units; and

(c) Suggested monitoring and inspection techniques and importance of ensuring catalyst is operating properly.

Exhibit 6—Example Text covering 2.3.6(a), (b) and (c) of this appendix:

“It is important to periodically monitor the operation of the catalytic combustor to ensure that it is functioning properly and to determine when it needs to be replaced. A non-functioning combustor will result in a loss of heating efficiency, and an increase in creosote and emissions. Following is a list of items that should be checked on a periodic basis:

- Combustors should be visually inspected at least three times during the heating season to determine if physical degradation has occurred. Actual removal of the combustor is not recommended unless more detailed inspection is warranted because of decreased performance. If any of these conditions exists, refer to Catalyst Troubleshooting section of this owner’s manual.

- This catalytic (or hybrid) heater is equipped with a temperature probe to monitor catalyst operation. Properly functioning combustors typically maintain temperatures in excess of 500 °F, and often reach temperatures in excess of 1,000 °F. If catalyst temperatures are not in excess of 500 °F, refer to Catalyst Troubleshooting section of this owner’s manual.

- You can get an indication of whether the catalyst is working by comparing the amount of smoke leaving the chimney when the smoke is going through the combustor and catalyst light-off has been achieved, to the amount of smoke leaving the chimney when the smoke is not routed through the combustor (bypass mode).

Step 1—Light stove in accordance with instructions in section 3.3.5.

Step 2—With smoke routed through the catalyst, go outside and observe the emissions leaving the chimney.

Step 3—Engage the bypass mechanism and again observe the emissions leaving the chimney.

Significantly more smoke will be seen when the exhaust is not routed through the combustor (bypass mode).”

### 2.3.7 Catalyst Troubleshooting

The owner’s manual must provide clear descriptions of symptoms and remedies to common combustor problems and importance. It is recommended that photographs of catalyst peeling, plugging, thermal cracking, mechanical cracking, and masking be included in the manual to aid the consumer in identifying problems and to provide direction for corrective action.

### 2.3.8 Catalyst Replacement

The owner’s manual must provide clear step-by-step instructions on how to remove and replace the catalytic combustor. The section should include diagrams and/or photographs.

### 2.3.9 Wood Heater Proper Operation and Maintenance

The owner’s manual must provide clear descriptions of symptoms and remedies to

common heater problems and importance. The owner's manual information must be adequate to enable consumers to achieve optimal emissions performance. Such information must be consistent with the operating instructions provided by the manufacturer to the approved test laboratory for operating the wood heater during certification testing, except for details of the certification test that would not be relevant to the user.

Owner's manual must include:

(a) Recommendations about building and maintaining a fire, especially for cold starts and the effectiveness of the top-down approach for starting fires;

(b) Instruction on proper use of air controls, including how to establish good combustion and how to ensure good combustion at the lowest burn rate for which the heater is warranted;

(c) Ash removal and disposal;

(d) Instruction replacement of gaskets, air tubes and other parts that are critical to the emissions performance of the unit, and other maintenance and repair instructions;

(e) Warning against overfiring; and

(f) Suggested monitoring and inspection techniques and importance of ensuring heater is operating properly, including ensuring visible emissions are minimized.

2.3.9.1 No example text is supplied for 2.3.9(a), (b), (d) and (f) of this appendix since these items are model specific.

Manufacturers should provide detailed instructions on building and maintaining a fire including selection of fuel pieces, fuel quantity and stacking arrangement. Manufacturers should also provide instruction on proper air settings (both primary and secondary) for attaining minimum and maximum heat outputs and any special instructions for operating thermostatic controls. Step-by-step instructions on inspection and replacement of gaskets should also be included. Manufacturers should provide diagrams and/or photographs to assist the consumer. Gasket type and size should be specified.

Exhibit 7—Example Text for Item 2.3.9(c) of this appendix:

"Whenever ashes get 3 to 4 inches deep in your firebox or ash pan, and when the fire has burned down and cooled, remove excess ashes. Leave an ash bed approximately 1 inch

deep on the firebox bottom to help maintain a hot charcoal bed."

"Ashes should be placed in a metal container with a tight-fitting lid. The closed container of ashes should be placed on a noncombustible floor or on the ground, away from all combustible materials, pending final disposal. The ashes should be retained in the closed container until all cinders have thoroughly cooled."

Exhibit 8—Example Text covering Item 2.3.9(e) of this appendix:

"DO NOT OVERFIRE THIS HEATER"

"Attempts to achieve heat output rates that exceed heater design specifications can result in permanent damage to the heater and to the catalytic combustor if so equipped."

#### 2.3.10 Wood Heater Installation, Including Stack Height, Heater Locations and Achieving Proper Draft

Owner's manual must include:

(a) Importance of proper draft;

(b) Conditions indicating inadequate draft;

(c) Conditions indicating excessive draft; and

(d) Guidance on proper stack height and proper heater locations, *i.e.*, not too close to neighbors or in valleys that would cause unhealthy air quality or nuisance conditions.

2.3.10.1 No example text is supplied for (d) because state, local and tribal requirements are model and location specific.

Exhibit 9—Example Text for Item (a):

"Draft is the force which moves air from the appliance up through the chimney. The amount of draft in your chimney depends on the length of the chimney, local geography, nearby obstructions and other factors. Too much draft may cause excessive temperatures in the appliance and may damage the catalytic combustor. Inadequate draft may cause backpuffing into the room and 'plugging' of the chimney or the catalyst."

Exhibit 10—Example Text for Item (b):

"Inadequate draft will cause the appliance to leak smoke into the room through appliance and chimney connector joints."

Exhibit 11—Example Text for Item (c):

"An uncontrollable burn or excessive temperature indicates excessive draft."

#### 2.3.11 Efficiency

Owner's manual must include:

(a) Description of how the efficiency was determined, *e.g.*, use higher heating value of the fuel instead of lower heating value of the fuel, discuss sweet spot versus annual average versus annual fuel usage efficiency (AFUE);

(b) How operation and fuels affect efficiency, *e.g.*, seasoned wood versus high moisture fuel; operation at sweet spot versus low-burn rates; and

(c) How location affects the efficiency, *e.g.*, in main living area versus basement versus outdoors in sub-freezing temperatures.

#### 2.3.12 Smoke and Carbon Monoxide Emissions and Monitors

Owner's manual must include:

(a) Discussion of smoke and carbon monoxide (CO) emissions, including the CO data submitted in the certification application and expected variations for different operating conditions;

(b) Recommendation to have smoke monitors; and

(c) Recommendation to have monitors for areas that are expected to generate CO, *e.g.*, heater fueling areas, pellet fuel bulk storage areas, sheds containing hydronic heaters.

#### 3. Instructions for Preparation of Wood Heater Temporary Labels

3.1 Temporary labels that show the values for emissions, efficiency, recommended heating area and the compliance status may (voluntarily) be affixed by the manufacturer to wood heaters that meet the 2020 particulate matter emission standards early or that meet the cord wood alternative compliance options in subparts AAA and QQQQ of this part.

3.2 The seller of each heater covered by section 3.1 may ensure that the temporary label remains affixed until each heater is purchased by the end user.

3.3 The temporary label option for the 2020 particulate matter emission standards end as of May 15, 2020.

3.4 The template for the temporary labels will be supplied by the Administrator upon request.

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