Masonry Heater Association of North America
www.mha-net.org

Comments on EPA's Proposed Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces, and for New Residential Masonry Heaters

Docket ID No. EPA-HQ-OAR-2009-0734

Contents

Introduction

The Masonry Heater Association of North America (MHA) appreciates the opportunity to comment on the EPA's proposed New Source Performance Standards (NSPS) for wood fired heating appliances as the Proposed Rule now includes masonry heaters.

What is MHA ?

MHA was founded in 1984 as an association of builders, manufacturers and retailers of masonry heaters. Its purpose is to promote the industry, sponsor Research & Development, shape regulations, educate the public and further the expertise and professionalism of its membership.
R&D is carried out through Lopez Labs, a network of private labs supported by MHA members. They are equipped with combustion analyzers and Condar portable dilution tunnels.
The association currently counts over 130 full voting members.

Masonry heaters differ in many ways from the other appliances covered by the NSPS

A masonry heater is a slow heat release appliance intermittently fired by solid fuel, constructed mainly of masonry materials. Its main distinguishing feature is a large thermal mass for heat storage.

Among the appliance classes, masonry heaters stand out in many ways :

- they are large and heavy (8,000 pounds for a large heater), require their own foundations and become part of the structure of a building. For these reasons, their design has to be site specific;
- Half of the masonry heaters in North America are constructed on site from hundreds of small building blocks (typically firebricks for the refractory core and regular bricks for the facing);
- they come in many styles, depending on the heat exchanger configuration : Contraflow, Bell, Kachelofen and Grundofen, to name the most common;
- they can take many different appearances depending on their facing material : bare bricks, plastered bricks or blocks, soapstone, field stone, river rock or a combination of those;
- they can receive a variety of add-ons : heated bench, white or black oven, cooktop and see-through firebox doors. They can be combined with a cookstove or a fireplace;
- they come in a wide range of sizes : from a small footprint, single room heater to a double story central heater that weighs 16,000 pounds and stands 17 feet tall.

From a construction point of view, masonry heaters have more in common with masonry fireplaces than with any other classes regulated by this NSPS. Wood stoves, pellet stoves, hydronic heaters and warm-air furnaces are all appliances that are mass-produced in factory

settings, with short product ranges being duplicated in large numbers.

From an emissions point of view, masonry heaters have always been clean burning. This is not due to elaborate firebox designs but rather to the way combustion is conducted : at a high burn rate, typically 10 times higher than in a wood stove. Smouldering never occurs. Other benefits include high turbulence which generates excellent fuel-air mixing. Masonry heaters' optimally sized fireboxes also provide the combustion gases a long residency time in high temperature zones. These "3-T" conditions naturally promote complete combustion.

The large thermal mass allows a high burn rate to be sustained without overheating the building.
In masonry heaters, clean burns also come with limited operator input which helps to assure good real life emission numbers. Since a daily fire commonly only last two hours, there is no fuel reloading and no air adjustment to be done. Proper firewood sizing and loading are the main requirements for a clean burn, and can be carefully planned before the fire starts.

The purpose of this long explanation is to strongly emphasize the fact that masonry heater designs don't require as tight a control as other wood-burning appliances, for the following reasons :
- providing enough air at the right place and applying simple dimensioning formulas assure a clean-burning and functional appliance;
- a high variability of shapes and sizes is needed for an appliance that is site-specific.

Masonry heaters are getting regulated by the EPA

MHA welcomes the EPA's decision to add masonry heaters to the appliances regulated in the NSPS.

The Preamble shows that the EPA has identified many characteristics of masonry heaters and its industry : the importance of custom models, the small size of the market players, the limited R&D capabilities of each builder.

The subpart RRRR shows valuable attempts to accommodate these characteristics : the special treatment given to small builders (5-year exemption, some certification requirements that don't apply to them), the alternative certification path.

The fact that this program was originally designed to regulate the manufacturers of mass produced appliances is nevertheless obvious :
- use of the terms "manufacturer", "product line", "representative model";
- the certification process consists in testing one representative model and allowing it to be duplicated within a very small tolerance only.
The program also shows its deeper origins (regulating industrial sources) when attempting to micromanage every aspect of certification through extremely detailed and strict requirements and heavily relying on accredited labs.

We offer to assist the EPA in adapting the regulatory program so it better takes into account the masonry heater industry's unique characteristics. To this purpose, we have identified certain issues and are proposing certain changes.

Comments and Proposals

1. Certification requirements need to be revised so that masonry heaters don't have to be certified on an individual basis

Most masonry heaters would have to be certified on an individual basis because :
"a model line must be recertified whenever any change is made in the original design that could affect the emissions rate for that model line or when any of several specified tolerances of key components are changed" (Preamble, page 47)

Most masonry heaters differ from one another by more than the allowed design tolerance of ± 0.25" (§ 60.533(k)(2)) because :
- their size & weight require site-specific designs;
- custom designs are prevalent, even with factory-made models;
- masonry building materials such as river rocks and field stone are not calibrated;
- the tolerance in masonry construction is beyond 0.25".

Having to test each unit is contrary to the goals of the program :
" Therefore, as in 1988, we are proposing that manufacturers participate in a certification program that tests a representative heater per model line rather than requiring testing each heater. If the representative heater meets the applicable emission limits, the entire model line may be certified and the manufacturer would not be required to test every heater." (Preamble, page 11)
"A typical NSPS source category approach that imposes emission standards and then requires a unit- specific compliance demonstration would have been very costly and impractical. Therefore, the 1988 NSPS was designed to allow manufacturers of wood heaters to use a certification program to test representative wood heaters on a model line basis." (Preamble, page 23)
"As in 1988, the cost of testing each unit would be an order of magnitude greater than the cost of a wood heater/stove and would be economically prohibitive. In addition, as in 1988, the testing of each unit could create a potential "logjam" that would stymie the certification of cleaner model lines." (Preamble, page 43)

Having to test each heater, would put the industry at risk :
- the masonry heater manufacturers would face a competitive disadvantage as certification costs would be higher than in the other industries regulated by the NSPS;
- the cost of certification would be incompatible with sales volumes;

- the length of the certification process is not compatible with the way small manufacturers operate (see paragraph 4 in point 7 for more details).

We have identified three possible ways to mitigate this problem.

A. Certified fireboxes

1) We propose to amend the definitions of *Model line* and *Representative affected masonry heater* in § 60.5485.

The goal is that a *Model line* becomes a group of units that have enough in common to be certified only once and that *Representative affected masonry heater* becomes truly representative of a model line.

Since what matters are the features that affect emissions (§ 60.533(k)(1)), this could be done in an uncomplicated way by acknowledging that, in a masonry heater, emissions are affected by the way the firebox is designed and built. Consequently, the firebox would be the only component that would need to be subject to the *Similar in all material respects* clause and stay within the *Design tolerances* as per § 60.533(k)(2).

The “k” list which is "the list of design changes that would result in a need to recertify a model line when certain tolerances are exceeded" only comprises the firebox and its components. It doesn’t include heat exchangers and heat storage components which is to be expected since changes with these components "may not reasonably be anticipated to cause wood heaters in the model line to exceed the applicable emission limits".

Tulikivi, for example, offers 8 variations of the TU1000 model line, all based on the same 310 x 245 mm firebox, rated for an 8.1 kg load. These variations differ considerably depending on heat exchanger configurations, heat storage sizes, decorative features and venting options. Weights vary from 1000 kg to 1730 kg. Nevertheless, all variations share a single European certificate of conformity.

The aforementioned definitions could be amended along these lines :

- *Model line* means all masonry heaters offered for sale by a single manufacturer <u>that feature fireboxes</u> that are similar in all material respects as defined in this section.
- *Representative affected masonry heater* means an individual masonry heater <u>that features a firebox</u> that is similar in all material respects as defined in this section to other masonry heaters within the model line it represents.

Some additional changes would be required :

- *Valid certification test (3)* (page 251)
From : "The test was conducted on a residential masonry heater similar in all material respects

as defined in this section to other residential masonry heaters of the model line that is to be certified; and..."
To : The test was conducted on a residential masonry heater that is representative of the model line that is to be certified; and...

- § 60.533(k)(2)(i) (page 196)
From : "Firebox : dimensions"
To : Firebox : internal dimensions

Lab testing procedures could be affected in the following way :

If a draft inducer was used, the representative firebox of a masonry heater model line could be tested for emissions without having to completely build the heat exchanger and the facing. This practice is becoming increasingly common in Austria and in Germany*.

2) We propose to increase *Design tolerances* to ± 0.5" in order to take into account the tolerance customary to masonry construction.

3) We propose to ensure that firebox doors are not on the list of key components. This is because :
- emissions are not affected by the size of firebox doors as heat losses are under 5% of the total heat output of a masonry heater*;
- air inlets built in doors are declining in use (more about this in point 15, line 6).

* See:
Appendix A(5)

B. Substantially similar

A consensus document created by two major industry associations, MHA and Association of Masonry Heater and Oven Professionals (AMHOP), and submitted to EPA three years ago, proposed that EPA adopts a “substantially similar” approach as one of the alternative methods for certification of masonry heater. This approach allows construction of a unit with a small percentage variation from the certified model/design without re-certification. The “Substantially Similar” method was found to be a viable approach for alternative certification of masonry fireplaces and masonry heaters in Colorado and Washington States and is currently in use in these jurisdictions. We believe that this approach is specifically suitable for masonry heaters because of the inherently clean nature of the technology. We propose that a “Substantially Similar” method, allowing variation of plus-minus 20%, is included in the Proposed Rule.

Below is a list of the supporting arguments for this proposal:
- “Substantially Similar” method is currently in use in Colorado and Washington States (Colorado Regulation 4, Section 3.2.2, “Comparison to Previously Tested and Approved Model”; Washington State “Substantially Similar” Method);

- Existing test data for several Tulikivi heater models, which are all similar scaled versions of essentially the same design, show similar emission levels despite of the size differences;
In-house test data on one of Tulikivi models with standard and extended heat exchange portion shows that larger size does not have negative effect on emissions;
(See:
Appendix A(1))

Verification of dimensions of site-built masonry heaters under a “Substantially Similar” method can be put in the hands of independent third party inspectors such as certified chimney technicians or certified home inspectors. This would expedite timely certification and reduce costs of the certification process. We have developed sample spreadsheet computer programs that could be used for such field verification. Such spreadsheet programs can calculate compliance automatically, according to entered measurements, and provide result, which cannot be influenced by the inspector.
(See:
Appendix A(2)
Appendix A(3))

C. Families of certified designs

We are also proposing a provision to allow the certification of “family of units” if successful performance of heaters within the proposed higher percentage of variation and within extremes of the family of units is proven by testing at an EPA-accredited laboratory. This would provide additional tools for alternative certification, while stimulating development of the better technology.

2. Alternative certification requirements need to be simplified

Allowing an alternative certification process based on software simulation instead of performance testing is ideal for appliances that are site-specific. Software simulation allows the testing of unique designs in specific conditions so that proper function is ensured. This, in turn, guarantees their performance in terms of emissions.

Unfortunately, the alternative certification requirements are extremely demanding as they involve submitting each simulation results to both a lab and the EPA which results in a long and costly procedure :
§ 60.5487 (a)(3) requires the test results of each heater to be submitted "for review and certification by the certifying entity and subsequent review and approval by the Administrator."

This is contrary to the straightforwardness announced on page 72 in the Preamble :
"Considering all of these factors, we believe a simple computer simulation showing how new models would perform may be all that is necessary for many of these models."

The length of the alternative certification process is not compatible with the way small manufacturers operate :
- they build one masonry heater after the other;
- they carry a very limited portfolio of orders at a time;
- construction has to start rapidly after the signature of the contract as clients want their heaters constructed before the next heating season starts.
As a consequence, having to wait several weeks until the green light is obtained from the EPA would jeopardize their activity.

In Austria, a country where masonry heaters are mainstream, certification requirements are surprisingly undemanding : Eco-labelled fireboxes will be compulsory in 2015 and the use of a simulation program is only optional. A three page document* is all it takes to describe the dimensioning rules of these new fireboxes.

We propose a simpler procedure :
- manufacturers submit individual simulation results to a single accredited lab with purposely trained personnel (MHA is currently discussing this with an EPA accredited laboratory) for review, certification and label deliverance;
- the centralizing accredited lab EPA submits a summary of simulation results and a list of certified heaters on a regular basic (quarterly, semi-annually...)

The benefits would be :
- shorter waiting time for manufacturers;
- a single stop procedure for manufacturers;
- reduced work load for the EPA.

* See:
Appendix A(4)

3. Small manufacturers need to be able to license certified designs

§ 60.5487 (a)(1) ..."If one entity licenses a model line to another entity, each entity's model line must be certified. If an entity changes the name of the entity or the name of the model, the manufacturer must apply for a new certification."

We strongly recommend removing this limitation and permit licensing without recertification on the part of the licensee. The reason is that once regulated, small masonry heater manufacturers will need to be able to licence certified designs without being required to recertify them. This will allow the spreading of certification costs and let MHA carry most of the burden of certification.

In the other industries regulated by this NSPS, Research & Development is carried out by each entity individually and generally in great secrecy. Proprietary designs abound and are put

forward as sales arguments. As stated in the Preamble (page 93) about wood heaters :
"The key differences tend to be confidential business information as to the specifics of the combination that the manufacturer uses and does not share with other manufacturers but rather holds as proprietary. Similarly, the industry trade association cannot facilitate exchange of such information because of antitrust regulations."

The masonry heater industry functions in a very different way. As small manufacturers have very limited resources, R&D is conducted cooperatively between builders and often under the umbrella of MHA. Here are a some examples :
- all test data gathered by Lopez Labs over the last decade has been published on the MHA website (www.mha-net.org);
- detailed construction pictures are posted on the MHA website;
- discussion forums are available for MHA members to exchange technical information;
- the Heater Masons Education and Development program (HMED) and the workshops offered during MHA's annual convention are taught by volunteer members;
- the MHA Heater Plan Portfolio offers a variety of detailed construction plans on which many builders base their designs. They are modified to meet the requirements of the building site. A majority of the designs has been tested by Lopez Labs.

As a result, most masonry heater designs in North America are open source (except certain Austrian "calculated" designs) and the licensing of certified designs is needed to ensure it stays that way.

4. The proposed emission reporting format requires an efficiency testing method which needs to be specified

Reporting Particulate Matter emissions in pounds per million Btu is technically the best choice because it relates emissions to the actual heat output of each appliance, meaning that its efficiency is taken into account.

There are nevertheless three issues with this reporting format :
- ASTM E2817 only recognizes grams of particulate per kilogram as a reporting unit (5.2);
- an efficiency testing method still needs to be specified for masonry heaters (more on this in point 10).
- there is very little original data reported in lb/MMBtu as most test data is reported in g/kg. Conversion is only possible if the efficiency and the fuel load during the test run are known, which is not the case for all models tested to meet the Washington State Emission Standards.

An example of conversion can be seen in MHA Testing data.doc, Appendix A(8):

The formula is :
PM lb/MMBtu = PM lb x (1,000,000 / Output Btu)
where Output Btu = (Fuel load lb x Heat value Btu) x Efficiency %
with Heat value = 7125 Btu/lb*

At 70% efficiency, 0.32lb/MMBtu convert to 1.60 g/kg
At 75% efficiency, 0.32lb/MMBtu convert to 1.70 g/kg

We propose to use g/kg as an emission reporting format until an efficiency testing method is specified for masonry heaters. E2817 should be revised accordingly.

* Value used by OMNI in 2010 during Condar calibration testing at Lopez Labs Seattle :
See:
Appendix A(6)

5. The emission limit was set somewhat arbitrarily and possibly too low for large manufacturers during the early stages of regulation

The rate of 0.32 lb/MMBtu is not based on test data specific to masonry heaters and from test data gathered according to the specified testing methods : it is the emission limit set for hydronic heaters and forced-air furnaces.

Masonry heaters are already clean burning : the majority of tests done by Lopez Labs since 2008 are under the proposed limit*.

These tests show that operator related factors have a considerable effect on emissions : the sizing of the fuel, the way it is loaded in the firebox and the way it is ignited (bottom, side or top ignition). This is why manufacturer's instructions are critical at ensuring the appliance will be clean burning.

When it comes to design factors, emissions are mostly affected by the air distribution system. Three main configurations can be identified :
A. Underfire air (large central grate on which the fuel load is placed) : 4.5 g/kg
B. Overfire air (small grates near the edges of the firebox floor and/or an air frame) : 1 to 2 g/kg
C. Eco-labelled firebox** (no grates, air injected through slits in walls) : 0.5 to 1 g/kg

Most builders are in the process of moving away from A.
B. is current BSER.
C. is very promising. This design was developed by the Austrian Kachelofen Association and will be compulsory in Austria in 2015. It is in the early stages of being adapted by MHA to North American heaters, which are larger than European ones. Test data from Lopez Labs is

currently limited to two heaters. It is too early to be considered BSER.

Tulikivi has received approval for 50 models in the State of Washington*** and these include some older designs that fall in the 2 to 3.8 g/kg range. If the emission limit was set at 2 g/kg, only 13 models could be grandfathered while at 4.5 g/kg, the tally would be 29 models. For this reason, we propose 4.5 g/kg as the emission limit, at least during the early stages of regulation.

* See:
Appendix A(7)
** See:
Appendix A(8)
*** See:
Appendix A(9)

6. The dimensioning standard approved for alternative certification needs to be adapted to North American market conditions

ASTM WK26558 is based on the European standard EN15544. The purpose of this standard is to guarantee the proper function of a custom built masonry heater during the most critical phase of the burn (maximum flue gas oxygen depression) and under the worst possible operating conditions (cold heater, half load, high outside temperature, low atmospheric pressure, high air moisture). This is done by ensuring that :
1) the volume of the firebox allows sufficient residency time to the combustion gases in its hottest zone ;
2) air flow velocity generates sufficient turbulence to proper mixing of air and combustion gasses ;
3) resistance and draft are properly balanced throughout the system (from the air intake to the chimney).

Additionally, the standard guarantees the emissions of a functional heater to be under certain limits.
Being originally developed in Austria, this standard is designed for Austrian types of heaters (Kachelofen and Grundofen), built with local refractory materials (chamotte) and operated according to local practices which involve multiple small firings. It comes as no surprise that to be operational in North America, this standard needs to be adapted to our local market conditions.

We propose to develop a revised & extended standard which addresses the limitations of EN15544 :

- allow the use of North American made refractory materials (firebricks, refractory concrete, soapstone) which are ruled out by EN15544 which stipulates conductivity < 0.90 W/mK

- allow larger sized glass firebox doors (EN15544 limits glass door surface area to 1/6 of firebox surface area). Recent Austrian testing has shown the heat loss through a 11”x15” single pane glass door to be only in the 5% range. Prior to this testing, losses were assumed to be in the 20% to 30% range*
- allow the use of a prefabricated or partly prefabricated core (covered by standard 15250 in Europe)
- make the burn rate variable. This will allow the simulation of firing with large firewood pieces (EN15544 sets firing duration to 77 minutes, whatever the fuel load, meaning that the larger the load, the smaller the pieces have to be, which is not how masonry heaters are typically operated in North America)
- base the dimensioning of the firebox on burn rate instead of on fuel load (EN15544)
- make the air factor variable (set to 2.95 in EN15544)
- make the air speed and gas speed variable (set at 4mN3/kg and 4.8 mN3/kg, respectively in EN15544)
- make the temperature at the top of the firebox and at the entrance of the heat exchanger variable (set to 700°C and 550°C, respectively in EN15544)
- allow the coefficient of heat transfer to vary with the cross section area of each channel
- allow the coefficient of heat transfer to vary with the orientation of the gas flow (horizontal, upward, downward) in each channel
- allow the coefficient of heat transfer to vary with the gas flow velocity in each channel

These last three changes are instrumental in making the standard accurately calculate thermal transfer in units where most transfer happens when the gas flow is descending (Contraflow and Bell heaters) and in units where the gas flow is very slow (Bell heaters).
EN15544 isn’t designed for these situations because in Austrian style heaters gasses mostly flow horizontally or upward and through channels where the ratio between height and width is no more than one in three.
These developments are very important to our members because Finnish Contraflow heaters have been the most popular type of masonry heaters in North America in the last 25 years and Russian Bell heaters have become increasingly popular in the last 5 years.

*See:
Appendix A(5)

7. The simulation program approved for alternative certification needs to be adapted to function with the types of masonry heaters built in North America

The EPA has approved the calculation program developed by the Austrian Kachelofen Association.
This program is based on European standard EN15544 and has the same limitations (see point 6).
MHA is actively developing a calculation program which :
- functions with Contraflow and Bell heaters;
- addresses the technical limitations of EN15544;

- is open source.
A demo version is attached*
*See:
Appendix A(10)

A. Adapting EN 15544 to North American masonry heater types

As of January 2014, the MHA technical committee has been working with Damien Lehmann, a French engineer who has spent 6 years developing an open source masonry heater software simulator that is based on EN15544 and EN13384.

To date we have instrumented 4 masonry heaters with internal pressure and temperature sensors to compare results predicted by EN15544 calculation with measured values. Initial testing indicates that the model predicts values well for the narrow range of heaters that is included in EN15544. These are channeled, Austrian style heaters with an assumed fixed burn rate where the interior channels fall within a narrow range of parameters.
Initial tests on Contraflow and Double Bell heater types indicates discrepancy between calculated and actual values, caused by the lack of buoyancy (Bernouilli's principle) effects being accounted for in large downdrafting channels at low speeds. We are conducting testing to verify the addition of a buoyancy coefficient to the pressure terms, to yield calculated results that more closely match measured results. Once this calibration work has progressed sufficiently, MHA is prepared to submit the calculator to vetting by a suitable certifying authority.

B. Example of Vetting a Masonry Heater Software Model

In order to verify a software model and ascertain its suitability for predicting the performance of masonry heater types, data should be submitted to a certifying authority. A certifying authority could be, for example, and EPA-accredited testing laboratory.
Attached in Appendix A is an example of this process undertaken at the Combustion and Emissions Certification Laboratory at the Technical University of Vienna, titled "Report about the test of the guideline "Kachelofen (Tiled Stove) with standard combustion chamber".
In Austria, the Tile Stove Association (Kachelofenverband) developed a proprietary software program based on the EN15544 calculations, that is now widely used to certify one-off stoves. The software was submitted to the Certification Laboratory, as well as test reports on several examples of stoves that were calculated using the software, and then tested.

Online : http://www.mha-net.org/docs/codes/EPA/submission/uploads/Calculator%20verification%20Austria%20-%20Appendix%20A.pdf

8. A method to determine the final PM emission factor needs to be specified

Test method ASTM E2817 doesn't specify the number of test runs to calculate the test

emission results.

We propose to use :
- the average result from two test runs if the second run is within 25% of the first one
- the average result from three test runs, otherwise.

This is a proper lab procedure which takes into account the variability associated with emission testing.

9. A method to determine the efficiency needs to be specified

Such a method is required for PM emission reporting in lb/MMBtu and for optional efficiency reporting. The selected method must be compatible with the procedure described in test method ASTM E2817 because efficiency and PM emissions must be measured together during each test run.

Using CSA B415 to determine efficiency is untested on masonry heaters and appears problematic for the following reasons :

- the heater must be tested on a scale which is unpractical, especially for particularly large two-storey units;
- the specified precision of the fuel weight measurement (B415 - 6.1.1) is not attainable with large scales;
- the method requires the fuel load to be placed on a live coal bed which is contrary to the procedure described in E2817 (9.1.1 and 9.5.1) ;
- using a live coal bed is the equivalent of bottom ignition which has been demonstrated to produce higher emissions than top ignition (recommended by typical manufacturer's instruction);
- bottom ignition is contrary to typical manufacturer's instructions which stipulate top or side ignition and therefore does not simulate consumer operation;
- test completion criteria (B415 - 8.5.10) are different than per E2817 (9.5.7).

We propose two options :

- use the efficiency calculation formula in the spreadsheet* supplied by OMNI with the Condar dilution tunnel;
- add an efficiency method to E2817 through the ASTM process.

*See:
Appendix A(10)

10. Models approved in Washington State and Colorado State should be grandfathered

If the compliance deadline for large manufacturers is 60 days after the final rule is published, these entities will not be able to sell their current product lines until they are certified, which will cause severe economical prejudice.
Some of these manufacturers like Tulikivi have already invested in having model lines tested to meet existing emission standards such as the ones in Washington State* and Colorado State. In order to retain the benefits of their investment, maintain sales and ease the pressure on accredited test labs, we ask for the grandfathering of models already tested, provided they meet the EPA's emission limit. If the emission reporting formats are different, we propose to use a simplified conversion.
Alternatively, we would ask for a five year exemption from compliance for large manufacturers.

*See:
Appendix A(9)

11. Compliance should be optional for small manufacturers

When it comes to masonry heaters, regulation is largely untested. For the first time, this NSPS will apply to appliances that are custom built and regulate entities that are very small. The risk to push them out of business is very real since the subpart RRRR is so much geared toward mass produced appliances. Even heavily amended, it may still prove to be excessively constraining. We therefore believe that a longer transition period is needed and propose compliance to be optional for small manufacturers until the next revision of the NSPS.
The effect on emissions for doing so is going to be minimal because our class of appliances is already clean burning and the process of adopting current BSER is well engaged.

12. The 30-day notification period prior to testing needs to be reconsidered

§ 60.5488 (e) requires a 30-day notification period prior to testing.
This requirement adds another 30 days to an already lengthy certification process which is not compatible with the way small manufacturers of masonry heaters conduct their business.
We suggest this requirement to be waived for small manufacturers.

13. The initial labelling requirement for small manufacturers needs to be reconsidered

§ 60.5490 (b)(2) requires small manufacturers to label their appliances during the period when they are exempt from compliance.
We understand this requirement is to avoid non-certified appliances to be sold once the exemption period is passed.
Since masonry heaters are permanently installed in a building and can't be moved, we believe this requirement should not apply to this class of appliances. We therefore propose its removal.

14. The storage requirement of test heaters needs to be reconsidered

§ 60.5491 (c) requires each test heater to be stored "at the manufacturer's facility for as long as the model line is manufactured. Each masonry heater must remain sealed and unaltered." Since masonry heaters are extremely heavy and constructed from hundreds of small building blocks fitted together without a frame or an enclosure, moving these appliances is very expensive, may compromise their structural integrity and in the case of two-storey units, almost impossible.

As a confirmation, ASTM E2817 (12.1) states : "the products involved are custom built and not moveable from one lab to another and the construction of several models in multiple laboratories is deemed to be cost prohibitive."

We therefore propose the removal of this requirement.

15. The definition of a masonry heater needs to be updated

§ 60.5485 Residential masonry heater
Paragraph (1) specifies a core weight of at least 1700 pounds when most common definitions specify 1700 pounds as the total weight of the appliance.
Paragraph (2) is too descriptive and language is too specific to heat exchangers found in Austrian types of heaters.
Paragraph (3) implies a design limitation : all of the combustion air has to come from a fuel loading door. This design is getting obsolete as newer designs have combustion air being supplied through a dedicated opening (door or damper) that can be operated independently from the fuel loading door and tightly closed after firing.
Paragraph (4) benefit is not obvious.

We suggest updating the definition so it includes some performance criteria and ensures adoption of BSER. It could be done along the following lines :

Residential masonry heater means a slow heat release appliance intermittently fired by solid fuel, constructed mainly of masonry materials* and which meets the following criteria :
1. has a minimum weight of 800 kg (1,760 lb.), excluding the chimney and foundation;
2. is site-built or site-assembled from factory-made components or is a combination of both;
3. has a firebox such that most of the combustion air is supplied to the sides and top of the fuel load in an overfire fashion;
4. has a heat exchanger such that average stack temperature doesn't exceed 200°C (400°F)**;
5. has built-in heat storage such that the surface temperature of the heater, except in the region immediately surrounding the fuel loading door, does not exceed 100°C (230°F) and doesn't drop by more than 50% of the maximum rise above ambient in 4 hours**.

* *masonry construction* : built predominantly of mineral building materials such as building stone (soapstone, granite...), sand & gravel, treated rock (cement, lime...) and brick & ceramic products [Earth & Mineral Resources, University of Wyoming]
**under normal operating conditions as described in the owner's manual

16. The definition of a manufacturer needs to be extended

§ 60.5485 "Manufacturer means any person who constructs or imports into the United States a residential masonry heater."
With this definition, distributors and dealers of manufactured masonry heaters may qualify as large manufacturers. Suppliers of pre-fabricated elements of refractory cores may also, to some extent, qualify as large manufacturers. To avoid this , we suggest extending the definition along the following lines :

For site-built appliances, manufacturer means any person who constructs or imports into the United States a residential masonry heater.

For factory-built appliances, manufacturer means any person who constructs or imports into the United States the pre-fabricated components of a complete masonry heater.

17. Certain points need to be clarified

A. § 60.5487 (a)(3) : "an applicant may choose to submit a computer model simulation program for review..." implies that it is the simulation program itself that has to be sent for review when what must be sent are the results of the simulation. It seems to be confirmed by the fact that "the administrator will post the certified model on the EPA Burnwise website".
(b)(2) would provides the adequate language : "Alternatively, an applicant may submit results using a validated computer model simulation program that demonstrates the masonry heater design meets the emission limit in § 60.5486(b).

B. § 60.5487 (e)(2) : "If the manufacturer qualifies as a small manufacturer as defined in § 60.5486(a)(2) and the model line was certified using the procedure defined in paragraph (a)(3) of this section, the recertification provisions of paragraph (e)(1) of this section do not apply."
One way to interpret this point is as follows: small manufacturers that use alternative certification are exempt from the re-certification requirements in 60.533(k) i.e. +/-0.25" allowed tolerance.
We are asking the EPA to confirm that this interpretation is correct or rephrase point (e)(2).

C. § 60.5488 (c)(2) : "If the Administrator approves an alternative computer model simulation program pursuant to §60.5487(a)(3), the approved simulation program also may be used as an alternative to certification testing as specified in paragraphs (a) and (b) of this section."

Section 60.5488 lists the standards approved by the EPA on which test methods and procedures must be based.
(c)(1) specifies ASTM WK26558 as the dimensioning standard approved for alternative certification.
The purpose of (c)(2) is to allow for another dimensioning standard than WK26558. There is a confusion in the language as the term "alternative computer model simulation program" is used when "alternative dimensioning standard" would be more accurate.

Requests for comments in the Preamble

Page 70
We are proposing that, as of the effective date of the final rule, no person would manufacture or sell a residential masonry heater that does not meet the proposed emission limit of 0.32 lb of PM per MMBtu heat output. We are also proposing a 5-year small volume manufacturer compliance extension that would apply to companies that construct fewer than 15 masonry heaters per year…We request specific comments on the degree to which these dates can be sooner.

We don't believe these dates can be sooner and suggest they are later :
- 5 years for large manufacturers if they can't grandfather models that were already tested (please see point 10 in our comments);
- until the next NSPS revision for small manufacturers, so the regulation can be adapted to their specific needs (please see point 11 in our comments).

Page 71
The current ASTM methods are ASTM E2817-11 "Standard Test Method for Test Fueling Masonry Heaters" and the draft work product ASTM WK26558 "Specification for Calculation Method for Custom Designed, Site-built Masonry Heaters." We propose that they be used for this rulemaking. We request specific comments on these methods and any changes that should be considered and supporting data for those changes. We request specific comments and supporting emission test data on the use of "Annex A1. Cordwood Fuel" and "Annex A2. Cribwood Fueling."

For comments on E2817, please see points 8 and 9 in our comments.
For comments on WK26558, please points 6 and 7 in our comments.
For comments: emission test data on the use of cordwood and cribwood, please see:
Appendix A(7) Lopez Labs Testing Summary
Appendix B(1) Lopez Labs Test Results

Page 72
The structure of the rest of the proposed new subpart RRRR is similar to the proposed subpart AAA certification and quality assurance process and contains similar requirements for labels, owner's manual, etc. One difference, however, is that for small custom unit manufacturers, we are requiring less stringent quality control (QC) procedures. Specifically, we are proposing that the initial certification for these custom units is sufficient and that no further QC is necessary since each unit is a unique model and subject to certification. We request comment on changes or improvements that might be needed to address special concerns related to certification of masonry heaters.

Our main concern is that the certification requirements in the Proposed Rule as such that each masonry heater would have to be tested individually (please see point 1 in our

comments).

Page 75
Note that we do not have national emission impacts from masonry heaters because they are not included in the RWC emission estimation tool. Because of the relatively high cost of emission testing versus the current small number of masonry heaters sold per manufacturer, and in total, there are few emission test data from masonry heater manufacturers and laboratories. Based on the limited data we have, we believe that nationwide emissions from masonry heaters are relatively low, given the low number of sales. Thus, we also believe that the total emission reductions from masonry heaters will be relatively low. However, the limited data we have do show that the emission reductions could be significant for some models that do not follow current best designs, perhaps as high as 70 percent for some designs. We do not know how many of these typically custom-made heaters already use best practice designs versus other designs and thus we do not have nationwide estimates of baseline emissions. We ask for comments and data to help us prepare emission estimates.

We don't have data that tracks every masonry heater built in the United States.
Among the heaters built by our members we have noticed a clear shift away from underfire air to overfire air designs which is current BSER (please see point 5 in our comments).

Page 84
Finally, we also assumed development costs of $356,250 for the masonry heaters. 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, implementation lead times and small volume provisions. Thus, we request specific comments on these estimates, including whether they should be reduced and thus allow greater emission reductions sooner.

Switching from underfire air to overfire air designs has an insignificant impact on production costs.
If certification tests had to be conducted on every masonry heater, the cost impact would be around $15,000 ($10,000 the test itself and about $5000 for building the heater at the lab and taking it down). Total cost impact on the industry is unknown since the sales volume would severely drop.

Page 88
Unit costs impacts (2020 $)

Appliance type	*Baseline*	*Post-NSPS*	*Incremental increase*
Masonry Heaters	*$9,157*	*$9,245 - $9,997*	*$88 - $840*

We request specific comments on these estimates.

Please see our previous comment.

APPENDIX A:
Data Sources Referenced in the Comments and Proposals

Note: the URLs occupy two lines. When pasting into a browser, remove the carriage return at the end of the first line (after "uploads/").

Alternatively, there is a Bitly shortened URL beneath the full URL

1) Tulikivi test data for "Substantially Similar":

http://mha-net.org/docs/codes/EPA/submission/uploads/
Tulikivi%20Test%20data%20for%20substantially%20similar.xlsx

http://bit.ly/1iiR3aK

2) "Substantially Similar" compliance spreadsheet, dimensions

http://mha-net.org/docs/codes/EPA/submission/uploads/
Substantially%20Similar%20Masonry%20Heater_Dimensions_V22.xls

http://bit.ly/1nj5zEG

3) "Substantially Similar" compliance spreadsheet, volume

http://mha-net.org/docs/codes/EPA/submission/uploads/
Substantially Similar Masonry Heater_Volume_V22.xls

http://bit.ly/1j2YWGp

4) Specifications for Austrian Eco-Labelled Firebox:

http://mha-net.org/docs/codes/EPA/submission/uploads/
MB_10_eco-friendly%20combustion%20chamber_20120424Version2.pdf

http://bit.ly/Q6C78R

5) Glass door testing by the Austrian Kachelofen Assocation: (in German)

http://www.kachelofenverband.at/wp-content/uploads/2009/03/Glastueren-im-Kachelofenbau1.pdf

http://bit.ly/1hsmy2x

6) Test results from ESS-Condar comparison testing, Seattle 2010:

http://mha-net.org/docs/codes/EPA/submission/uploads/Test%20results%20OMNI%20Lopez%20Labs%20Seattle%202010%20Condar.pdf

http://bit.ly/1ojVCa2

7) Lopez Labs 2010 testing summary 87+14

http://mha-net.org/docs/codes/EPA/submission/uploads/2010%20testing%20summary3.pdf

http://bit.ly/1mvzjRU

8) MHA Testing Data

http://mha-net.org/docs/codes/EPA/submission/uploads/MHA%20Testing%20data.pdf

9) Washington State approved masonry heaters

http://www.ecy.wa.gov/programs/air/indoor_woodsmoke/pdfs/Wood_Masonry.pdf

10) Sample Condar emissions and efficiency template

http://www.mha-net.org/docs/codes/EPA/submission/uploads/Condar-template14.xlsx

11) Demo of Open Source Enhanced EN15544 Masonry Heater Simulator

http://www.mha-net.org/docs/codes/EPA/submission/uploads/CalculPdM%20-%20v0.3.34%20-%20Norcore%205.ods

http://bit.ly/1neZY4Q

Note: this software runs in Open Office. You can download Open Office for free for PC or Mac here:
http://www.openoffice.org/download/index.html

When the spreadsheet opens, you need to select “Enable Macros”

12) Austrian example of vetting a masonry heater software model used for certification

http://mha-net.org/docs/codes/EPA/submission/uploads/Calculator%20verification%20Austria.pdf

http://bit.ly/1q7QF8S

APPENDIX B: Additional Data

1) Lopez Labs Test Results:

Crib Testing Summary 2008 -2014:
http://www.mha-net.org/docs/codes/EPA/submission/uploads/Crib%20testing%202008%20-%202014%20PM%20lb_MMBtu.xls

http://bit.ly/1mvzsEN

Crib Repeatability testing, 2010:
http://heatkit.com/html/lopez2a.htm

Eco-Firebox testing:
http://www.mha-net.org/docs/codes/EPA/submission/uploads/DataSummary%20Ecobox.xls

More details on eco-firebox testing:
http://www.heatkit.com/research/lopez-2014-03-01.html