

## Operation and Fueling (O/F) Workgroup Meeting Notes from February 9, 2017 Teleconference

(Note: Voting Members are in bold-face)

Meeting led by **John Crouch** (HPBA, Co-Chair of O/F Workgroup) and **Lisa Rector** (NESCAUM, Co-Chair of Steering Committee)

**Meeting Invitees (not necessarily all present):** **Bob Lebens** (WESTAR, Co-Chair of Steering Committee), **Rod Tinnemore** (Washington) & **Phil Swartzendruber** (Puget Sound Clean Air Agency), **Cindy Heil** (Alaska), John Wakefield (Vermont), **Lisa Herschberger** (Minnesota), Anne Jackson (Minnesota), **Randy Orr** (New York) & **John Barnes** (New York), Adam Baumgart-Getz (EPA OAQPS, Wood Heater NSPS Group Leader), Amanda Aldridge (EPA OAQPS, Wood Heater NSPS Lead), Stef Johnson (EPA OAQPS, Measurement Group Leader), Mike Toney (EPA OAQPS, Measurement Group), Bob Ferguson (Consultant to HPBA, President of Ferguson, Andors & Company), **Tom Butcher** (Brookhaven National Lab, BNL), Rebecca Trojanowski (BNL), Adam Bennett (BNL), **Gregg Achman** (Hearth & Home Technologies), Allen Carroll (Applied Ceramics), Rick Curkeet (Intertek), **Ben Myren** (Myren Labs), **John Voorhees** (US Stove), **Tom Morrissey** (Woodstock Soapstone), Dan Henry (5G3 Consulting), Mark Champion (Hearth Lab Solutions), John Steinert (Dirigo lab), Doug Towne (Dirigo lab), Gaetan Piedalue (Polytests lab), Jared Sorenson (OMNI lab), Sebastian Button (OMNI lab), Alex Tiegs (OMNI lab), Kelli O'Brien (ClearStak), Jeff Hallowell (Biomass Controls), Lee Mitchell (Applied Catalysts), Martin Morrill (Applied Catalysts), Jill Mozier (EPA contractor, meeting note taker)

### Primary Conclusions from Meeting:

- The workgroup (WG) discussed ASTM's hybrid approach to defining low, high and medium burn rates along with capped minimum burn rate(s) and burn duration requirement; the idea of basing burn rates on how the individual stove being tested was designed; the continued need (or not) for a specified minimum burn rate (as in EPA's Method 28); the importance of heat output to the consumer and the consumers' tendency to burn at low settings; the problem of a stove's low air setting being designed to meet M28's low burn requirement on crib and then burning cordwood in the field (in-homes); the value of moving toward a test method that better reflects in-home use; and the value of labeling the tested burn rates and achievable burn duration of each stove for the consumer (while allowing stoves to be tested based on their individual design).
- The WG voting members present on the call voted on which of the following 3 concepts to move forward with as a basis for burn rates in a cordwood test method. Seven (7) of the voting members present voted for #1 below, while 1 member voted for #2, with 4 votes TBD:
  1. Let the manufacturers design the stove and test according to that design (i.e., the low burn rate is whatever the lowest setting and burn rate is for that specific stove, the highest burn rate is at the max air setting for that stove and the medium is in between), aka "definitional burn rates";
  2. Specify burn rates with fixed numbers regardless of the individual stove being tested (i.e., define burn rates as M28 does); or
  3. Specify burn rates as a percentage of the maximum burn rate for that stove.

- The O/F WG voting members voted as follows:
  - Gregg Achman – #1
  - John Crouch – #1
  - John Voorhees – #1
  - Rod Tinnemore – #1
  - Cindy Heil – #1
  - Randy Orr – #1, but with the caveat that the burn rates and burn times must be expressly indicated on the label
  - Bob Lebens – #2
  - Lisa Rector – #1, with labeling requirement
  - Ben Myren – not present, Lisa will contact and obtain his vote;
  - Tom Morrissey – not present, Lisa will contact and obtain his vote;
  - Tom Butcher – not present, Lisa will reach out to and obtain his vote;
  - Lisa Herschberger – not present, Lisa will contact and obtain her vote.
  
- The WG agreed to discuss refinements to the definitional burn rate approach on February 23<sup>rd</sup> using the draft ASTM cordwood method as a starting point – for example, should ASTM’s 8-hour burn duration be required with capped minimum burn rates or should these requirements be dropped in favor of strict labeling requirements.

**To-Do List:**

- Lisa Rector, John Crouch and Bob Ferguson may put a chronological summary together regarding ASTM’s process in developing the approach taken in the ASTM draft cordwood method.
  
- Lisa Rector will obtain the votes of the 4 WG voting members not present.
  
- John Voorhees will prepare a short summary (~3 sentences) of the refinement being contemplated (ASTM’s refinement versus John Voorhees’ market-driven labeling idea) and e-mail it to Lisa Rector and John Crouch for editing. Lisa Rector will post the refinement summary to Basecamp so WG members could review it prior to the next meeting on February 23<sup>rd</sup>.
  
- Bob Ferguson will send Lisa Rector the current ASTM draft cordwood method and Lisa will post it to Basecamp for everyone.

**Highlights from Meeting:**

- Lisa Rector opened the workgroup (WG) meeting, noting that the meeting was being recorded since meeting note-taker, Jill Mozier, could not be present on the call.
  
- Lisa noted that the following people were in attendance: John Crouch, George Allen, Gregg Achman, Amanda Aldridge, Bob Lebens, Cindy Heil, Mark Champion, Gaetan Piedalue, John Vorhees, Kelli O’Brien, Randy Orr, Bob Ferguson, Rod Tinnemore, Mike Toney, John Wakefield and others who may have joined the meeting after roll-call.

- Lisa noted that on last week's call the WG left it that burn rates would be discussed today and that a vote would be taken regarding where the group is going with burn rates. Lisa further noted that since some voting members are missing today, the floor would be opened up for discussion on different ways to define burn rates within the test method and the pros and cons of each of these ways would be discussed. When the end of that discussion is reached, Lisa noted that she would like to take a vote to see where the group is on this issue. Lisa noted that 4 voting members were not present on the call but, according to the rules agreed upon for the WG, these voting members could vote subsequent to the meeting.
- Lisa reminded the WG that the following people are voting members: Cindy Heil, Tom Butcher (not present), John Crouch, Gregg Achman, Lisa Herschberger (not present), Ben Myron (not present), Randy Orr, John Voorhees, Rod Tinnemore, Bob Lebens and Tom Morrissey (not present). Note: Lisa Rector is also a voting member.
- John Crouch noted he thought this [how to handle burn rates in the cordwood test method] is a fundamental question that the states need to decide. John explained that industry has some consensus about this issue already, as determined by the ASTM process. So, John noted that he hoped states/regulators could reach some consensus.
- Lisa asked Bob Ferguson to summarize for state regulators where ASTM is [on the burn rate issue] and why the ASTM group came to the conclusion they did.
- Bob Ferguson noted that he had hoped to provide cliff notes on burn rates to the WG, but he'd been unavailable/too busy recently. Bob had pulled together 25 separate meeting reports and documents all of which contain some information on burn rates, starting back in 2013 when ASTM initiated the cordwood test method (CTM) process. Prior to 2013, the CTM was an annex to the crib method (i.e., in ASTM E2780). In 2013, ASTM moved to develop a standalone method for cordwood. Bob noted that burn rate categories are a big part of that CTM effort and many approaches were proposed. Lisa Rector, John Crouch and Bob Ferguson will see if they can put a chronological summary together.
- Bob continued that one big change from having very specific burn rates defined in kg/hr was ASTM's move away from that to redefining the low burn specifically as representing an unintended fire or overnight burn, with a minimum burn duration of 8 hours. ASTM's proposed CTM also recognizes that an 8-hour burn may not be possible for all stoves. Bob noted this was discussed over many meetings and it was concluded that an 8-hour burn would be the primary criterion, but that smaller stoves [not able to burn for 8 hours] would still have to meet a 1.15 kg/hr burn rate. Bob noted that ASTM also put an upper limit [of 1.5 kg/hr] on [the 8-hour burn] as well, because there was some concern that big stoves could have too high of a burn rate. All decisions were reached by discussion until consensus was achieved among ASTM's large diverse group.
- Bob noted that these ASTM discussions led to the minimum burn rate definition being tied into loading density (lbs/cubic ft) and also what the test load looked like, for the low fire test. ASTM

was able to get some testing done in 2014 by Mark Champion and this testing was helpful in looking at all burn rate categories. Bob explained that, for a long while, burn rates had been looked at in the context of hot-to-hot tests (that is, starting and ending on a hot coal bed) such as in M28 and the current ASTM (E2780). But a paradigm shift occurred at the end of July 2014 when ASTM moved to introduce the cold start. This had an impact on how burn rates would be defined. So, Bob noted that he tends to consider [wood heater testing history] in terms of a pre-cold-start era and then a post-cold-start era.

- Regarding ASTM's high, low and medium fires: Bob explained that the high fire burn rate is straightforward: from a cold-start, the max air setting is used followed by slightly lower load of wood that's allowed to run until 90% of the fuel is burned. The low fire burn is a hot-start at a higher loading density at 12 lb/cubic feet and the low burn rate definition requires an 8-hour burn [not to exceed 1.5 kg/hr] or meeting a minimum burn rate [of 1.15 kg/hr]. The medium fire is defined to be less than 50% the difference between the high and low fire [burn rates], which puts the medium fire burn rate in the bottom half of the operating range. So, Bob concluded that those are the 3 [ASTM] burn rates.
- Bob had intended to create a summary from the 25 documents looked at, but he ran out of time, as it was not as straightforward as he hoped. Bob noted that ASTM's task group asked complicated questions about what they were really doing. When stuck, ASTM's prime directive was how to best simulate what people would do in their homes. A secondary consideration was guarding against creating too much variability in the method when deciding to take one course of action versus another. Bob pointed to the example of dividing a load into 3 sections and adding it in parts to simulate someone who wants a medium fire before bed, by putting logs in every 1 to 2 hours. Bob noted that all of this was addressed and discussed, but ASTM needed a means to judge if the task group was moving in the right direction. The information from Mark Champion's testing was used to assess whether or not the task group's proposals passed the reasonable test.
- Bob concluded that that's the quickest summary, but answering questions the WG has may be more informative. Bob again summarized that ASTM's CTM does assess using individual test runs, including a cold-start high fire, a low fire, and then a medium fire in the lower half of the operating range. So, Bob noted, ASTM's CTM does focus the weighting on the lower half of the operating range and, in conjunction with weighting, puts 80% [of test] in lowest two categories, where stoves are more sensitive to issues.
- Lisa thanked Bob for his summary and asked Bob if, for the ASTM method, the stove is tested at the lowest air setting for the low burn rate. Bob confirmed that was correct and clarified that the stove is tested at the lowest setting consumers can push the stove [controls] to. Lisa noted that this means essentially the manufacturer/stove model determines what the lowest air setting is [for ASTM's low fire test].
- John Crouch reminded the WG what Bob said regarding the ASTM task group wrestling with this issue – that is, how to avoid the manufacturer setting low at 50,000 BTUs, an absurd setting. To

avoid this, the caveat in the method requires that, because of the higher load of cordwood (higher than the crib load), the stove needs to have a target of an 8-hour burn, since consumers expect this. John pointed out that this is an important caveat because, although the lowest setting is determined by the manufacturer/stove, the ASTM task group put some effort into bounding that low setting, so that it's consumer-friendly. Even with a big stove, the burn rate can't exceed 1.5 kg/hr at the low setting, at least as it's defined today. So, the stove must burn for 8 hours and not more than 1.5 kg/hr, or it has to burn at less than or equal to 1.15 kg/hr. In other words, there are still tight constraints on what that low burn rate can be.

- For clarification, Bob Lebens asked what “not higher than 1.5 kg/hr” meant. Bob Ferguson explained that a large stove that holds a lot of wood, with high BTU output or a high burn rate, can easily achieve an 8-hour burn that may have a 2.5 kg/hr burn rate at even the lowest air setting. Therefore, the ASTM task group recognized the need for a limit/cap on how high the low burn rate could be. The ASTM task group recognized, for example, that for a 4.5 cubic foot stove it should not be permissible to call 2.5 kg/hr that stove's low burn rate just because the stove was at the lowest air setting. The task group agreed that was too high a burn rate, even if the stove met the 8-hour primary criterion. Therefore, the task group included a reasonable not-to-exceed low burn rate of 1.5 g/hr; otherwise the stove would overheat people in their homes.
- Bob Ferguson further noted that another way to explain this was a graph he had previously prepared (that he could send out) to show this issue. If one does the math, it becomes clear that at a certain size firebox – and with a 12 lb/cubic ft load divided by 8 hours – a 2.5 kg/hr low burn rate can easily result. For small stoves, 2.5 kg/hr may be their max burn rate. Therefore, Bob explained, the ASTM Committee at the time didn't want to get away from the recognition that people often operate their stoves at lower burn rates and own stoves that, even if properly sized, would not be able to get down to the lower end of the burn rate range. Such a stove could achieve perhaps a 12 or 16 hour burn and meet the 1.5 kg/hr burn rate requirement. But, the ASTM Committee didn't want the minimum setting to be too high, just because the stove was large and could be loaded with a lot of wood.
- Lisa noted that the ASTM language requires both an 8-hour burn and that the device be set at the lowest burn setting. Lisa asked for confirmation that there's therefore no wiggle room for the manufacturer to set it higher than the lowest air setting. Bob Ferguson confirmed that was correct and noted that ASTM wanted it to be at a setting equivalent to what the consumer would do and so the requirement is to put the device at the lowest setting. Bob clarified that it's not appropriate to, for example, set the device at 1 inch open [for the low fire test] with a device that can go lower than that – as emissions would in that case not be measured as low as the device could go – even if that device could meet ASTM's burn rate criteria. Bob noted that this was discussed quite a bit [by the ASTM committee].
- Bob Ferguson further noted that the current M28 has an interesting “out” that hardly ever gets used. Bob explained that M28's low burn rate definition is less than 0.8 kg/hr, but any runs less than 0.6 kg/hr don't have to be counted. According to Bob, this recognizes that if the device can meet 0.8 with its air controls, then the requirement has been met, even if the air controls can go

lower. But Bob noted that this “out” has hardly ever been used to his knowledge, and it’s confusing in the test method and regulatory language. So, ASTM’s requirement, on the other hand, is simply to turn the stove to its lowest air setting and that [by definition] is low. How much air that represents is up to the manufacturer but it does represent where the stove’s air is at its lowest setting from the consumer’s perspective. Bob noted that some of this discussion and resulting language is coming up on its 3<sup>rd</sup> or 4<sup>th</sup> year of existence and ASTM has moved onto other issues. But, Bob pointed out, ASTM was more closely tied into maintaining some connection to M28 and its burn rate definitions by not straying too far afield. For example, Bob explained that ASTM was never really at the point in the conversation then of proposing that low is whatever the manufacturer says it is; if the stove can only burn for 4 hours then the consumer will hate it and the stove won’t last long in the marketplace. Rather, ASTM recognized then a need to maintain some semblance of a defined low burn rate in the method.

- Lisa noted that describes ASTM’s low fire requirement and asked for confirmation that ASTM’s high fire requires the device to be on the highest air setting. Bob Ferguson confirmed that was correct, noting that high is the opposite end of the spectrum. The combustion air control must be at the max setting for the high fire.
- In response to Lisa asking Bob Ferguson to explain the medium burn rate more, Bob replied that the medium burn rate was an interesting problem and the reason ASTM ended up where it did was specifically because of the testing that Mark Champion did. Bob explained that ASTM proposed that the air control had to be at the point visually halfway or lower of the distance between the high and low air settings. Thus, ASTM proposed that the medium fire air setting would be a visual reference, with the air control placed in the middle of the operating range. Bob noted that many stoves at high typically operate at wide open and other categories all occur in bottom half or below of visual [halfway point in] range of controls. Bob explained what drove the definition [of medium fire]. When Mark Champion ran the high fire tests (from cold starts), the tests were cut-off at 90% because the long tails were doubling the length of the high fire test. Bob noted that in some cases there were 6-hour high fire tests because of this long tail. So, half of that time was burning the last 10% of the fuel. Bob explained that, interestingly enough, Mark Champion’s [and Ben Myren’s] analysis of the data showed that cutting-off the test at 90% fuel consumption will provide an appropriate high fire test and, by burning the remaining 10% at the exact same air setting, the stove happens to fall into ASTM’s definition of a medium burn rate.
- However, Bob explained that ASTM did some conceptual development to ensure that the medium runs would be run with the air control setting in the position of medium heat output, rather than merely meeting the burn rate criteria of being less than half the burn rate between high and low. Bob explained that ASTM wanted to avoid the medium burn rate being merely an artifact of a test method and rather be based on a physical action on the stove, to cause the stove to burn slower. Bob noted that there’s quite a bit of discussion in the ASTM reports regarding this. Mark Champion’s data was helpful in underscoring the need for specificity about how the medium fire is defined to ensure an air control setting is made and that the actual burn rate is achieved because that air setting was turned down. ASTM was trying to get the medium

fire to be in the lower half of the operating range in recognition of the fact that people operate their stoves more often in the lower half than the upper half of the range.

- Bob noted there exists a no man's land where a medium test could be run and not make the burn rate criteria as defined, but rather end up too high, somewhere between what ASTM calls medium and high fire (that is, a "no man's land"). Bob explained that those tests have to be repeated with the air control set lower to ensure they meet the medium point. [Note that ASTM's 1-3-2017 draft CTM states the following regarding the *Medium Fire Test Combustion Air Control Settings* – *The primary combustion air control(s) shall be set at a position no greater than half-way between the lowest and highest primary air control settings as measured on the control actuator (lever, knob, etc.). The half-way setting may be a linear or angular position depending on the air control actuator. If the resultant dry burn rate is greater than the mid-point between the dry burn rates for the low fire and high fire test runs, the primary combustion air control shall be set to a lower position and the test run repeated.*] Bob further noted that ASTM's definition did accomplish the objective of ensuring that 2 out of the 3 burn rates were in the lower half of the appliance's burn capabilities – that is, one burn rate is the lowest and second is in the lower half of the burn rate capabilities of the appliance.
- Bob Ferguson opined that anything the O/F WG proposes will need to be confirmed by testing because of the possibility of unintended consequences, especially if the test runs will be ended prior to 100% of fuel consumption or have other definitions for the end of the test. The end of test definitions will all impact the category definitions. So, for instance, Bob noted, if all tests are going to be cut-off at 90% [of fuel consumed], then the 8-hour burn may have to be rethought, because a stove that could otherwise burn for 8-hours may not be able to do so if the test is cut-off at 90%. Bob noted that it's important to understand how elements of the test method are intertwined. The ASTM protocol as defined was exercised to the point where no unintended consequences were ensured. An example of this was the medium burn rate work [explained by Bob above], where the ASTM task group realized there could be an unintended consequence, depending on how the medium burn rate was defined and what was required in the test. Hence, the requirement of a physical change in the air control setting to a medium or lower position.
- Lisa noted that, based on John Crouch's introduction, it sounds like the industry is solidly behind this definition of burn rates. Lisa further noted that industry folks on the phone who disagree should feel free to contradict that claim. Lisa wondered what the regulators think – e.g., whether or not regulators have concerns about the ASTM method, or support a different burn rate definition/test method such as the two alternatives discussed last week. Lisa reminded the WG that the two burn rate definitions discussed last week are (1) burn rates being defined as a percentage of maximum burn rate, which is not a definition used with stoves to-date, but which has been used by CSA for central heaters; or (2) the burn rate definitions currently used in CSA as well as in M28 for the crib test.
- John Voorhees, calling at 1:30 in the morning from China, noted that he appreciated Lisa's effort. John commented, regarding whether or not industry is fully behind the current definition of burn rates [in ASTM's draft CTM], that he's not sure if the answer is yes or no. John opined

that, regarding the low burn rate, industry felt that some kind of [specified] minimum low burn rate was needed because of EPA's perceived feelings and history behind M28. John noted therefore that it may be worth asking industry on the next call whether or not industry feels like they need to be saddled with a minimum burn rate. John noted that he's bringing this up in light of the knowledge he's gaining regarding European testing, where there is no specified minimum burn rate number. Rather, the minimum burn rate is determined by the lowest air setting on that particular stove. John reiterated that industry has been saddled with a minimum burn rate for over 30 years and perhaps it's time to consider whether the market should determine what the minimum burn rate is, rather than a technicality forcing the stove to burn at possibly an unrealistic number and produce more emissions.

- Bob Ferguson explained that ASTM uses a consensus process, so the end result was a compromise among all parties – that is, everybody got to the point where they could live with the end result, although it may not have been anyone's first choice. Bob explained that the end result was an interaction from different perspectives. Regarding the percentage approach to burn rates that Lisa Rector mentioned, Bob noted that ASTM put that into its original crib method, ASTM E2780, with the understanding that at that point in time EPA would not allow it [as a certification test method]. When ASTM moved onto the draft CTM, ASTM discussed it again in detail and got the same feeling from EPA – therefore, ASTM moved off it. Bob clarified that people are not unsupportive of the percentage idea. However, the current draft CTM [that does not include the percentage approach] resulted from a consensus process, in which common ground was sought.
- Lisa thanked Bob for that history and noted that, one of things that John Voorhees raised, is that the low setting requirement in the ASTM method includes a caveat. So, with respect to the ASTM method, there might be a question of whether that 8-hour burn rate time should remain. Lisa asked John if she was understanding him correctly – that is, she understands John to be supportive of testing at the lowest setting, but not supportive of also requiring an 8-hour burn.
- John Voorhees replied that perhaps neither a specific burn time or burn rate should be required. Thinking outside the box, John noted that he's wondering why parameters have to be put on the minimum burn rate. Rather, let the market decide that. John noted that, if a particular model of stove has a lowest air setting and that lowest air setting is used for the testing, perhaps it should not matter what that lowest burn rate time or burn rate is.
- Bob Lebens gave a different view. Bob Leben's general thinking is that the appliance needs to be tested in the range in which will be operated. In addition, Bob noted that what consumers are interested in are the BTU's delivered to the room. Bob Lebens further noted that the minimum burn rate limit of 1.5 kg/hour [explained by Bob Ferguson as ASTM's low burn rate cap] would seem to produce a fairly high level of BTU's, given the distribution of heat demand that people are looking for. Bob Lebens opined that, given that these are space heaters or essentially room heaters, that minimum setting [of 1.5 kg/hr], that heat demand/output, will drive people out of the room.



- In response, Bob Ferguson explained that those numbers are stove size related and that [1.5 kg/hr] was for a large stove. That stove would have had to meet the 8-hour burn, but just couldn't go above the 1.5 kg/hr cap. Bob reiterated that that [large] stove would have made an 8-hour burn duration or longer, but couldn't go above 1.5 kg/hr. The 1.15 g/hr minimum burn rate cap is still in effect if a [smaller] stove can't make the 8-hour burn. Bob Ferguson noted that this is all about ensuring the stoves are properly sized to the size they're attempting to heat. Bob further noted that there are larger spaces being heated by a single stove and their heat demand is different than a small space heated by a small stove.
- Bob Lebens responded that he understood that and noted that, probably more important than the size question, is the fact that the most prevalent technology in use for certified appliances is non-catalytic technology that relies on secondary combustion air. Bob noted that, because of that, he understands it's a real challenge to produce clean burning stoves at the burn rate currently required by the NSPS. But, Bob Lebens further noted that he thinks there's good reason for that, honestly, because people do shut the stove down to produce the desired heat demand as well as to get an overnight burn. Bob Lebens opined that appliances really need to be challenged at those low burn rates, because it's difficult with lower combustion temperatures for those stoves not to produce a smoldering condition, at those low heat demands. Bob stated that he would challenge the industry folks that, because this is a performance-based standard and the technology currently [predominantly] adopted [non-catalytic] is really challenged in this area, the appliances really ought to be tested in a rigorous method, as they will be used in the homes, at low heat demands. Bob opined that he thinks there's good reason for the current low burn rate requirement. According to Bob, there's a distribution of heat demands out there that suggests that people will use the appliances at such low heat outputs. Bob noted that he knows it's a real challenge to get these appliances to burn clean at these low burn rates and so that challenge should be met by everyone cleaning up the appliances in that range in which they're used for heating.
- John Crouch responded that he didn't think anyone was suggesting they didn't want clean appliances. John noted that he didn't know how to respond because the implication of Bob Leben's comment is that industry doesn't want the appliances to be clean, or doesn't want to challenge them [with the test method]. But what Bob Ferguson went through is how industry – along with EPA and some states - after a lot of discussion came up with several things [in ASTM's method] which are much more relevant to how consumers use their stove than [what's required by] M28. First and foremost, John noted [that ASTM's method uses] a much heavier load of fuel, much heavier. The ASTM committee decided that when people burn their stoves overnight, they really pack it, so that load needed to be more. John noted next, regarding the assumption that people will always turn the stove down to their lowest setting, no one is arguing that it shouldn't burn cleanly at the lowest setting. John pointed out that ASTM set boundaries at what the lowest setting could be, so a manufacturer couldn't claim an absurdly high lowest setting (such as 50,000 BTUs). So, John concluded that no one disagrees with Bob Leben's fundamental concept.

- Bob Lebens replied that people seem to have a problem with the current testing requirement of 1 kg/hr, since in this [ASTM] proposal it's 1.15 kg/hr and 1.5 kg/hr.
- Lisa clarified that right now, under M28's current burn rate, the minimum burn rate must be less than 1 kg/hr. However, Lisa asked for confirmation that, under M28, that might not be the lowest air setting. Bob Ferguson clarified that [at 1 kg/hr] it is the stove's lowest air setting and two runs are required. Bob noted that, that is the kick-out there, because the real burn rate is 0.8 kg/hour unless the stove can't meet 0.8 and then two Category 2 burns must be run. This is similar to what happens with hydronic heaters. So, Bob further clarified that 1 kg/hr is the defacto cut-off, but if that is the case, then the air setting has to be at the lowest setting.
- Bob Ferguson noted that he doesn't disagree with what Bob Lebens is saying. But, Bob Ferguson pointed out that an amazing shift is occurring going from crib loaded at 7 lb/cubic feet to cordwood loaded, in ASTM's method, at either 10 lb/cubic feet for high fire or 12 lb/cubic feet for low fire. Therefore, Bob noted that the burn rates that are relevant from EPA's M28 are totally irrelevant and the air settings are also totally irrelevant. Based on Bob's experience, there's a 50-50 chance that the stove's fire will go out when a stove that burns crib wood at a 1 kg/hr burn rate is loaded instead with 12 lb/cubic feet of cordwood at the same air setting. Such a load will require a completely different primary air setting to get the same burn rate. Therefore, Bob explained, anything the WG comes up with for the cordwood method has to be confirmed through testing, as it can't be assumed that what's relevant for crib applies to cordwood for certification.
- Bob Lebens responded that he can appreciate there will be these differences, but it's all about BTUs, as that's what the consumer is interested in. Therefore, Bob noted, that's an important comparison to look at.
- Bob Ferguson noted that he doesn't disagree and that ASTM did essentially look at ensuring that 2 of ASTM's 3 runs were in the lower half of the stove's operating range. And further that stoves have to be ~2.4 cubic feet before the 1.5 kg/hr cap would kick in. So, Bob explained, stoves smaller than 2.4 cubic feet are going to be living with [a low burn rate specification of] 1.15 kg/hr, whereas with M28 burning crib they'd have to meet 1 kg/hr. But, Bob again explained, it's an apples-to-oranges comparison based on what the testing revealed. Bob noted that his testing revealed (which Ben Myron would also confirm) that there are radical differences in what the stove's air settings will look like compared to today.
- Bob Lebens replied that while this may be the case, burn rate is burn rate; given the same efficiency that's going to be equivalent heat output. Going back to Lisa's question, Bob Lebens noted that if a stove can burn at lower than 1 kg/hr, then that's the minimum. Bob remarked that Bob Ferguson has noted in the past that manufacturers will mark the point at which the stove burns at 1 kg/hr and that's where the stove's stop will be. However, if the stove tests below 0.8 kg/hr, [the lowest setting] doesn't have to be at that stop.

- Lisa Rector noted that she heard John Voorhees saying if someone wants to design a stove with a minimum burn rate that delivers 50,000 BTUs, then the manufacturer should be allowed to do that, that [the test method] shouldn't be putting these artificial constraints on the manufacturer. Lisa noted that she understands Bob Lebens's concern to be if a stove like that were sold, then the unit shouldn't be able to be operated below 50,000 BTUs, to use an extreme example. Lisa asked Bob Lebens if he was concerned that the homeowner would do something to modify the stove, in such case, to get a lower burn rate. Bob Lebens replied that yes, he was absolutely concerned about that.
- Lisa concluded that that's the crux of the issue that Bob Lebens is having. It's not that Bob is necessarily opposed to the philosophical idea of letting the manufacturer design. Rather, it's the practical concern regarding what the homeowner will do to get the stove to deliver a lower heat load – that consumers will modify the stove to get there anyway. Therefore, Lisa explained, the minimum burn rate should reflect this because, even if the stove is not designed to get to such a low burn rate, the homeowner will make the stove get there.
- Bob Lebens noted that this concern is still relevant. Bob also noted that there's lots of different variables to consider in the various test methods and that he's open to being persuaded that the minimum [burn rate] level ought to be different than it is. But, as Bob Ferguson pointed out, now we're dealing with cordwood not crib wood; so there are different elements of the test method that factor in regarding what an appropriate burn rate is/should be.
- Bob Ferguson noted that part of the problem, when comparing field performance to lab performance, is that the air setting used to achieve the 1 kg/hr burn rate based on crib wood burning becomes the permanent low air setting. This air setting may deliver emissions that are below the limit. But, as soon as cordwood is burned in this stove in the field at this low crib setting, that's where smoke/dirty burns happen. Bob explained that all of these stoves have a sweet spot where it doesn't matter if the stove is burning crib or cordwood. But, the low air setting is being defined based on burning crib wood at 1kg/hr. Then, when different fuel (cordwood) is used in the field compared to what was used in the lab, everyone's surprised that the same performance is not achieved in the field as in the lab.
- Bob Lebens responded that he can appreciate that, but he's not sure revising the minimum burn rate requirement slightly upward will solve that problem necessarily. Bob Ferguson responded that it may not solve the problem, but it's moving in the right direction from the perspective of making it more difficult for a homeowner to make a stove burn with crappy performance. Bob Ferguson noted that he can take both sides of this argument but concluded that the goal is to develop a more representative method that produces less surprises when moving from the lab to the field [in-home use]. Bob Lebens agreed, noting that's why it's good having these discussions regarding moving to cordwood.
- Lisa Rector noted it's important to hear from other state people and asked Cindy Heil, John Wakefield, Rod Tinnemore or Randy Orr to comment. John Crouch noted that he would like to put Rod Tinnemore on the spot, as Rod watched cordwood burn in and EPA-certified stove at

the low burn setting (using a single-story stack, as typically used for testing in the lab) and Rod saw what happens with all that secondary air. John noted that Rod is one of few [state] people who saw what Bob Ferguson is referring to – that is, the amount of secondary air that the minimum burn rate on cribs requires and how that negatively affects cordwood burning.

- Rod Tinnemore replied that yes, without a doubt, a slightly higher air setting is needed in order to work with cordwood. Period; end of discussion. Rod noted that this is old news that he's tired of rehashing.
- Lisa asked Rod if he is comfortable with how ASTM has defined the burn rates and air settings. Rod replied yes, although he would also be comfortable with what John Voorhees is talking about it – that is, sticking with the lowest setting that a device is designed to achieve. Rod noted that he is still struggling with balancing the need of having a defined low burn rate setting as a bridge back to M28 versus the look to the future – that is, to have the burn settings follow the devices. Rod further noted that he didn't see the relevance of worrying about cheating when the device is tested at the lowest setting a consumer can use. Unless [the consumer does] something very unusual like adding a damper in the flue, [the consumer] will not be modifying that low burn rate on the device, because it can't go any lower.
- Lisa Rector noted that that's where I'm at too, noting she understands Bob Leben's concern [regarding consumer tampering], but [a consumer] could do that now – for example, take a stove with a 1 kg/hr minimum burn rate and make it burn at 0.5 kg/hr. There's a lot that can't be controlled once the device gets out in field. Rod agreed, noting that's less a practice now than it used to be.
- Cindy Heil noted that she too was leaning more toward what Rod Tinnemore just expressed.
- John Voorhees noted that he understands Bob Lebens' concerns, but it's pretty clear in the current [NSPS] requirements that you can't alter the damper or flue; it's not legal. John also pointed out that the argument flies in the face of single burn rate stoves, in which the burn rate is not adjustable and it's set where it's set. John opined that, based on what he's seen in Europe, the market should determine this, but the labeling needs to be clear (e.g., that the stove burns between here and there, based on the test setting or test load). Lisa Rector asked John to confirm if he was suggesting testing at the lowest air setting, but also have test requirement that allows consumers to see how long the burn time is for that lowest air setting. John Voorhees clarified that it should be reported. John proposed that it should be made clear to the consumer; the consumer shouldn't be deceived. The appliance should be required to be set at the lowest setting, but that lowest setting should be whatever the manufacturer decides/designs for that stove.
- Bob Ferguson noted that industry has always anticipated finally a common basis for labeling, regarding heat output and efficiency. Whatever labeling requirements are, Bob noted that minimum overnight burn duration is important and something consumers can understand.

Consumers may not be familiar with g/hr ratings, but consumers would understand a 4-hour burn duration versus a 10-hour burn duration. John Voorhees heartily agreed.

- Randy Orr noted that this made sense, pointing to the US having gone through a history of automobiles being tested one way but having totally different results [in the field]. Randy noted that he thinks Bob Lebens is saying that the wood heater stakeholders don't want a wink, wink, nudge, nudge as has happened in the auto industry. But, Randy opined, if there's a lowest setting to the stove and it's posted on the tag, that should be fine – and the lowest level should be the level the stove is tested at.
- Bob Lebens noted that, when comparing labels, it's relative and under lab conditions. So, the labels would publish relative [lab-based] differences. But, Bob pointed out, there's very big differences based on in-home installation. The burn rates will differ a lot and so, for example, one of these stoves may have a published [lab-based] minimum burn rate on the tag that is quite different from how that stove will actually perform under in-home installation, because of draft conditions, etc. Therefore, Bob noted, the appliance should be put in, for example, a low draft situation to ensure clean burning in that situation, if at all possible.
- Lisa asked the WG if it was ready to take a vote, or if other items needed to be discussed first.
- Cindy Heil remarked that unfortunately she had to leave the call, but that she is leaning towards what Rod Tinnemore said. Cindy noted that the [cordwood method effort] is in a transitional period and that perfection can't be reached; but it's a start and the process is moving in the right direction. Cindy left the call at this point.
- John Crouch suggested clarifying the question regarding which options were being decided upon. Bob Ferguson noted that, for now, the WG could answer the question conceptually and getting that concept into workable language is important, especially regarding how to make any decision work without unintended consequences. For now, the question is what burn rate concept does the WG want to proceed with.
- Lisa agreed that only the concept was being decided today and listed the following 3 options:
  1. Let the manufacturers design the stove and test according to that design (i.e., the low burn rate is whatever the lowest setting and burn rate is for that specific stove, the highest burn rate is at the max air setting for that stove and the medium is in between);
  2. Specify burn rates with fixed numbers regardless of the individual stove being tested (i.e., define burn rates as M28 does); or
  3. Specify burn rates as a percentage of the maximum burn rate for that stove.

Lisa noted that these are the 3 conceptual frameworks and once the WG knows where it wants to go conceptually, there will be details that will require further refinement. Lisa asked the WG voting members to voice their decision.

- Bob Ferguson clarified that ASTM's method uses a hybrid approach. Lisa agreed, noting that's why she didn't call it the ASTM approach, although the WG may later refine it and decide on whether or not, for example, ASTM's 8-hour burn idea should be used. But, for now, Lisa merely wanted to get a sense of where people are conceptually.
- The O/F WG voting members responded as follows:
  - Gregg Achman – let the stove define the burn rates;
  - John Crouch – seconded Gregg Achman;
  - John Voorhees – agreed stove should define the burn rates (#1 of Lisa's options);
  - Rod Tinnemore – also #1 of the options;
  - Cindy Heil – had indicated she agrees with Rod, so #1 of the options;
  - Randy Orr – also #1, but with the caveat that the burn rates and burn times must be expressly indicated on the label so the consumer understands and so that it will be blatantly obvious if “they're tricking it out on the burn rate”. John Voorhees also agreed with this labeling requirement. Gregg Achman agreed 100% regarding labeling being important (both g/hr and burn duration) so consumers know what they're getting, similar to the city and highway mpg's being listed on an auto label.
  - Bob Lebens – there needs to be a minimum burn rate requirement [presumably #2 on Lisa's above list]. Bob explained that on their NSPS public comments, WESTAR was in support of what EPA ultimately established, but he realizes he's an outlier here.
  - Lisa Rector – agrees with Randy – so #1 on the list, but Lisa agrees that burn time and other information have to be provided to the consumer on the label.
  - Ben Myren – not present, Lisa will contact and obtain his vote;
  - Tom Morrissey – not present, Lisa will contact and obtain his vote;
  - Tom Butcher – not present, Lisa will reach out to and obtain his vote;
  - Lisa Herschberger – not present, Lisa will contact and obtain her vote.
- Lisa Rector noted that, in terms of process, there are 7 folks who want to move forward based on the design-based definition concept, while Bob Lebens wants a minimum burn rate, and 4 people are not present and haven't voted yet. Lisa noted that there is a majority in a certain direction, but need to hear from 4 more voting members. The process previously laid out is that the WG moves forward with the majority decision, but the minority position can be captured for presentation to EPA when the majority decision is presented to EPA. Lisa noted that therefore, there won't be a final vote until the remaining 4 voting members vote. The decision so far is to move forward with the burn rate definitions being based on the design of the stove.
- Lisa asked the group if it was ready to move forward with a discussion about ASTM's hybrid approach – that is, requiring the 8-hour burn or not requiring an 8-hour burn but instead

requiring clear labeling. Lisa noted that there might be some third alternative, but those are the 2 refinements she has heard so far.

- Rod Tinnemore suggested tabling the refinement discussion for a future call. Gregg Achman seconded that. Lisa agreed to table that discussion.
- Lisa asked the WG if they wanted to have the next call on February 23<sup>rd</sup>, as scheduled, or since it's close to the start of the Expo, if the WG would rather reconvene on March 6<sup>th</sup>.
- Bob Ferguson noted that there are a few manufacturers who have a big responsibility about getting new products to show. Lisa agreed, noting she's cognizant of that and didn't want to divert from important activities that are underway for the Expo.
- John and Gregg noted that they were fine with either having the call on the 23<sup>rd</sup> or waiting until March 6<sup>th</sup>.
- Amanda Aldridge noted that she would hate to go a whole month without a call and suggested that the call on the 23<sup>rd</sup> be for one hour and focused on refinement. Amanda suggested that someone can summarize quickly and then focus the WG on refinement. Bob Ferguson opined that a 1-hour call is a good compromise and John Crouch agreed.
- Lisa noted that she liked the idea of 1 hour to focus on refinements. Lisa noted that one refinement to be discussed would be John Voorhees idea of removing the burn rate and time component versus leaving the requirement in. The refinements to the "definitional burn rates" – that is defining burn rates by stove design rather than by specified burn rates – will be discussed on the next call. Lisa further noted that she welcomes other ideas for a short-hand name, other than "definitional burn rates".
- Amanda wondered if perhaps John Voorhees could put the refinement down in writing, so people could read it before the call on the 23<sup>rd</sup> – perhaps just 3 sentences or so. John Voorhees agreed to write up 3 sentences. Lisa suggesting that John write up his proposal versus ASTM's, as the two options currently on the table for refinements.
- Bob Ferguson agreed that it'd be good to use ASTM as a starting point, rather than starting from a blank piece of paper. Bob Ferguson will send Lisa the current ASTM method as soon as he gets off the call. Amanda noted it would be good for everyone to see. Lisa Rector agreed to post ASTM's current method for everyone.
- John Voorhees will send his 3 sentences to Lisa Rector and John Crouch, in case they want to edit. Lisa will then post both to Basecamp.
- The WG will meet again in two weeks, on February 23<sup>rd</sup>.
- Thank you to all. Meeting adjourned.