

## Operation and Fueling (O/F) Workgroup Meeting Notes from January 12, 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), **Marc Cohen** (Massachusetts), **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:

- Lisa Rector and John Crouch discussed the option of having an O/F workgroup (WG) meeting at the HPBA Expo in Atlanta, GA (March 1-4, 2017).
- EPA's wood species testing by Mark Champion is continuing and is moving from burning crib wood to burning cordwood. EPA will post Mark's spreadsheet data after adding explanatory metadata to the spreadsheet to aid in data understanding/interpretation. Meanwhile, Lisa Rector has posted George Allen's real-time TEOM data to Basecamp and has provided graphs to the WG via e-mail. Any questions about the TEOM data should be directed to George Allen via e-mail, with Lisa Rector cc'd.
- The WG discussed the causes of emission spikes (as seen in the TEOM plots) including stirring/poking the fire, the natural release of organics from the wood, late pyrolysis from unburned wood catching and baking, how wood falls in the firebox, and [for lower fire burns] the lack of enough heat later in the burn to optimize the emission reduction system (whether thermal or catalytic). WG members from industry and lab explained that such spikes late in the low burn cycle can happen with any technology stove and are unpredictable.
- It was noted that going from a high fire to a medium fire is 2/3rds of the way to an integrated test run. As such, the ASTM method serves as a road map for a large portion of an integrated protocol. A fully integrated test run method would also go from medium to low fire. If a fully integrated test method was developed, the next goal might be designing the test to be achievable in one day, so that three days of testing would result in an N of 3 for each burn rate. Basing certification on an N of 3 instead of an N of 1 is important to regulators.

- WG members discussed the advantages and challenges of shortening the test by re-defining the end of a category burn and developing a formula to link back to a full burn's Method 28 emissions. Advantages include shortening the test enough to get 3 data points (N of 3) for each burn rate, rather than the current single (N of 1) data point and developing a test that is more reproducible and reflective of actual stove operation. Challenges include the fact that efficiency calculations using CSA B415 assume a full burn down to 0 fuel load weight. Related to this, WG members opined that cutting-off the high fire test at 90% is not a problem, but shortening the low and medium fire burns is problematic and needs more research. It was also generally noted that, since stoves are designed to pass the certification test method, the implication of shortening (cutting-off) the test method on stove design needs to be understood, as the new test method must not negatively impact real-world performance.
- WG members discussed the possibility of defining a shortened end of the test for PM emissions, but define another end of test for efficiency calculations and/or calculating efficiency differently.
- Regarding efficiency, Bob Ferguson offered (when he has time) to run ASTM's and/or EPA's current stack gas data through the B415 algorithms and perform sensitivity analyses to determine the impact of shortening/cutting-off the test at various points.
- It was emphasized that in terms of determining compliance and a passing grade, any new values from a re-designed (shortened, integrated) test method would have to be correlated with the 4-burn steady state crib run values. The results of the new method would not have to meet [as-is] the NSPS's limit without the use of a formula to relate/translate the values.
- It was noted that a shortened test would require smaller fuel loads than used currently (e.g., in ASTM's draft cordwood method).
- It was noted that firebox size is another variable to consider when designing a new test method because larger fireboxes require longer tests. It was suggested that instead of time, the % of fuel weight consumed be the metric used to shorten the test – that is, that an integrated test run be based on fuel weight conditions. Nonetheless, it was agreed that the impact of different firebox sizes should be researched.
- The WG began discussing how to define burn categories (e.g., low burn defined as 30% of high burn) and it was decided to continue this aspect of the discussion on the next call in January. Bob Ferguson offered (when he has time) to review ASTM data regarding fixed burn rates versus burn rates defined by percentages.

**To-Do List:**

- WG members should e-mail Lisa Rector if attending the HPBA Expo and are interested in having a face-to-face O/F WG meeting. In the e-mail, indicate what days would work best for that meeting.
- John Crouch will send the HPBA Expo agenda to Lisa Rector, who will distribute to the States.

### Highlights from Meeting:

- Lisa Rector opened the meeting and noted that the following people were in attendance: John Crouch, Bob Lebens, Mark Champion, George Allen, Gregg Achman, Cindy Heil, John Barnes, John Steinart, Gaetan Piedalue, Randy Orr, Rick Curkeet, Robert Ferguson, John Wakefield, Ben Myron, Stef Johnson, Lisa Herschberger, Tom Morrissey and Adam Baumgart-Getz, as well as others who did not announce themselves.
- Lisa noted that the meeting's agenda includes reviewing the schedule for today's call, meeting updates/questions (regarding the IEA [European] Task Force meeting and the HPBA meeting), an update on Mark Champion's testing for EPA and a discussion of data analysis.
- Lisa noted that she and John Crouch had shifted the scheduled February and March calls and left April as it was. The Fueling and Operation Work Group (WG) should be getting an invite to IEA task force occurring in Graz, Austria. Lisa can be e-mailed questions while there, as she's attending. Lisa will send an agenda for that meeting to everyone and reminded the WG that it's a 6-hour difference from the East Coast and a 9-hour difference from the West Coast.
- Lisa asked how many people would be attending the HPBA Expo [in Atlanta, see <http://hpbexpo.com/>]. Lisa noted that this year there's no ASTM meeting before the Expo and wondered how many people from OF WG were attending the Expos, as it may make sense to have a face-to-face meeting there. WG members should please e-mail Lisa if attending the Expo and interested in having a face-to-face O/F meeting and indicate what days would work best. Lisa noted that John Crouch secured a meeting space on Tuesday that could be used; and on Wednesday, the group could meet in the evening or at EPA Region 4 offices.
- John Crouch clarified that the EPA regional office might be obtained for Wednesday, for the entire day, and then Thursday morning the group could tour outdoor wood burning. John further noted that on Friday morning there will be a short presentation aimed at retailers and what they need to know about options in cordwood testing. John asked the WG to please plan for several days if possible. John agreed to give the HPBA Expo agenda to Lisa this afternoon, so that Lisa can send it out to the states. John further clarified that last year in New Orleans and previously in Nashville the HPBA had meetings [prior to the start of the Expo]. But given that people are coming from different time zones and given that the ASTM method is essentially complete, nothing will be planned for Tuesday afternoon.
- Lisa noted that during the December call the O/F WG had gone through Bob Ferguson's ASTM review and Mark Champion's EPA species testing, which is ongoing. Lisa asked if there were any updates from Adam or Mark.
- Adam Baumgart-Getz noted that, regarding a quick overview, the work is continuing. [Mark Champion's testing is] close to being done with crib wood work and the cord wood species burning is starting. Adam further noted that EPA will share data with the WG, as it can be shared. In response to a question from Lisa regarding whether the old data sets were posted to Basecamp, Adam explained that the spreadsheets will be updated with metadata and that EPA

hopes to get that metadata soon and then will post [the updated spreadsheets to Basecamp]. Adam explained that not all the columns in the current data spreadsheets are intuitive, so adding metadata will help with that. Lisa wondered if there would be misinterpretation of the data without metadata added. Adam replied that there could be, which is why EPA wants that metadata added before posting it to Basecamp.

- Lisa explained that real time TEOM data is on Basecamp, although [Mark Champion's] filter pull data is not yet posted. Lisa clarified that the study involves looking at TEOM data in addition to species [differences], to help determine how to define the end of test. Lisa suggested that the WG refer to the e-mail she sent with TEOM data in PDF, including a slide of [the TEOM's] correlation with the filter pull data. Lisa noted that there are also plots of different species by burn rate (although Lisa did not include the white pine data in those plots, as that data is too weird/different from the rest). Lisa explained that these are 15-second averages, glued to 2-minute running averages and they [especially Lisa and George Allen of NESCAUM] are looking for patterns from the TEOM data.
- Lisa noted that many have suggested that the test could end when 90% of the fuel is burned. The TEOM data shows that most of the emissions occur during the first 30 minutes of the burn.
- Lisa noted that it's important to think about an operational protocol to get at the data EPA needs to ensure compliance with the standard, but it's also important to move the test to an integrated test run. Lisa further noted that George plotted the different species information (with the exception of white pine) for high burns, medium burns and low burns.
- Rod Tinnemore asked if the peak at minute 160 is a reload situation. Lisa replied that it wasn't a re-load and that's why metadata is important. Rather, the fire may have been stirred/poked at this point. George Allen agreed that stirring/poking did indeed change the test. Lisa noted that she would like metadata added to the data to elucidate whether or not the two spikes on the low burn data are from stirring/poking. This would allow the impact of stirring to be shown. Lisa opined that it'd also be important to know the weight of the fuel charge at 110 minutes on the low burn, where the emissions are tailing off prior to stirring/poking.
- Ben Myron explained that organics come out of the wood in waves and are not evenly distributed over time. The wood alcohol peak comes, then there's a dip [in emissions], then a peak, then another dip, then finally the pyrolysis peak, followed by a dip and charcoal tail. Ben further explained that these peaks [in the TEOM data] could occur because some of the wood didn't get burned in the back of the firebox. This wood caught later but there was not enough heat in the firebox [at this later point] to fully burn, so these spikes occurred. George clarified that this is crib wood data. Ben noted that this can still happen with crib, not as often as with cordwood, due to the spacing; but [these peaks] could happen even with crib wood. Ben concluded that peaks don't surprise him and are well within the normal scatter of data that wood burners regularly see.

- Lisa asked if her following understanding was correct: Towards the end of the burn, the emissions are not so much a reflection of the efficacy of the stove to control emissions, but are rather more indicative of how the end of the fuel charge is burning. Ben replied that it's a combination of both: If the stove can't handle the emissions [emission spikes might occur], but in addition, as more and more of the fuel is consumed, there is less fuel to sustain the emission reduction system, whether it's thermal or catalytic. Ben further explained that there may not be enough heat in the system to do the job, so a spike may occur. In this way, Ben explained that the later part of the burn can overwhelm the early part of the burn; a spike at the end can cause the loss of [an otherwise] compliant run and nothing can be done to control this.
- George explained that the spike occurring on the black Douglas fir curve at 200 minutes was caused by stirring/poking. Ben noted that if all the fuel was charcoal, then that spike wouldn't occur. Ben explained that pyrolysis (yellow flames) started and then that piece baked out and the firebox went back to charcoal. Mark Champion clarified that only 2 early burns were poked/stirred on Douglas fir. After that, the test end criteria were developed and poking was no longer required. Mark further clarified that these spikes are possibly caused by the 4x4's collapsing. The rise in CO<sub>2</sub>, the drop in air-to-fuel ratio and the rise in burn rate indicate a rise in wood ignition and this was probably the 4x4s falling. Mark noted that there's real time stack gas analysis; so these spikes could be explained with the data.
- Lisa noted that the stove being used [in Mark Champion's EPA testing] is a pre-NSPS stove. Lisa asked how often unburned wood is left at the end of a compliance test using an NSPS-certified stove – that is, is it common or rare to have wood left in an EPA-certified stove? Lisa also asked if this issue is more common with certain burn rates, like lower and middle burn rates, or with all types of burn rates. Ben replied that any stove would be more prone to have this on the lower burn rates, because the stove temperature is low. On the high burn rate, Ben explained that there's a high enough temperature for the organics to come out of the wood. Regarding how often wood is left unburned at the end of a compliance test for an NSPS-certified stove, Ben notes this was a more difficult question to answer.
- Bob Ferguson noted that [labs and industry] call that a "chunky end". Bob noted that sometimes a 4x4 end remains and this would be a fair amount of the leftover weight, compared to ash and charcoal. So, you do see chunky leftover pieces, according to Bob. Ben agreed, but noted that there's not a stove out there that that couldn't happen to – this happens to all stoves. Bob agreed that spiking is not predictable at all and could happen on any stove. Regarding the pre-NSPS Vigilant stove in particular, Bob was somewhat familiar with it and noted that it can leave wood on the left end versus the right end and is known for that tendency.
- Lisa noted that she had something for the regulatory people to consider – that is, that burning down to 0 doesn't necessarily mean burning down to no fuel, so when thinking of a new test protocol to accurately represent stove and real world burns, consider whether it is important to go to 0. EPA may need to backtrack to the emission standard, but for a new test method, the goal is to characterize the performance of the stove, not how the burning wood falls within the firebox (for example). Looking at high and low burns hopefully allows for a way to end the test

earlier and develop a formula to link back to a full burn's emissions. Lisa noted that this is important since the standard uses a g/hr metric – that is, time matters. Lisa noted that the WG needs to think about a definition for the end of a category burn, and develop a formula to get to 0 weight, so that the result is more reproducible and reflective of stove operation than a 0-weight end might be.

- Rick Curkeet reminded everyone that this test is being used to determine efficiency too, and the input is determined by the higher heating value of raw wood that's assumed to be fully burned in the test. Rick explained that the WG must consider this in deciding to cut the test off early. Rick noted that the efficiency determination assumes the stove burns back to starting conditions. Bob Ferguson agreed, noting there would be a difference in cutting test off before the charcoal phase, which may occur long before 90%. Bob noted that cutting off the test before all the volatiles are consumed could account for PM emissions, but looking at only parts of the burn cycle may increase the air band by quite a bit. Bob explained that the weighted average is based on the rate of fuel consumption and other parts of the algorithms. Bob concluded that it might be tricky if the test is cut off too soon.
- Ben Myron noted that the stove design itself is another aspect. For Method 28, all the test fuel must be burned. So, the stove must be designed to burn all the fuel. If the test is cut short, then the design will focus on [the new] test and that may or may not be a good thing for real-world performance. Ben emphasized that the WG needs to consider that implication. Lisa asked Ben what kind of test he would design, if he were to design a test to better reflect how the stove behaves in the real world. Would the test look like the ASTM test? Ben replied that he doesn't have a problem with cutting high burn at 90%, but the medium and low burns ought to go all the way to the end of the fuel load. Ben explained that, for stoves with asymmetrical air flow, if the test is cut off when the burning starts to release organics, that will be missed in the test results. Ben noted that one wouldn't want to cut that off. This happens in asymmetrical stove designs and the data is skewed from what the stove will do in the real world. It was suggested that the medium and low burns be run all the way to the end, until there is enough data to confirm that the test can be shortened.
- Lisa agreed that any changes [to the test method] shouldn't be made arbitrarily. These are research ideas. Lisa noted that she keeps circling back to an integrated test run – for example, going to a medium fire run after the high fire run is 2/3<sup>rd</sup> the way to an integrated run. Lisa wondered however how to go from a medium fire run to a low fire run. Lisa pointed out that if that third piece can be achieved, the goal then becomes how to achieve one test in one day and then repeat that test 3 times, because one data point at one burn rate is not enough. Lisa opined that it would be better to run that test 3 times. If the test doesn't go well at first, then there are 2 more days of testing.
- Lisa noted that an N of 3 instead of an N of 1 is important especially to regulatory people. Lisa asked if there is interest in heading in the direction of an integrated run. Ben Myron replied that he is willing to talk about [an integrated run], but the WG needs to be aware of the pitfalls. Lisa Herschberger noted that an N of 3 is much more valuable than an N of 1. She understands that

there may be a problem with efficiency. Lisa Herschberger further noted that a test run of 2 hours may be sufficient. Lisa Rector noted that the WG is here to figure out if there is a way to understand the tradeoffs of going that route.

- Ben Myron asked how issues will be taken into account when determining compliance and a passing grade. Lisa Rector replied that since the [test] end wouldn't be what it currently is, the new value will have to be correlated with the 4-burn steady state crib runs. Lisa clarified that in no way is anyone thinking that the results of the new method would have to meet [as-is] the NSPS/standard's limit; a formula is needed to relate/translate the two values.
- John Barnes wondered if the end of the test can be defined one way for emissions and [another] way for efficiency. Lisa Rector replied that she has seen that; there's an integrated run that measures different burn rates and cuts off PM sampling but keeps the burn going for efficiency measurements. Lisa noted that that might be a way to approach it, as Bob Ferguson was getting to. It would require research and testing regarding how the efficiency number on an integrated run correlates to the CSA B415 number and associated error bands.
- Ben Myron noted that, if going out on a limb, overall efficiency could definitely be calculated in a different way. Bob Ferguson noted that the thinking could conceivably be altered to look at a representative period of time instead of looking at the full time, in order to calculate efficiency. Bob noted that this is not impossible; it's an interesting challenge but it's not impossible. Bob further noted that CSA B415 has its downsides – for example, the method doesn't deal well with excess air during the long tail, so it's not perfect. Bob suggested that a separate group of people who have knowledge of B415 algorithms is needed.
- Rick Curkeet suggested to keep in mind that B415 is a stack loss basic traditional type method, developed from first principles. As such, there are no correlation factors or fudge factors. Rick further noted that wood burning is unlike other fuel burning because the fuel changes so dramatically during the burn cycle –consequently, the incremental calculations are never really accurate. Therefore, getting an average at the end that is a good/reasonable number relies on the expectation that errors cancel each other out during the course of the burn cycle. Rick explained that this means if a chunk of the series is left out, then some of these internal corrections are also left out. Rick opined that one wouldn't know how to compensate for leaving a period out, without doing a lot of research to determine how to adjust for the omission.
- Bob Ferguson noted that the group has tons of CSA B415 data with which a sensitivity analysis could be performed. The data could be analyzed to determine where there is a divergence. Bob explained that existing data could be used to look at where cut off could occur – for example, use the data to determine what happens [to the efficiency value] when the data/test is cut off at 60%, 75%, etc. Ben Myron noted that they have looked at that [already] and it matters more in some wood stoves than others. Ben explained that this is a difficult issue for stoves with active air controls, as there's a much bigger impact to [the calculated efficiency value] on such stoves [when data is truncated]. Bob explained that they had looked at what happened when the data was cut off at 90% and those impacts were small and so ASTM went with that [for its draft

cordwood method]. However, the group didn't look at what kind of impact an 80% cut-off would have and it might be good to look at Mark's ASTM datasets and see what happens in general. Ben noted that he agreed and was not trying to sound negative, but rather just underscore that it needs to be investigated. Ben noted that the idea seems to work okay and makes sense with integrated runs on pellet stoves, using the B415 algorithms. Bob noted that he could perform a few sensitivity analyses with the current data – that he may try to take that on, although he couldn't take it on currently [due to his work load].

- Lisa asked if it would be useful if hash marks were added to the TEOM data at 50%, 75%, etc. Bob noted that he doesn't have ASTM data run through CSA B415, so if EPA wants to share stack gas, then Bob could run it through B415. Bob noted that while he can do this, it's not a trivial effort. Bob suggested speaking with Adam and Mark to see if they want to release that data. Lisa clarified with Mark and Adam that all the data would be released. Mark confirmed it would be and that all data is available in his spreadsheet, but currently it's not necessarily clear what all the columns mean. Therefore, the data needs to be cleaned up [with column headers and units added, etc]. Adam agreed and told Bob that the data would be available soon, but he was not sure exactly when. Bob noted that he has worked before with Mark's data and so could crunch the numbers for B415 once Adam and Mark are ready. Adam replied, sounds great.
- Regarding the idea of ending up with a one day test, Bob noted that even if all problems are solved and any part of the test is shortened, if the ASTM loading densities are used, it would be difficult to finish the test in one day. Bob further noted that this would be true even if the test were cut-off at 50%, because low fire tests go for a very long time. Bob suggested therefore that the WG needs to think about smaller fuel loads [in addition to] cutting-off the test time. Bob noted that all aspects will need to be considered, so that the test can be accomplished in a reasonable test day. Bob further noted that the WG would have to be creative regarding how to shorten up the test, if the goal is to accomplish all 3 burn rates in one fell swoop/one day. Bob clarified that a test day can be longer than 8 hours, but if 3 runs is the goal, then the goal should be not to exceed what a current run takes, so as not to increase costs.
- Lisa asked the labs what a reasonable length day would be. Rick Curkeet replied that the low and medium fire tests are a long day, with 12 to 16 hour days common. Rick noted that outdoor boilers may take 40 hours, which is expensive given the labor. Therefore, Rick explained that labs like being able to complete a test run in 8 to 12 hours. However, the reality is that if a run lasts 6 to 8 hours, there are also hours before and after the run. Therefore, even short test days are always longer than 8 hours.
- Ben Myron noted that, even for a high burn test day, it's an 8-hour day. Ben explained that the amount of time needed depends partly on firebox size – large fireboxes take longer (e.g., Blazeking's 4.5 cubic foot firebox takes a long time to test). The test time needs to be prorated by firebox size, therefore. Ben noted that a 1.5 cubic foot firebox is very different than a 4.5 cubic foot firebox [in terms of test time]. Ben concluded that firebox size is a huge variable that should be prorated by.



- Lisa thanked Ben for his input and reiterated that firebox volume is one variable. Lisa asked if the general design of the stove is another variable – that is, tube stove vs catalytic stove. Ben replied that tube versus catalytic design was not really a variable, as both stove types are approached the same [for testing]; testers get both stoves hot.
- Bob Ferguson noted that the TEOM data collected derives from one stove, but that a different stove would provide different TEOM data. Bob clarified that he was suggesting using the % of fuel weight consumed rather than time as the metric. Using the % of fuel weight consumed will allow for more similar conditions in each stove, rather than an arbitrary time pick. Bob noted that the question is: Do they end up in same place in terms of chemistry when the same amount of fuel is burned? Bob again noted that the times will be different for different fireboxes [as Ben had explained as well].
- Lisa noted that she liked thinking about an integrated run being based on fuel weight conditions – that is, looking at scale weight data. Research wise, Lisa noted that different firebox sizes should be looked at.
- Rick Curkeet noted that it's very important to recognize that this Vigilant is not controlled. Real-time TEOM data for current stoves would show much lower peaks and those peaks would last a much shorter time. Rick noted that, within the first 10 minutes, the smoke is gone and the unit has low emissions for the duration of the burn. Rick further opined that if the g/hr metric is used and the actual burn cycle is not used, the differentiation of good versus not so good stoves could be lost.
- Lisa agreed that it's important to remember it's a g/hr metric and that something may have to be given up for everything gained [with a new test method]. Lisa noted that TEOM data has been run on a certified stove and the high fire looked similar to the Vigilant pattern (not quantitatively, but similar pattern). Lisa concluded that the patterns look similar, but more research would be needed to determine if the pattern held up. Rick agreed that the pattern may look similar on a clean stove, except that emissions will be 10% of this scale.
- Regarding the TEOM data and this concept, Lisa asked if anybody else had comments and also asked if the discussion [so far] raised any red flags for EPA.
- Adam replied that [the discussion] is a reminder that this work is foundational and valuable, but more work on current stoves will need to be done before going forward.
- Lisa noted that the goal is to get in the lab and try to do research on newer technologies with other funding. But good feedback has been received on how to look at an integrated run as an option for a cordwood test method. Lisa further noted that the ASTM method went a long way and serves as a road map for a good portion of that integrated protocol.
- Bob Ferguson noted that fuel loads will need to be considered, as well as fuel consumption (rather than time). Using fuel consumed would keep the status quo in terms of shorter test days

for small stoves and longer test days for larger stoves. Bob clarified that that's how it is now and basing the new test on % of fuel consumed will keep that status quo. Bob opined that it is probably not possible to get away from longer test days for larger stoves.

- Rick Curkeet noted that right-sizing of stoves is an option and that what homeowners do would be consistent with that. However, Rick noted that forcing a big stove down to a low burn rate is not real world.
- Bob agreed and noted that forcing low burn rates on every product is different than allowing a stove to operate where it's supposed to operate.
- Rick suggested that the duration of the test would be the same if burn categories were defined based on the stove itself – for example, the low burn being defined as 30% of the high burn, etc.
- Lisa suggested that defining burn categories would be a great spot to dig into on the next call.
- Bob noted that ASTM had looked at finite fixed rates and this data is available. CSA cutoffs were used, but in the end these CSA cutoffs were taken out. Bob explained that there was support to keep them, but also a firm belief that we needed to keep the low burn rate in. Therefore the ASTM work group eliminated the percentage option. However, Bob opined that it was worth talking about again in detail.
- Lisa noted that she wanted to talk about different options and then circle around something this group could support, assuming EPA would be comfortable with connecting back to previous Method 28 burn categories.
- Bob noted that he could help bridge that gap, as the ASTM work group did analyses relevant to a fixed versus percentage defined burn rates. Bob explained that this work was done in 2010 and he can provide that data. Bob offered to look into the 30% cutoff data versus the finite burn rate data and provide it to the WG. Lisa replied, great.
- Lisa suggest that the WG discuss burn categories for the second January call.
- In response to a question from Ben Myron, Lisa noted that the [TEOM] graphs were posted to Basecamp and provided via e-mail. George Allen suggested that anyone who had questions about the graphs e-mail him and cc Lisa.
- Lisa noted that she would send an e-mail to everyone regarding the HPBA Expos and would talk again with everyone in 2 weeks [at the next teleconference meeting of the WG].
- Thank you to all. Meeting adjourned.