DOCKETED

Docket Number:	17-BSTD-01
Project Title:	2019 Building Energy Efficiency Standards PreRulemaking
TN #:	220643
Document Title:	Transcript of 07/18/2017 Staff Workshop
Description:	Staff Workshop on Residential Heating Ventilation and Cooling Measures and Acceptance Test Technician Certification Provider Requirements for the 2019 Standards
Filer:	Cody Goldthrite
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	8/10/2017 11:47:12 AM
Docketed Date:	8/10/2017

CALIFORNIA ENERGY COMMISSION

STAFF WORKSHOP

In the Matter of:	)	
	)	Docket No.
RESIDENTIAL HEATING VENTILATION	)	
AND COOLING MEASURES AND	)	
ACCEPTANCE TEST TECHNICIAN	)	
CERTIFICATION PROVIDER	)	
REQUIREMENTS FOR THE 2019	)	
STANDARDS	)	
	)	

CALIFORNIA ENERGY COMMISSION

1516 9TH STREET

ART ROSENFELD HEARING ROOM A

SACRAMENTO, CALIFORNIA

TUESDAY, JULY 18, 2017

9:00 A.M.

Reported by:

Gigi Lastra

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P R O C E E D I N G S

9:02 A.M.

SACRAMENTO, CALIFORNIA, TUESDAY, JULY 18, 2017

MR. BOZORGCHAMI: Good morning. My name is Payam Bozorgchami. We're going to start the 2019 pre-rulemaking related to residential HVAC. And we have one topic on nonresidential ATTCP.

First and foremost, we've got some housekeeping items we have to deal with. We have to do this every time, unfortunately. So the bathrooms are out the double doors to your left. Upstairs on the second floor, right under the white awning, there's the snack bar. And in case of an emergency, the fire alarm goes off, so we'll reconvene at the Roosevelt Park kitty-corner. Please do not take off and go home. We have to do a headcount.

Bob, that means you.

So the discussion topics today, Mark Alatorre will be discussing the small duct-type velocity systems, the proposal for 2019. Jeff Miller will be doing the residential HVAC HERS verification data registry requirements and the ATTCP requirement for nonresidential.

So in reality, I'm going to do this -- my presentation should not take more than five minutes. I'm going to go as fast as possible and give more time. I'm

going to try to get you guys out of here before lunch.

So the history of the Energy Commission, it started in the early '70s by two legislators, Warren and Alquist. Because of the energy crisis that we were heading into, they proposed to Governor Ronald Reagan to develop this thing called the Warren-Alquist Act that was signed by the governor in 1974, right before he left the office. And in 1975, Governor Brown, at that time, funded it and started the Energy Commission.

Since then there's been a lot of policy drivers that's been mandating our work. One of those is we have to hit this so-called zero-net energy in residential buildings by 2020. Folks, this is the 2019, and we have to figure something out for this code cycle to get us there. We have the nonresidential by 2030. That actually is only three code cycles away, and it's not that far. I think we'll be back in here in a couple of years doing the same thing.

These are some of the other responsibilities the Energy Commission has. Transportation, to support development of alternative and renewable fuels. We do the permitting process for power plants for 50 megawatts or larger, and quite a lot of other areas that we deal with.

One of our goals, one of our requirements is to avoid power plants. When we develop the energy efficiency measures, we look at energy efficiency and demand response

first, then we look at renewable generation, then storage system, and then we try to do it the cleanest way possible.

The Energy Commission, with the staff and the help of the public utilities, develop the standards every three years. And we go through vigorous workshops, pre-rulemakings, research studies, with the help of the utilities. And the utilities and their consultants have been very helpful in developing the 2019 standards. Those would be Pacific Gas and Electric, Southern California Edison, Southern Cal Gas, San Diego Gas and Electric, Sacramento Municipal Utility District, Los Angeles Department of Water and Power, Southern California Public Power Authority, and their consultants do a tremendous uplift in the development of the 2019.

I also would like to thank Kelly Cunningham and Heidi Hauenstein, who actually help with the communication between the staff here at the Energy Commission and the consultants that work on these measures. Without them, I'm not sure if we'd be here right now.

California, as you know, we have some areas that we focus on. We have to look at all 16 climatic zones within California. We're not -- we're a little bit different than ASHRAE, but the majority of California's zoned climate is Zone 3 ASHRAE.

When we develop our measures, we go through a

time-dependent valuation. And we base our life cycle (indiscernible) cost on that evaluation.

So far our goal, we're doing the best we can, and this is the history of what it looks for California for our space cooling, space heating and water heating, it's a downward trend. It's a pretty good trend. In a few years we'll probably have something similar for nonresidential buildings.

One of the biggest uplift we're doing this year is we've taken on hospitals within Title 24, so that is a new challenge for us. And there's been a lot of work and discussions happening with the hospital organization, with Gabe Taylor and our staff.

The standard process, right now we're in the pre-rulemaking phase. Hopefully, we'll be finished with that by August 30th. We will be doing expressed terms. Our goal is to get to expressed term and have two workshops, maybe in late September, early October, to actually show the cross-down (phonetic) underlyings of what we're presenting for the 45-day language, which will happen in, hopefully, in December, mid-December of so. With that, then we'll go into the 15-day language after that. And then we go into the adoption process here at the Energy Commission and at the California Building Standards Commission for approval.

Our effective date is January 1st, 2020. And our

goal, again, is to try and get everything done, packaged, the manuals, the programs by one year in advance of the effective date, to give you guys ample time to play with it, tinker with it, find any mistakes, have us fix it, and have it really working by January 1st.

So for the schedule as it is, we've had quite a few pre-workshops here at the Energy Commission. Today, again, being July 18th, we're doing the residential HVAC measures. One of the areas that everybody's been looking for and, I guess, at the edge of their seats is the whole solar/storage EDR rating that's happening August 22nd. Then on August 30th we'll have the proposals for what we call Part 11 CALGreen, California CALGreen, and we'll be presenting those on August 30th.

A couple key website links. These are the links where you could find the case reports, the draft case reports at this time. The ones that were done with the help of the utilities will be here, the title24stakeholders.com (phonetic). The Energy Commission website will have the reports that we did in-house. An example would be the hospital measures, the small duct-high velocity proposals will be here. And you could go there, download and review them and provide any comments or feedback, if needed.

For this workshop today, if you have any comments, please submit them by close of business July 28th. We'd

like to get those comments earlier to give Staff the proper amount of time to get those issues dealt with and taken care of, before we go into the 45-day language. If you could get them done earlier, less stress is on us and gives some of us a little bit more time to sleep.

Some of the key contact information is here. Mazi Shirakh, he's the -- used to be the Project Manager for the Building Standards. He's just walking right now, shaking everyone's hand. And then we've got -- he's now the Technical Lead on this Energy Design Rating Solar and Storage.

Myself, my contact information is there. I'm the Project Manager for the 2019 Standards.

Larry Froess, he took over for Martha, as some of you may know. And he's now the Senior Mechanical Engineer responsible for the development of the software programs for California.

Peter Strait, he's a Supervisor of Building Standards Development Office. He deals with Mark Alatorre mainly.

And then we have Todd Ferris, who is the Supervisor of the Software Tool Development. So if you have problems with those two guys, please email them.

And Christopher Meyer is our Office Manager. And if you have any issues of questions, you can always reach

out to him.

Any questions?

With none, I will let Mark Alatorre give his presentation. Thank you.

MR. ALATORRE: Thank you. Good morning. I'm Mark Alatorre. I'm with the Building Standards Development Office, here to present small duct-high velocity and how it applies to Title 24.

A little background. So in Title 24, residential HVAC systems have been the target for increased efficiency measures. In each code cycle, we've tried to increase these measures to, you know, try achieve the rated deficiencies in the field. For example, some of the measures that have been targeted have been duct systems that are attached to the HVAC system, they had to comply with minimum leakage resource, or maximum leakage requirements, for that matter, and as well as refrigerant charge and other installation variables that can impact the system's capacity of efficiency.

You know, as a state government, though, we prohibited from mandating increased deficiencies, than what the federal government have already specified. So that's why we're trying to ensure that every other thing that we can enforce gets done correctly in the field, so we can get to those deficiencies.

A little background. Starting in 2005, I'm going to show kind of how, through the code updates, how HVAC systems have been treated on the residential side, and how much more measures have been put onto new installations.

I wanted to put a caveat. What I'm going to be showing is just for newly constructed buildings or complete replacement of an HVAC system, that would be the equipment, as well as the duct system.

In 2005 there was only two mandatory measures; it was minimum efficiency, federal efficiencies, and minimum duct insulation. We have prescriptively a little higher insulation, depending on the climate, also refrigerant change, depending on the client, and a duct leakage of six percent or less. I want to say, that should be maximum duct leakage, not minimum duct leaker.

But in 2008 we added some more prescriptive requirements. And here we saw introduction of minimum airflow per nominal ton, and a maximum fan watts. The metric for fan watts was watts per CFM.

As we go to the 2013 update, we see that a lot of these became mandatory, and also had a minimum filtration efficiency, a MERV 6. Also, minimum condensing unit clearance from the home, away from the home and away from other vents, like dryer vents.

And finally, for the 2016 Standards, the only

thing that we changed is the duct leakage of five percent of less.

So going back to 2008 and the introduction of airflow and fan watts, the analysis that was done to justify these numbers did not take into account small duct-high velocity systems. They were -- there was a survey of about 60 homes, and they were all forced, traditional central forced-air systems. So in the report it identified the duct system as being the key variable in the film (phonetic) that effected HVAC system performance. It noted that improperly-sized ducts could restrict airflow, resulting in increased fan power and reduced system capacity due to insufficient flow across the cooling coil. So this new prescriptive requirement would require builders to improve their duct systems or install high-efficiency air handlers. But like I mentioned, what was not taken into account for establishing the 350 and 0.58 was this other class of HVAC system.

So what is a small duct-high velocity system? They're defined by the federal government as a heating and cooling product that contains a blower and indoor coil combination that is designed for and produces at least 1.2 inches of external static pressure when operating at a certified air volume rate of 220 to 350 CFM per ton of cooling. Also, when applied in the field, use of velocity room outlet generally greater than 1,000 feet per minute

that have less than 6 square inches of free area. So that's the federal definition of what small duct-high velocity system is. And they are a separate class than traditional heat pump or air conditioners and having to comply with a different SEER and HSPF. So this is what's now required for any system that's been manufactured after January 1st, 2015.

Craig, you want to say something?

MR. MESSMER: Hi Mark. This is Craig Messmer with Unico.

Yeah, the slide that you're showing there, it does have an error in it. The January 1, 2015 for SD-HV is really 12 on the SEER, and 7.2 on the HSPF. That was an error propagated that was corrected in 2012 by the federal government. It's a hold-over from something that happened a long time before that. But anyway, it's been corrected. And so --

MR. ALATORRE: Okay. Well, yeah, this is what was currently on DOE's website.

MR. MESSMER: Yeah, I know. You kind of have to dig a little bit more into where -- because this one, this website, the federal website, is an older website. You've got to go to the latest docket to get the numbers.

MR. ALATORRE: Okay.

MR. MESSMER: So I can -- I'll send you the link for that.

MR. ALATORRE: Thank you.

So compliance with the current code, so these systems, you know, like we said, we're preempted from barring their sales of installation, so they're legally allowed to be used. And so how do they comply with current code. They can meet everything on this list. However, what's highlighted in red, they cannot. They cannot comply with the 350 CFM per ton at 0.58 watts per CFM. The one avenue that they have is to comply with the exception. We have one exception in there that they have been using, and that's referring to Tables 150.0-B or 150.0-C. This is a return duct sizing increase. So depending on capacity, they would have to enlarge the return duct diameter and the return filter-grill gross area. I mean, in some cases, you know, given that small duct-high velocity systems would use seven- to ten-inch ducts, in some cases they're double the size. So again, this table was also designed for a conventional system.

So going forward with the proposal, we're proposing new CFM-per-ton targets and watts per CFM that would be applicable to these. This class of HVAC system, the numbers that we ran, that was 265 CFM per ton and 0.54 watts per CFM. We arrived at this number based on the HERS Directory. There was 583 certified heat pump combinations. Using the condensing unit nominal capacity and the rated

airflow that was within the directory, I was able to come up -- or plot this graph here. So if you -- they're all coming in at 265 or 275. So putting the floor at 265, I think was appropriate. You'll notice that there are some combinations that didn't comply with this. I counted 13 out of the 583. That's only two percent of the certified combinations that wouldn't be able to comply with this measure.

As for fan watt draw, these were the assumptions that went into the calculation. I assumed a 1.5 inch total static pressure. And I arrived using these efficiencies for the motor and blower wheel, and noting that all the combinations use ECM fans, I came up with 0.54 watts per CFM.

So the proposed code language is right here. It would be a new section to 150.0-13. It would be 150.0(m)13D. And it would -- it's basically word for word what's in 150.0-(m)13B, just with new targets. So they would comply with the 265 CFM per ton and the 0.54 watts per CFM. And they would be subject to the same field verification as conventional systems.

So I believe that is the last slide. Here's my contact information if there's any questions. And comments due, I know Pam said July 28th, but my slide says August 1st. So can I have a couple more days?

MR. BOZORGCHAMI: August 1st is good. Okay.

MR. ALATORRE: All right.

MR. BOZORGCHAMI: So I'm open now to questions. I have representatives of the largest stakeholder (indiscernible) of small duct high velocity systems in the house. If there's any questions for them, they'll available, as well.

MR. SHIRAKH: Mazier Shirakh, CEC Staff.

How does this impact the overall efficiency of the system? I mean, we have higher static pressure LORS CFM per ton. And how does that compare to the overall efficiency of the conventional?

MR. ALATORRE: Well, that's how these systems are designed and rated. So they meet a SEER 12; is that what it is now, not 13? So they have to comply with the minimum federal efficiency of SEER 12. And with these specs, that's what they hit.

MR. SHIRAKH: So then, I mean --

MR. ALATORRE: So they come in at a lower SEER than traditional.

MR. SHIRAKH: So that's -- so the higher SEER rating will basically compensate for the duct losses, is that what --

MR. ALATORRE: It's not a higher SEER rating, it's a lower SEER rating.

MR. SHIRAKH: A little bit lower?

MR. ALATORRE: But maybe they can talk to it. From my understanding, it's the velocity at which the air comes out, it has better mixing in the room, so maybe there's less runtime. But they can probably speak better to their technology.

Go ahead, Craig.

MR. MESSMER: Hi. This is Craig Messmer again. Let me try to answer that.

The SD-HV has a separate product class. It has its own -- it's a different test standard and a different metric for minimum efficiency. It is -- it uses the same name, SEER, because it's measured in a very similar way as other air conditioners. But it is tested at a higher external static pressure and a lower air volume than more conventional ducting systems. So it necessitates the establishment of a different minimum standard. It's maybe interesting to note that the 12 is actually much closer to what would be considered max technology for this type of a system than more conventional systems.

That being said, you asked -- your first question was about overall efficiency. And, of course, we all know that any air conditioning and cooling system is effected not just by the equipment, but also by duct work and installation. And with these, with small duct systems, we find from our own information that the duct leakage is quite

low, and these systems are usually installed in a very good manner, and they're often inside the conditioned space.

So it depends on what you compare to, but they can be and most of the time they are very efficient in the applications that they're intended to be used.

MR. SHIRAKH: So you showed the prescriptive language. But when you use the software, your standard design is going to be based on, you know, the standard equipment, split system --

MR. ALATORRE: So where the problem is --

MR. SHIRAKH: -- with the SEER 14 --

MR. ALATORRE: -- what's now the airflow --

MR. SHIRAKH: -- and the standard --

MR. ALATORRE: -- and fan watts --

MR. SHIRAKH: -- air distribution system? When this becomes your proposed design, how is that going to compare?

MR. ALATORRE: Well, currently they're in the software now. They're allowed to be modeled, but they're compared against the traditional system. The base or standard design doesn't change. It's compared against a standard heat pump. That's how it is currently handled, I believe.

Larry, is that correct? Yeah.

The problem, Mazier, is the airflow and fan watts

isn't prescriptive, it's mandatory. And the only way out of it is with the return duct table, which defeats the purpose of what they're designing. So again, they're a federally covered product. And making them do something that's for a different class is why we're here doing -- proposing this.

MR. SHIRAKH: Okay.

MR. RAYMER: Bob Raymer with CBIA. I'm really unfamiliar with the system. Does it use a flex duct, a rigid duct, or either?

MR. MESSMER: Hi. Again, this is Craig Messmer with Unico.

Both, actually, in a sense. Let me explain.

First of all, as the small duct would imply, the ducts are quite a bit smaller and the velocities are higher inside of them. They are designed to fit into very tight spaces. Typically the duct systems are built with a main duct, we refer to it as a planum (phonetic), but it's a main duct. It's typically a sheet metal duct. And from there you have branch ducts. The branch ducts are typically flexible ducts. Those are usually manufactured by the SD-HV manufacturers. They're specialty ducts. And they're usually around ten feet long. They can go longer, but that's typically how long they are. And they terminate into the room with just an opening. There's very rarely a grill.

And you don't want to do that, because one of the benefits of the system is the effective mixing of the air. And you need that little jet of air to keep the air mixed up.

So does that answer your question?

MR. RAYMER: Yeah, it does.

Do you notice any noise problems with the rigid duct?

MR. MESSMER: No. Actually, that's because the duct work itself has, of course, an inner liner, okay? But it's a double-vapor barrier duct, so we don't -- we actually had to go through a process with the CEC to make sure that the internal lining didn't -- had two vapor barriers, so if you punctured the exterior --

MR. RAYMER: Oh, got it.

MR. MESSMER: -- you wouldn't have any leakage. And it does an excellent judge muffling the sound. It's a very quiet system.

MR. NESBITT: George Nesbit, HERS Rater. I've actually installed one system.

I guess the question from the manufacturer would be what range of watts per CFM do you see in installed system? That would be a question for you.

MR. MESSMER: Okay. I don't think we gave a slide on this one. But the watts per CFM typically range from 0.5 to 0.6, okay, with the EC motor. Okay. Our older models,

which we don't sell much of any more, but single speeds, we're a little bit higher there, closer to 0.8. I think that's pretty typical of what you find with conventional systems, as well.

I'd like to kind of point out that because these systems do use slightly less airflow, if you're really wanting to compare blower efficacy, it's a better -- you should really use CFM per rated ton, rather than CFM. The numbers would actually be a little more comparable. But that's not the way the standard is written. We don't really need to change that. As long as it's made appropriate for this product class, then I think everything is good.

MR. NESBITT: So I guess one of the issues you said is the requirement for CFM per ton versus then being able to do it prescriptively by sizing return duct. What's the relationship between how you size the return duct and how your system works? I mean, those tables are based off of the more traditional systems. And so oversizing a return duct is not necessarily a problem. Is that a problem with the --

MR. MESSMER: Well --

MR. NESBITT: -- high velocity systems?

MR. MESSMER: -- the whole intent of those tables is to decrease static and increase airflow; right?

MR. NESBITT: Right.

MR. MESSMER: So -- and these systems look at their federal definition. When they are operating they have to be at 1.2 or above. So if they comply with that table, they have some issues with then -- with their static pressure.

MR. MESSMER: I think I -- again, this is Craig Messmer.

Yeah, we actually had some concern with that, as well. And we'll submit some comments on what we think is more appropriate for return air duct sizing. But in actuality, they're smaller return ducts because of the smaller air volume to begin with, and really for no other reason than that. So, I mean, if you have a duct that's normally 20 inches or a three ton (indiscernible) for a return, if you have two-thirds the airflow, then your return duct size should also be smaller, as well. That's typically how that works.

But the way the standard is written, it's based on tonnage, not airflow. So that's another one of those things that would probably be better if it were either based on airflow or pressure drop. But that's not the way it's written. And so if you go by tonnage, then the numbers probably would need to change for small duct.

MR. NESBITT: Okay. Well, one thing I wanted to mention in this slide, when I was coming up with the CFM per

ton, using the HERS Rater combinations, from what's in the HERS Directory ranges from one-and-a-half tons to five. And in all those combinations, this is what the rated airflow. So they had a rated airflow in the directory. And even if you have a one-and-a-half ton or a five ton, the CFM per ton was consistent at 265 or more. You know, they were just going back and forth.

What I concluded from why it was jumping like that is you would have a single cabinet for a two-ton and two-and-a-half. So when you go to two-and-a-half, you need a little more airflow but you're using the same cabinet. So they were just fluctuating, you know, by ten CFM.

MR. MESSMER: Thank you, Mark. That last slide was no accident. We actually do design for those airflows.

MR. ALATORRE: Okay.

MR. WICHERT: So we're going to go to a question online. This is from Ben Lipscomb.

This is,

"What is the underlying rationale for studying a minimum CFM per ton(indiscernible)? Did you verify the presumed assumption that higher CFM per ton results from lower energy use?"

MR. ALATORRE: So the CFM target is to achieve the rated capacity. So, you know, the higher CFM across the coolant coil(indiscernible) is better. That's why there are

also a couple that were limiting the fan power.

MR. WICHERT: So he has more parts.

"For the units that had lower CFM per ton, did you check to see if they also have lower fan power that could also -- that could offset the presumably lower sensible efficiency? And did you examine the market share of the units that would not meet the proposed targets for CFM per ton?"

MR. ALATORRE: So the 13 systems that could not meet it, the HERS Directory didn't specify which blower was included. I think there's two different fan blowers that are offered for that cabinet and it didn't say which one was used in the rating, so I couldn't come up with that number. And I also didn't -- I did not investigate the market share of those 13 systems that did not -- that did not meet.

Okay. Are we moving on? Okay.

(Colloquy)

MR. MILLER: Good morning. I'm Jeff Miller. I'm a Mechanical Engineer in the Buildings Standards Office. I'm going to speak now this morning on the topic of residential HVAC, HERS verification, and data registry requirements.

Oh, these keys aren't working. There we go.

First off, I'd like to acknowledge the California Utilities Statewide Codes and Standards Team, in particular

the Residential HVAC case author, David Springer.

The agenda for this slide deck starts with residential HVAC, then goes to HERS verification, and concludes with data registry requirements.

There were three proposals put forward by the case team, and the Energy Commission is moving forward with one of them. It's the reduction in the fan efficacy compliance target.

A little background on fan efficacy, beyond what Mark has already shared, it's defined as energy and watts expended per unit of delivered airflow in cubic feet per minute, so the metric is watt per CFM. Two major characteristics that effect the efficacy are the motor technology used in the fan, and then the distribution system that's attached to the fan. Currently in Title 24 Part 6, it requires HERS verification of simultaneous compliance with a minimum of 350 CFM per ton of system airflow and the maximum of 0.58 watt per CFM fan efficacy.

So this was first adopted in the 2008 code cycle as a prescriptive requirement. And subsequently adopted as a mandatory requirement in the 2013 code cycle.

The proposed change is to revise the maximum fan efficacy requirement in Section 150.0(m)13 and 150.1(c)10 changed to require less than or equal to 0.45 watt per CFM. The existing is 0.58. It's a mandatory requirement,

applicable to all ducted space cooling systems. It's also a prescriptive requirement. And 150.1(c)10 which is applicable to central fan integrated ventilation systems on both heating and cooling systems. It impacts all residential buildings. And we're not proposing any changes to the tables, the return duct sizing tables in 150, those tables, 150.0(b), 150.0(c). The proposed change applies to the following building scope: new systems in newly constructed buildings, and complete system replacements for additions and alterations to existing buildings.

There's a new standard for residential furnace fan efficacy that the DOE has completed their rulemaking on. And they determined a fan energy rating, and I'll go through a few slides that have screen shots from that DOE Rule.

So the fan energy rating has units of watts per 1,000 CFM. And FYI, there's an error in this table that's being displayed here. It says that the units are watts per CFM. But in other aspects of the rule, it's stated correctly as watts per 1,000 CFM. And I believe a correction is expected to be implemented on that.

This is the equation for the fan energy rating. I won't say too much more about it, but I'll describe more in subsequent slides.

So testing is conducted with the following conditions and fan speed settings. So for furnaces that

don't have an evaporator coil the static pressure is 0.65 inches water column. And for units that do have an internal evaporator coil, it would be like a fan coil unit, the static pressure is 0.50.

Also, there are airflow control settings that are required as part of the method of test, and those are given in Table 3.2. So a little bit more about that -- on that.

There are operating our assumptions incorporated into the method of test. And so it means that the power portion of the FER rating is a function of three fan speeds. And those are fees are weighted by the operating hours. For a single-stage furnace the weightings are 44 percent for heating, 34 for cooling, 21 percent for constant circulation speed. And so the calculated FER value has units of watts per CFM, but the calculated FER value does not represent the watts per 1,000 CFM that would be expected at system cooling speed, that's high speed, in a residential system since the FER is a weighted combination of heating, cooling and constant circulation speeds.

Thus, it's not possible to make a direct comparison between the FER rating and the cooling mode fan efficacy specified in Title 24. And it is not possible to determine a cooling speed, watt per CFM, from the FER rating with any degree of confidence since two-thirds of the rating is based on heating and circulation operating modes. So

it's unlikely the furnace -- it's also likely a furnace would be -- unlikely a furnace would be capable of meeting the FER Standard, unless its motor efficiency is similar to that of a brushless permanent magnet motor.

So we expect the new federal standard to cause all furnaces to use a brushless permanent magnet fan motors in place of the current standard PSC motors.

So it raises the question, are brushless permanent magnet furnaces capable of meeting a requirement of 0.45 watt per CFM in California homes, as we've proposed?

So one example, furnace testing by Proctor Energy Group for the Energy Commission in 2006 shows two brushless permanent magnet furnaces, that's Units 4 and 5 in this slide, operating between 0.3 and 0.4 watts per CFM at realistic external static pressures for California homes.

Also, a furnace model database compiled by Lawrence Berkeley Lab in 2004 provides brushless permanent magnet furnace characteristics based on manufacturer expanded performance ratings similar to those measured by Proctor Engineering in the laboratory, the data indicate that an external static pressure of 0.7 inches water column in the fans would comply with the 0.4.

The Statewide Case Team tested to brushless permanent magnet-equipped furnaces. One rated at 1,000 CFM maximum that uses a constant torque motor. The other rated

at 1,600 maximum that uses a motor that behaves like a constant CFM type. And the results indicate that an external static pressure of 0.7 inches, the water column in the fans would comply and -- okay.

So incremental costs-beneficial costs ratio, cost effective analysis. The incremental cost is assumed to be zero for this measure. The measure is cost effective in all climate zones. The rationale for that is the only changes to use a lower watt per CFM compliance criterion, and federal standards will enable that lower watt per CFM for furnaces, so compliance with Table 105.0(b) and (c) is not changing. And added costs are expected -- no added costs are expected, but only savings are expected. The assumptions are that the DOE FER Standard is in effect, and no incremental maintenance costs are incurred.

So the baseline and proposed conditions are showed here, baseline 2016 compliant (indiscernible). And the differences, the 0.45 watt per CFM airflow fan efficacy. And these are the values determined by the Case Team for annual TVD (phonetic) and cost savings, and annual energy savings.

And I think that's going to be the last slide on that. Yes.

So I'm going to move to HERS verification now. Do you want to do questions now, do you think? Yeah? Okay.

Any questions? Yeah.

MR. HODGSON: Mike Hodgson, ConSol.

Jeff, when does the DOE Standard -- has it already come into effect?

MR. MILLER: No. It's scheduled 2019, I think it is.

MR. SPRINGER: July 2019.

MR. MILLER: July 3rd, 2019, yes.

MR. HODGSON: And how long do the manufacturers have to remove inventory?

MR. MILLER: I don't know the answer to that. I can get it for you.

MR. HODGSON: Okay. I'm just curious, because that was an issue, also, when the '14 standards -- '14 SEER Standards came into effect --

MR. MILLER: Uh-huh.

MR. HODGSON: -- that we have kind of a one-year overlap between the standards and when the federal standards came into effect, and had to have kind of a little change in how 2013 was implemented.

MR. MILLER: Well, specifically when the cutoff is, when you can no longer sell a unit; yeah?

MR. HODGSON: Correct.

MR. MILLER: Okay.

MR. HODGSON: Yeah.

MR. MILLER: I'll find out for you.

MR. HODGSON: Right. In the last NEPA standards, I believe it was 12 months, so just curious. Okay.

MR. MILLER: Okay.

MR. HODGSON: Thank you.

MR. PENNINGTON: Bill Pennington, Energy Commission Staff.

Typically there is no inventory clearance deadline on federal standards. It got into a different situation with air conditioners. They had original standards that got into the distribution of those. And they ended up talking about sales in there, how do you implement that standard for air conditioners? But I don't think that --

MR. MILLER: I'm sorry. So anyway, what I was saying is that traditionally for federal standards, there is no inventory clearance deadline and you can sell them until they're gone. Probably, that tends to be six months, or something like that. But, you know, it can drag on if you've got some dead inventory somewhere that's hard to sell, or whatever.

The only time when there was something different from that, that occurred, was with the efficiency standards for air conditioners that Mike was referring to where DOE got into consideration for how products were going to be sold by region. And, you know, so that was a regional

standard, and it was just kind of a unique scenario, the first time DOE dealt with it that way. I don't think the air conditioner experience will be relevant for this fan efficacy implementation.

So I would suspect that there is actually no inventory clearance obligation. So if you have the inventory manufactured prior to the effective date, you can sell it, is what I think will happen. So I'm not sure it's even worth Jeff chasing that down, kind of, but if he wants to --

MR. HODGSON: Mike Hodgson again, responding to Bill.

The concern I have is we got kind of caught off guard in the last cycle. And if we just look ahead and it will state in the ruling whether or not there's inventory clearance and we have clarification, we would really appreciate it. So I would encourage you, Jeff --

MR. MILLER: Okay.

MR. HODGSON: -- to do that. And we'll do the same thing. Thank you.

MR. MILLER: Inventory clearance.

MR. WALKER: Good morning. Chris Walker with Cal SMACNA. And one of our members had a quick question on the cost effectiveness calculations on the fan efficiency.

And the question is: If you're going to have

higher filtration from the indoor air quality requirements for residential, how does that factor into the higher filtration? How does that factor into the cost effectiveness or the fan efficiency? And you're looking at how those fans operated in current systems. How will they operate in systems with higher filtration?

MR. MILLER: So there's very little impact due to the higher efficiency of the filter, according to our researchers. And I think that's what your question is; right? Yeah. So I think that's the answer.

Yes? Okay. We're going to go to a couple online questions.

Andy Llora, I'm going to un-mute you now. Go ahead and state your name and association.

MR. LLORA: Yes. Andy Llora from QC Manufacturing.

MR. MILLER: We can hear you.

MR. LLORA: And did you need me to speak, or were you --

MR. MILLER: Oh, I saw your hand raised.

MR. LLORA: -- (indiscernible) you guys' planning regarding the HERS verifications?

MR. MILLER: Oh, I saw your hand raised, so I thought you had a question. But we'll go ahead and mute you, and go ahead and raise your hand at the next topic

then.

MR. LLORA: Oh, yeah, I'm sorry. We did not mean to raise our hands.

MR. MILLER: Okay. I'm going to start with HERS verification now.

Oh, we have more? All right.

MR. WICHERT: This is coming from Amiruddh Roy.

"Were MER 13 filters incorporated into the analysis leading to the 0.45 watts per CFM proposal? The slides didn't show the MER 15 figures."

MR. MILLER: We've not included them in any analysis. We don't believe it's going to be a significant impact in terms of the operational characteristics of the furnaces, no change from current filtration.

MR. WICHERT: Okay. And our next question is from Bruce Hill.

"Title 20 governs the" -- this might be more of a comment actually. "Title 20 governs the sales of regulated appliances, such as HVAC components. There's an unlimited sale-through date for models certified through the CEC. Installation of them in new construction under title 24 is a separate concern."

MR. MILLER: so I can't understand what you're saying.

MR. WICHERT: This is a comment on the sale of

HVAC components.

"Title 20 governs the sales of regulated appliances, such as HVAC components. There's an unlimited sale-through date for models certified through the CEC. Installation of them in new construction under title 24 is a separate concern."

MR. MILLER: I didn't get that. Did anyone else have trouble?

MR. WICHERT: (Off mike.) (Indiscernible.)

MR. MILLER: Inventory clearance? That was an answer to --

MR. WICHERT: Yeah.

MR. MILLER: Okay. All right. Okay.

MR. WICHERT: and that's it.

MR. RAYMER: Can I make -- yeah, Bob Raymer with CBIA.

Yeah, we recognize, and this goes to plumbing fixtures, as well, that Title 20 may have a certain specific, you know, construction specific in it. And, indeed, manufacturers in the state, under Title 20, can produce items. But the point here is Title 24 discusses what goes into the home. And under the Health and Safety Code, 18938.5, you need to comply with a set of standards that are in effect on the day that you submit your permit application. So while at the front end of the line you may

be able to have access to this product, you cannot use it after that particular effective date. So that's why the last discussion was key.

MR. MILLER: Okay. Yeah. Okay. I'll need to get on top of this, so I understand it, too; right?

More? Okay.

I'm going to start HERS verification now.

We're going to propose five new HERS verification protocols, and describe a couple of areas to HERS regulations that we're going to be updating. So there's a heat pump capacity verification, whole-house fan, airflow rate verification, central fan ventilation, cooling system verification, kitchen range hood, HVI certification verification -- well, I -- and multifamily building central ventilation shaft or duct leakage verification. Modifications are an update -- are RA3.8. That's the field verification and diagnostic testing for building air leakage. And also some updates to third-party quality control program, TPQCP, clarify the update and update specifications and procedures in RA2.4.3 and RA2.7.

So the first verification, heat pump capacity verification, performance compliance encourages heat pump sizing that minimizes use of resistance heating backup. So verification of the installed ratings for the proposed heat pump capacity is needed to be performed. The verification

utilizes the certified rating data from the AHRI Directory, or another director of certified product performance ratings. And the procedure consists of visual verification of the AHRI certification for the installed equipment, manufacturer model numbers, and AHRI heating capacity at 47(f) and 17(f). That information would go on to a compliance document. This is almost the same kind of a verification that is done for EER and for SEER.

Next, the whole-house fan airflow rate verification. HERS verification is proposed in order to address concerns that some installed whole-house fans are not delivering the required airflow rate. Energy savings due to use of a whole-house fan for ventilation cooling is only realized if the installed whole-house fan provides the required airflow rate when it's operated. Two whole-house fan airflow measurement alternatives are proposed to be added to reference Appendix RA3 for use for demonstrating compliance.

First, there's a blower door measurement using a pressure matching technique, similar to HVAC system duct leakage pressure matching protocol that's in RA3.

And the second is a powered flow capture hood measurement using a technique similar to the HVAC system airflow rate measurement protocol in RA3. The powered flow capture hood attachment designed for use with a blower door

fan flow meter is used for that procedure.

Verification of the required attic vent area is also proposed. The details of that protocol are to be determined. And verification of the installed watt per CFM is proposed. And details for that protocol are to be determined, as well.

So the two airflow rate protocols, this is the summary of what they entail. So using a blower door and pressure matching, set up the blower door as you would for an air infiltration test using positive house pressure, and cap off the blower door fan. Then open the window or windows that are typically open during whole-house fan operation. That's usually opening a window in each bedroom that you want to receive some cool air, and any other air that you want to receive some cool air from outside. Then turn on the whole-house fan and at whole-house fan normal operating conditions, record the house depressurization with reference to outside that happens as a result of operating the whole-house fan.

After that, remove the blower door fan cover, energize the blower door fan, close all the windows, and then increase the blower door fan speed to match the house depressurization recorded under the whole-house fan normal operating conditions, record that blower door airflow, which is also the whole-house fan airflow.

The other protocol, using the powered flow capture hood, open the window or windows that are typically open during whole-house fan operation, turn on the whole-house fan, and then measure the whole-house fan airflow using a calibrated powered flow capture hood.

The next protocol, central fan ventilation cooling system verification, I guess I'm going to say CFVCS throughout this. This is -- it's a lot of acronyms and stuff. Here we go.

So the 2013 Building Energy Efficiency Standards case report called for HERS verification of central fan ventilation cooling systems. But Staff neglected to -- that's in 2013. The Staff neglected to include a HERS protocol in RA3 for that code update, so the purpose of adding it now is to complete that process. Energy savings due to CFVCSs only realized if the installed CFVCS is operated to meet the proposed CFVCS airflow rate requirements specified on the Certificate of Compliance.

The field verification procedure uses the same system airflow rate measurement protocols as are used for verification of full-system airflow in RA3.3, and so this is the sequence. In addition to complying with duct leakage, airflow rate and fan efficacy verifications, they're applicable to non-CFVCS, air handlers also measure and confirm that the CFVCS airflow and fan efficacy meets the

value specified on the Certification of Compliance while the system is operating in ventilation-only mode. That's an input to the compliance software.

Verify that the manufacturer model is certified to the Energy Commission as a CFVCS. And we'll put a procedure into place for certifying those system. Verify attic-free vent area. Verify central fan type; it's either fixed or variable flow. And verify the outdoor temperature sensor.

The next protocol is the kitchen range hood. We've mentioned this already in the Indoor Air Quality Workshop. But again here, HERS verification is proposed to improve compliance with the ASHRAE 62.2 requirement for use of HVI certified range hood fans. And the procedure is to record the manufacturer model number for the installed kitchen range hood, reference the certified performance rating data in the HVI Directory for the installed kitchen range hood, and verify that the HVI certified performance listed for the installed range hood meets the required airflow and sone ratings required by ASHRAE 6.2. It's generally 100 CFM and 3 sone.

I'm told that the HVI Directory is updated often enough that it's recommended that this verification use a reference to the electronic version directly each time a verification is performed.

The next protocol, multifamily building, central

ventilation shaft or duct leakage. This was also mentioned in the Indoor Air Quality Workshop. The procedure is new for 2019. The procedure is a modification of the duct leakage protocols already specified in RA3 for diagnostic duct leakage from fan pressurization of ducts. The procedure is to seal all grills and registers, attach a fan flow meter, and pressurize the ducts to 25 pascal, record the flow through the meter, divide the leakage flow by the total ventilation system airflow and convert to a percentage. And the leakage flow must be equal to or less than six percent of the total ventilation system airflow.

I'll say one more thing about these. The actual -- the details of the protocol will be developed after the workshop during the -- or over the course of the next couple of months, and will be available when we go to 45-day language.

So for the modifications, RA3.8, field verification and diagnostic testing of building air leakage, must be updated to the field diagnostic protocol language to make it consistent with the new version of resident standard, that's ANSI/RESNET/ICC 380-2016. And additionally, we propose to limit the protocol options to only use of the one-point or single-point test. Efficiency Characteristics and Opportunities for New California Homes was a research project done by Proctor/Chitwood/Wilcox in

2011. It concluded that a single-point method at 50 pascals provides results within five percent of other methods. And eliminating optional use of the multi-point test and repeated single-point test will simplify the protocol ad eliminate six compliance documents.

Also, we will make some modifications to the Third Party Quality Control Program language in order to clarify and update specifications and procedures.

Field diagnostic instrumentation has evolved quite a bit over the years since the TPQCP was first conceived. Therefore, it's necessary to revisit our expectation for the functionality of the diagnostic tools and diagnostic software TPQCP uses.

Wireless network connectivity for field diagnostic equipment and cloud-based data logging, sophisticated diagnostic software has become widely available for use by any HERS rater. And data transmittal relationships between new cloud-based data services and HERS data registries are expected to be clarified in Joint Appendix JA7, the data registry requirements, which will impact clarification of this data transmittal relationship between TPQCP services and data registries they are approved to use for HERS verification compliance of their installations. So clarifications of procedures of TPQCP approval and QA oversight are also needed.

Should we pause for questions? There's just really one more. Data registry is a single slide. Why don't we -- okay.

Joint Appendix JA7, data registry requirements and Data Registry Requirements Manual updates, so portions of the Data Registry Requirements Manual that are well established, features that are implemented by all HERS providers will be moved into JA7, into the adopted JA7. Section JA7.8, data registry approval will be updated to clarify the data registry approval procedures. And JA7.9 will be rewritten significantly to specify the approval procedures for data transmittal services between data registries and cloud-based data services, such as those used by diagnostic tool manufacturers. These data transmittal procedures are an alternative to current keyboard input of information for completing and registering the Title 24 Part 6 compliance documents.

And that's it for HERS verification and data registry requirements. Any questions?

MR. NESBITT: George Nesbit, HERS rater. Maybe I'm too tired that I didn't hear.

Are all the first five verification measures mandatory, or are they prescriptive?

MR. MILLER: Well, they're used when they're specified to be used by standards language, or ACM

procedures.

MR. NESBITT: So they'll be part of the standard design?

MR. MILLER: No. They're verification protocols. They're not specifications for compliance.

MR. NESBITT: So those are all available for credit?

MR. MILLER: When the --

MR. NESBITT: Right. So they're not mandatory?

MR. MILLER: Well, it's a funny way to say it, but you --

MR. BOZORGCHAMI: So, George, let me see if I could explain. This is Payam.

So if you take a HERS credit, you're mandated to do these five verifications also.

MR. NESBITT: Right.

MR. BOZORGCHAMI: It is a performance --

MR. NESBITT: So these are --

MR. BOZORGCHAMI: -- and then you take the credit.

MR. NESBITT: -- performance credits?

MR. BOZORGCHAMI: To take the credit of the HERS verification, you're going to have to inspect these five areas also.

MR. NESBITT: Okay. That's -- so for the whole-house cooling fan, can you tell me what powered fan hood can

read thousands of CFM, and where can I buy one, and how much is it going to cost?

MR. MILLER: There's at least one tool that's commercially available. Is that sufficient to answer your question?

MR. NESBITT: No.

MR. MILLER: Okay.

MR. NESBITT: What is wrong with unpowered flow hood that can read thousands of CFM and is quite accurate, especially at higher CFMs and especially reading essentially what's a return airflow? I mean, I've done enough readings over the years comparing flow grids to unpowered flow hoods using multiple styles of flow hoods on the same registers. So what's wrong with something simple?

MR. MILLER: If it could be demonstrated to be accurate, I would say there's nothing wrong with it. Can you provide that kind of assurance, that an unpowered flow hood would be appropriate for this application?

MR. NESBITT: Yeah, I can.

MR. MILLER: Okay.

MR. NESBITT: I'm confident. I'll put my stamp of approval on it.

So let's see, the blower door, how come we don't have credit door testing in multifamily or nonresidential? Does air leakage not play into those types of buildings?

MR. MILLER: It's not really an easy answer. One very good answer, though, is that we don't have a protocol that is a reliable protocol to measure leakage for the purposes of determining infiltration for energy considerations. So separating out the leakage to outside to the leakage to the adjacent dwellings is not easily done. So that's why California hasn't offered an Energy Credit for infiltration reduction in multifamily.

Have I said that correctly, Bruce? Oh, great. Good.

MR. NESBITT: Gee, I've tested whole multifamily buildings leakage to the outside. There's a variety of protocols. I mean, I think those -- how you do that is known. There's a variety of methods you can use, depending on the type of building. So you're suggesting also that -- well, you used to require that we used a multi-point pressure/depressure test, but no one actually did it. Then you said we could use RESNET, which said we could do a whole bunch of different things. So now you're saying that we should do a single-point only. So is that a pressure or a depressure test, or is it both?

MR. MILLER: I think it would be either. I really want to double check, but I believe it's either, but a single-point.

MR. NESBITT: The old chairs versus the new chairs

used to tell us that for new houses, we pressure tested, but for existing houses, we did a depressure test.

What I would suggest, based on fairly large sampling, would be that it has to be a plus and a minus test. And I've compared large numbers of samples to full multi-point pressure/depressure tests. It's very quick and easy to turn a fan around, change the hose settings, take a second reading, average it out. And what you do is you eliminate the fact of wind and other forces by doing so.

MR. MILLER: You're proposing to do both and then average the results?

MR. NESBITT: Correct. Remember, it's all an estimate anyway. The whole relationship between a blower door and actual air leakage is highly --

MR. MILLER: I do agree with you.

MR. NESBITT: -- suspected.

MR. MESSMER: So the single-point measurement, however?

MR. NESBITT: Single-point, yes.

MR. MILLER: Yes?

MR. NESBITT: Absolutely.

MR. MILLER: Okay.

MR. NESBITT: It's far easier. You don't have to lug around a computer and have things muck it up. I mean, I've done probably as many as 20 multi-point

pressure/depressure tests in a day in a production setting. It's very boring.

MR. MILLER: Have you don't whole building verification of multifamily buildings, you know, with the multiple fan setups?

MR. NESBITT: Yeah.

MR. MILLER: Okay.

MR. NESBITT: Yeah. I'm not going to suggest that as buildings get bigger that it's easy.

But -- so the last issue you talked about was HERS registry stuff. And in the appendices, what's the relationship between what we're -- HERS raters and HERS providers and all that is regulated under Title 20. So you're talking about changes to what is in Title 24, where you're putting it or what you're doing. So how does the two relate, the Title 20 versus what you're -- what you want to do in Title 24?

MR. MILLER: Well, the language that's in RA2 which has to do with the HERS procedures, that's, you know, that's within the scope of Title 24. We're not proposing any changes to Title 20 requirements. But the data registry requirements are Title 24 issues because they're all about gathering data from field diagnostics or other information sources that are needed to complete documents. Data registry is about creating the documentation. And so in

JA7, Joint Appendix JA7, the data registry requirements give direction on how a data registry should do those procedures. It just happens to be that we require for residential documentation that a data registry must also be a HERS provider.

MR. NESBITT: Okay. I just want to make sure we don't go and create conflicting requirements or duplicating efforts between the two sections of the standards.

MR. WICHERT: Neil smith, I'm going to un-mute you now. Go ahead and --

MR. SMITH: Okay. Ready for me? Hi. Neil Smith, Air Escape, whole-house fan manufacturer. A couple questions on the field testing of whole-house fans, or as you like to call them, CFVCSs.

So the accuracy of field measurements compared to the measurements we get in a lab, just a little concerns about drilling down and getting some more details on that. Because, you know, we're doing it at lab conditions according to a certain protocol, NASD (phonetic) certified, you know, traceable instruments, rather. And so are you going to allow some tolerances out in the field, and how are you going to get to that? Because that's -- I think that's going to be difficult to do. I don't think it's going to be trivial. And it probably has to be discussed and thought about a little bit more.

Three parts to the whole question.

Number two was a comment about differential pressure in the attic. And I would suggest that we -- that the rater measure the differential pressure in the attic, because that's going to tell you a whole lot of problems. Because maybe there may be the venting in the attic, or it may not be performing properly, and I think that's a simple measurement to do.

Number three is do you have any plans for measuring the insulation value in the doors, in sealing doors on whole-house fans?

And that's all my questions. Thank you.

MR. MILLER: Bruce, do you want to step up?

MR. WILCOX: Bruce Wilcox, a consultant to the Commission.

We don't require insulated doors on whole-house fans, so there's no reason to measure that.

MR. SMITH: Well, that's simple. Okay.

MR. SHIRAKH: Yeah. This is --

MR. SMITH: Suggestion that you do.

MR. SHIRAKH: This is Mazi, the Energy Commission.

Do you have any data to actually share with us about your fans, you know, the lab testing versus home installed that can show us how it might correlate?

MR. SMITH: I'm sorry, is that for me?

MR. SHIRAKH: Yes.

MR. SMITH: We don't have -- we don't do any field testing, so, no, it would be -- I would love to get some data on some of our fans and see what the comparison is. If you have any projects on that, I'd love to give you my feedback on that.

MR. SHIRAKH: Sure. I mean, if you can share some of your installations and do some estimates.

MR. SMITH: Okay. Not a problem. Certainly.

MR. SHIRAKH: Thank you.

MR. MILLER: Go ahead, Dave.

MR. SPRINGER: David Springer, Davis Energy Group.

One issue with testing central fan systems is that if you measure the return air, you're getting relief air leaving the building, but you're not capturing leakage through a window, open windows and bathroom exhaust fans, and that's sort of thing, so it's inaccurate. It's going to give you a low measurement. And the only way to get a true measure of what the system is supplying is by measuring each individual register, which is -- can be kind of time consuming and a challenge. So that should just be considered in developing the method.

MR. MILLER: What's your recommendation for how we go about that?

MR. SPRINGER: Well, I mean, I think it's either measuring every register or every supply register or, you know, allowing some kind of credit for additional leakage that you're going to be encountering. You could apply the same test method for whole-house fans that you use for central fan integrated systems. But again, you're not capturing the full airflow, so there might be some, you know, accommodation of that difference, and I'm not sure how you come up with that.

MR. MILLER: Okay. Something to attend to. I've made a note and I'll get back with you on that.

MR. SPRINGER: Okay.

MR. HODGSON: Mike Hodgson, ConSol.

I'd like to take up something in George's train of discussion that he was talking about, multifamily buildings and measuring them. And the housing market has kind of changed, we don't if permanently or not, but now it's kind of a 50-50 mix of multifamily and single-family, and that's kind of new, the new normal we think. And in so, there's more and more multifamily buildings, three storeys and less, that are being built out of insulated concrete forms, and those buildings are very tight. And I'm not sure if there's a methodology we can test air infiltration on yet. I think nationally, RESNET is developing one or has developed one.

But assuming that there is a methodology for that,

is that something that that class of buildings could receive, potentially, compliance credit if they're less than five or three or whatever the number is?

MR. MILLER: Well, I would say, yes, but it would have to be the whole building protocol, not --

MR. HODGSON: Correct.

MR. MILLER: -- not by measuring individual dwelling units.

MR. HODGSON: Okay. Good.

MR. MILLER: Yes.

MR. HODGSON: And if there is a resident methodology, go forward?

MR. MILLER: There is, yes.

MR. HODGSON: Great.

MR. MILLER: Uh-huh. Go ahead.

MR. WICHERT: Andy, I see your hand is still raised. Do you have a comment or question? I can un-mute you now.

MR. LLORA: Yes, I do. Thank you. This is Andy Llora with QC Manufacturing.

Could we go to the slide with the HERS verifications for whole-house fans central systems?

MR. MILLER: For whole-house fan or for central systems? Which?

MR. LLORA: For whole-house fans. One more slide

prior to this one. There you go. I'd like to address these in reverse order.

Verification of the installed whole-house fan, I want to see if that is proposed. That would obviously be dependent upon how you measure the CFM in the field. We are not opposed to this. We actually agree that these two values, since they are the values that are monitored and modeled on the Title 24, are the primary values that should be looked at by the CEC and the HERS rater as to what is in the CFM. Currently, net-free venting is appearing on the CF2R. And from our previous discussions, we know that very little computations for attic cooling, actually, none at all for attic cooling credit is actually given for a whole-house fan. And we're not sure why the attic ventilation plays such a huge portion of the data that's on the CF2R.

Second to the last item on the bottom, verification of the required attic vent areas proposed, this is very difficult for the installer, and currently appears on the CF2R. If a whole-house vent is installed by the mechanical trade and the wiring is done by the electrical trade that's doing the C10 wiring on the new construction project, which of those trades is to currently fill out the CF2R and determine how much venting appears on the roof structure. Neither one of those trades is currently capable of computing or going onto the roof and getting those values

for calculating whether a 0.58 O'Hagin is used or a 0.68 square footage O'Hagin is used. I don't think that they're also educated on the proper computing of attic ventilation.

So even as it stands right now, trying to determine what -- the existing venting that exists on the structure in the field is very difficult for any of the trades, other than the roofer, to do. And since the roofer plays no part in the installation of a whole-house fan, he's actually the one who should verify the actual venting exists in the structure and meets what was designed at design time for the CFM value for a Title 24 model with a whole-house fan, see that that is used to divide -- and divide it by 750 to determine the attic ventilation at design time. What's installed in the field can really only be verified by the roofer, and their role is nonexistent on the CF2R currently. So we currently have mechanical and electrical trades debating on who should actually sign that. That's a current issue that we had prior to you having a HERS verified attic ventilation figure computed in the field.

MR. MILLER: That's why we didn't propose a specific protocol for now. We recognize that people would want to discuss these details, and we really need to determine if it's reasonable for us, I would say, to do this verification. However, there is a requirement for net-free area relief. And it's worth exploring how to go about

ensuring that that's provided as it effects the performance of the fan.

What is your recommendation for who would do that verification?

MR. LLORA: Do I have a recommendation for who would do --

MR. MILLER: Yes.

MR. LLORA: -- for attic ventilation? I personally believe that attic ventilation should be removed from the computation of all verifications, because that should be a warranty issue with whole-house fans. That determines whether or not that attic vent -- that whole-house vent is going to cool the attic in one hour. And if you have, you know, a reduced amount of venting, it will take an hour-and-a-half to two hours to cool the attic. But we know from our discussions with, you know, Mazi and Todd and Bruce that we had previously discussed and inquired about how much cooling of the attic is actually computed in getting Title 24 compliance, and I believe the answer was none. So cooling the attic with a whole-house fan does nothing towards your compliance credit. Our compliance credit is derived by how much we cool the actual home and offset the AC usage by running the fans from 7:00 p.m. to 11:00 p.m. We don't get credit for a whole-house fan because we're cooling the attic.

So why is venting even an issue there? Because that's only going to affect the performance of how fast we cool the attic, which doesn't give you any compliance on Title 24, per my discussions with Bruce.

MR. MILLER: So Bruce is going to respond.

MR. WILCOX: Hi. This is Bruce Wilcox.

I think the main reason for being worried about the size of the attic vents is in order to make sure there's enough -- that you can get rid of the air that you're dumping into the attic at a low pressure so that you can actually move the air. If there are no vents in the attic the whole-house fan can sit there and churn away and it won't move any air because there's no place for the air to go. So it's not a question of cooling the attic, it's a question of ensuring that the whole-house fan CFM actually is delivered.

But I've been sitting here thinking that if you're actually going to measure the delivered CFM and the watts per CFM for a whole-house fan, then maybe you don't need to worry about the venting. Because if you actually achieve the CFM and watts per CFM that you claim, then the venting must be fine. I think we have to look at it. (indiscernible).

MR. LLORA: That's exactly my point. I'm in complete agreement with Bruce on that matter. Because if

they don't have enough venting, that becomes a warranty issue between the builder and the manufacturer, and that's an SB 800 issue. And all of our building clients and any whole-house fan manufacturer that's getting installed in new construction should be telling the builder that you will void the warranty is you don't have this adequate amount of venting. That's something that the builders have to address, but that's just like radiant barrier has to meet certain requirements, or any other piece of equipment that gets installed into a new construction home, the manufacturer handles a certain amount.

However, since CFM and wattage are the model values on the Title 24, those are what we believe you should have as your primary focus, both for two pieces of data that get inserted into the Title 24 report, and the two pieces of data that are collected in the field. Because ultimately if the watts-to-CFM ratio is adequately meeting what is modeled on the Title 24, they have enough venting for that fan to perform at what was modeled in the CF1R compliance report.

MR. WILCOX: So the other aspect here, which is maybe kind of a secondary issue, is that if there's too much pressure in the attic, there's a tendency for a large fraction of the whole-house fan air to leak back into the house, instead of going outside. And so you tend to set up this circular situation where the fan is blowing air into

the attic and it's leaking back into the house. It all depends on how leaky the attic is, the ceiling is versus the leakage in the attic, and so forth. But that's -- if that leakage is large that really defeats the efficiency of the whole-house fan. You're bringing that hot attic air actually back into the house.

So one possibility would be to measure the back pressure to make sure it's not too high, and that might be easier than verifying the ventilation area. I agree that that's a really difficult thing to estimate.

MR. LLORA: Well, that's a viable concern. So if we were to actually think about, let's say 500 CFM of air from the attic shooting back into the home with a 6,000 CFM fan that's changing all the air in the home and evacuating it, the entire home's volume, in five minutes, 500 CFM going back in, within the period of an hour, we're going to change the air in that home structure a dozen times. That figure of 500 CFM of air, which is -- that's a very large figure that I'm giving you there, even if that much was going back into the home, it would be irrelevant within 15 minutes because it's going to be 80 degrees outside, 80 in the home, and 80 in the attic --

MR. MILLER: So --

MR. LLORA: -- within 15 minutes.

MR. MILLER: So if you -- the example you used, there's about, what, 500 over 6,000, eight percent of the fan flow is actually not moving air out of the house, so that's equivalent of having, you know, a 5,500 CFM fan instead of a 6,000 CFM fan. So whether that's important or not --

MR. LLORA: No, I understand.

MR. MILLER: -- it's important.

MR. LLORA: No, I understand. But I gave you a very large figure. It's very unlikely that 500 CFM is going to come through your electrical outlets and light switches. I think it would most likely be under 100 CFM, if it was measurable.

MR. SHIRAKH: This is Mazier.

MR. WILCOX: If I could? I'm sorry, I need to respond to that, because that, you know, we have done measurements. We have done a bunch of measurements on whole-house fans. And I think that ten percent leakage back to the house is actually quite common in typical Title 24 houses that were built, you know, five, six, seven, eight years ago. We haven't done it recently. So 100 CFM is, I don't think, even in the ballpark.

MR. SHIRAKH: And this is Mazier.

MR. LLORA: You think ten percent leakage --

MR. SHIRAKH: And we don't really know --

MR. LLORA: -- back to the home?

MR. SHIRAKH: -- how much air is coming back. You know, we're assuming numbers here. But once the blower door is set up to check the CFM, checking the static pressure in the attic is almost trivial. It can be done very quickly.

MR. LLORA: Okay.

MR. NESBITT: George --

MR. LLORA: (Indiscernible) regarding the powered flow hood. I'm practically in agreement. I would be interested in knowing what the powered flow hood that's capable of doing this measurement, and what is the margin of error of this device? And more importantly, how close is that reading to the current CEC system of rating a whole-house fan on the CEC database, just using the HVI method in an ideal (indiscernible)close booth environment?

Proposing a HERS test in the field midstream of this code cycle is something that we're debating whether or not we can support that with any confidence, because we are testing in an ideal HVI lab system and it's HVI rated, which is the same system that is used for kitchen range hoods. And if HVI rating is available and acceptable for kitchen range hoods and the simple HERS verification of the HERS rater, checking the model number and checking with the HVI rating on AHRI, shouldn't that same method be used? That would currently be the easiest method to compliance with the

HERS rater is for a HERS rater to verify the whole-house fan that was installed in the field and compare it to the CEC database which has the HVI rated values, and then that fan is determined to be compliant.

You currently have an HVI system. If you use that in conjunction with a HERS verification that is a completely different method, that is going to throw a whole bunch of issues that we're not going to be able to get around as an industry. Both the builders are going to have issues with that, the manufacturers of the whole-house fans are going to have an issue with that. The title 24 companies are going to have an issue with that. The reason being, with the discrepancy of an HVI rated number that's done at Title 24 design time, if you spec out a 2,000-square-foot home and you put out a 4,000 CFM fan in there, there's two ways that that can be done. You can check the box for a prescriptive whole-house fan which will add 1.5 CFM, so it will model a 3,000 CFM fan.

So let's assume that this is the first pathway that the T24 consultant does, is that they check the box for a prescriptive whole-house fan on a 2,000-square-foot home, and that models a 3,000 CFM fan. So now the architect looks at the Title 24 and puts venting required for a 3,000 CFM fan, so they'll take 3,000 and divide it by 750 and you'll get four square feet of venting that's needed at design

time. So they plan out the roof venting, compare that to their 1-in-300 or 1-in-150 and say we have enough venting, we have four square feet of venting.

That's all in good -- that's all looking good so far on paper. But when it comes time to bid the job, we don't make a 3,000 CFM fan. We make a 3,700 CFM fan to meet that 3,000. That's the model number that would need to be installed.

So currently what would happen is, is a 3,700 CFM fan gets installed in the field, and the architect only put in four square feet of venting. So that house is now built vertical, roofing is done, venting is done, and the whole-house fan with 3,700 CFM gets installed, and now there's inadequate venting on the CF2R report. This is something that currently exists in the way the current code is written.

So we've explicitly asked all of our T24 consultants to never use the prescriptive checkbox or prescriptive default whole-house fan. They have to model our CFM with 3,700 CFM, so the architect knows to take 3,700 CFM and divide by 750 to get 4.XX amount of venting that's needed. This is the only way to ensure that at design time, prior to the structure going vertical, that the correct amount of O'Hagins and vertical vents gets installed into the structure. And we verify that all on paper at design

time, then the structure is built. If we did not do that and they modeled a prescriptive whole-house fan, you would have a HERS verification or a CF2R form that has a 3,700 CFM fan and only four square feet of venting on the structure, so it's now missing half an O'Hagin or one O'Hagin, which you can no longer add because the homeowners are ready to move in if there is testing done at final.

So who's going to get onto the roof, take off the tiles and add one O'Hagin because it failed the HERS test? That is a very expensive figure. So this is another reason why we believe that HERS verification and the net-free venting should be taken out of the computation, because that's -- it's basically a third variable, whereas fan watt and airflow for the HVAC industry has two variables that bounce back and forth. Like a scale that they have to balance, we have a third variable. We have the venting, and that's effected by the venting that's computed at the design time by the architect that's conflicting with the CFM that was modeled on the T24 and the wattage, which are also both verified in the field.

So you're going to have, actually, five figures that need to be maintained when this HERS verification takes place. You're going to have CFM and wattage that's maintained at design time on the T24 that is modeled with CVI -- I mean HVI values. You're going to have CFM and

wattage that is recorded and measured in the field by the HERS rater. And then you're going to have venting that was designed by the architect based on the CF1R models. And then you're going to have venting that's actually installed in the field and no longer matches what could possibly be a higher or lower CFM value of what was installed in the field.

MR. MILLER: If we --

MR. LLORA: (Indiscernible.)

MR. MILLER: Excuse me. If we --

MR. LLORA: Sorry.

MR. MILLER: If we --

MR. LLORA: (Indiscernible.)

MR. MILLER: If we simply --

MR. LLORA: I'm sorry.

MR. MILLER: If we simply measure the static pressure in the attic rather than verifying the free area of the venting in the attic, would that satisfy your concern?

MR. LLORA: The static pressure in the attic, that's changing one variable for something that's never even been looked at. So I don't think that that would meet my concerns.

I think what would meet my concerns is going back to what Bruce said, is that if it delivers the CFM and meets the CFM-to-watt ratio, that should solve everybody's

concerns because we know that that whole-house fan is getting the CFM and delivering it at the wattage-to-CFM ratio that was modeled on the T24.

But there's another statement here at the top of the slide, the second bullet item here, that energy savings due to whole-house fan ventilation cooling is only realized if the installed whole-house fan provides a required airflow rate when operated. That's something that is up for debate because whole-house fans, as you all know, anybody who has a whole-house fan that has a multi-speed, you're going to run it on high for only the first hour. And that high figure of CFM at the highest value and the highest wattage that is consumed by this fan when it's operating in high, that's what is modeled.

But everybody who has a high-speed ECM motor whole-house fan system that has three or four speeds, you're going to run it on high and flush your attic. Once it's 80 degrees outside, 80 inside, and 80 in your attic, you're going to kick it onto low and you're going to go to sleep and run it all night long for extremely low wattage. Some of our fans operate at 60 watts and are pulling 2,000 CFM with the ECM motors on those speeds. No credit or no benefit is even assumed for a homeowner running the fans on low speeds.

MR. MILLER: So --

MR. LLORA: This --

MR. MILLER: -- that's not what this statement --

MR. LLORA: -- (indiscernible).

MR. MILLER: -- is trying to elicit. It's just simply stating that if the whole-house fan doesn't provide airflow, it doesn't provide a benefit. And what we're proposing to do is to measure the airflow so we can determine whether the fan complies with the proposed benefit. That's simply the whole purpose of that statement.

MR. LLORA: Okay.

MR. MILLER: Have we addressed most of your concerns at this point --

MR. LLORA: Yes. Thank you.

MR. MILLER: -- or not addressed them and --

MR. LLORA: Thank you all for your time.

MR. MILLER: -- and we'll follow up with you? I assume we'll have a dialogue. This is Andy, is it?

MR. LLORA: Yes, it is.

MR. MILLER: Okay.

MR. LLORA: Thank you very much for your time and the opportunity.

MR. MILLER: Okay.

MR. NESBITT: This is George Nesbit, HERS rater.

Although Bruce did say that if we just measured

the airflow and the watt draw, the efficiency, that that would be a gage of it working. He also said if there's leakage to the house -- so if there wasn't enough relief from the attic, the leak -- there would be leakage, more leakage to the house. So just measuring airflow doesn't actually tell us if it's working.

So I guess my question is: Are there any standards, or does anyone have a thought as to -- I mean, okay, there's requirements, you're supposed to have so much free vent area, you know, based on your flow. But the problem with vents is they get clogged, they get painted over, they get clogged, or they don't get put in, or people put in the wrong thing, or they put in too little. And so how much pressurization of the attic would be too much?

But I also want to say, if we have to do too many things, it becomes too complicated. Either no one is going to do it or, you know, we have failures, and then we have problems when we have failures.

So we have QII. Now if we want the whole-house fan to actually draw air out of the house and not push it back in, should we require QII? Although QII is only a visual verification of the air barrier. We can certainly test how tight the house is to the attic. We can test the pressure of the attic with the fan running. I've done a little bit of this.

And then just another comment the person on the phone had brought up about, you know, who should sign off for what? We should think of -- we should not think of compliance forms. You know, we just -- we got over 100 forms. What you -- what we should think of and since it's all computer-based registries generated, there's only one, the CF1R, the compliance form, now the CF2R which is the installers form, and a CF3R which is the HERS rater form. There's really only three forms.

The question comes down to who signs off for what? So the installer forms, any section of any given installation that needs to be signed off on should be able to be signed by whoever the responsible party is. So you shouldn't think of say a whole-house fan as being necessarily the whole -- only the responsibility of one person. So in essence, the roofer should be able to, if they're the ones that installed all that venting, maybe it's the general contractor. Whoever was actually responsible for implementing that should be signing off for that portion. Now that's a portion of a verification. There's many verifications, but there's really only one CF2R. It just -- it blows my mind to think of 100 forms and try to think what they are.

MR. MILLER: Are you proposing multiple signatures on a single document instead of multiple documents with

single signatures on each, is that your opinion?

MR. NESBITT: I'm proposing a single document with multiple signatures for the responsible party for each thing. I think the old CF -- the old, what was it --

MR. MILLER: It's okay. I understand what you're referring to.

MR. NESBITT: There -- well, now -- yeah. There was an insulation certificate. But we've also had installation certificates that I think had multiple sections, and I don't know if people signed off on those on separate sections.

MR. MILLER: Right.

MR. NESBITT: But there's really only one compliance form. There's just multiple people responsible for whatever needs to be on it.

MR. MILLER: I agree with that.

MR. SHIRAKH: We need some WD-40 for this mike. Mazi Shirakh.

So on this question of measuring the static pressure in the attic, maybe what we should do is measure the static pressure, instead of at the maximum rating of the fan, measure it at the CFM that's prescriptively required. Using Andy's example, you know, if the prescriptive requirement is 3,000 CFM, but somebody puts in a bigger fan

that delivers 4,500, you know, he could be right that, you know, you're going to have a problem in there. But if the -- if you're only required CFM, maybe we should test it at that level to prevent this short circuiting, so that might be something.

MR. MILLER: Okay.

MR. WICHERT: We have a follow-up question from online.

Neil, I'm going to go to you. Go ahead.

MR. SMITH: Okay. Hi there. Neil MR. SMITH: with Air Escape.

Some of my -- after I put my hand up, I guess metaphorically, I think Bruce answered some of the questions. But I wanted to reemphasize, I think, some of the things, some of the thoughts about airflow leakage from the attic back into the space. Of course, that's -- you know, whatever it is, five percent or ten percent, that's a waste. But, actually, it's more significant than that because you will be blowing air that is significantly hotter than ambient back into the space. And so you're going to reduce the effectiveness of the fan by much more than that five percent leakage rate. We can do the math on that, but it's just as bad as pulling hot air into a duct by -- when it goes through a non-conditioned space, so that's a bad thing.

The other, of course, effect of that is you would have potentially bad indoor air quality because you blow insulation dust. Whatever, whenever and wherever it's coming from into the space, that's a bad thing.

The other thought that was brought up that I think should be mentioned is, of course, airflow throughout a space is not uniform. It flows from doors and windows into the whole-house fan grill, and then up to the attic. Whole-house fan houses do not cool uniformly. It's not a uniform process, so you don't want to exacerbate that by having any leakage on the attic.

What I would suggest on this is that I'm going to reemphasize my idea of actually measuring the pressure in the attic. And the reason that's important is that you have to go back to the first principles. HVI specifies a net-free area which is based upon flow and differential pressure.

So I think if somebody wants to think about this, I guess it's Bruce, if you're the consultant, about what differential pressure a ceiling assembly can withstand to minimize that leakage in average of new conditions. And then you'll arrive at what either differential pressure or net-free area, because I'm not sure, maybe you have thought about this, but the 750 feet per minute per net-free area is always been higher than what we've recommended at 500. And

I think that gave us a very conservative differential of like 0.05 inches. Correct me if I'm wrong.

Lastly, my comment is on the HERS testing, and I think that's important for a lot of reasons. I'm sure there would be difficulty. And I've mentioned before, it has to be thought of about how we're going to achieve some reasonably accurate measurements in the field by -- with -- outside of the lab, but we can catch a lot of problems. Installation errors of fans, it's not just placing it down there. Many systems use a duct, and a duct can be installed quite badly. We're seen over the years installations where performance has been reduced dramatically, just because of sloppy installation, and I think that would -- this would catch it.

That's the end of my questions and comments. Thank you.

MR. MILLER: Was that last comment applicable to central systems? I may not have been listening closely enough, but could you revisit the last statement that you made?

MR. SMITH: I'm sorry, central systems? You mean a central -- a whole-house fan?

MR. MILLER: So you're talking about whole-house fans, not central air handlers?

MR. SMITH: Yes.

MR. MILLER: Okay. Thank you.

MR. SMITH: No, no, no, no, no, no.

MR. MILLER: Thank you.

MR. SMITH: Thank you.

MR. MILLER: Any other questions?

MR. WICHERT: That's it.

MR. MILLER: Okay. I have a note here, a five minute break. Really, five minutes?

MR. BOZORGCHAMI: Ten-minute break, until we get ready for the ATTCP discussion.

(Off the record at 10:55 a.m.)

(On the record at 11:10 a.m.)

MR. MILLER: Okay. We're going to start. The next topic is Acceptance Test Technician certification provider requirements. We'll start off with acknowledgments.

The subject matter experts for this topic are seated up here, Joe Loyer and Veronica Martinez. They've provided most of the material that I'll be speaking, the slides and such.

The agenda, this is the background, overview of the proposed changes, and then the proposed changes.

Some background on ATTCP, acceptance test or a set of functional tests that ensure nonresidential lighting controls and mechanical systems work as designed after

they're installed. A Field Technician is a person who performs acceptance tests. The Acceptance Test Technician is a Field Technician certified by an acceptance test provider. Acceptance test employer is a person or entity who employees an ATT. And Acceptance Test Technician certification provider, ATTCP, is a professional organization that is approved by the Energy Commission to provide training curricula, certification procedures, complaint resolution, including disciplinary procedures, quality assurance, and accountability measures for ATTs and ATEs.

You've given me a lot to read here, Veronica.

The history of the ATTCP Program, 2005 Building Energy Efficiency Standards adopted requirements that nonresidential lighting and mechanical installers perform acceptance testing on newly installed lighting controls and mechanical systems to help ensure these systems perform as intended.

The 2013 Standards established new requirements to allow organizations to apply to become ATTCPs to train, certify and provide oversight for the technicians that perform lighting controls and mechanical acceptance tests, as well as the employers for those technicians. And ATT and ATE certification requirements shall take effect when industry certification threshold conditions in Section (b)

are met, as determined by the Energy Commission. And as of June 18th, 2014, lighting controls acceptance testing requires an ATT. And the threshold for mechanical systems has not yet been met.

The 2016 Standards marked the first code cycle that all -- that call for ATTCPs to submit update reports to the Energy Commission and recertify their ATTs and ATEs.

Throughout this presentation, we'll be referring to two different sections of 10-103. There's 10.103.1 and 10-103.2, but these sections are parallel language. They essentially had the same requirements but are -- one is directed at lighting and the other is directed at mechanical. Nonetheless, we'll be describing the same changes in both, so we'll abbreviate. I'll actually, when I'm speaking, I won't even talk about 10-103.1 or 2. I'll just highlight the subsequent section. Just know that the same first part of the section number is intended.

So there are some substantive changes proposed for this language in 10-103.1 and 2. Here's the list: provide the Energy Commission with the authority to rescind the threshold findings; new restrictions for decertified ATTs; requirements for recertification training; requirements for recertification status reporting; a quality assurance discussion -- more on that when get to that slide; expand the annual report to include ATT audit results; and expand

the update report to include all amendments to an approved ATTCP application.

Non substantive changes include attention to defining abbreviations or acronyms, and clarification of the scope, grammar in certain locations, certification number, clarification requirements for certification numbers, and language in the quality assurance section. Also require underlined strikethrough copy of effected application sections.

So these are the substantive changes that are proposed.

In Section (b) there's threshold maintenance. The proposed change, to provide the Energy Commission with regulatory authority to ensure that the threshold requirements are maintained. Though the threshold requirements may deteriorate over time, the availability of ATTs to do the test is significant, is necessary in order to have someone to do the tests. So if something changes, this is going to give the Energy Commission the authority to rescind that, pull out any Field Technician to perform the test.

Sections (c)3B and (g), Decertified ATT Restrictions, proposed change: When an ATTCP decertifies an ATT, the acronyms are -- here they come, the ATTCP must

notify other ATTCPs of the action. Decertified Acceptance Test Technicians may not apply for certification with other ATTCPs. Decertified ATTs may not submit acceptance testing to any ATTCP. So the justification for this change is that the ATTCPs that are decertified by one ATTCP may apply to another without addressing their decertification, and that's not desired.

I'd say there's been several instances when HERS providers were required to decertify a rater, and that rater applied to another HERS provider without addressing the issue. And so this is intended to prevent that type of thing from happening with the ATTCPs, but there have not been any problems with that, not yet.

Section (c)3B(vi), the proposed change require that ATTCPs develop recertification training curricula consistent with training requirements in Section 3A through C, and submit recertification training curricula for Energy Commission approval as part of the update report. The justification is this allows the Energy Commission to ensure that the recertification training scope is scaled appropriately for substantive acceptance test changes.

I'm bypassing on reading a lot of these notes. I hope that's okay. Yeah. All right.

The next change is in Section 3C(b)(vi).

Did I change the slide yet? No, not yet. Sorry,

(c)3G, recertification status. The proposed changes require that ATTCPs keep a public record of an ATT or an ATE recertification status and provide verification of recertification status upon request to those that should know. The justification is that ATTs and ATEs are certified and recertified for acceptance testing required under a specific code cycle of the standards. To prevent ATTs from performing acceptance testing under new code cycles without being recertified, they must be restricted to only those code cycles they have been certified or recertified for. So the ATTCP will track the status of an ATTs certification status. Ultimately, it's the ATTCP's responsibility to ensure that those persons that complete compliance documents are properly certified to do that documentation.

Section (c)3F, Quality Assurance, Staff is not proposing a change to this, but inviting public input. We request that stakeholders and public identify any issues regarding compliance with the quality assurance requirements, and make recommendations to modify the language of Section 3F to resolve the issue. I'll read some of this. These are the requirements in (c)3F.

One is, "The ATTCP shall review a random sample of no less than one percent of each ATT's completed compliance forms." This is also referred to as the paper audit requirements. The paper audit requirements is unchanged

from 2013 Standards.

Also, "The ATTCP shall perform randomly selected onsite audits of no less than one percent of each ATT's completed acceptance test." This is the new requirement for the 2016 Standards referred to as the onsite audit. The onsite audit has two basic requirements. The onsite audits must be randomly selected. And the audits must constitute one percent of the ATT's completed acceptance forms.

Staff is aware that there are issues with this, and here's some of the notes that I have here. The cost of the QA program is an issue, scheduling and logistics concerning sending auditors to construction sites at the right time, providing trained auditors, and then getting access to the site are some of the difficulties or challenges that are being considered. So Staff invites stakeholders and the public to recommend solutions that resolve these issues and comply with the intent of the regulation.

Section D1 on Annual Reports propose to expand the annual report requirements to include summarized audits, both paper and onsite. Justifications requiring the ATTCP's to report their auditing activity will help the Energy Commission verify that quality assurance measures are being followed.

Section D2, Update Reports, propose to expand the

update report requirements to include all application amendments justification as the update reports are limited in scope to training curricula adjustments. Adjustments to an ATTCP's program outside of this scope for newly adopted standards are not required, but may greatly affect the program. Therefore, Energy Commission needs the authority to require those modifications.

On substantive changes, I'll go through this pretty quickly. There will be some clarifications in definitions to set the stage for use of acronyms in the language that will be in Section 10-102.

The definition for ATTCP is clarified to include the word "oversight" as part of their authority.

There are grammar corrections that are included.

And ATT scope has a similar clarification, to use the word "oversight" in the language.

Adjustments to the quality assurance language in Section 3A. I guess it's unclear currently whether quality assurance requirements for the ATTCP and the ATTCP program and the ATT, it's unsure, it's not clear, so this is to help with that.

Section (c)3G, Certification I.D. Numbers, this is to add a requirement that the ATEs be issued a certification identification number. Previously, it had not been explicit.

Section (f)1A, Non Substantive Application Amendments, require that for non-substantive amendments the ATTCP's must submit an underlined strikethrough copy of the affected application sections, and a clean copy of the entire application. This is to assist Energy Commission Staff in reviewing their application.

That's it. Any questions?

MR. BERNETT: Thank you. Dave Bernett with NEMIC. We are an approved ATTCP. The piece I want to speak on is really on the quality assurance which, as you probably know, surprised anybody here that has dealt with NEMIC.

So when we initially made application and were approved, the quality assurance, the onsite audits was an issue with us from the beginning, that the burden to do this was going to be overwhelming.

So I will submit some strikethroughs and some proposed language, but I wanted to speak on a few pieces.

So when we talk about the quality assurance, we're proposing that we replace the paper and onsite audits and mandate a renewal of the ATT certification every three years. That renewal will be mandating a hands-on assessment in the laboratory settings that will meet the requirements.

So in Paragraph (h) under C3, we would add that the Acceptance Test Technician certification will be valid

for three full years from the last date of the calendar quarter that the candidate is certified. And then, for example, that certification originally issued, let's say May 1st of 2015, would expire June 30th of 2018. So on the certification renewal, the ATTCP will send a notice to that technician no later than 90 days before the cert expires. And at the time that the person is renewing, they must meet all qualifications and requirements for the mandatory initial ATTCP certification.

So renewal, the individual will come into the same lab or a similar lab, one of the labs that were certified or approved by the CEC, and do a full renewal based on the requirements under the CEC.

Our rationale for this is that it takes away from the burden of going jobsite to jobsite. There's liability when you go to jobsite. But also, it's a lot different than what you see. The lighting or the control people, when they do an onsite audit, they have five tests that range probably between a total of 6 hours to 20 hours to complete all five of those tests. For a mechanical technician, that test can go up to 60 hours. And what you're doing as a function test is you're really shutting down the entire building to perform those tests and to do it adequately.

So to eliminate that burden, we're really saying, look, pull those technicians off the site in the fashion

that they should be and renew the certification. But not only that, you're not only doing a renewal of the certification, but you're hitting every single technician that's certified. You're not doing just the individuals that are hitting a certain level of performance and pulling them in for an audit, you're renewing every -- you're looking at every single technician every -- in a three-year period, which I think is more fully -- you're really assessing every technician out there, whether they do one acceptance test per year or in three years, or if they do, you know, 100, 200.

So I think it reaches fuller to what I think we want to do, is make sure that the technicians are qualified doing the work.

MR. MILLER: Will you be submitting this comment in writing?

MR. BERNETT: Yes.

MR. MILLER: Okay.

MR. BERNETT: Yes. So that's -- I'll keep it to that point.

MR. BOZORGCHAMI: So a quick question. This is Payam.

So even if they come and get a recertification test every three years, how do we make sure that they're -- they come and get the recertification done at

your site, no problem, but they go out in the field and do something different than what they're supposed to do here, how do you guys see what's happening out in the field then?

MR. BERNETT: Okay. So this is where we're not clear on exactly what we are doing as far as the certification. Are we certifying the ability of the individual, or are we certifying the results of that equipment in the field? If it's the individual, I can assess the skill ability of that individual in, should be any setting, laboratory or not.

If you're looking for the results of the readings of what they're doing in the field, then you're basically asking me to certify the equipment and the readings that are being gathered in the field. That becomes even more complex because now I'm dealing with changes in the weather, the occupancy of the building. So there's a lot of factors that play into whether or not my readings are going to be the same as that technician. And is that a qualifying or disqualifying factor in his certification, his or her certification? So a lot of that, we need answered, as well, because --

MR. BOZORGCHAMI: The other question I have, you said it's going to take about 6 to 20 hours for, I think it was mechanical, and something, up to 60 hours for lighting -- or the other way around, sorry, for doing a QA. How much

does it -- how long does it -- how much time does it take for an ATT to go out there and do the verification? If the QA takes 6 to 20 hours --

MR. BERNETT: If I walk through each acceptance test, I'm showing there's 17 acceptance tests for a mechanical technician. And that, we're rating that on a high-to-low. I'm saying on the low side, 24 hours, on the high side, 61-and-a-half hours, that's for the mechanical. On the electrical side -- or on the lighting side, you have one, two, three -- you have five acceptance tests, and we're saying they could be performed probably between 6-and-a-half to 19 hours. The mechanical side is far more complex and detailed. Right.

MR. MILLER: Joe or Veronica, do you have any follow-up conversation?

MR. LOYER: Oh, there it goes. This is Joe Loyer, California Energy Commission, Senior Mechanical Engineer.

I think, Dave, you know, as part of this proposal, you're going to be submitting this, you said, in writing, I think one of the aspects of this quality assurance is that we have to really address the intent of the original requirement. And as you said, it really gets right down to what are we trying to do. And Payam brought up -- I think touched on it, but I'm going to just touch on it a little bit harder.

The intent, as I read it, as I read the regulations, as I, you know, as we created them, they were twofold. One is to test the technicians abilities. And I think if you want my personal opinion, I think your proposal serves as well as anything else that I've heard to do exactly that, to test the technicians themselves, their abilities. The other part is to try and make sure, as much as we can, that when technicians go out into the field, they aren't doing things, like, and I'm going to use a common term, pencil whipping, you know, filling out a form in a diner instead of actually going onsite and doing the testing required -- requirements, falsifying tests to, you know, under pressure, say from the building or designer.

So I think in that second part of that, I think that isn't going to be addressed by this proposal, but can be with your current quality assurance process, when we look at the paper audits. I think if we do the paper audits in conjunction with what you're proposing here, I think we do get to that point of saying, you know, whilst we will never, in HERS or the ATTCP world, we will never catch all the cheaters, but we will put enough fear out there and responsible -- and not put too much burden on the responsible members of these two groups that are doing the right job to give everybody the opportunity to make sure that the quality of the product that is still enforced.

So I think when we talk about the quality assurance program, I think we do have to talk in terms of both of these. So with your current paper audit that you did propose in your original application, in conjunction with this three-year renewal proposal, I think that's something the Energy Commission would consider.

MR. BERNETT: I appreciate that. Thank you.

Can I make one comment? I'm backing up.

You had mentioned something about decertification of an ATT. So my question on that is: Can he ever get his certification back? Can that individual ever --

MR. BOZORGCHAMI: Like go on a probation period, maybe?

MR. BERNETT: Or even to retrain? Let's say that they fail the audit and we fail them, and that's part of our proposal, as well, is what do we do with someone that fails an audit? And so when I see it on these slides about decertification, I just want to know if there's a way to -- are they decertified for life, or can they somehow get re-schooled?

MR. LOYER: So I'll respond to that. Decertification is actually an authority we give to the ATTCPs. And all ATTCPs, mechanical, lighting controls, have the authority to decertify any of their technicians. There are a variety of reasons why an ATTCP might recertify a

technician. Most of them are technical in nature. They have been caught in a QA. They refuse to correct their mistakes. There are other reasons, as well. I don't want to go into all the different issues. But when it comes down to it, these modifications that we're proposing here, at least in this particular slide, are about when the ATT actually does make the decision to decertify --

MR. BERNETT: Okay.

MR. LOYER: -- what happens to the ATT? And what we don't want the ATT to be able to do is to then end run that decertification and go to another provider to simply not address their issue.

And the other thing to recall -- remember, as well, is all the ATTCP providers provide this mechanism of granting an ATT the ability to come back into the fold, so to speak, to readdress their issue. So it is up to the ATT to readdress the issues that they have been decertified for.

MR. BERNETT: That helps. Thank you.

MR. STRAIT: This is Peter Strait with the California energy Commission.

Just as some clarifying language in the code, perhaps would we consider specifying that that requirement applies when they have been decertified for professional misconduct, including but not limited to, and add a few examples in that language? Would that be better, or is it

better to leave it open-ended?

MR. LOYER: I would prefer to leave it open-ended.

MR. STRAIT: Okay.

MR. LOYER: Because there are many other reasons why a provider might decertify an ATT. So I definitely prefer to leave that open-ended.

MR. STRAIT: Okay.

MR. WALKER: Chris Walker with Cal SMACNA.

We would like to associate our comments with NEMIC. And we support the proposal for the QA changes for the mechanical programs. Well, we wish we had the lighting controls systems, but mechanical is so much more complicated. And the legal environment of having someone come onto a job site for that long and shutting down buildings, it just creates an impossible barrier.

So we definitely support NEMIC's proposal. We think that it hits on both sides, making sure that the technician is certified and qualified, but is also doing the proper job in the field.

So thank you.

MS. RYMAN: Hi. I'm Amber Ryman, representing NEBB. I also want to comment just on the changes that, obviously, NEMIC has proposed, as well as just what we are up against with this onsite completed random sampling forms being done in the field.

I mean, we all know the logistics of what it's going to take to actually, you know, be able to get back onto the site, that's one major thing. But you have no control over who's touched that system after the technician has left. So you really do not have an opportunity to prove that that technician left it in the same conditions that you have actually -- that they originally set it up as. So that's one major thing, when you are going back to a job site. Obviously, the logistics of getting back and those types of things play into it, of course.

We will also be submitting some strikethroughs on what we see could help in the changes for the 2019 code, too.

MR. LOYER: Thank you, Amber.

MR. BOZORGCHAMI: Please do so. And if you can by August 1st, that would be great. Thank you. August 1st.

MR. STRAIT: This is Peter Strait, again, with the California Energy Commission. I do have one -- so hearing the support for the NEMIC proposal, I do have one question.

The proposed three-year time to retest, is that intentionally coincident with the updates to the building codes, so that when we have an update, they'd be brought back in to kind of overlap that training?

MR. BERNETT: If it does, then it's coincidental, and, yeah, that's exactly why we did it. This is Dave

Bernett with NEMIC.

No. The reason is that we have a certifying body under NEMIC called the International Certification Board. And the way that we do our certifications is that it's a two-year certification, and they have to renew. But they have up to one year to renew, so that really is a three-year certification if you stretch it out. So it really falls right into the scope of how we're already set up and functioning as an entity. But, yeah, that's -- we just followed the scheme that we use with our other certifications.

MR. STRAIT: Okay. Thank you.

MR. LOYER: And that's -- when we get to a point of -- oh, this is Joe Loyer from the Energy Commission.

When we get to the point of actually seeing an application from any of the ATTCPs, we'll be taking into consideration all the ramifications of it. There is not only the quality assurance program to consider and, you know, possible changes to it, but also we have to consider the update requirement that is directly connected to our code. So to a certain extent we would perceive these things as maybe overlapping, but maybe it's just a timing issue so they don't hit one hard upon the other, so the ATTs and ATEs are not burdened with continual, you know, reeducation.

MR. STRAIT: Sure. I should specify, I'm asking

from the perspective simply of thinking ahead to what the underlined strikethrough would look like in code and anticipating what they would submit. So if the intent is to align those two aspects of it in code, just trying to anticipate that.

MR. LOYER: Yeah.

MR. WICHERT: We have a question online.

Mark, I'm going to un-mute you now. Go ahead and state your name and association.

MR. OUELLETTE: Okay. Can you hear me okay, first?

MR. WICHERT: Yes, we can.

MR. OUELLETTE: My name is Mark Ouellette. I'm an administration for the company named (indiscernible), which is one of the ATTCPs for lighting controls. So just three quick comments.

First off, (indiscernible) will also submit comments, and I understand by August 1st, timeline revisions.

And then two, on the quality assurance, we (indiscernible) strongly supports maintaining the current onsite quality assurance requirements for lighting controls, but we also understand that whether it is feasible for lighting controls may or may not be falling on mechanical. We have found that the current requirement to be effective

and feasible, we have done over 125 onsite audits, and we believe that this is a big deterrent to preventing the (indiscernible) dry buy or paper audits that Mr. Loyer discussed earlier, and to actually verify that the tests are being performed onsite. Even though we do strongly support the current QA process, we do, again, (indiscernible) reasonably feasible for lighting controls, but it may not be for mechanical, and so whatever's most feasible for that moving forward.

And then last comment, still the biggest issue for ATTs and ATEs is the lack of enforcement by building officials. Our records still indicate that there are a number of counties where there has been zero compliance with the requirements to use certified acceptance testers. And so we would like to see in the regulations that not only do ATTCPs (indiscernible) that force in the annual reports where acceptance testing is done by counties, I'd also like the AHJ (phonetic) level, so the Commission has identified AHJs that are not enforcing the currently code.

And that's it. Thank you.

MR. BOZORGCHAMI: Mark, this is Payam of the California Energy Commission. Quick question for you.

How many QAs have you done in the past for the first code cycle. (indiscernible)?

MR. OUELLETTE: Well, 125 onsite.

MR. BOZORGCHAMI: A hundred and forty-five onsite?

MR. OUELLETTE: (Indiscernible.) I've done 650 onsite and paper, and 125 of those are onsite.

MR. BOZORGCHAMI: A hundred and twenty-five offsite. Okay.

MR. OUELLETTE: But we've also done over 10,000 not functional tests, projects, actual projects with more than one functional test(indiscernible).

MR. BOZORGCHAMI: And have you found any type of -- has there been a lot of discrepancies with the work that you've seen?

MR. OUELLETTE: Yeah. Really, you do some interesting things in our audits. So we've got a team of auditors that go out that are randomly assigned projects. And so, you know, you seem some things if you (indiscernible) audit a company more than once, given the number, or even the technician more than once, given the number of projects, sometimes there's things that you are surprised by, such as I've seen in instances micropharma (phonetic) occupancy center in a bathroom in a restroom where they play music that never turns off, so we discussed that as not meeting the code. Skylights not on the plans, or identified as a different daylight zone. So you do things that you do have to discuss with technicians on those visits.

MR. BOZORGCHAMI: Thank you.

MR. OUELLETTE: And then also we see (indiscernible) you see some plans where you do question. And even on the paper audits, we still do street views of all the sites and (indiscernible). This could be a daylight zone, then they show us copies of their daylight plans and there were no daylight harvesting in that. So we do see things.

MR. BOZORGCHAMI: Thank you so much.

MR. STRAIT: This is Peter Strait one more time.

I would like to mention, just since there's an opportunity to do so, we are aware of some of the issues with enforcement. We are actually working as one step to help the process on publishing a smart lighting form that will allow a lot of that documentation to be done in a simpler, more streamlined format that's both easier to fill out and easier to review. And after that's been (indiscernible) published, we're going to take some of those same principles and create an automated, smart, mechanical form. So hopefully those two will be available to aid both the work of the ATTs in completing some of these, the ATTs and the people that are completing these forms in doing their part of the job, and the person on the other side of the desk at the building office to do the review work. So we're also working behind the scenes on some of those other

areas where we can make improvement.

MR. WICHERT: We have another online question.

Danny, we're going to go to your next. Go ahead and assoc.

MR. KASONIK: Yeah. Danny Kasonik (phonetic), California State Pipe Trades.

I agree that trying to achieve this one percent infield auditing would be very difficult. So then are we saying that those that we got suspicion of forms that do not appear to be properly filled out, that we can bring them into the lab and test them there if logistically it would be difficult to do in the field?

MR. LOYER: This is Joe Loyer. I just wanted to clarify that, your question, Danny.

So you're saying that if we have a project, an ATT performance an acceptance test out in the field, can we then -- and we're suspicious, you know, acting as the provider, we suspicious of that particular project, we can then bring that project and somehow replicate it in a lab and have that technician be tested on it; is that what you're asking?

MR. KASONIK: Yes. Because sometimes it would be logistically difficult to return either to that jobsite or to another jobsite that this technician may be on and just to confirm that his auditing practices are correct.

MR. LOYER: I don't -- I would just guess, and

it's just my guess, I would just guess that trying to recreate the project in a lab would be fairly difficult to do. I would say it's up to the ATTCPs, the providers, to propose something of that nature. I would think that a pretty good way to go in that regard is if you're concerned about an outside air test, say a Mech 2 (phonetic), that the technician did not perform correctly, that the provider can then look at that and say this guy has performed a couple of these wrong, and maybe he should come in for a quick lab checkup on that particular, but not try to construction site that he's been in. I would say that's a fairly reasonable approach. But, you know, that's up to the providers to actually propose something along those lines. And when it comes down to it, when we do get a proposal from the providers, our job will be to make sure that that proposal is in line with what the current regulations are.

MR. KASONIK: Okay. Thank you.

MR. MILLER: Anything? I think we -- is there a comment?

MR. SCALZO: Michael Scalzo with NLCAA. We're an ATTCP.

With regards to the onsite audits, we actually really prefer those over desk audits. We use those as a mentoring tool, so we found them very useful out in the field. But logistically, you're right, they're very

challenging, trying to schedule and coordinate, plus access on the site. But we do these when the test is actually being performed, as opposed to afterwards.

I actually wanted to read a quick email regarding compliance and code, if you don't mind.

This is regarding a conference call from one of our active ATTs. He also is a lighting designer. I'm sorry, I'm reading an email that I recently sent out.

"Lighting controls manufacturer rep and a lighting distributor rep regarding noncompliant designs. This call was very concerning and it caught me off guard, but I felt I wanted to share it with you today. The main question was the explanation of Section 130.4A as it applies to what controls are required and what gets tested. My response simply was that we test what's installed per the 134 -- 130.4A requirements.

"They also brought up the serious -- they also brought up serious concerns over how they are starting to see more frequently designed plans that are not compliant with the 2006 BEES (phonetic). These have been -- they have been receiving requests not to design the controls to the 2016 BEES, but rather the engineers noncompliant designs. These designs are compliant -- their designs are compliant, are being compared to other projects that are designed, installed and ATT tested that are not compliant and pass AHJ

plan check, AHJ inspection and ATT testing, testing the equipment that has been installed.

"With the removal of the highlighted" -- sorry -- "the highlighted line below, which is line A of the 2013 Standards in 130.4A, ATTs do not enforce compliance anymore of plans and specifications, thus the installations are becoming less compliant on projects. The practice is becoming more common on projects and is undermining the energy conservation requirements, the BEES, the CEC and the ATTCP programs. There is no measure in place as of 2017 to ensure compliant projects are being installed. ATTs only test to 130.4A requirements. AHJs are still relying on the ATTs for enforcement. We are losing ground on compliance and reverting back to pre-2013 designs. There are a handful of testers that are leaving the industry because the functional testing is becoming less needed, and as a testing scope of work on a project is being reduced by the lack of required controls being installed.

"Myself and many others have worked diligently to educate the designers on how to conform to the BEES over the years, and now they are -- and now they -- and now they are" -- I'm sorry, I apologize, I lost the other part of that.

"In closing, they're losing ground on compliance. I am on the ground, seeing these changes over the last five months. Reports and questions coming from ATTs, designers,

manufacturers and developers now revolve around the test requirements and noncompliant designs. It is not uncommon to see a lack of dimming, day lighting or demand-response controls installed. This is reflected by the design or the installer wanting to value engineer the project due to the lack of compliance enforcement by the ATT, and rarely by the AHJ. I feel this impact is bigger than people understand, otherwise it would have been addressed already.

Thank you.

MR. BOZORGCHAMI: Would you be submitting that to docket, please?

MR. SCALZO: Yes, I will.

MR. BOZORGCHAMI: Thank you.

MR. MILLER: Do you have any follow-up to that comment? That was in your area.

MR. LOYER: I feel like we should have a little bit of follow-up to this. And this is an ongoing problem that we are aware of. This is Joe Loyer again.

When the AHJ approves a project plan and has issued the project a permit to construct, the ATT does not have the authority to overrule the AHJ. If the only recourse for the ATT is to inform their client that the design is noncompliant and, you know, let them know, give them the option to either make the project compliant or have the ATT test what has actually been installed and see if it

does pass the acceptance test. If it passes the acceptance test the ATT has no further responsibilities.

There is -- you know, in talking to AHJs, what we had one propose for us to tell the ATTs to do is to inform the AJH that they had made a mistake. I can't really in good conscience tell -- you know, we do give the ATTs the option to do that. But in all good conscience, they would essentially never work in that industry again if they were to become -- you know, turn their clients into the AJH.

I don't know what the solution is for this. This is something that is an ongoing problem with the Energy Commission's standards. Enforcement is always a major issue. We have much in the way of outreach to local AHJs to inform them about compliance, how to do a compliance, and what their responsibilities are. I think this is something that we will be addressing for, as far as I can see, the foreseeable future.

So, Peter, if you have any other further comments to make?

MR. STRAIT: No. I think you summed it up very succinctly, that unfortunately there's that issue where they -- since they can't override what the AHJ says, that language had to be amended for that reason.

Lay Very good.

MR. BOZORGCHAMI: Okay. So --

MR. MILLER: Anything else?

MR. BOZORGCHAMI: -- any more questions?

MR. MILLER: I neglected to include a contact information slide at the end of this presentation, but we'll add it before post it.

MR. BOZORGCHAMI: Yeah. So we'll add that one sheet to the PowerPoint. And all these PowerPoints that you heard today will be posted by tomorrow.

And I think this whole thing is being recorded, and that will also be posted in the near future.

So if there's no more questions or comments, thank you for participating today.

MR. STRAIT: Actually, let me add one clarification.

The notice actually has all the contact information necessary for submitting comments. So you don't need for this presentation to be posted in order to send us commentary. Thank you.

MR. MILLER: Thank you.

(The meeting concluded at 11:59 a.m.)

REPORTER'S CERTIFICATE

I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were reported by me, a certified electronic court reporter and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

And I further certify that I am not of counsel or attorney for either or any of the parties to said hearing nor in any way interested in the outcome of the cause named in said caption.

IN WITNESS WHEREOF, I have hereunto set my hand this 10th day of August, 2017.

_____

Eduwiges Lastra
CER-915

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I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were transcribed by me, a certified transcriber and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

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I certify that the foregoing is a correct transcript, to the best of my ability, from the electronic sound recording of the proceedings in the above-entitled matter.

MARTHA L. NELSON, CERT**367

August 10, 2017