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BEFORE THE
CALIFORNIA ENERGY COMMISSION

In the Matter of:	)	Docket No. 17-BSTD-01
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Pre-Rulemaking Staff Workshop on
2019 Residential Energy Standards

CALIFORNIA ENERGY COMMISSION
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ART ROSENFIELD HEARING ROOM
SACRAMENTO, CALIFORNIA

TUESDAY, JUNE 6, 2017
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Reported by:
Kent Odell

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I N D E X

P R O C E E D I N G S

JUNE 6, 2017 9:16 a.m.

MODERATOR BOZORGCHAMI: I'm going to start. I apologize for being a little bit late. We had some technical issues going on. RJ -- sorry about that. So real quick, some housekeeping rules, items. Restrooms, outside through the two doors to your left. Snack bar upstairs. And in case of an emergency please when we evacuate the building, please meet at the Roosevelt Park across the street and we'll reconvene over there.

Today's discussion is going to be mostly about indoor air quality, and nonresidential exhaust fans and loading docks and systems like that. But first of all, we got to go through some formalities we do every time we have these presentations.

The history of the Energy Commission, how it started by two legislations of Warren Alquist in 1975 under Ronald Reagan, and it was funded by Jerry Brown when he first came into office.

Some of the goals that we have here at the Energy Commission that was set up on us by the governor and legislation. I'm going to go through these slides real quick, because I want to -- we're behind about 15 minutes. I want to try to catch up.

So the other responsibilities that we have here at the Energy Commission, we're looking at permitting power plants 50 megawatts or larger. We're looking at fuels and transportation and our forecasting measures of what's looking for our energy usages.

One of our goals is to avoid power plants and maintaining a reliable, affordable in safety and energy measures, and looking at the lowest cost and the least environmental impact to society. Energy Commission with the staff of its utility partners, develop the standards every three years, and we provide these measures at meetings like this.

But I would like to thank the utility partners that helped out with these measures that we're going to be hearing today. Those would be Pacific Gas and Electric, Southern California Edison, San Diego Gas and Electric, Sacramento Municipal Utility District, Los Angeles Power -- Department of Water and Power, Southern California Public Power Authority, who helped out with the 2019 standards.

And I would also like to thank Heidi Hallenstein and Kelly Cunningham to keep us moving forward and keeping the program moving and helping with the communications between the utilities and the CASE authors and the Energy Commission staff.

As you know, California is divided into 16 climatic zones. It's not -- it's a little bit different than what ASHRAE has. ASHRAE has us as all climate zones three, where you're looking at San Diego being part of climate zone three, and also areas like Stockton being under climate zone three, where we know that doesn't work. So -- for California. So we divided California into 16 climatic zones based on the degree temperatures.

All of our measures have to go through a rigorous life cycle cost analysis based on the current time dependent value. This is based on the energy consumption for every hour of the year. Where we're at right now, this is our tentative time line of how we need to get the 2019 standards moving forward to meet our time that's set on us by the Commissioner and the Building Standards Commission.

Right now, we're in the August 2016 to June 2017 era where we're looking at measures and workshops and doing the pre-rule-makings. The 45-day language will be happening around the December-November time era.

Here's the time line of the discussion topics that we're going to be -- that we've gone through so far and what we're presenting today, Indoor Air Quality Measures, Laboratory Measures and Warehouse Topics are on for today's schedule.

June 20th will be the Nonresidential HVAC

Measures. June 22nd will be the Nonresidential Lighting Measures. June 29th will be the Residential HVAC Measures with one exception. The Small Docked, High Velocity Measure will be presented on July 13th. It'll be the first topic of that day.

July 18th will be our Solar and Storage and the EDR or Energy Design Rating that's going to be happening. And we kept August 30th just in case that we fall behind and we need that date. The case reports, the draft case reports, you could find these on the 2019 Title 24 Utility Sponsor Stakeholders' website.

The Building Energy Efficiency Standards Program is our website here where you could get the notices and see what's happening and what we have in our -- for 2016 standards, where we're at for 2019. Our comments link is below.

For today's meeting please submit your comments by June 23rd, close of business. That's very important for us. And also, at these meetings, the more communications we have from the public, the better at this time, versus trying to have that communication later on, because we need that time to really think about the issues and topics that the public brings to us.

So if you could -- if you have any concerns please, when you come up to the microphone, state your name and your affiliations, and we would like to hear what you have your -- we would like to hear your comments.

Some contact information for our senior staffs, and any questions?

MR. RAYMER: Yeah. Bob Raymer, with CBIA. Could you go back to the dates? I've got a question about the July 29th -- or I'm sorry, June 29th. You've got Residential HVAC listed there. Originally we had that for hospitals.

MODERATOR BOZORGCHAMI: The hospitals are also on 28th.

MR. RAYMER: Okay.

MODERATOR BOZORGCHAMI: But the OSHPOD's having their own internal meeting on the 28th, and so we had to move that down to July 13th.

MR. RAYMER: Okay. Thank you.

MODERATOR BOZORGCHAMI: So with that, I'm going to get the mic to Matt Chalmers. He's with our Legal Counsel Office and he's going to give us a quick presentation.

MR. CHALMERS: Morning, everyone. I'm Matt Chalmers. I'm an attorney here with the Commission, here to briefly discuss CEC's legal authority to regulate indoor air quality. This probably will not last very long, since the law involved here is fairly straightforward.

In short, CEC isn't just authorized, but we are in fact required under California law to address indoor air quality when setting building efficiency standards, and have been for the better part of the past three decades.

So first, I'd like to show you here public -- California Public Resources Code Section 25402.8. Feel free to read this. These slides are also going to be available. But in plain English this, once again, not only authorizes but directly requires the Energy Commission to address indoor air quality when considering building standards.

As you can see, this requirement was enacted in 1988, and this has been a routine consideration at the Energy Commission for decades. We are also required to address indoor air quality by another set of statutes.

This is only slightly more complex. The Commission's authority to promulgate building standards comes from Public Resources Code 25402, as we saw earlier. California law requires the Commission to not focus solely on efficiency.

Instead, we're required to consider and justify the need for building standards on the basis of other factors, such as health and safety. For example, under

California Health and Safety Code Section 8930, note that the Section 18935 referenced above is procedural, which we don't need to worry about here.

Under Section 8930 of the Health and Safety Code we are required to address the public interest. So here, the public interest requires the adoption of our building standards. Now, the public interest is defined immediately afterward as, including, but not limited to, first health and safety, and then if we skip ahead, and consistency with public health statutes and regulations.

So in short, that means we have two likely independent justifications here. The first is that we have to be consistent with health and safety itself, and then we have to be consistent with health and safety statute and regulations.

So that takes us over to California Health and Safety Code 105400. In 1982, the California Legislature declared that the people have a primary interest in indoor air quality and that degrading indoor air quality endangered public health, safety and welfare. You can see that down at the bottom.

The California Legislature then continued onward by noting that we are required to comply with mandatory efforts to protect and enhance the indoor environmental quality in residences, public buildings and offices in the state.

In short, the California Energy Commission is required by law to insure that building standards are consistent with Health and Safety Code 105400 and 105410. And with that, I'm happy to answer any questions.

Okay. And I'm hearing that we have nothing online. So with that, I'm going to turn it back over to Payam.

MODERATOR BOZORGCHAMI: So with that, we're going to have Jeff Miller present the proposal for the Residential Indoor Air Quality requirement.

MR. MILLER: Which controls? How do I go back and forth?

(Pause)

MR. MILLER: Okay. Good morning. Am I broadcasting? Okay. My name's Jeff Miller. I'm an engineer in the Building Standards Office, and I'm going to talk about Residential Indoor Air Quality, the proposals for the 2019 Standards.

I want to acknowledge our case authors, the California Utilities Statewide Codes and Standards Team, Dave Springer and Marian Groebus. Thank you. This is a very high level overview of the slide deck. So for background.

There was a study that was published in 2009 by

Offerman. It was funded by the California Air Resources Board, which studied 105 homes and discovered that nearly all the homes had formaldehyde concentrations exceeding guidelines for cancer and chronic irritation, while 59 percent exceeded guidelines for acute irritations, this very concerning result.

It was known, the results of this research were known in advance of the publishing of the report and were strong motivators to the Energy Commission. The Energy Commission then determined to adopt by reference ASHRAE 62.2, the 2007 version.

That included mandatory mechanical ventilation in newly constructed buildings, and a California amendment was to exclude window operation, because another finding in the Offerman Study was that occupants were not using their windows.

A large percentage of the occupants were not using their windows and yet they had contaminated air they were breathing. MERV 6 air filters were required on space conditioning systems under that standard.

Subsequently, in the 2013 and 2016 updates to the California Title 24, Part 6 adopted a version of ASHRAE 62.2, which was somewhere between the 2010 version and the 2013 version. 62.2 is under constant maintenance. So as each new addenda is approved it's considered to be part of the Standard, the current Standard, even though it's a separate published edition to the Standard.

So that's the version of 62.2, we call it the California version, that we've been using for the 2013 Standards and the 2016 Standards. And that included mandatory HERS verification for the whole building, indoor air quality airflow.

What we're going to consider is adoption of the 2016 Standards for 2019 Title 24. Another study reducing in-home exposure to air pollution, a Singer, Bret Singer study, also funded by Air Resources Board, completed in 2016, evaluated eight combinations of ventilation air cleaning systems for pollutant removal and energy use.

The systems were installed in an unoccupied 2006 house located 800 feet downwind of Interstate 80 in Sacramento. The results demonstrated substantial benefits of high efficiency filtration at reducing air pollutant exposures, but with varying energy costs associated with that.

MERV 13 to MERV 16 filtration on a central forced air system reduced outdoor PM 2.5 by 90 to 97 percent when that system was operated at least 20 minutes each hour or continuously at low speed.

Exhaust ventilation, pulling outdoor air through the envelope, this was a surprising finding. It yielded indoor PM 2.5 levels that were reduced to 70 percent lower than outdoors. It was that ventilation system configuration was performing almost as well -- it was performing actually a little bit better than a supply system with MERV 13 filtration of outdoor air.

The study also determined that deeper air filters was beneficial for system operation and for particulate removal. One of the key changes as compared -- comparing the 2016 version of 62.2 with the current version that we're operating under is the method of calculation of the target airflow rate.

When I do this, yeah, the -- okay. So you can see this cursor. So the current calculation method uses a factor of one percent here times the floor area in determining the airflow rate. In the 2016 version of 62.2 that number is increased to .03.

We actually have this .03 version in our current Standards, as well, along with the infiltration credit at it's -- it's just an optional compliance pathway in our California version. But it's not likely that many people will use it because it's so easy to use just the standard calculation.

So the new methodology eliminates the opportunity to have this default value of one percent times the area of the floor, and instead offers an opportunity to reduce this total indoor air quality airflow requirement according to the amount of infiltration the home has.

And so there's an infiltration calculation, infiltration credit calculation that cannot be more than two-thirds of a reduction of the total air. And so the final value for the target, for the requirement for indoor air quality airflow, QFan, is Qtot minus Q infiltration.

Partial credit is given for horizontally attached, single-family dwellings. Another change is that the 62.2 scope now covers high rise residential dwellings. It's actually a pretty big new item for us to react to.

The intermittent ventilation section of our current 62.2 version has been changed. It's gone and now three sections, variable mechanical ventilation, real time control equivalent ventilation provide options for compliance using alternative system designs or controls.

But 62.2 does not provide any guidance for methods to verify that these systems would comply with the required ventilation airflow rate. So I think that's a challenge for enforcement going forward.

There is a -- I would call it a guideline, a optional blower door methodology for determining dwelling unit air tightness. In the current Standards, in current 62.2, it's -- the target value for compliance is 0.2 CFM per square foot of dwelling envelope area, and that's been loosened to .03.

It was thought that this was more attainable. Also, there's something about gravity barometric dampers, nonpowered, makeup air systems are not allowed for providing compensating outdoor air. It's new for this version of 62.2.

The new calculation methodology for determining the airflow rate calculation using infiltration credit, one of our first considerations was -- seems like this is going to be a mandatory blower door test for every dwelling.

And one of the first amendments that we arrived at was to determine to use a default value so that we could arrive -- so we could know what the value of airflow was in advance of the building being built and, you know, checking the blower door leakage of the dwelling.

Just to give you a sense of what the -- how the values for airflow change based on blower door HCH 50, the tallest light blue bar represents the airflow rate that you would be required to provide if the building was very, very tight, only one HCH 50 blower door result.

The dark red bars represent 5ACH50, which is what our standard design is now in our performance compliance software. And also, it's -- correct me if I'm wrong, anyone, but I think it's considered to be very, very similar to what most new homes attain in terms of envelope tightness. Maybe that's becoming tighter these days.

Also interesting, I think is 7ACH50 is right down close to the maximum that you could be allowed to have for an infiltration credit. So this is the one-story, what a one-story looks like. There's the two-story. It has a little different shape, but same tendencies.

I'll do just a high level overview of the proposed Code changes, then go back through them again in a little more detail. Probably could have done a once-through, but that's the way it's going to go.

The scope is new-constructed buildings, additions greater than 1,000 feet, single-family, low rise multi-family, high rise multi-family is new, and altered components and existing buildings have always been required to comply with the standard.

So the new 62.2 2016 California amendments, the, amend the method of calculation for dwelling unit mechanical ventilation rate. They use a default value of 2ACH50 for calculation of infiltration credit for determining required dwelling ventilation rate for all dwellings.

No blower door test required for almost all dwellings. There was an exception. There's an increased air filter efficiency from MERV 6 to MERV 13, and a requirement for two inter-depth filter grills to be installed.

We are also going to require air filtration for supply ventilation systems and the supply side of balanced ventilation systems. And just to note, the air filter requirement currently applies only to ducted space conditioning systems.

For multi-family dwellings, they may comply -- they may only use balanced ventilation or there's a requirement for HERS verified dwelling enclosure ceiling if they use unbalanced. We're adding a HERS verification to insure that a kitchen range hood is HVI certified.

And for a high rise multi-family there's the scope change from 62.1 to 62.2, which will result in a reduction to the mechanical ventilation airflow rate for those dwellings, and we'll be asking for HERS verification of the central ventilation duct shaft if the building has that type of system, seal it to less than or equal to six percent of the total system airflow, and also, to balance the system so that the required amount of airflow is being provided to each of the dwellings. And that airflow should be greater than or equal to the 62.2 minimum.

I think it's important to emphasize that for calculating the infiltration credit, which requires a blower door test, we have two different, very similar reasons for doing a blower door test of a dwelling. One -- and we're going to decouple those two reasons, those two uses of a blower door test.

So for energy efficiency credit we have a blower door test that's required if you claim that you can have a tighter envelope higher than the standard 5ACH50. So a blower door test would be required for that.

And it's very easy to think that a blower door test that's done for that measure would also be used to calculate the infiltration credit, but it's not the way we have it structured. We have them decoupled, separated.

So we will use a default value of 2ACH50 to determine the indoor air quality airflow rate for almost all buildings. The only exception would be is if the building is actually claiming credit for tightness below 2ACH50. Then in that case the indoor air quality airflow rate will be based on the proposed air leakage for the dwelling.

The infiltration credit is not allowed for multi-family dwellings. No change in that. And this is just another expression of another way of describing what the IAQ airflow rate calculations would look like.

The flat line shows that that's a straight use of 2ACH50 till you get down to two, and then when you propose less than 2ACH50 then the infiltration credit becomes smaller and the mechanical ventilation airflow rate that is required gets larger.

And that's a profile for the values for each climate zone, based on 2ACH50. So since the calculation uses not only the building envelope leakage, but also weather data, that's what accounts for the variation from climate zone to climate zone.

And I don't know if we've determined whether we're going to use climate zones or weather stations. I don't have an answer to that, Bruce, and I don't know if it's been decided. Okay. So now, the filtrate efficiency topic.

So goals to reduce dwelling indoor particulate matter concentrations due to both indoor and outdoor contaminant sources. California has one of the most serious particulate pollution problems among the states, human caused emissions, mainly vehicles, windblown particulates from roadways, deserts and agricultural operations.

PM10 contamination affects almost all areas of the state. PM2.5 contamination is more concentrated near busy roadways in the Central Valley and metropolitan areas. Kitchen ranges are also a major source of PM2.5.

So our proposed requirement for air filter efficiency is to require MERV 13 air filtration on ducted space conditioning systems. Currently, the requirement is MERV 6. Additionally, proposing to require MERV 13 air filtration on supply ventilation systems and on the supply side of balanced ventilation system. That's a new requirement.

There are considerations that people are going to want to discuss about this proposal. So central fan run time is limited to calls for space conditioning, and thus, it limits the amount of time devoted to air filtration.

MERV 13 filters may impose approximately five percent higher pressure drops for equivalent filter face area sizes. So attention to proper filter grill sizing is necessary during the system design and installation.

A two-inch depth filter grill is proposed. Increased HVAC filter replacement costs will be an issue. Increased cost for installation of the two-inch filter grill and Title 20 labeling requirement for effective date has been postponed until 2019.

However, some filter manufacturers have already begun complying with the labeling requirement which provides the performance information needed to do the design work for the systems, the pressure drop information.

I thought to just share some graphics here to highlight some of the challenges faced by multi-family dwellings. Infiltration in a single-family dwelling is easily used for indoor air quality purposes, but the same is not true for a multi-family building.

Multi-family dwellings within a multi-family building leak across party walls, and that presents a problem for -- a variety of challenges arise from that, and it makes exhaust ventilation a questionable way of accomplishing indoor air quality in these dwellings.

So stack effect is one aspect of a multi-family building that is worth paying attention to. Hot air rises, and thus, airflow will rise up through ceilings and floors between dwellings and will create the higher pressures in the higher levels of the building and lower pressures in the lower level of the building.

But this is again an expression of airflow from dwelling to dwelling within a multi-family building. Wind effect causes higher pressures on one side of the building than the other, forcing air to flow through holes in the walls in these dwellings and distribute air between the dwellings, transfer air between the dwellings.

Also, mechanical systems provide pressure differentials that drive air transfer between dwellings in multi-family buildings. So compartmentalization is a word that I've been hearing a lot this year.

And in multi-family, compartmentalization is desirable, and so it's an expression of how well sealed the dwellings are. And well, I'll just launch into these bullets. Multi-family dwelling envelope ceiling for building.

Energy efficiency is mainly concerned with infiltration air leakage to the outside of the building, emphasizing leakage to outside. California Title 24 Building Energy Efficiency Standards currently does not require multi-family buildings or dwellings to comply with a blower door verification to limit building envelope leakage.

Many states require compliance with the IECC blower door performance metric, 3ACH50 or 5ACH50, depending on the climate zone. California Title 24, these -- currently does not offer energy efficiency credit for multi-family buildings for reduced infiltration air leakage.

The issue here is we really don't have a reliable metric for determining the leakage to outside in a multi-family dwellings. Blower door testing of individual multi-family dwellings units determines leakage that is a combination of leakage to outside the building and leakage to adjoining dwelling units through the floor, ceiling and walls. It's transfer air.

Transfer air can transmit pollutants between dwellings, so as to adversely affect indoor air quality. Unbalanced, that is, supply only or exhaust only ventilation systems may create pressure differences between dwellings and thus increase the transfer airflow between the dwellings.

A balanced ventilation system minimizes pressure differences in the dwelling due to the ventilation airflows. Title 24, Part 6, Section 110.7 general requires sealing of the building envelope, but does not specifically require sealing to limit air leakage between dwellings.

That's the transfer air in multi-family buildings. However, ASHRAE 62.2, 2016 version, Section 6.1 requires sealing of partition walls between multi-family dwellings. So it's a mandatory requirement and has been.

So these are the proposed requirements for all multi-family dwellings, and so compliance with either Option A or Option A is required for compliance with the dwelling unit ventilation airflow rate requirement.

And Section 4 of ASHRAE 62.2, 2016 with

California Amendments Option A, allow use of unbalanced ventilation systems, and that would be exhaust only or supply only, with passive makeup or relief air vents only if a HERS blower door test verifies that the dwelling unit envelope leakage is less than 0.30 CFM 50 per square foot of dwelling envelope area, using the procedure in ASHRAE 62.2.

Option B would be to require use of a balanced ventilation system, and that could be an HRV, ERV or a paired standalone supply and standalone exhaust system. Could also be a balanced multi-family building central system.

Additional guidance for best practices to assist with improved compartmentalization ceiling will be provided in the Residential Compliance Manual. And I don't think I want to mention -- there's a new procedure that is applying the aero sealing method that has been applied to ducts previously, but is being used successfully in multi-family buildings and is making it possible to tighten these dwellings down to a very, very, very low level, very, very tight.

Here's some graphics that show some variations on multi-family building system types. This is a supply only system, a single fan providing air to three dwellings at a time. Over here, this is a balanced multi-family building central system.

For the case that the building has a central exhaust system on the roof with a shaft, balancing of that system is important, as displayed in these graphics. Without balancing, without some method of balancing, the air flow to the dwellings or from the dwellings would be much greater closest to the fan and higher up in the building.

With some kind of regulating device on each of those air inlets, could be self-regulating, could be manual, the amount of air being exhausted from each of the dwellings can be made to be very much the same in all dwellings, which is desirable.

So our requirements, our proposed requirements for multi-family building central ventilation systems require HERS or ATT verification of sealed ventilation shafts or ducts to make less than or equal to six percent of the total system airflow.

Also, HERS or ATT verification of ventilation system air balance. So all dwelling unit ventilation airflows are expected to be greater than or equal to the required dwelling unit rate, but not more than 10 percent greater than the required dwelling unit rate.

And the method of balance is optional. Methods such as constant air regulation devices or orifice plates may be used in conjunction with variable frequency drive controlled central fans. We've compiled a few references that we believe are supportive of our proposals.

I'm not going to spend time with them, but we anticipate that you'll want to get a copy of the presentation and study it further, and you can acquire those references. Kitchen range hood topic. Many studies have reported substantial emission rates of pollutants from cooking.

Cooking associated with pollutants include fine particulate matter. That's PM2.5, PM10, ultrafine particles, PAH -- I ducked that one -- various volatile, organic compounds; high operating noise levels discourage range hood use, we've heard.

And range hood capture efficiency is not yet regulated for residential products. However, an AST and standard method of test is in development for residential products. And it's worth also noting that by contrast, commercial hoods are required to have a very high capture efficiency, approaching 100 percent effectiveness is expected for commercial hoods.

In 2008, 2013 and 2016 Title 24 Building Energy Efficiency Standards adopted ASHRAE 62.2 requirements for use of HVI certified kitchen range hoods rated to provide 100 CFM at three sone. Energy Commission staff has the understanding that the required HVI certification for 100 CFM at three sone is often not enforced, and there are currently no over-the-range microwave combination kitchen hood products certified through HVI.

The graphic is just expressing the concept of capture efficiency. So if 100 percent represents all of the pollutants that are generated by the cooking and the combustion at the range, if the exhaust hood over the range pulls 40 percent, and that means that 60 percent of the pollutants are being generated and distributed into the dwelling.

What would be desirable is for 100 percent of the pollutants to be exhausted and to not enter the dwelling. So our proposed requirements for range hoods, and from ASHRAE 62 2016, for an enclosed kitchen, a 100 CFM range hood or 100 CFM downdraft, vented to outdoors, or five ACH continuous exhaust.

For a non-enclosed kitchen, a 100 CFM range hood vented to outdoors, and all range hood exhaust fans less than three sones unless the minimum's feed on the fan is greater than 400 CFM. The proposed enforcement measure is HERS verification that the hood is HVI certified to meet 100 CFM and three sone.

And so it would involve for HERS Rater, matching the installed range hood's model number with that model's listed performance in the HVI directory. I've compiled some references to -- that describe the cooking hazards that we're concerned about, that we believe are supportive of our proposals, and references that describe efforts to characterize capture efficiency.

So the remainder of the slide that will be very similar to what you've already seen during the stakeholder meetings, and I'll go through it really quick -- I didn't even keep the track. Am I up beyond half-hour yet? Oh, yeah? Okay.

So there'd be a larger ventilation fan call for single-family homes due to the larger airflow requirement. And I think that all of our costs are -- probably we'll, as we work with this, we'll understand the costs better.

So I would characterize the cost information that I'll describe today as preliminary in estimates unless Dave or Marian disagree. So -- sorry. We thought $10 an incremental cost for the larger fans. For kitchen range hoods, those combinations that meet 62 airflow and noise requirements may not be available.

So additional costs for HERS verification is another challenge. And so resolutions, possible resolutions. Consider installation of a combination microwave oven instead of microwave range hood. And urge manufacturers to certify their products to HVI.

The extra cost for the higher MERV filter, if we're talking about one-inch deep filters the cost may be less than $4. If the expectation is that the filter will be two inches deep, which we're not requiring, we're requiring two-inch filter grills, but if the filter is a two-inch filter, that filter will be more expensive.

And I don't have an estimate on the extra cost for that. But we are requiring two-inch deep filter grills to be installed and there'll be an extra cost associated with that, and I'll have a value in a later slide for that.

We anticipate builders might resist the higher costs of many of the ventilation air and compartmentalizations, sealing requirements and so what we offer as a resolution is consider that units that are advertised as having cleaner, healthier air may have a higher market value.

And for sealing, utilize the same sealing contractors and strategies for sealing partition walls as currently used for sealing exterior walls, and this may provide an economy of scale for cost reductions.

Compliance and enforcement. Do I need to go through these again, I wonder? Generally, design phase, we create the CF1Rs, the -- I'm trying to -- I don't think I want to read all these bullets. So we'll generate a

CF1R on the design phase and submit it to the Building Department.

And the compliance process in the construction phase is to install equipment that complies with the requirements. Verification phase in residential units -- had a little message pop up there -- in residential uses, verify dwelling unit IAQ ventilation airflow per current practice and verify range hoods are HVI certified.

Multi-family dwellings, verify compliance with less than 0.3 CFM per square foot if unbalanced ventilation is being used. Otherwise, verify central shaft ventilation leakage less than six percent if that's applicable.

And who will perform the tests? HERS Raters would continue to do these tests in low rise buildings, and we might discuss who performs the tests in high rise buildings. For high rise, residential dwellings we're as a starting point suggesting that a HERS Rater would do that because it's very similar to a single family dwelling.

Barriers to compliance and enforcement, verification of kitchen range hoods, how's performance information obtained. We imagine the HERS Rater can carry a directory, HVI Directory or be connected to the directory wirelessly.

Testing and verification of multi-family central ventilation ducts, fans and outside air provisions. Who tests and verifies? We can discuss this further, but as a starting point we still are of the opinion that HERS Raters can do these tests. However, ATTs may wish to do the work.

So cost impacts. The baseline conditions are the same as reported during the stakeholder meetings as other proposed conditions, and with a variable being that the indoor air quality compliance is to the new 62.2 Standards and California amendments.

Incremental costs for single-family, electric fans, $8, kitchen hood compliance, estimate $50 for their verification and the increased MERV rating for air filters includes increase in the filter grill costs, estimated at 117 for that; so a total 175, single-family dwellings.

This is a really busy slide of incremental costs for a multi-family. For single ventilation fans, the same incremental costs. For MERV rating increase, 117, same as before. For high rise ventilation strategies we have two categories; two for the dwelling units and two for the building, central.

So for dwelling unit unbalanced, estimate $57 for sealing, which really is a cost that should be considered part of the mandatory requirements and perhaps not an incremental cost, I was thinking, but the HERS lowered R test we estimate $200 for the multi-family dwelling.

The balanced system alternative, the equipment may be quite expensive. For a heat recovery ventilation system some estimates that I've seen are between 945 and $1600. But systems that utilize standalone exhaust paired with standalone supply, I don't have an estimate for that, but those costs are likely to be much less.

So for the multi-family building central exhaust, there would be still be partition sealing, central exhaust, shaft duct sealing, makeup air vents, exhaust airflow balancing, and so the estimate for all of those lumped together are 563.

And we need to generate a similar estimate for multi-family building, central balanced systems. We haven't done that yet. The energy impact of ventilation rate changes is shown in this graph. The gray line is the -- corresponds to the percent change on the right column.

It's interesting I think that in one climate zone there's an energy improvement. But for the most part it's -- what do you think the median is, Dave, is about three or four, something like that?

MR. SPRINGER: That's about right.

MR. MILLER: Okay. This is an extract from a report from Western Cooling Efficiency Center that did central shaft sealing and some Energy Plus modeling, and determined some savings that are available for sealing those exhaust shafts. So that's one part of our proposal that is an energy savings feature.

Benefit to cost ratios are not being performed for indoor air quality measures. We are expected to report the energy impacts, the indoor air quality impacts and what's the third item. Think of it later.

So the energy savings, neutral or negative, except for multi-family building shaft sealing, CBECC analysis used 2019 case measures, other than these IAQ proposals, including assumed use of 62.2 2016 ventilation rates and the California amendments.

Any energy penalty for increased ventilation airflow rate included in the benefit cost calculations of other 2019 case measures included these features that we've just talked about. And this is a Table of Values. So I'm at the end of my talk here.

These are Web resources, and here's contact information. Feel free to contact me if you want to talk about these things. I kept that picture. I liked it. Okay. So are we going to do questions now? Okay.

How -- what's the format? So anyone in the audience have a question that they want to step up to the mic and speak to us.

MR. RAYMER: Bob Raymer with CBIA. We're just seeing this for the first time. So we're going to need some time to absorb it, and I'm assuming you'd want comments back in, what, two to three weeks?

MODERATOR BOZORGCHAMI: Yeah, hi. This is Payam. June 23rd is what we want comments back for today's meeting.

MR. RAYMER: Okay. Just, once again, we'd like to give you some comments now, but I'm having a hard time understanding the actual cost impacts and whatnot. I can tell you the assumption that, for particularly multi-family, that the renter may give extra credit or extra desire to rent a unit with this as opposed to one not.

This is going to be way down the line of the decision-making things that happen. Unfortunately, as you're probably well aware, we're having a massive affordability problem, particularly in rental stock these days.

And it would be nice to have a lot of new units coming online, but that's not really the case. So I don't know if that's going to fall into this. Another issue that I had as you were making the presentation, we've found through your testing that the occupants aren't opening the windows like we had assumed they were back in the '80s and '90s.

Are we assuming that they're going to be keeping the air filters clean, you know, doing that every four to six months? So that would be something else that we don't know if that's happening. Once again, we'll get comments.

MR. MILLER: All right.

MR. STONE: Nehemiah Stone, Stone Energy. A couple things. This looks like really good work and I'm glad to see that we're paying a little more attention to air quality. I think also, though, that it's time to start thinking about actually guaranteeing good air quality, rather than guaranteeing that you meet ASHRAE 62.2.

If the -- and there's going to be a lot of cases where you can meet 62.2 and you're still not getting good air quality. And so if we had systems where the air quality was being sampled and the ventilation was appropriate to whatever moisture conditions or CO, CO_2, particulate matter, whatever, was controlled on that basis, we would have -- we could get better indoor air quality for people.

The other thing related to what Bob said. I'd like to remind you that in the last Standards update the UCLA Anderson Center did an analysis showing that increased cost of construction has absolutely nothing to do with housing affordability, that if FDIA were to say that you're hurting the profits of builders by adding costs, that would be honest.

Saying that we're hurting affordability is not. There's a -- I would encourage people to go back and read that study that's in the record supporting the 2016 Standards. Thank you.

MR. HODGSON: Jeff, a couple questions. Mike Hodgson with Consol. You quoted the Offerman Study back in 2009 that showed formaldehyde was in residential construction.

MR. MILLER: Yes.

MR. HODGSON: And that kind of what triggered the requirement for ASHRAE 62.2.

MR. MILLER: Yes.

MR. HODGSON: So are there studies on the record that have shown that ASHRAE 62.2 has reduced the issue of formaldehyde in new construction or does it still exist?

MR. MILLER: I think it's being studied right now again. The LBL is studying that again. I don't think they're finished.

MR. HODGSON: I'm sorry. It's -- I know LBL's studying it, but is there anything on the record that says it works?

MR. MILLER: I can't answer that. I can

investigate and respond --

MR. HODGSON: I think it's interesting that --

MR. MILLER: -- at a later time.

MR. HODGSON: Right -- we're kind of moving down this road that I'm sure ventilation is incredibly important and we're doing it for a reason, but we don't know whether that reason really works. So be good for getting studies on the record --

MR. MILLER: Right.

MR. HODGSON: -- to say ASHRAE 62.2 works and as we improve it, this is what we're going after.

MR. MILLER: I think Dave did present a slide at the stakeholder meeting that provided some preliminary results from this kind of study that LBL is conducting, and it showed that most of the homes were in fact meeting the -- they were meeting the airflow rate, but I don't know if --

MR. HODGSON: Are they meeting the formaldehyde -- are they reducing formaldehyde in households?

MR. MILLER: I don't know about the formaldehyde part, yeah.

MR. HODGSON: Okay. So I mean, that's the kind of stuff that would be more practical if we talked about.

MS. GROEBUS: Sure. This is Marian Groebus. It's a good question. I know that the Home Study is studying that, and I know one problem that they're having, actually, is trying to -- since they have different methods compared to what the Offerman Study did that I know that the results are not comparable.

I know some of the preliminary findings were that formaldehyde continues to be an issue, but that was just on I think those preliminary studies based on just a few homes. So I think we have to wait until the Home Study is published and all the data is in. But yeah, I agree it's better to look at the IAQ impacts.

MR. HODGSON: Right. I'm wondering if we should kind of wait on additional IAQ requirements until we actually understand the impacts, too. So I mean, this is kind of an issue of, you know, we're regulating before we know what the answer is.

MR. SPRINGER: If you drill down into the data from the Offerman Study you do see a correlation between ventilation rate, measured ventilation rate and formaldehyde concentration.

MR. HODGSON: Yeah. So those are the kind of studies that we need to -- or comments that we need to have on the record, since we're kind of in a defensive position in the building industry, trying to defend against indoor air quality and issues of indoor air quality.

So anyway, I would encourage that. If the Energy Commission was to promote indoor air quality, then they should actually have studies that say what they're doing works. Second thing is, on multi-family you're proposing a lot of regulations on sealing multi-family.

And from the HERS industry we've had a lot of issues with trying to get air tightness in multi-family. So do you have examples on how to seal a central shaft in a high rise building for $563?

MR. MILLER: You mean case studies?

MR. HODGSON: Case studies or can you just show us, you know, exactly what you did to do that? How long did it take? How did you do the blower door? What equipment did you use? I mean, if you're doing blower doors in high rise, I have no idea what you're doing.

MS. GROEBUS: I'll just parse out, I guess, two different things. So I think there was the -- I mean, the sealing the shafts is a different -- that's the central exhaust shafts and that's a different measure from sealing the actual unit.

So we help provide the blower door estimate so that's sealing the individual -- that's testing of the individual units, and that we heard was about $200 and maybe up to 250 or 300 if it's a small number of units and in larger units --

MR. HODGSON: But you sealed all the party walls inside and out?

MS. GROEBUS: That is not for the sealing. That is for the test. That's for the blower door test.

MR. HODGSON: Okay. So how did you seal the party walls?

MS. GROEBUS: The party walls is, you know, sealing at the interfaces between baseboard and the walls, around electrical outlets, around all of the electrical penetrations, plumbing penetrations, and the estimate to seal those party walls, we did not provide the estimate for that.

So I'll have to go back to the Energy Commission. I can only provide you with, you know, where we got the blower door results, and that was from interviewing some -- sorry -- the blower door costs were from interviewing some Raters.

MR. HODGSON: So most of our experience doing multi-family is in low rise residential, and Nehemiah, you can probably add comments to this, but it's very difficult to seal up a multi-family building.

And so I'm just going to comment more on the multi-family side and trying to seal party walls and getting that done. Basically, from the compliance side the industry has said, we can't do this so we're not going to take credit. So we move on, right?

So that's one of the things, if you're thinking that sealing a single-family unit is, you know, $200 for the test, that's great. I'm not arguing with that cost. But sealing the unit's going to be difficult and it's going to be costly.

So I'd like to see how you did it and what the results of how you do it. Then when you move to a high rise building and you're talking about shafts, especially central shafts would have a lot of equipment in them, I'm very curious on how you're going to seal those, because I don't think it's possible to do.

I shouldn't say it's not possible. It's not reasonable to do. So if you have examples on how you do that, great. That's on how the actual physical sealing's going to happen, then show me how you're going to test that.

And I don't know who tests that and I don't know what equipment you use to test that, because the equipment in the field that we use for multi-family does not allow us to go to that large of a volume.

MS. GROEBUS: I do want to respond to the comment about at least sealing the individual unit.

MR. HODGSON: Um-hum.

MS. GROEBUS: And that has been part of the

Energy Star High Rise Program and the LEED for Homes Midrise Program and the LEED essentially -- LEED new construction when it's applied to high rise. Those programs have all required that individual blower door test that Jeff proposed, the .3 CFM50 --

MR. HODGSON: Have they been in the California market with the sprinkler?

MS. GROEBUS: That has been in the California market, yeah.

MR. HODGSON: With sprinklers?

MS. GROEBUS: I mean, there's a certainly a lot of homes that -- or multi-family units that have been certified under Energy Star High Rise or LEED for Homes Midrise in the California market.

MR. HODGSON: With sprinklers?

MS. GROEBUS: I can't say yes or no in terms of sprinklers, but I would assume that if sprinklers are required for Fire Code --

MR. HODGSON: They are.

MS. GROEBUS -- and they -- okay -- then yes, there are multi-family buildings that have been certified under those programs, and those have required those -- that blower door test for several years.

I worked on the LEED for Homes Program starting in 2010, and that requirement was put in, in 2010 for the

Midrise Program. So it's been --

MR. HODGSON: Right.

MS. GROEBUS: -- been there for a while.

MR. HODGSON: So the sprinkler requirement, Bob, is 13. When did sprinklers go into --

MR. RAYMER: For single-family it went into effect in 2011. For multi-family it went into effect in 1988.

MR. HODGSON: Okay. So that's the question, is -- I mean, and we'd just like to see examples, because we have -- I'm sure it's possible to do, but it seems to be very difficult to do.

MR. MILLER: So, um, Bret Singer is on the phone, and Bret, did you want to speak? Speak up.

MR. SINGER: Am I unmuted yet?

MR. MILLER: Yes.

MODERATOR BOZORGCHAMI: Yes, we can hear you.

MR. SINGER: Oh, good. Okay. I was just looking at the muted/unmute. Just one small correction. We will be able to compare the formaldehyde measurements that we are obtaining in the HNGH Study, the Healthy New Gas Homes Study with results of that Offerman Study, and so far the one caveat to all these comparisons is we have to make that adjustment for air exchange rate.

So I think as a group we're seeing lower air exchange rates than Bindit (phonetic) saw. We saw a much wider band, including some very low ones in the high formaldehyde that didn't have mechanical ventilation.

Though ours are kind of in a narrower band, there's a couple that are -- we're making sure that the ventilation system's operating in all the homes, but we're still analyzing that data. We only have data processed from about 15 homes.

We've got about another half-dozen completed that we're still processing the data and we're looking at the context of the actual air exchange rate to be able to make those comparisons. So I know it's frustrating.

We had intended to be -- have that data by now, but it was a field study with lots of complications that pushed the schedule back. So we're racing as fast as we can to get that data in.

MODERATOR BOZORGCHAMI: Question. Do you -- Bret, do you know when that study will be completed?

MR. SINGER: Yeah. The data collection should be completed at the end of this calendar year. And we are trying our best to process and analyze the data as they come in. So the -- at least the preliminary results with all the data for something like formaldehyde we expect to be completed shortly thereafter. So it may be the first quarter of 2018.

And you know, we're putting out interim results as we have them, but right now, at least as to the formaldehyde, we have the actual measurements for the first 16 houses, but the processing of the air exchange rate, you know, that type of question is much more complicated and we're still kind of verifying that.

MR. MILLER: Thanks, Bret.

MR. TUCK: Hi. Bob Tuck, with Atlas Heating and Air-Conditioning in Oakland. I also am associated with Cal SMACMA and serve on the National Steering Council for Residential Contractors for National SMACMA.

Question on the kitchen hood vent ventilation verification, first of all. I think it was mentioned that the HERS verification would not be required for -- of sone rating would not be required for hoods over 400 CFM.

MR. MILLER: That's if the lowest speed for the hood is greater than 400. That would make it something more than the usual residential size system.

MR. TUCK: Right. So there'd be no HERS verification of sone rating for those higher airflow kitchen hoods.

MR. MILLER: Correct. But I believe we would still expect the kitchen to comply with a range hood that could operate greater than 100 CFM, and less than three sone.

MR. TUCK: Okay. So just one observation on that. Many of the newer homes, single-family, are using hood combinations with an indoor hood and the fan on the exterior, and I don't believe you're going to find any manufacturer sone ratings that would allow even an HVI verification on a sticker that would allow the HERS Rater to come in and verify sone ratings of not to exceed three when you have that combination, which is pretty common these days.

You've got an exterior blower that may or may not have a rating on it, and you have a hood shell with a grease filter and controls that will have no rating because it doesn't have an interior blower. So you'll have to kind of figure out that little snafu before you go to that level.

And I think it was also mentioned that for makeup air. Is that MERV 13 filter rating going to apply for kitchen hood ventilation makeup air also, aside from the whole house ventilation?

MR. MILLER: Not that I am aware. We're talking about ventilation fans, not makeup air.

MR. TUCK: Okay.

MR. MILLER: Though makeup air is --

MR. TUCK: So I thought there was a mention there that the MERV 13 was going to be required on makeup air on supply ventilation.

MR. MILLER: On, yeah, supply ventilation and the supply side of balance --

MR. TUCK: Okay. Not makeup. Okay.

MR. WILCOX: I think that the requirement for that are --

MR. MILLER: Microphone's not on, Bruce.

MR. WILCOX: I think the higher filtration is required on whole house continuous ventilation systems, not on kitchen ranges.

MR. MILLER: Right. He was just asking --

MR. TUCK: Not on makeup air for a large kitchen hood exhaust.

MR. WILCOX: (inaudible).

MR. TUCK: Okay, because that would be a problem. Moving to the MERV 13 requirement for low rise residential, certainly that may happen, eventually trickle down to alterations and replacement of equipment.

But currently, that's only going to apply to new construction, low rise residential and high rise multi-family. And then alterations adding more than 1,000 square feet, but not on change-out of equipment, change-out in residential?

MR. MILLER: Correct. Well, the filter requirement is applicable only to newly constructed buildings. For alterations, the way the language is written it's when you replace a piece of equipment, the item that you replace must meet the current Code.

And so I guess, you know, you could make the argument that if you replace the air filter it's got to be a MERV 13. I don't think that's what we intended.

MR. TUCK: Okay.

MR. MILLER: Or would intend, but -- so that's the answer I have for right now.

MR. TUCK: Because on retrofit in the industry that would be a pretty big problem, because maybe 80 percent of the installations currently out there because of the fact that furnaces are often in the attic or the crawl space in California, the builders put filter grills in.

And most of the filter grills from the '60s, '70s, '80s, '90s and even more recently are badly undersized. So if on the retrofit you're required to go to MERV 13 your system performance is really going to get hurt. We've already got an undersized filter grill and you throw a -- especially a one-inch MERV 13 in there, it could have a lot more than the five percent maximum as to the methods you've got in your literature right now.

MR. SPRINGER: I think the way we've been thinking about it is that replacement of equipment and ducting would trigger that requirement, but --

MR. TUCK: Yeah. Yeah. So still going to be an issue because a lot of these return airs that are going to filter grills, they're not all accessible. So upsizing the ducting and upsizing the filter grill, just something to look out for.

And I think that's about it from the practical viewpoint of a contractor. We deal with maybe 600 change-outs a year and do a lot of high-end remodel work, which would be over 1,000 square feet of additional square footage to a single-family home, and which all of these would be triggered by that, also. Okay. Thank you.

MR. MILLER: We're going to go to some online questions. I'm going to call on Mr. Roy first. Go ahead when you're ready.

MR. ROY: Yes. Hello. Can you hear me?

MR. MILLER: Yes, we can.

MR. ROY: Okay. Fantastic. So I have a question. I'm still going through the entire case report on the residential indoor air quality, but one of the sentences in there says, "A requirement for higher efficiency filters may increase the difficulty of obtaining a lower efficacy."

I know that in the past during the Title 24 stakeholder workshop meetings .4 watch per CFM has been considered and will probably be discussed at some point during these pre-rule-making workshops. Has the impact of the higher MERV proposal here been evaluated on the fan efficacy, even the current .058 watts per CFM requirement, to see if there is an adverse impact there?

MR. MILLER: I think the best answer is that the way the requirements for filter sizing are described in the Standards, the expectation is that you would know the filter -- characteristics of the filter and design your system to accommodate that.

And so I think, really, it's not part of that argument. Another question would be whether the .4 is the right number, which I think is an entirely different discussion. I couldn't really speak to that at this time.

MR. SPRINGER: Yeah. The current number we're proposing is .45, which is based on testing of two typical furnaces with ECM motors that came in at or a little below .4, at .7 inches external static pressure. So I think .45 is a comfortable number, and Jeff, I support your comment that, you know, it's about filter sizing. That's the main issue.

MR. MILLER: Okay. Could --

MR. SPRINGER: This is Dave Springer.

MR. TUCK: Bob Tuck again. If I could just jump in on this on the high rise application for the MERV 13 filters. I forgot to mention that currently, in one of the more common equipment combinations in high-rise residential would be in many cases multiple small air handlers, either water source heat pump or other on these high rise buildings.

Very often, they use the plenum above a drop ceiling as the return air without duct work. And the air handler itself is designed -- most these air handlers are designed only for a one-inch filter. So you're going to run into this fan efficacy issue on the high rise, because these air handlers can't overcome a whole lot of static and you can't move up to a two-inch filter, which would pretty much take care of that problem, I think in most cases, if you go to a two-inch pleated filter.

But you don't have that ability in the marketplace right now in many of these equipment combinations. You're stuck with a one-inch filter. You've got a pretty low fan performance and you're going to ask them to go to MERV 13. I think you're going to butt heads, again, well beyond the system, you know, affect than you've estimated.

MR. SPRINGER: This is Dave Springer. So you don't believe that there's adequate service area, then, in those situations to provide filtration?

MR. TUCK: In many cases you're limited by the manufactured rack that is part of the air handler itself. It's going to take an x size filter that's going to slide in there, and you don't have, a, a lot of room, and you don't have a ducted system where you could transition to a larger filter size and then back to your return duct work.

It's just either a rack right in the face of that air handler as you open up the closet or cabinet, or in a home situation, or up flow, down flow or a horizontal, it's just a slot in the end of the air handler, and that's still fairly typical among all the major manufacturers. So you have a problem by 2020 getting past that one.

MR. MILLER: Going to another question online. Frank, I'm going to unmute you now. Go ahead and state your name and association before you make your comment.

MR. STANONIK: This is Frank Stanonik with AHRI. So in the discussion regarding range hoods, I'm just curious, has there been any assessment as to what a typical daily usage is of a range nowadays in California?

I appreciate that you've looked at what the emission rates might be, but I didn't really see anything that explained that, okay, but what's the -- let's say typical exposure that might occur over the course of a day in a home.

And a second part of the question is, does that consideration factor in what you're requiring as the -- I'll call it the general whole house ventilation rate.

MR. MILLER: I wonder if our researchers would like to answer that question. Peggy, you or Bret? All right. You're unmuted, if you'd like to speak.

MR. SINGER: Yeah. Thank you, and if Peggy wants to jump in, I'm happy to also defer to her. She knows quite a lot about both. But there's a question about, if you know anything about range use and some of the emissions and exposures associated with it.

A couple of answer to that. I'd say from a population representative sample we don't have very current data on cooking (phonetic). In California the last one we have is from kind of before 2010, with a residential energy survey where we asked, was that practical or how often they used their range to cook.

But there are a couple other data points before you go on. In general, exposures from cooking vary quite a lot. Certainly, the particulate matter depends a lot on what you cook and how you cook it, in addition to whether you use your ventilation.

One of the data points we have on that -- two data points. We're looking at the -- for gas burners, natrium dioxide in gas burners. We did some modeling work and also some experimental work, and it all kind of show that if you use natural gas burners without using kitchen ventilation, without using any kitchen ventilation you can fairly frequently get natrium dioxide exposures that exceed the outdoor ambient air quality standards.

Now, as you have bigger homes you cook less, and certainly, when you use your kitchen ventilation then that gets cut down a lot. And there's quite a lot of data showing high particle levels in homes where cooking happens and when it happens.

Across the population cooking is probably the second most -- second largest contribution to -- from an indoor source for particle matter. There's obviously the outdoor particles. These standards are taking care of the outdoor particles by insuring there's adequate filtration for the supply air, but for the indoor generated particles you need to use ventilation, and cooking is a big source of the indoor particles.

So there's some data that shows that. I think it's in the studies that Jeff put up earlier. There were some studies that addressed that issue of the kind of aggregate exposure from cooking related (phonetic) particles.

MR. MILLER: Okay. Thanks, Bret. Any followup on that?

MR. STANONIK: There's still -- this is Frank

Stanonik, at AHRI again. I guess it still isn't clear to me, again, obviously, with a range hood you're looking at localized ventilation, right? But so let's say a person that wasn't using their range hood, there is still, with all the other requirements either being proposed or existing, there is still ventilation going on within the kitchen because it's part of the house.

And I guess my question was, is that factored in when you're looking at what you might require the range hood to do? Or is it irrelevant? I'm not -- clear to me.

MR. SINGER: It's certainly not irrelevant, but we have to consider the general ventilation requirement, the dwelling unit requirement is kind of a base ventilation for catch-all pollutants, and it's more focused with things that are being emitted.

Certainly, the pollutants from materials, products you use, et cetera. Cooking is a special case, because you usually generate a whole lot of pollutants at once, and so slowly taking those pollutants out of the air through ventilation is not adequate and not effective enough.

You need to remove them quickly and efficiently, and the easiest way to do it is to remove them, and the most efficient way to do it is to remove them at the source. The amount of general ventilation that you would need to adequately deal with that, with the kitchen problem, would be actually much higher. So the amount of ventilation that's put in the Standards does not deal with things like the big slug of pollutants that come out when you cook, or when you use your gas burners.

It's really there to deal with, you know, the more spread out emissions and things from products. Just another note, you know, this is not targeting gas. Electric burners do emit pollutants, as well, but I think you got to certainly put gas on the air side and every other gas appliance is directly vented, right. So we have -- we require --

MR. MILLER: No.

MR. SINGER: When I say gas is -- I'm sorry. It's vented meaning there's vents -- the exhaust from the appliance has to be vented out of the house. Water heaters, furnaces, gas fireplaces in California, they are all vented without the person having to do anything.

The only gas appliance that's left in the home that is -- where the exhaust can come into the home is the kitchen one, and that kitchen ventilation is basically the ventilation or the removal of the pollutants from that open burner.

So the kitchen ventilation is actually a very important requirement of the Standards.

MR. SPRINGER: This is Dave Springer. You know, the ASHRAE Standards back to 2007 required that hoods be rated at 100 CFM, three sones. So this measure is really just a compliance verification measure, not a change in the Standards.

MR. MILLER: Anyone else on it? Yes. We will go to George, and then I'll meet you now -- actually, one follow up question. Bret, were you saying that larger houses cook less? There's a clarification question online.

MR. SINGER: Well, we don't know that. You know, it's certainly possible that if you have a larger house you just have more dilution volume. So cooking the same egg in a 600 square foot apartment versus a 4500 square foot house is going to create a different concentrations because there's a much larger volume, but it's the same emission.

And cooking does scale with the number of people, right, but the same cooking event would produce lower concentrations in a larger home. It's just the basic physical consideration. The Standards don't really try to address that because, you know, it doesn't get into the level of -- this is how I interpret it -- the level of trying to predict how people are going to use their small home versus their large home.

It just recognizes the fact that there's a point source of pollutants that is most efficiently address, and that's efficiently for both health and for energy purposes, because it's much more efficient for energy purposes to remove the pollutant at its source than to try to remove a lot more air at lower concentrations.

So we don't know about that great question you asked, but it is basically the same requirement for all the homes.

MR. MILLER: I think that answered it, actually.

MR. SINGER: From a kitchen --

MR. MILLER: Thank you, Bret.

MR. SINGER: Yeah.

MR. MILLER: That answered our online question. Okay. So we'll go to our next online question. George, I'm going to unmute you now. Please state your name and association before you make your comment.

MR. NESBITT: George Nesbitt, HERS Rater. Can you hear me?

MODERATOR BOZORGCHAMI: Yes.

MR. MILLER: Yes.

MR. NESBITT: So I'm going to quote from a book. "We still hear the standard line that indoor air pollution is caused by efforts to weatherize and tighten housing. In fact, energy efficiency and indoor air quality need not necessarily force a tradeoff. The single major factor affecting indoor pollutant levels is the pollution source, not the ventilation rate."

That comes from, Residential Indoor Air Quality and Energy Efficiency, written by Peter DuPont and John Morrill, back in 1989. Honestly, for the most part I don't think everything I've learned in the past 15 years has necessarily -- has contradicted that.

Overwhelmingly, building sciences, building performance people agreed, build tight, ventilate right. We can argue over what ventilate right is, but mostly, we don't argue about the building tight. So we -- you know -- a leaky building with random, uncontrolled leaks is a penalty.

It's an energy penalty. It's a comfort penalty, and it's possibly a indoor air quality penalty, although I do say that -- I would say that the link between how tight a house is and how leaky is not necessarily a gauge of indoor air quality.

So you talk about on the ventilation rates for 62.2, basically giving a blower door -- by doing a blower door, giving you credit and allowing you to reduce the ventilation rate, I'd argue that's not a credit. It's a penalty.

It's an energy penalty, a comfort penalty and maybe an indoor air quality penalty. If we're assuming the average new home is 5ACH50, and we're letting you do a blower door test, and if it's leakier we're going to let you ventilate less, well, that's the wrong message.

Plus, it's a message that comes too late. By the time you can blower door most buildings and know what the air tightness is, you've already had to have installed fans and ducts. So now you're trying to change ventilation rate after the fact.

So I think we need to eliminate that possibility. We either should set the ventilation rate on our assumed 5ACH50 or actually it should probably be around four. I think most studies have shown new homes are around that neighborhood.

I've tested a lot of new multi-family that's in the neighborhood of 3ACH50. You know, some other things we know, generally, a tighter building allows the mechanical ventilation to work more properly. Other things, a tight building allows you to filter and reduce outdoor air pollution.

I'm going to kind of bounce around. So one of the proposals is the 13 MERV filter on the central system. Well, I think one of the problem with that is as we build more energy efficient houses and as the industry continues to refuse to believe load calcs and oversize equipment, not only is the demand of the building requires less run time, but the equipment is not going to run.

You have heating only climates without air-conditioning, and so we're not running the central fan in the summer to improve the indoor air quality. So and in the Code we have discouraged using the central fan as the indoor air quality ventilation system by making it very hard and restrictive to do so.

We also don't recognize that some people do run their fans continuously, often at a large energy penalty, you know, for a perceived benefit. You know, the -- on the plus side, putting high rise multi-family into 62.2 I think is a great move, long overdue.

High rise residential apartments already fall under the residential domestic hot water, as well as the lighting. Honestly, the building envelope should fall under the residential Standards and not in the non-res Standards.

We should expand the amount of HERS credits available in high rise multi-family. I do think the HERS Raters should be doing the 62.2. I think it's preferable if a HERS Rater does the air tightness test on a central ventilation shaft and not an ATT.

I think unfortunately if they are -- an ATT is allowed to do it the question will be whether the HERS

Rater can compete with the contractor/installer who can also test it. I've done actually a lot of blower door testing on multi-family.

It is totally possible. It's a shame blower door credit was removed from the Code, although I doubt it's something people want to use much. It is possible, and there's actually a lot of information out there on sealing the central ventilation shafts, even after the fact, and testing them. It's totally doable.

And I guess maybe the last thing is, I have had no one call me for a 62.2 HERS verification under the 2013 Code in, what, four years now. So there's a total lack of enforcement, especially on additions, alterations, but probably even new construction. Thank you.

MS. GROEBUS: This is Marian Groebus from TRC. Thanks, George. I just want to comment on one thing, just in terms of the blower door test for multi-family and the value of that. So there is, you know, one field study that I wanted to quote, which was done on six multi-family buildings. These were existing buildings.

So they did a blower door test before and after, and they also did some tracer testing to see where the leakage was coming from, and they found that essentially the contaminant transfer, which would include environmental tobacco smoke, was reduced by 41 percent on average between the -- you know -- for those six buildings after they had compartmentalized.

So there is a reduction of -- I mean, that was unfortunately not to the .3 number. These were existing buildings. It was hard to get to that value, but it does show that compartmentalization does reduce pollutant transfer, including for environmental tobacco smoke, which is one of the, you know, big concerns for health.

MR. NESBITT: Yeah, absolutely. I mean, I think compartmentalization in multi-family is far more important than leakage to the outside. And in my testing as -- I've done both high rise and low rise multi-family.

I've tested apartments that were under a minus .50 PASCAL baseline pressure. It's because -- and some of that -- a lot of that has to do with the (indiscernible) on exhaust only ventilation. So these buildings really suck a lot.

And we really need to pay a lot more attention to makeup air. It's just, we can't just suck all this air out of the building and we really have to provide makeup air.

MR. SPRINGER: Okay. Are we ready to move on. Is there another?

MR. MILLER: Yeah, there are some more. Thank you.

MR. SPRINGER: Thank you, George.

MR. MILLER: I'm going to go ahead and read a comment. So I'm going to go ahead and read a comment from Roger Hedrick. "The scope change between Standard 62.2 and 62.1 moved all the dwelling units into the scope of 62.2, but it also moved all the common areas in multi-family buildings, low rise and high rise, into the scope of 62.1. How is that change being addressed?"

MR. SPRINGER: Well, we're very clear on what to do with the dwellings themselves. When it comes to how to write the regulations for the remainder of the building, we're just in the preliminary part of how to organize Section 120.1, but we intend to make it clear.

We understand -- what you said is true, part of the building is regulated by 62.1, or could be. It's addressed by that Standard, and inside the dwellings it's addressed by 62.2. We're aware of it and we'd be open to any comments about a good way of going about it.

We'll be likely sharing some graph language and, I don't know, perhaps some preliminary sharing with stakeholders. Roger, maybe you would help us with that, yes?

MR. MILLER: I'm going to go ahead and call on Rob. I'm going to -- I'll need now, go ahead and state your name and association.

MR. PENROD: Rob Penrod, Villara Corporation. You got me?

MR. MILLER: Yeah, Hi, Rob.

MR. PENROD: Okay. The MERV 13 filter cost analysis for the single-family residential, I question the $117 when you consider all the impact that that filter brings. As Dave mentioned, you obviously are going to increase filter sizes, and probably deck sizes as well, to accommodate that, if not adding filters, more filter -- return filters to the room.

So you put that on top of going to a .45 watts per CFM you're really adding some challenges on the design side that are doable, but not for $178. And then I would add, I brought this up at one of the earlier ones, your CFM per ton, 350 CFM per ton requirement, it really should be changed to BTU, because we know all five-ton units aren't created equal.

Some of them are as low as 54,000 BTUs, and it makes it very challenging, even with extra 13 ECM motors to meet that requirement on some of these systems. So I'd encourage you to rethink how you -- your requirement there.

MR. MILLER: Bruce, do you have a response?

MR. SPRINGER: Rob, this is Dave Springer. So would you -- what value of BTUs would you use like the

ASHRAE -- I mean -- the 95 -- the outdoor rated condition or, do you know what?

MR. PENROD: Yeah. Just whatever they're -- yeah, just their outdoor total capacity, you know, that's typically how they're rated. And so, like I say, it can be from 54 to 58. It's rarely 60,000 BTUs.

So if you did it per the rated BTU it gives us a little leeway on those five-ton, and even some four-ton units, as well, to get into those lower watts per CFM and still maintain the 350 CFM per ton requirement that you have. And like I say, make it a CFM per BTU.

MALE SPEAKER: We'll take it into consideration. Thank you.

MR. MILLER: Okay. I'm going to go ahead and read another comment. This comment from Steve Taylor. "The balanced ventilation within 10 percent is not realistic when you consider that toilet exhaust fans and kitchen exhaust fans are intermittent. How does the system stay balanced when those fans may be on or off? A typical two-bedroom condo may have zero CFM, 50 CFM, 100 CFM, 300 CFM hood and 400 CFM hood plus toilets exhaust rate.

"Supply fan would have to be variable speed with complex control systems and interlocks to all the fans. Very unrealistic. Please read this comment." And that's from Steve Taylor.

MR. SPRINGER: Marian, did you want to --

MS. GROEBUS: Yeah, that's a great comment. I think the proposal was to balance the system, you know, under a certain set of conditions, recognizing that it's not going to stay within 10 percent, particularly if it's done through a manual balancing system, or through fixed orifice plates or something.

You know, we recognize it's not going to stay within that range, but just to balance it under one set of conditions so that it's -- you know -- works pretty well, and then based on our interviews, you know, our understanding that it's -- the system -- once you balance it within one set of conditions, you know, yes, things will change, yes, it's not going to stay within 10 percent always, but it's still going to work reasonably well and would better than if you just don't balance it at all.

MR. WILCOX: Bruce Wilcox. I agree with that and I think the intention is that the continuous ventilation fans would be balanced within 10 percent and you wouldn't have to include the kitchen exhaust or bathroom exhaust fans in that balance, that those operate independently.

MR. MILLER: Right. Thanks, Bruce. Okay. So we've exhausted the comments. If there are no other in the room, then I think we're ready to move to the next topic, and we're out of time, as well, so.

MODERATOR BOZORGCHAMI: I think we're going to take a five-minute break real quick.

MR. MILLER: Thank you.

MODERATOR BOZORGCHAMI: So get Mark ready. Thank you.

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

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

MODERATOR BOZORGCHAMI: Now, so Mark Alatorre is going to be talking about Nonresidential air -- Indoor Air Quality.

MR. ALATORRE: Good morning. I'm Mark Alatorre. I'm an engineer in the Building Standards Development Office, and I'm going to be presenting the topic of Nonresidential Indoor Air Quality, if I can get the slides to move. There you go.

So first off, I want to acknowledge the California Utilities Statewide Codes and Standards Team, and especially the case authors, Ryan Sit, who is here up at the table with Pam and Anna Brannan, both from Integral Group.

So ventilation indoor air quality, well, in general the purpose is to dilute contaminants, ventilation rates that are currently called out in 62.1. They address occupant by effluents and space building material, equipment or furniture off-gasing.

In the commercial world there's many space types and many space uses, you know, and that's why we are trying to go to a standard that has a more expansive occupancy table. To reiterate what was presented at the stakeholder meetings, there is a connection between indoor air quality and human health.

And California Air Resources Board concluded in 2005 that the impact of indoor pollutants on health was far greater than outdoor pollutants, and they had a link to these various illnesses. Also, these studies found that there is a benefit to indoor air quality, particularly on productivity, and it would outweigh the economic impact of increased energy use.

A little background. The Energy Commission has been requiring ventilation throughout its history. Prior to 1992 it referenced ASHRAE 62. However, in 1992 the Standards were updated and called out specific ventilation rates.

However, these ventilation rates have since been unchanged, and it has a limited list of occupancies and it does not address exhaust or makeup air, and it only specifies minimum ventilation rates for supply.

However, the California Mechanical Code adopts

ASHRAE 62.1, which does contain requirements for supply, exhaust and makeup, and of course, has many more occupancy types. But there is confusion in the industry as far as which standard to follow.

I highlighted that conflicts and how to resolve conflicts between Standards, which is often cited when -- I'll go ahead and read it -- "When the requirements of this Code conflicts with the requirements of any other part of the California Building Standards Code, Title 24, the most restrictive requirement shall prevail."

That is generally how the Codes are used. However, as our attorney, Matt Chalmers, mentioned in the beginning, the -- that's not the case for ventilation. The Energy Commission has the authority over the occupancies that we regulate, which is stated in the beginning of Chapter 4, Part 4 of the Mechanical Code, which I also highlighted here.

Ventilation air supply requirements for occupancies regulated by the California Energy Commission are found in the California Energy Code. However, it still leads to confusion in the industry. The case team conducted a survey that has 34 respondents to the survey.

The first question was about that Section 402.1, and when they asked a question, if people are familiar with this passage, 80 percent of the 34 said yes. Another question of the survey was, "Which ventilation air supply rate calculations does the firm design to?"

And this was a little more mixed. Almost 30 percent said that they design to the Energy Code. However, another 30 percent said that they -- that the higher of Part 4 or Part 6, which was using that conflicts -- that conflict resolution passage.

Another question was, "How comfortable were these firms in the 62.1 multi-zone system calculation?" And this was some good results. Forty percent said that they were very comfortable. Another -- over 35 percent said that they were somewhat comfortable, and they understood the calculation and the procedure.

So moving into the case team proposal, they were proposing the align the ventilation and indoor air quality requirements of 62.1, and bring those into Title 24, Part 6. That would include -- or these are the -- these bullets highlight the changes that would happen in Part 6.

So there would be an update to the minimum ventilation rates, harmonization with the full ventilation rate procedure that's in 62.1, revise the natural ventilation requirements and revise or actually incorporate the outdoor air treatment, as well as specified exhaust ventilation.

One thing that we decided not to pursue was the indoor air quality procedure from 62.1. We felt that that procedure was too subjective to the -- too many decisions for the designer that we felt that could have had a negative impact on indoor air quality.

So on that first bullet of expanding ventilation rates, that would impact primarily in Table 120.1(a), which currently includes the limited occupancy spaces, and it would -- also, part of the proposal was to increase the rates by 30 percent.

So there's an adjustment factor in the equation that I'll show later in the proposed language that would increase the rates by 30 percent, and that 30 percent number was determined based on several studies that concluded the increased energy cost due to ventilation is outweighed by increase in productivity.

And again, we're talking primarily of -- these are commercial spaces that are used for businesses or schools, and productivity and human health is a large concern. The ventilation rate procedure that's in 62.1 calculates the rates as the sum of the ventilation required for both people and related sources.

You know, again, the space types and the off gasing of the furniture and whatnot. It also accounts for the ventilation efficiency for zone air distribution. So there's adjustment factors depending on the method in which the air is being delivered.

The natural ventilation proposal expands on how to calculate the open area than what we currently have. It also requires that a mechanical ventilation system still be installed so that you would have a mechanical ventilation of the backup to the natural ventilation.

However, there are multiple exceptions to that, which I will show in the proposed language. But primarily, it will -- you don't have to put in the mechanical system if your openings are permanently opened or have controls that prevent them from being closed.

However, there is a safeguard of if your openings do not do that, that you have to have a mechanical backup. The proposal also includes air treatment, outdoor air treatment, filtration, in other words.

So 62.1 requires that the designer do a regional and/or local air quality survey that would incorporate -- the stipulation is that they would go onto the site prior to design and look at the surrounding buildings, and also check USEPA website for local air quality, and based on that they would either use a MERV 8 or a MERV 11, depending on the PM levels.

However, the case team recommended increase to MERV 13 versus MERV 11 in the case where PM 2.5 was considered nonattainment. Also noted here is that California CALGreen has a MERV 8 filter requirement that they were also recommending that we follow.

There are some issues that we had with this proposal. First of all, it's hard for implementation of this, that we felt it was hard to implement. Also, hard to enforce. We would -- the Building Department would be required to become air specialists and know their local air quality and look at surrounding buildings and whatnot, and we felt that that was -- it was adding complexity to the Standards that we would have rather not.

CASE Team proposal also included exhaust ventilation, which would be a new, you know, including into Title 24, Part 6, essentially bringing over the exhaust ventilation rates from CA 2.1, Section 6.51.

I'm going to start now with CC Staff recommendations. These are where we deviated from the Case Team Proposals. So first, the MERV 13 requirement. We feel that that should -- it should be a single air filter performance requirement throughout the state.

We think it'll simplify enforcement. It'll benefit most of the state and it would do away with the local or regional air quality survey that's stipulated in 62.1. The reasons we think it'll benefit the state is the following.

This is a map that I got from California Air Resources Board's website. It's an attainment map of parts of the state where it's either classified as inattainment or a nonattainment for PM 2.5. What's highlighted in red is what is considered in nonattainment, or in other words, where PM 2.5 levels are high.

And as you can see, the greater Central Valley, Los Angeles and the coastal areas by San Diego, with high population densities, are impacted by this. Also, this is the map for PM 10, and what's highlighted is actually the parts of the state that's considered okay.

The rest of it is nonattainment area, meaning that PM 10 levels are too high. And if you see, most of the state is considered with -- is considered in nonattainment and the highlighted areas are not that populated.

So here's a MERV performance table from ASHRAE 52.2 2007 Team version. And if you look at the -- I don't know if everybody could see that, those small numbers, but a MERV 8 is from the range of PM 1 to PM 3. It's 20 percent efficient.

From range three to 10 it's 70 percent. So that's what's current CALGreen, MERV 8 requirement, which if you -- when you go back to the PM 2.5 map, it's only capturing 20 percent of the, you know, PM 2.5 in the

Central Valley and Los Angeles area basins.

If we move to MERV 11 we get an increase in efficiency to 65 for the PM 1 to 3, and 85 for PM 3 to 10, which is better. But if we're going to specify a filter level for PM 2.5, we wanted to recommend MERV 13, which gets us all the way up to 85 percent and 90 percent for PM 3 to 10; so essentially, giving away most of the PM 10 particles and doing very good on the PM 2.5 particles.

Also, this is another deviation from the CASE Team proposal. Their 30 percent adjustment factor, they were planning that for all space types. We felt that there are certain instances where that rule shouldn't be applied, and I highlighted three examples: system with an air economizer and demand control ventilation.

There has been studies done that show that air economizing over-ventilates and the CO_2 levels on a PPM level are very low; also, dedicated outdoor air systems that are bringing in 100 percent onsite air; and lastly, if we did a comparison of current ventilation rates to the 62.1 ventilation rates, only applying the adjustment factor for when the ventilation would be less than what's current. So in those instances is when we would recommend the 30 percent.

Also, we're considering a simplified multi-zone calculation method. There's one currently out for public review that the ASHRAE 62.1 Committee should be making a determination on at the end of this month, and depending on the outcome we may be going for that simplified multi-zone method, given that there's been some concern that the multi-zone calculation is complex, and that certain assumptions that are made by designers, if they're being conservative, can really increase the amount of air brought in unnecessarily, and that would really impact energy performance.

Also, we wanted to address the Mechanical Code and make the reference to the Energy Commission more clear. This is the example language that we wanted to change. It's not a big change. It's -- instead of saying that the air supply requirements are found in the Energy Code, we say they're specified.

The CASE Team had a different recommendation that was a little bit more explicit, but you know, that we can also consider, as well. But our intent is to address the Mechanical Code and try to clean up this reference here.

So with that I was going to go to the proposed Code language if -- and my hyperlink is not working. So let me see if I can get to it. There we go. Am I still sharing?

(Pause)

MR. ALATORRE: So this is the proposed Code language that's found in the CASE Report. The CASE Report will be posted for review. Actually, before getting into the proposed language, I wanted -- I didn't show any of the energy savings or penalty.

I wanted to mention that in the CASE Report they did -- they had two prototypes, a small school and a small office. The small office did show energy savings compared to current Standards, and the small office, however, showed an energy penalty.

But again, the CASE Report did a good job of documenting that and it will be posted. The reason I didn't show it is because, you know, again, referencing back to the first presentation today, the Energy Commission has the authority and we did not have that it showed cost effectiveness for this measure.

So in the proposed Code change they added definite -- this is the wrong file. Here we go. So they added definitions. What's in strikeout are my edits to this. "Cognizant authority," the definition's not needed because that is only associated with the Indoor Air Quality from 62.1, which we are not incorporating here. So there's no need to have it in our definitions.

This is how they're recommending we edit 120.1. What's stricken out here is the local air quality survey and the need to go to USEPA's website and determine local air quality. So that's been stricken, as well as some of the outdoor air treatment when it references the Part 11.

So it's now a simple MERV 13 for particle filters or air cleaning devices. Natural air -- natural ventilation, again, requires that a mechanical system designed in accordance with the mechanical ventilation rate procedure be installed.

Exceptions would be if the natural ventilation openings to comply with the requirements are permanently open or have controls that prevent opening or being closed during periods of expected occupancy, or mechanical ventilation systems are not required if the zone is not heated or cooled.

Other than that, you would have to install the mechanical backup. So this is the ventilation rate procedure calculation with a 30 percent increase in ventilation rate. And I just wanted to kind of give you and give Ryan kind of the -- showcase his hard work here and his recommendation of this proposed language.

So again, this will be posted for review. I assume that that's a lot of information to digest now, and I'm just going through it kind of quickly. But with that I will go back to the -- if I can get there. There we go.

Am I showing? Okay. With that, I am ready for questions or comments.

MR. WALKER: Hi, Mark. It's Chris Walker. Chris Walker, with CAL SMACMA. And thank you again for making the presentation. This information is -- we're digesting it. Kind of going back to what Bob had said earlier, this is a lot of information to digest.

One quick question. As far as the Code change proposals themselves, we -- you know -- right now I'm having to go to the CASE Study website and pull down the Code change proposals one by one. Is there -- and this goes beyond just your presentation -- but is there going to be a place, a consolidated location on the Energy Commission website that will have all of the Code change proposals, as modified and recommended by Staff, easy to get? I'm just having a hard time fishing them out from all the different links right now.

MODERATOR BOZORGCHAMI: As soon as we're done with the pre-rule-making process we pretty much understand where we're going to set our Standards. Too, we will post them on our 2019 page as our -- prior to the 45-day language.

MR. WALKER: And the only reason I ask is because I'm sending out this information to our members to get feedback from them. If we have to wait till the pre-rule-making process is over to have these documents, and I understand that you want input before you put them back out.

MODERATOR BOZORGCHAMI: Sure. Sure.

MR. WALKER: But if there can be a pre-pre-rule-making --

MODERATOR BOZORGCHAMI: I see what you're saying. So--

MR. WALKER: -- provision of these -- of this Code language it would help me get feedback from our members.

MODERATOR BOZORGCHAMI: Good point, and I'll what I could do, and we'll probably put it on with our PowerPoint presentations that are on there right now. So as we get them, I'll put them up.

MR. WALKER: Terrific. I mean, that will help me. I've got 300 members throughout the State of California, contractors working on this every day, and for them to see the actual proposals in a very easy, consolidated way helps them provide you the feedback that you want.

MODERATOR BOZORGCHAMI: sure. But as of now, these presentations will be posted the day after the presentation's given. So you will get those tomorrow.

MR. WALKER: Thank you.

MODERATOR BOZORGCHAMI: Um-hum.

MR. ALATORRE: Need one online? No. Come on, Jon.

MODERATOR BOZORGCHAMI: You turn on the mic.

MR. McHUGH: Sorry. Jon McHugh, with McHugh Energy Consultants. You know, this -- I think this is a great start in harmonizing with ASHRAE 90.1, and there's a number of commercial buildings that, you know, currently have to do their ventilation calculation procedure twice, once to comply with the Code and then once to comply with the lead requirements of 30 percent beyond ASHRAE 90.1.

And I was looking at the proposal to not include the 30 percent beyond ASHRAE 90.1 for spaces that are using DCV and economizers. And you know, one of the concerns about the 62.1 protocol is that it substantially reduces the amount of ventilation rate per person.

And the -- for high density occupancies the carbon dioxide level is going to actually be quite high. For highly, you know, densely populated occupancies you can have 2,000 parts per million in those occupancies.

And you might think, oh, the DCV, that's going to help me out because we set that to 1,000 parts per million. But if you look at the requirements for DCV, the standard specifically exempts increasing the outdoor air to hit the 1,000 parts per million.

So you only increase the outdoor airflow rate to that maximum design outside air level, which for some of these high density occupancies now has very high levels of, you know, of internally generated CO_2.

The thought is, well, I've got an economizer. So in the morning I'm getting lots of additional air and that's great for removing, you know, pollutants that might have accumulated overnight. But now, once you're actually -- you know -- now, it's gotten hot in the middle of the day, you can have a substantial fraction of day where the economizer is not applied.

When you get up to these higher levels there's this -- there's been three studies that are replicating the reduced cognitive performance at higher CO_2 levels, you know, around 2,000 parts per million.

Those studies done by Bill Fisk, you know, the exposure time for running those tests were on the order of three hours. So even though you have an economizer that might be operating a couple of hours in the morning, the -- thinking that that's going to assist people's performance in the middle of the day I think right now the data doesn't show that.

So I like where you're going with this proposal. There are a couple of -- the other concerns that you brought up are the complexity of the multi-zone calculation. And I understand there's two proposals out there, one that's by Steve Taylor, as well as the one by ASHRAE.

And you know, selecting, you know, either of those before we get to the end would be highly desirable, as we've heard that the current methodology is really unenforceable. Thank you.

MR. ALATORRE: Thank you, Jon. And yeah, just to mention, we're aware of the Taylor's recommendation, he did submit it to the CASE Team and it was evaluated, and that's also being considered as a possibility.

MR. SIT: This is Ryan Sit, from Integral Group. To address your question about those space types that have higher occupancy, and thus, will have CO_2 PPN above the 2,000 threshold where adverse health affects occur, I do want to say that the ASHRAE 62.1 Committee is actively in parallel working on researching adjustments to ventilation rates for all the occupancy types.

So that work is done in parallel, but we can look into, you know, we can look into the analysis to see which -- exactly which space types are having those concentrations above undesirable levels.

MS. JENKINS: Bringing that down. So Peggy Jenkins, with the California Air Resources Board. And I just wanted to comment that we do support very strongly the proposals to increase MERV to go to higher filtration for both the residential and the commercial buildings.

And just from the air pollution perspective, of course, Mark did a great job showing, you know, unfortunately, our nonattainment maps for PM 10 and 2.5, despite our agency's, you know, efforts with regulating fairly extensively our automobiles and trucks and so on.

It does take time for fleet turnover. There's still a lot of sources of PM, and as time has gone on the health studies have shown more and more health impacts of particles at lower and lower levels. So we see not only respiratory effects, but also, cardiovascular effects.

And really, PM is the pollutant that has the greatest health impact on Californians relative to all the other pollutants that we do regulate. So it's a very high priority, the highest priority from the health perspective.

So we do appreciate that the Commission's moving forward with an effort to help reduce our exposures. We also have some new, or I would say newly heightened concerns relative environmental justice areas.

And folks here are very near typically, not just industries, but more often busy roadways where the fine particular and ultra fine particle levels are extremely high. So moving our MERV filtration up and increasing our energy efficiency I think is really going to help reduce exposures for those individuals that are most highly impacted. So we appreciate your effort here. Thank you.

MR. ALATORRE: Thank you, Peggy.

MR. MILLER: You have some online questions. I'm going to go to first Tom. I'm going to unmute you. Go ahead and state your name and association.

MR. FELTZ: Thank you. Great job on trying to update these Standards and address indoor environmental quality and ventilation and so on. This is Tom Feltz, Healthy Building Research in Davis, and technical adviser for the Collaborative for High Performance Schools.

Was also co-author for the Indoor Environmental Quality Research Update for the Energy Commission back in 2011, 2012. And one of -- two of the many issues that we address and recommended as being high priority were moisture and thermal comfort.

So I thought I'd just throw in some comments there because others really haven't addressed that. In terms of moisture, newer buildings and airtight buildings are at high risk for moisture and mold problems, and improving the whole house ventilation is one good strategy to help minimize that.

But more importantly, probably, is the source or local control such as range hoods, because that's one of the key moisture sources in buildings and homes. So beefing up those range hood Standards is great.

In fact, I would also recommend adding some onsite testing requirements, which I think the ASHRAE 62.2 Chair has commented on recently in another proceeding that you have there. On a similar vein for -- while I'm there -- on ventilation, enforcement and operation and maintenance are clearly kind of the weak links in all of this building performance issue in the real world.

But we do in California have a minimum building ventilation standard for workplaces, at least, which requires annual inspection and maintenance. So I would recommend that you try to make very explicit connections to that in your regulations and see if you want work out some way of tying that into enforcement, and at least letting people know that they're responsible for that.

I don't know, haven't thought about that a whole lot yet, but I'm sure that from my experience, when building owners find out that that's something they're responsible for it gets their attention real quick.

And on thermal comfort, that was another key risk for low energy buildings. That is, they can easily overheat if the solar gain and internal gains aren't carefully managed. And it's already a problem in new homes.

Offerman's study on new single-family homes found about 19 percent of the homes were reporting that they were too hot. And we haven't looked into that data a lot, and some of that is just probably from bad system installation, but I think based on a pretty large body of literature around the world that low energy homes can easily overheat.

And so one needs to be very careful about shading and ventilation and so on. And so we also need to address future climate and that was one of the recommendations in the California Department of Public Health plan for extreme heat adaptation.

They recommended that the building standards, Building Energy Standards address ways to keep internal buildings cool, and as well as, you know, urban areas and urban heat islands. But that's something that some groups are already doing around the world. And I think California could do a lot there.

The case -- there was a case study of new homes also around 2011 that modeled new homes, and Bruce may have been involved with this, looking at ASHRAE Standard 55, thermal comfort compliance, and a lot of the model prototypes of homes were not meeting just the basic thermal comfort standards.

And so I think that needs to be revisited seriously for current climate, as well as future climates.

And I guess I think that's roughly it. And so my basic question is, how do you plan to address these risks of moisture and overheating in the current and future climates. Thank you.

MR. ALATORRE: Thank you, Tom. I think that was more of a residential question that he was posing.

MR. FELTZ: Well, it's overlaps a lot. For example, schools overheating is, you know, a big problem, especially in the older schools. But if they go to do a major remodel then they need to address it. And the minimum building ventilation standard applies just to nonres.

But I would argue that we need something like that on point. Some countries are already doing that. They have a pretty strict chain of custody and performance testing, and they even have -- there's a lot of actually overheating guidance out there in the Passive Home Program in several countries where they have overheating criteria, so many hours above a certain temperature, for example, or an operative temperature.

And LEED has pilot credits now for looking at overheating, as well as passive livability in a building if the power goes out. You know, how long before you have to evacuate it.

MR. ALATORRE: Okay. Thank you for that, for that comment.

MR. SPRINGER: This is Dave Springer. I think the overheating problem is primarily with, you know, for example, passive homes in heating only climates where there's no air-conditioning, and if it occurs elsewhere it's primarily a problem of inadequate sizing or inadequate zoning.

And you know, one of the things that's unfortunately kind of discouraged in current residential standards is zoning systems, and I think some work needs to be done there. But anyway, I don't think it's as much of a problem, and where it has been a problem we've seen some legal action that has resulted in contractors being very careful about sizing. In fact, the problem is more of the opposite of over-sizing cooling systems.

MR. FELTZ: Well, I think that's maybe generally true for now, but in the next decade or two we're expecting to have a lot more severe power outages and heat waves and so on. And so something that's designed to perform pretty well will now -- will then become a big energy hog.

And so if one's looking at life cycle assessment analysis of the energy performance, I think there's a lot that we can do to build in and get ready for those problems and prevent them. And some people have done --

there's a lot of people have done optimization, looking at mid and late-century strategies to improve shading and glazing and so on, and insulation, and looking for different tradeoffs. And so that's I would say best practice at this point.

MR. MILLER: All right. Thank you, Tom. We're going to move on to Mara. I'm going to unmute you now. Go ahead and state your name and association.

MS. BATARI: Hi Mark and everyone. My name is Mara Batari. I work with Embedded Systems and I'm the Chair of the Indoor Air Quality Procedures and (indiscernible), and the Vice Chair of the Indoor Air Quality Working Group and ASHRAE Standards 62.1.

And I have a question about the indoor air quality procedures, and why it was excluded from the new -- from the changes. So Mark, you mentioned it was excluded because it was found too subjective. And in 2015 the CEC funded a study, or support a study in Lawrence Berkeley Lab, and the title of the study was, Should Title 24 -- let me just read it so I can be accurate about this.

So Should Title 24 Ventilation Requirements Be Amended to Include An Indoor Air Quality Procedure. So they had indicate in many ventilation scenarios and they found that including an (indiscernible) to the VRP or the Indoor Air Quality Procedure, you can, you know, name it whatever you want, it actually meets the risks.

So it's acceptable from this perspective and will lead to energy savings, and actually exceeds -- from health standpoint it exceeds Title 24. And they expect significant adoption of this alternate VRP. And just so you know, so the alternative of VRP states that -- or proposes to decrease the ventilation rate 30 or 40 percent beyond ASHRAE 62.1.

So instead of the proposed increase 30 percent, the alternative VRP can decrease 30 percent and -- sorry -- so it's decrease 30 percent, and as long as they make mandatory air-cleaning or filtration. That was on particulates. So that's my first point.

And actually, there's a lot of study that showed that you can do a new air quality procedure, and at the same time meet the requirement for this and pollutant limits. The second point is that many, many people on the phone mentioned about the new studies and how reducing pollutant limits can lead to better indoor air quality and productivity.

And that's true. You know, the latest study by the Harvard public health, school, they say they need pollutant level, for example, carbon dioxide pollutant level, to -- they will lower the pollutant level, the better (indiscernible) the government's ability.

But you can exceed that by doing different scenarios. One of them is ventilation. So hence, the 30 percent increase above the ventilation rate. Another task can be air-cleaning. So these two methods can be alternative to each other.

What I'm proposing is that if we can talk about the second method as an alternative compliance task and to be considered, as well, because it will lead to energy savings, so it will meet the goal for not including more load on the power plant.

At the same time, if it was done correctly it will not compromise indoor air quality, maybe it will be embedded in indoor air quality. Thank you.

MR. ALATORRE: Thank you. You know, and when we were making that determination we found that the requirements that are in 62.1 for the indoor air quality procedure, they did not -- the stipulation is that you're going to have air filtration or air cleaning devices.

It wasn't specific on one type of technology, and there's -- we feel that's still a growing industry that needs more research before we can bring it in. It's also contingent on maintenance of the system, which we don't have a lot of confidence in that being continued.

So again, this being a health and safety measure, we felt we were going to be conservative and limit it to just the ventilation rate procedures.

MR. SIT: This is Ryan Sit, from Integral Group, just piggybacking on what Mark said. Yeah, the design procedure we found was too subjective, and therefore, would face enforcement issues. And we also corresponded with Carbon LBL and they agreed with our recommendation of determining ventilation rates using the ventilation rate procedure and not the IAQ procedure.

MR. ALATORRE: Okay. I think we're done with comments and questions.

MODERATOR BOZORGCHAMI: So if we're done, I think we're a little bit ahead of schedule. So we could take a one-hour lunch break and be back here by 1:00 o'clock, if that's okay. So with that, thank you and we'll see you back this afternoon.

(Off the record at 11:53 a.m.)

(On the record at 1:11 p.m.)

MODERATOR BOZORGCHAMI: All right. Good afternoon. This is Payam again. We're going to start the afternoon session, but before RJ gets up and talks about his topic, I want to give you guys a quick update of -- we just made some changes to our schedule, and it's -- and I apologize for that.

What we -- apologize. Give me one second so I can get this on the screen. The workshop that we had --

pre-workshop that we had scheduled for June 29th conflicts with another national meeting that's happening in San Diego, and a lot of the mechanical engineers will be attending that.

So the idea was to reschedule that to July 18th. This is the residential HVAC. At the same time, so we'll talk about residential quality HVAC and small duct, high velocities. We'll move that also under July 18th.

Gives Mark a little bit more time to work on his presentation, hopefully. At the same time, what we're doing with the solar and storage and the energy design rating that Moz (phonetic) is going to be presenting, we're going to move that to August 8th. Okay.

Apologize we had to make that decision, because we wanted to get more feedback from the public on mechanical systems and that conflict would have been kind of a hardship. So if you have any questions, please let me know. If not, I'm going to let RJ do his presentation.

MR. WICHERT: Good afternoon. I'm RJ Wichert, Mechanical Engineer in the Building Standards Office. And today, I'm going to be presenting on two process measures, starting off with variable exhaust flow control.

And at this time I'd like to acknowledge the work and thank the Statewide Cogent Standards Team and specifically for this measure, Jared Landsman of the

Integral Group, who's the author for this proposal.

So for exhaust flow, lab exhaust flow the current Code sets no limit on exhaust fan energy for laboratory and process facilities, and this proposed measure will set a limit on this process fan energy, but give exceptions so that you can use either wind speed sensor or contaminant sensor control to vary the exhaust flow, depending on conditions.

So I'm going to go into background on exhaust stack design. So the conventional stack exhaust, the stack height allows for the exhaust to get to a safe height for -- so that reentrainment does not occur of contaminants.

This type of exhaust has a relatively low discharge velocity, and therefore, a lower exhaust energy. One of the down sides is this is less aesthetically pleasing. So architects tend to favor shorter exhausts, which have higher energy use.

And so we go into induction exhaust fans. So these have lower stack height, which requires additional momentum, and therefore, additional fan energy to get a effective plume height that's at a safe level.

And these are typically not visible from the ground level. Therefore, they're preferred by architects. So we'll go further into induction exhaust fans. The effective plume height is highly dependent on the wind speed, the mass flow rate and the stack height.

You need an effective plume height, a high enough plume height so you don't get reentrainment of the contaminants in the exhaust air, and you also need to make sure workers on the roof are not affected by any contaminants.

So here we have a graph of the induction exhaust fans compared to traditional stack exhaust fans. You can see these lower gray lines, these represent different conventional exhaust systems at 1,000 feet per minute, 2500 feet per minute and 4,000 feet per minute discharge rate, and you can see the green lines here are to induce exhaust systems. And you can see that -- the higher power fan energy power relative to the discharge rate.

So one of the alternatives proposing to get around that fan energy -- prescriptive fan energy limit is animometer control or wind speed control. So in this system you'd have a animometer on the rooftop that would measure the wind speed, and depending on the wind speed the fan can be -- the exhaust fan can be run at a lower rate.

Or if the fan wind speed is very high you'd need to run it at a higher rate. So therefore, when the wind is at a lower rate you can save energy. At this point since there's no prescriptive requirements currently, these fans are basically run at their design rate.

So they're designed to run at one percent fan maximum wind speed. And so they're always running at full speed, and that's a lot of energy and when the wind is not there you don't need to run them at that high of a rate.

And the other alternative is speed control through a chemical monitor. So in this system you'll have a chemical monitor in the exhaust stack that is measuring the concentration of contaminants. If it's low enough it's deemed safe and the dilution -- the amount of dilution is not as high, and therefore, you can lower the fan discharge rate.

Basically, if there's nothing really -- not -- the concentration of chemicals isn't high enough to really need that discharge rate you can save energy in the system. So what are we proposing? We're proposing a prescriptive requirement that would limit the fan power, the maximum fan power for systems that are greater than 10,000 CFM.

We're also proposing that these systems must meet ANSI Z9.5 2012, and they -- and you have the two exceptions for a local wind station control or contaminant sensor control. And then additionally, this would require acceptance testing.

So I'm going to go into the methodology for how the energy savings was calculated. So in order to calculate the energy savings a spreadsheet modeling tool was used, basically just modeling the exhaust fan energy versus the wind speed control, or wind speed data.

So the modeling assumptions operate 9:00 to 5:00, exhaust airflow out of 10 ACH, a 40 percent turndown during unoccupied hours, and maintain an effective plume height of 20 feet and a static pressure of 2.5 inches and a maximum contaminant concentration of 400 micrograms per cubic meter.

Some of the lab sizes that were modeled, 1,000 square feet, 2,000 square feet. 5,000 square feet, 10,000 and 20,000, and basically, forecasting was used to determine what size labs were going to be in which climate zones.

And based on that forecasting data that's the types of labs that were run for each individual climate zone. So you'll see in a later slide that basically, because of that difference between each zone, there is a difference in the initial cost per climate zone, which I'll explain a little further in detail later.

So going a little further, for the baseline conditions, sort of modeling what is currently happening right now, the fans are running at an assumed constant 10 mile per hour wind speed, and then the proposed conditions, we're varying it based off of that wind speed to see what the difference in energy usage is.

So some of the incremental costs for this measure, a calibrated animometer, $1500. Low temperature range animometer costs a little bit extra. The cables, mounting adapters, bird screen comes to a total of 2500 for the incremental cost per lab.

So those are a constant. So if you had a 10,000 square foot lab or a 5,000 square foot lab it'd be the same incremental cost. And then your maintenance costs, so it was deemed that the sensor would need to be replaced during a 15-year period. That's $1500. So a total incremental cost over a 15-year period is $4,000.

And as we'll go into further in the next slides, the total energy cost savings per square foot was about $39 to $92, depending on the climate zone. That's a savings per square foot. So here's just a graph of the first year energy impacts per.

This is actually, the title is incorrect, but this is the first year energy impacts for the variable if full control exhaust fan. So this is the TTV energy cost savings per square foot over a 15-year period.

And the life cycle cost effectiveness from those numbers were ranging from four and a half to about 20 for the benefit to cost ratio. And here's just a graph showing that, and you can see the green line is your total incremental cost.

And the variance I was speaking to you earlier, that's because of a variance in the types of labs and the square footage of those labs, depending on the forecast data for what would be built in 2020. That's why the incremental cost varies.

You can see that the -- any bar that's above that green line is cost effective. The savings are greater than the cost, and the purple line is your benefit-to-cost ratio. So just to go back over the summary of what we're proposing.

So we're proposing a new prescriptive requirement for cover processes. This would set a fan power limit on laboratory and process exhaust fans systems that are greater than 10,000 CFM. The currently proposed limit is .45 watts per CFM.

Exceptions available if the system is controlled by a rooftop wind sensor or contaminant sensor, and the system also must meet ANSI 7 -- Z9.5. Types of buildings that are affected, nonresidential, scientific laboratories and process facilities, supplies, additions and alterations, and it does align with existing relevant Sodes and Standards.

As on modify existing Code language we'd rather add to it. We're adding this prescriptive requirement. So to go into detail with the proposed changes to the Code language, have the prescriptive requirements for laboratory facility exhaust.

There's going to be a fan power limit with exceptions. Reference appendices. We need to add a new section that would go over the acceptance test requirements for this measure, and the nonresidential ACM Reference Manual would need to be modified to explain how the performance method is treating the standard design and the proposed building.

Here's some key links to find more information and contact information. Going to questions. Don't everyone jump up. Chris, do we have anything online? Well, if there's no questions, then I guess we'll go to the next presentation.

So next no our schedule is the Automatic Sash Closure System Measure. So I'd also like to acknowledge this team, again, our Statewide Codes and Standards Team and some of our authors for this measure, Briana Rogers, M.L. Velmiki and Joseph Wing of Alternative Energy Systems Consulting.

So laboratory fume hoods, they -- it's a device enclosed, except for basically you're enclosing chemicals that you don't want to get into the room in a exhausted fume hood. This is the definition of what a fume hood is.

Some of the different sash types, vertical sash, horizontal, sliding doors and combination. A little background on VAV hood operation. You have the sash control and exhaust valve actuator, and you're varying the amount of exhaust, depending on the position of the sash.

These are some diagrams of where the sensor would be located. This is showing the sensors to tell if there's anything obstructing the sash during closure when it's automatically closing. So some background.

There are no existing requirements for automatic sash closure systems in Title 24. Other relevant Code requirements, Title 24, Part 6, Section 140.9, prescription requirement for VAV laboratory exhaust systems, the California Mechanical Code, Section 503.5-11-2, requirement for our VAV laboratory exhaust and room supply systems for labs.

California Mechanical Code also has a section that deals with codes for healthcare facilities, mostly relating to air change and pressurization for health and safety in hospitals. And then additionally, Section 410.3 establishes the average freeze velocity requirements for laboratory fume hoods.

Continuing with Code history, Code Federal

Regulations, Volume 29, requires employers to actively manage safety in laboratories. Training for closing the sash when it's not used is required in some of these Codes.

So an overview of what we're proposing, a new mandatory requirement for covered processes that would require automatic sash closure systems on VAV fume hoods in fume hood driven labs. Building types impact, nonresidential laboratories, scientific spaces, applies to additions and alterations.

This does align with the existing relevant Codes and Standards, doesn't modify existing Code language, but adds to it and it would require a new compliance form. So the proposed definition of fume hood driven lab, especially sharing a common exhaust system with fume hood density greater than one square foot of hood work surface per 35 gross square feet of laboratory. It's based on sensitivity analysis.

Going to the methodology for how the savings were calculated. So baseline conditions, modeling with how things are today. It's divined by the Best Practices and Literature Review of Laboratory Design, a 5,140 square foot fume hood driven prototype lab with central VAV, hot water reheat, operating on 24/7 safety controls, occupancy 8:00 to 6:00 on weekdays, 10:00 to 2:00 on weekends, utilizing 100 percent outside air, six air changes per hour when it's occupied, four air changes per hour with it's unoccupied.

Sash stops, install 18 inches and a fume hood diversity of .46 when it's occupied and .38 when it's unoccupied. The fume hood diversity basically is saying what percentage of fume hoods are open versus closed during the unoccupied or versus an occupied times with a minimum face velocity of 100 feet per minute, and fume hood airflows minimum 25 CFM per square foot of workspace when closed, and the sash closed height is six inches.

Some additional energy-saving methodology here. So the proposed conditions were complying with the new Code we're proposing and the fume hood diversity for the current Code or the proposed Code would be an occupied ratio of .11 and unoccupied of zero.

So when the space is unoccupied all sashes would be closed and when it's occupied 11 percent of them would be open. So some of our incremental costs, the sash closure systems were found to be just over $3,000 for cost, maintenance.

Failed sensor was found to be about six years for their lifetime, so $100 times two sensors replaced during the 15-year period. So a total incremental cost of 3450. And the cost savings as we'll go into detail later, range from 11,991 to 15,418 per fume hood.

And this is just showing the first-year energy impacts per fume hood for a new construction and alterations per climate zone. And I have the TDV energy cost savings per fume hood over a 15-year period, again, new construction and alterations.

And we're going to have this in a graph here in a second. Life cycle cost effectiveness summary, which we'll show in the next graph. So here you can see the TDV benefits are greater than the incremental cost in each climate zone.

The green line is the cost, the blue represents the benefits and then you have your benefit to cost ratio with the purple graph. So this is cost effective in every climate, so. So what are we proposing?

We're proposing a new mandatory requirement for automatic sash closure systems on VAV fume hoods in fume hood driven labs, so that in effect, nonresidential laboratories, scientific spaces, applies to additions and alterations and it aligns with existing codes and does not modify the Code language, but adds to it.

And to go into a little more detail on the actual Code language and the Standards, we had that prescriptive requirement for fume hoods limited to VAV hoods. Also, we're proposing to require that manual overrides are installed along the -- complying with ANSI Z9.5 and occupant sensor requirements complying with Section 110.9 and other fume hood specific language.

And for the reference, appendices, every new section need to be added for acceptance test documentation and, again, with the ACM we would need to describe how this will be modeled, both for the standard and the proposed conditions.

Key links and contact information, and any questions? Go ahead, Val. Oh, yeah.

VAL: Okay. Thank you, RJ. This is Val, from AESC. I just wanted to make a couple comments, since I know this is pre-rule-making, so things are still getting fleshed out. But the first two drafts, I believe, were drafted as though this was going to be a mandatory measure, but based on a lot of stakeholder feedback it was changed in the case report to prescriptive.

And I know this last slide showed prescriptive. So I just wanted to make sure that's what the case study was representing. And then the second key comment I had was, early in the presentation there was a description of what is fume hood driven based on the one square foot of hood work space per 35 square feed of lab work space.

That was our first attempt at delineating when the measure would be cost effective and when it wouldn't, when a lab is fume hood driven and when it isn't. Also based on a lot of stakeholder feedback about labs and their operation and the building parameters, we did a sensitivity analysis instead to a lot of the building parameters to define more of a parametric space, what would be fume hood driven and what wouldn't.

So the cost effectiveness in the fume hood driven space is now based on three different variables about the building, rather than this one fume hood density. So I would direct you to the case report if you want to see more details about that.

MR. WICHERT: Online, Chris? Well, if there's no comments or questions I guess we'll move on to Mark's presentation.

MODERATOR BOZORGCHAMI: Mark Alatorre will be talking about hybrid condensers.

MR. ALATORRE: Okay. Good afternoon. I'm Mark Alatorre. I'm an engineer with the Building Standards Development Office, and I'll be presenting the topic of hybrid condensers. I want to acknowledge the California Utilities Statewide Cogent Centers Team, as well as the CASE authors on this measure, Doug Scott, Trevor Bellon and Catherine Chappell.

Background on this measure, we'll go back to it the 2008 Standards where we began to cover what we call process spaces or process energy. Prior to the 2008 regulations we did not do that. We only regulated air-conditioning as it related to, you know, human comfort, human occupancy.

But in 2008 we started regulating refrigerator warehouses, and within that we had -- related to this measure we started having requirements on the condensing units. Specifically, we had saturated condensing temperature requirements, depending on if you have a evaporatively colder air-cooled condenser, as well as variable speed fans on the condenser, and the fans needed to incorporate a split capacitor or an ECM motor.

The next round, the 2013 Standards, there was some changes to the condenser requirements, and for refrigerator warehouses that included removing the split capacitor or ECM requirement, but adding condensing temperature reset requirements, as well as condenser-specific efficiency and a minimum FIN density.

Also, Section 120.6 was expanded to cover more processes and that included commercial or supermarket refrigeration, where there were similar condenser requirements to that of refrigerator warehouses.

There were some key differences, though, in the specific condenser efficiency, and at that time in the CASE Report, the CASE authors, who were the same firm, Baycom, they did an analysis on hybrid systems.

However, there was limited information because they were still new to the market and they didn't feel confident with setting condenser requirements at that time. Under the 2016 Standards there was no changes to both the refrigerator warehouses or the supermarket refrigeration sections.

However, we began fielding calls on how the current Standards did apply to hybrid condensers, and also, there was a rise in the use of hybrid condensers, which results in us getting those calls. There was interest because of the large water savings compared to evaporatively cooled condensers, as well as large kilowatt savings and potential kilowatt hour savings, when you compare them to air-cooled.

So this is a slide that was presented at the stakeholder of current industry practice for supermarket refrigeration. Both air-cooled and evaporatively cooled, condenser are used throughout the state, with hybrid being one of the emerging condenser technologies being used right around five years, and that's coincidental with the 2013 Standards; and also, an increase in trans-critical CO_2 systems.

Also, that was for supermarket. For refrigerator warehouses they historically have used ammonia systems evaporatively cooled for -- when evaporatively cooled, and air-cooled systems are to reduce water use and cost.

So a description of the proposed Code change is to add hybrid condensers in addition to the air-cooled and evaporatively cooled condensers, both in the supermarket refrigeration section and the refrigerator warehouses section, as well as include CO_2 as a refrigerant.

This change is more to clarify how the existing Standards apply to CO_2 sensors -- I mean -- to CO_2 systems as a refrigerant or that use CO_2 as a refrigerant. So you'll see in the proposed Code language how certain sections, there was an exception provided that made, you know, somewhat like the condenser sizing, the specific efficiency not applicable to CO_2 based systems, but it does incorporate the saturation and condensing temperature of the variable speed fans and variable set point control to those systems.

The CASE Team in their proposal or in their CASE Report they use three prototype buildings, a large supermarket, small refrigerator warehouse and a large refrigerator warehouse. The saturation control temperature, the three different control logic that was used I outlined here.

Option A used a reset based on dry bulb, and it did that for both wet mode and dry mode. Option B reset based on dry bulb and fixed when they were operating in wet mode. And in Option C it reset the saturation condensing temperature based on the precoil inlet air.

So this was after it passed through the adiabatic pads or, you know, when it was in wet mode. Also, they analyzed a maximum dry mode temperature difference requirement, and this -- that measure results in condenser sizing.

So the temperature difference would be the saturated condensing temperature versus the outdoor dry bulb, and the bigger the temperature differences, the better the outside condenser. And the last thing that they analyzed was a specific efficiency requirement.

And here's a table that kind of illustrates the assumptions that were made for each one. So when they were analyzing the saturated condensing temperature reset, that's this blue row here, and the three options were the variables. Everything else stayed the same as the base case.

When they were doing the condenser sizing the base case assumed a 10 degree temperature difference in dry mode and a 30 degree in wet. What they analyzed was a series of five different ranges, which I'll show in a graph later.

And then they stuck with the 20 degree difference when it was in low temperature and 30 degree when it was a medium temperature, and I'll explain it a little bit later. And lastly, the minimum efficiency, they compared the base case for ammonia and halocarbon refrigerants, and they compared it to 25 BTU per watt up to 65 BTU per watt in increments of five, and then they narrowed in on which one was being recommended.

So the results of the analysis is all three control strategies achieved TDV energy savings. The proposed language is focused on Option B, and that was chosen so that they would not inhibit innovation for controlling pre-cooling mode. So there's still questions to be asked on how to maximize or optimize the control strategies for when these condensing systems are in wet mode.

And Option B uses a fixed temperature when it's in wet mode to kind of still allow the market to develop or evolve. So here we have the annual energy savings per square foot for the variable saturation condensing temperature set points.

I showed the -- this is the energy savings for Option B and here we have the large supermarket, small refrigerator warehouse and large refrigerator rated warehouse. I want to remind everybody that this is a per square foot savings. So when you apply, those hard square footages shows, you know, the large energy savings.

The life cycle cost effectiveness, the incremental cost that was assumed that included installation, wiring and, you know, everything that would be involved in incorporating Option B, and when you compare it to the energy cost savings where you come up with the benefit cost ratios.

And I highlighted in red where the climate zones were, this option is not cost effective, and that's reflected in the proposed language as exceptions for these climate zones.

The analysis for the condenser sizing. So again, they studied various temperature differences. I put them up here on the slide. Ultimately, they chose the 20 degree and 30 degree. at that point for the large supermarket it showed energy savings in this range here, and in TDV.

And these are what were considered the warm climate zones versus the cool climate zones, which is one, three and five, which had a lower impact on TDV savings. Same thing for the small refrigerator warehouses.

However, the large refrigerator warehouse had better performance in the cool climate zones. So the incremental costs for the -- what was ultimately chosen, the 20 and 30, and the first cost is reflected here in the last column and then so forth for the smaller refrigerator warehouses and the large are down here at the 267,000.

The life cycle cost effectiveness, again, if you compare incremental cost to the TDV energy savings we get the benefit cost ratios. I highlighted in red again where it was not at one or more. We're still trying to come up with if it's reasonable to have exceptions for these or not.

That's not in the proposed language yet, as you will see at the end, but I wanted to highlight that there were three cases where the benefit cost ratio did not reach one. As far as the condenser specific efficiency, here's the graph that showed the specific efficiency and where it becomes cost savings on a TDV basis, and we have inflection points at 45 BTU per watt.

This is for the large supermarket and this is for the warm zones. The cool zones have that same inflection point of 45 BTU per watt. From a benefit cost ratio perspective you got a -- at 45 BTU per watt is right when it hits one, and that's true for the warm climate zones as well as the cool climate zones for the small -- I mean -- for the large supermarket scenario.

The small refrigerator warehouse showed the same trend, where at 45 BTU per watt was where we were hitting the inflection point, and where the cost benefit ratio was one. And although there was greater specific efficiencies, like at 52 BTU per watt, the CASE Team landed at 45 and that was, again, to not put undue burden on the new technology that's coming out, and they would leave most of the options open for designers selecting these systems.

The large refrigerator warehouse is -- this system was a ammonia-based system, and if you see the inflection points at 35 BTU per watt and the benefit cost ratio was there, too. However, they did not recommend a specific efficiency for ammonia-based systems and that was due to lack of data, again, that this is a newer type of technology today.

Similar to what happened in 2013 when these systems came out, there was not enough information for them to pursue or recommend a specific efficiency for the large system, ammonia-based. So now, we're going to jump into the proposed Code language.

I'm going to do what I did last time, since my hyperlinks don't work. I would like to bring attention to some of these definitions. So when we're talking about hyper condensers in reality they're defined as adiabatic condensers.

This is a proposed definition for an adiabatic condenser. I would like to get comments on this definition, if not now, during -- in the docket. This is how it would be applied to refrigerator warehouses.

Again, the added clarification on what sections are applicable to transcritical CO_2 refrigerator systems. In this case having design saturated condensing temperatures limits is not practical for these systems.

So there's exceptions added. So this is for a evaporatively cooled and this is for air-cooled. Here's where we have the condenser sizing requirement added, again, with the exception for transcritical CO_2 systems.

So I didn't intend to go through each one of the scenarios or all the lines here. But I did want to show the proposed Code language, and it will be posted along with the presentation and open for feedback.

So with that, I'm at the end of my presentation. Let me get back to the -- if I can get there. Say stop sharing there. So I can take questions now. Anything online? Okay. I'd like to thank the CASE Team again, and especially for making the trip from San Luis Obispo. Sorry you couldn't field questions, but.

(Pause)

MODERATOR BOZORGCHAMI: Sorry about that. So I'm going to introduce a new concept, the loading dock seals, and I just wanted to see -- get some input from public and to see where we're going with this and if it's the right path to go.

I want to give acknowledgment to the Cogent Standards team and especially John Arent and Katie Gustafsen. Sorry about that. It's not as Bozorgchami, but I apologize.

(Laughter)

MODERATOR BOZORGCHAMI: So loading dock seals, it's not been a concept in Title 24, but has been measured. It's been in ASHRAE 90.1 since, if I'm not mistaken, 2006 for climate zones four and eight -- four through eight, not four and eight. Sorry about that, four through eight.

So what is a duct seal? Duct seal is that little foam/fiberglass mesh covering that goes around the loading dock doors. And there's two types. There's duct seal and there's the duct shelter. It's the protection of the back end of a truck, so as it backs up the environment is not -- there's -- the outside air, the unconditioned air, is not really interacting with the environment within the building.

Here's a little bit of definition of what it is and the pros and cons of each one. The duct seals are a little bit less expensive versus the duct shelters. They both were not really intended for energy efficiency, but they were mainly intended for privacy to prevent the elements from interfering, rain, moisture and pest control.

But what John did, and noticed that there's an energy benefit to this also. So one of the measures go, the possible mandatory, is to maybe require duct sealing for all roll up doors where it looks feasible in the climate zones.

The baseline analysis that was taken and field measurements done is provided. I think that it was done on two different locations with two different types of scenarios happening. And what they did when they did the energy monitoring, they looked at different types of loading frequencies.

How often is that loading dock used? Is it used a low, two times a day, medium, five times a day, or a high, 11 times a day, and what the benefits are for that. These systems do get beat up pretty bad.

I mean, you got to remember, these are very heavy trucks that back into these and they provide the seal. So when the analysis was done, they looked at the incremental -- estimated, expected use of useful life, about seven and a half years.

I think these were done by surveys with contacting different vendors and different users of these products. And if you notice, the first cost roughly fluctuates between $1400 for a sealed system versus a shelter system of $2400.

What the analysis was done, it was based on a 15-year analysis, but it was based on the higher cost system, because you could use either one in any climate zone. I believe there's seven manufacture of these products that sell in California currently.

Again, what they did was they separated the cost effective based on the climate zone, and we have three different analysis done, one by low duct uses, and it shows that there's a benefit cost for two climate zones.

But you got to remember, these are the two extreme climates, one in 16. The analysis was done based on heating loads. But if you look in the -- which twice a day versus five times a day. At five times a day you capture a lot more climate zone.

And if you look at the climate zones that you're capturing, you're capturing in a lot of climate zones that there is a lot of movement in products. Climate zones three, South San Francisco, four and up -- five are -- you get a lot of I'd call it produce movement within the Salinas, Monterey County, Sacramento.

We've got a lot of warehouses and we've got a lot of storage facilities here in climate zone 14. But if you look at a area which has 11 times of movement or higher movement, you notice that there's a lot more savings.

There's a higher benefit coast based on the low -- or actually, the medium duct uses. And you're capturing a little bit more climate zones. So the proposed language would be something like this if we do implement it into our Standards, 10-117 for requirements for limiting air leakage.

We would have to add definitions for both loading docks, dock seal and dock shelters, which at this time we don't have any. In reality, I just wanted to see what people's feedback would be on this topic, on this measure.

So that's why we're proposing it today. This measure, again, here's the web links. If you're not able to participate today verbally, please submit your comments to our comment log. It's the third link on the bottom.

The proposal is in the Title 24 Utilities Sponsored Stakeholders' Meeting, and again, our own website is the one in the center. My contact information; and questions or comments or feedback would be appreciated. John, could you turn it on, the mic on.

MR. McHUGH: I'll learn by the time it's 5:00 o'clock, I guess. Remind me, is there a similar requirement already in place for refrigerated warehouses?

MODERATOR BOZORGCHAMI: Not like this, no, not for these roll-up doors.

MR. McHUGH: Okay. So does it make sense if there is a requirement that applies across all climate zones for -- because I'm assuming that the thermal benefit is markedly enhanced for refrigerated warehouses.

MODERATOR BOZORGCHAMI: The refrigerated warehouses where the dock is right there and it comes back into a conditioned refrigeration system I think it would, but John would be the better person to answer that question.

MR. NERESCO: Yes. John Neresco. Yeah. It's a great point, Jon. I think we didn't really focus on that. We're focused primarily for this measure on the nonrefrigerated, just because of the -- to provide a scope of analysis.

As you know, it's a little harder to estimate the benefits of a seal for a refrigerated warehouse, because of the complexity of the store, but that being said it seems like it would be a good and reasonable requirement to include them on refrigerated warehouses.

The other thing is, I think it's more commonly done on those buildings than nonrefrigerated where it's a little bit unevenly used, but yeah, that's a good point.

MR. McHUGH: Okay. Thanks.

MR. NERESCO: Yeah. And just to clarify some of the scope and how we structured the study. So this analysis that you're seeing and the savings, it's looking at a warehouse where there's -- in the storage area there's heating, but there's no cooling of the space provided.

So obviously, any space that has cooling as well could have additional benefits. And also, while we're kind of characterizing this as a warehouse measure, it would apply basically to all spaces that have these loading dock doors.

So the large big box retail that have storage areas that back, they would be subject to this requirement if we in the CEC decide to have it go through for the next Standards update.

MODERATOR BOZORGCHAMI: Well, with that, if there's no more questions, I think we're done for the day. Our next workshop, Pre-Rule-Making will be on June 20th, sorry about that, on Nonresidential HVAC Measures.

And all the presentations today will be posted by tomorrow and we will provide an update on our schedule as we had changed it this afternoon for the rest of the workshops. With that, thank you.

(Adjourned at 2:13 p.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 21st day of June, 2017.

Kent Odell

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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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IN WITNESS WHEREOF, I have hereunto set my hand this 21st day of June, 2017.

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Myra Severtson
Certified Transcriber
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