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Inclusion in the 2013 California)
Building Energy Efficiency Standards)

Design Phase Commissioning, Acceptance Testing, Refrigerated Warehouses and Commercial Refrigeration

CALIFORNIA ENERGY COMMISSION
HEARING ROOM A
1516 NINTH STREET
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MONDAY, APRIL 18, 2011
10:00 A.M.

Reported by:
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Present: (* Via WebEx)

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Presenters

*Karl Stum, PECI
*Glenn Hansen, PECI
Doug Scott, VaCom Technologies

Also Present

Attendees

Patrick Eilert, PG&E
Mike McGaraghan, Energy Solutions
Jamy Bacchus, NRDC
Jon McHugh, California Statewide Codes & Standards Program
*Tim Fryxell, Guttman & Blaevoet
*George Ronn, SUPERVALU
*Sean Gouw, Southern California Edison

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P R O C E E D I N G S

APRIL 18, 2011 10:04 A.M.

MS. BROOK: Here we are, it's 10:00 and we're at the Energy Commission in California, and we're talking about updates to the 2013 Building Energy Efficiency Standards. Today we're talking about things in the Non-Residential Building Energy Efficiency Standards domain. So, let's move on.

So, just to make sure you're in the right room, or on the right Web call, today we're going to talk about these topics: Design Phase Commissioning and Acceptance Testing, and then we're going to take a lunch break and, then in the afternoon, talk about Commercial Refrigeration and Refrigerated Warehouses.

In the last two workshops, the one we held on April 4th and April 11th, Mazi spent several minutes talking about, in detail, our policy objectives. And I would direct you to those presentations on our Building Energy Efficiency Standards website, I didn't include the whole presentation here because I thought that those of you that are participating in multiple workshops would get awfully sick of hearing the same thing over and over again.

So, anyway, just as an overview, we are trying to make aggressive steps towards Zero Net Energy Building

Codes. For residential, the goal is to do that by 2020 and, for non-residential, the goal is to get to a Zero Net Energy level of building energy performance by 2030. And in this round, the 2013 update, we expect between 15 and 25 percent improvements in our Standards.

Another policy objective that we have is to get a Commission approved set of Reach Standards, which is what we call our voluntary level of efficiency standards that go onto the base standards that the Commission adopts. And this will be inserted into the Energy Chapter of Title 24, Part 11, that's part of the California Green Building Standards that gets developed and updated. Okay, hold on a second. We have some technology issues we're going to interrupt our presentation for, but you can't hear me anyway, and that's what we're going to fix. Okay, you can't hear this if you're on the Webinar, but we're going to take a break and try to fix the audio part of the Web meeting that doesn't seem to be working and I think Ron just typed in something to that effect. So stay tuned.

(Off the record at 10:07 a.m.)

(Back on the record at 10:11 a.m.)

MS. BROOK: I think we're back. So, if a few of you could chat over there to Ron and see if you're actually hearing our presentation that would be great.

You didn't miss too much, in fact, you've read everything I've said, so I'm going to keep going and you can, of course, ask any clarifying questions you have as we go through the day.

So, I was talking about our Reach Standards and that we'll be proposing our Energy chapter into the Part 11 update process, which will actually be aligned at the same time as our 2013 Energy Code Update, and so the Part 6 and Part 11 will be updated at the same time, with adoption in 2012, publication in 2013, and implementation in January 2014. And that is actually the last bullet on this slide, is that we're making every effort this Code cycle to get alignment with the California Building Standards Commission's three-year Code Update cycle for the California Building Code.

So, this is our overall 2013 Energy Efficiency Standards Update Schedule. We are in this pre-rulemaking activity now where we are reviewing proposals developed by the Investor-Owned Utilities Codes and Standards Enhancement Program, and there's been many stakeholder workshops that the case program has sponsored and managed, and now we're doing public workshops to present the final recommendations that we will be moving into Code language this summer, so we expect a Commission adoption of our 2013 update in March 2012, and as I said,

that would be published into the California Building Code in 2013 and have an implementation date of January 2014. So, we are working collaboratively with many people that the Investor-Owned Utilities are managing work over to get many proposals brought forward for consideration in our 2013 Update, and I think I've said the rest of this, we will be preparing 45-day language this summer, and we'll begin our formal rulemaking in the September 2011 timeframe.

So, our first proposal or set of recommendations that we want to talk about this morning is Design Phase Commissioning. And just as sort of a disclaimer for the day, I'm going to be doing most of the presentations, and I'm going to be saying "we" a lot, but when I say "we," I really mean the Case Authors, the people, the consultants and technical experts that have put the Case Proposals together, and have been working with stakeholders to iron out issues. So, that work is what we're bringing forward today and it's going to sound like it's coming from me, but it really is based on the Case Reports that are posted under this Workshop heading on our website, and I would encourage you to look at those case reports, there is a wealth and depth of information in there about how the proposals were developed and what justifications are made in there, what assumptions are made to get to

expected levels of energy savings and benefit cost ratios, and all of that detail is available on our website for you to review.

So, Design Phase Commissioning. This will be the first time in any energy code that I know of where the design review process that's key to commissioning is included in the Building Code. So, first, we'll talk about what is design review and then where it fits into in an energy code context. So, the Design Review Process is a key part of building Commissioning, it confirms that the design conforms to the project requirements, it checks documents to make sure they're clear and complete, and are free of significant error, and then also, through the design review process, there is the ability to suggest to the building project team best practice designs and enhancements that can be made to improve the energy performance of the buildings.

When you think about Design Review in the code compliance context, we want to use it to confirm that the design conforms to building codes, so it will improve code compliance. We want to make sure that the performance-based compliance, the energy modeling inputs that are used as part of the performance based code compliance are reflected in the design documents, so this is an opportunity to really bring forward the key

features of buildings that a designer wants to take credit for in our performance-based compliance approach and make sure that these key features are getting checked and reviewed as part of that design review process. And there are other commission related requirements in the Green Building Standard, CALGreen is the nickname for the Green Building Standards, Title 24, Part 11, there are commissioning requirements in there, but the commissioning requirements in CALGreen do not include this design review step, and so we'll be inserting this design review process into the Energy Code, specifically for energy-related systems that are part of our compliance process and our energy performance standards. And we also have acceptance testing that we're doing more and more for more measures and to confirm performance in the field for energy efficiency measures, and we want to use the design review process to make sure that there's a strong connection back to the design phase for these key efficiency measures that we'll need to get acceptance tested at the end of the process. And we want to make sure that these requirements are reflected in the design documents early in the building project process.

So, what are the benefits of design review? So, you know, it has cost and time benefits, it reduces the number of significant change orders in the building

design project, and reduces administrative time to issue change orders and requests for information, it reduces delays associated with resolving deficiencies. It saves energy, it increases the compliance with Title 24 energy requirements, and it also increases the adoption of best practices that go beyond Title 24 because, again, you're getting a team of experts to do an independent review of your design and they are qualified and capable of making recommendations for increased levels of energy efficiency. And the result is a quality building that operates as intended, it's easier to construct and maintain, and has a lower long-term operating cost.

So, the objectives of design review in our Energy Code is for it to be effective, but not overly burdensome, for it to be practical with the target items that have the most impact, and not be duplicative of existing compliance processes. The effort and cost needs to be scalable to the project size and, as we said before, we want to integrate it with our acceptance test requirements and the other commissioning requirements in the Green Building Standard. And we, of course, want our suggested procedures to be enforceable.

So, our proposed requirements, it's a two-step requirement, the first, well, I think I'm jumping ahead of myself here – yeah, so this is an overview of the

requirements and the two-step process, I think, is in the next slide. So, we will require a design review for all non-residential projects, and the design review requirements will vary with building size and the complexity of the energy systems that are included in the building. There will be a requirement at the schematic design kick-off meeting stage of the design process and also at the construction document design review process. So, there will be two distinct activities that will happen, that will be part of these requirements.

For simple systems, the reviewer qualification, you can basically check your own design if your building is less than 10,000 square feet, the qualifications for a design reviewer increase with project size and complexity, you can do an in-house review for buildings less than 50,000 square feet by a registered engineer, so that's an engineering associate with no direct involvement in the project design, and then third-party review for large complex buildings by a registered engineer.

So, this is sort of the path of where the requirements fit into the design permitting and construction process, so there will be a design review kick-off as part of the schematic design phase, and then a design review at the stage of preparing construction

documents, and those will result in a completed design review checklist that gets signed by the appropriate parties and submitted as part of the permit application.

So, the first step of the schematic design kick-off meeting, it's an initial coordination of the design project and design review needs. The kick-off meeting will be held with the owner and the project team, they'll discuss the design review process, and present the required and best practice checklists that need to be completed, and they'll discuss the future construction document design review approach and any timing or scheduling factors that are relevant.

The second phase, the Construction Documents Design Review, is intended to substantially complete the design documents that have been distributed. You're checking to make sure the design documents are completed, the design review performs a checklist review, and the design review checklist is signed and sent to the owner and the project team. The project team addresses review comments, design review forms and sign-off are printed on the bid set and submitted with the permit application, and the Code Official confirms that the signed forms are included in the plans as part of the compliance check.

So, in order to understand the value in the code context of the design review, we had to estimate the cost

of the design review requirements and this is what was assumed, that a simple and small building less than 10,000 square feet, the design review process could be completed in 16 hours, and a moderate building that is relatively simple and less than 30,000 square feet could be completed in about 50 hours and a larger complex building that requires third-party design review would take approximately 145 hours when that includes both time by the design reviewer and the designer to address issues that are identified in the design review process.

So, the other half of the equation in the benefit cost ratio is to assume how much energy savings will be realized by including the design review in the Code compliance process. So, in order to do this, what we did was we used energy simulations with and without compliance, with the efficiency measures that are most often identified and fixed as part of a design review process. Then, we had like the perfect energy performance based on complete compliance, and then we had a faulty simulation where the faults that are typically identified in the design review process were not fixed, and so those gave us the before and after design review energy usage. And those savings that result from that were discounted significantly based on the typical frequency of fault occurrence, so we’re not going to

assume that those faults happen 100 percent of the time, so we discounted the savings based on how often we expected to see those faults in a design review process. They are discounted further to account for the ability of the design review to actually identify the faults, so we're not assuming perfection there either, we are assuming that there are times when faults go unidentified in the design review process. And then, we're also discounting the savings based on not getting complete compliance with our new design review requirements, so we understand that it would be wonderful to get 100 percent compliance, but we're not assuming that for the basis of understanding expected savings.

Then, we also included a slight upward investment of energy savings due to the fact that the reality of a design review process actually results in adoption of advanced or increased levels of energy efficiency, again, because you have experts reviewing your design early on and giving you enough time to respond to their recommendations and you're able, then, to adopt advanced energy efficiency measures that weren't in your original design. So, we took a conservative estimate of that, but we did try to account for that because it's one of the real benefits of a design review process.

So, this is a summary and if you want to look at

this in detail, it is in the case report. This measure is very cost-effective, it's got a simple average cost-benefit ratio of over 4.5, it's over a multitude of building types, it's got societal energy cost savings that are significant and we think this is actually a conservative estimate of the benefits of including design review in a Code Compliance process.

So, the next steps for this work is to develop an effective package of design review checklists, and to also make the connection between the generation of that checklist and our compliance software reporting requirements, to make sure that, as I mentioned before, if there's design features that are getting modeled and getting taken credit for in the performance compliance approach, that those features end up on a design review checklist and make sure that they are included in the design documents. And then we'll be developing code language for this measure and it will be very simple, probably only a few sentences that actually get inserted into the Code language, because most of this work, the checklists and the explanation of the process, will go into our compliance manual, but there will be a reference to these requirements in our Code language.

So that is it for Design Phase Commissioning, and the way that I've organized the workshop is to kind of –

I can do two things, I can open it up for questions now, or we can go all the way through the Acceptance Testing Proposals and kind of open it up for all Commissioning related proposals at the end of that, so I'm open to either one. If you're not hearing a lot of chat, Ron, then I'm going to probably keep going.

So, the next – yeah? Oh, and you're supposed to tell them to come up to the microphone and all that.

MR. EILERT: Hi. Pat Eilert from PG&E. So, Martha, the question is, is should we be including something like a non-compliance discount into the savings calculation at this point? Have we done that before?

MS. BROOK: I don't know. My guess is that some proposals probably did and most didn't, but this one, you know, I actually think it's appropriate because, 1) it's still very cost-effective, right? And then, the other thing is that this is a requirement that's never been in the Energy Code before, right? And it is all about improving compliance, so to assume that that process is going to be perfect, I don't know, it just seems appropriate in this instance to include that. Are you concerned for –

MR. EILERT: Well, I just wonder if we're –

MS. BROOK: You're setting a precedent that –

MR. EILERT: Mazi is about to correct me.

MR. SHIRAKH: Go ahead.

MR. EILERT: I'm just wondering if we're setting a precedent here. Generally, I'm not sure if it makes sense.

MS. BROOK: Okay.

MR. EILERT: At this stage. Maybe it does, but I haven't thought it through.

MS. BROOK: Okay.

MR. SHIRAKH: This is Mazi. In the previous cycles of standards, every time we adopted a measure, we always assume 100 percent of the savings were going to be there. Unfortunately, that not only is not correct, it kind of makes it harder later on to take corrective action because the savings have already been claimed for that measure. So perhaps what we need to do is actually, for each measure, consider the persistence of the savings and the measures we need to take to Acceptance testing, design phase commissioning, you know, fault detection, and diagnostics, and all of those should probably be an integral part of each and every measure that we consider from here on out for persistence purposes.

MR. EILERT: Yeah, and with the understanding that would change over time, right?

MR. SHIRAKH: Right.

MR. EILERT: You know, compliance should increase

in the early years fairly quickly. So, it's time dependent. Okay.

MR. YASNY: Martha? There's a question from online: "Are you considering best technologies such as IPD and BIM or BIMStorm during design review processes?

MS. BROOK: Well, so that's – I guess what we will focus on in the design review is the design review of the energy systems that are already considered and part of our energy code, but if there's – I included this concept that there's other technologies that are recommended during the design review that increase energy efficiency and go beyond Title 24. I'm struggling to understand the question because building information modeling is a great idea, but we don't have any requirements for the project design to be done with BIM compliant tools, so I'm not exactly sure how it would be included in the design review process.

MR. YASNY: Well, Karl Stum is online and he is helping you answer the question. "As a Case Author, I can say that the design review will include a list of beyond code energy saving features for the designer to consider. This checklist could include BIM, though the link to energy efficiency may be a little obtuse."

MS. BROOK: Okay, great. Thanks, Karl. Okay, any other questions? Okay, so we're going to keep going.

Our next proposal is on Acceptance Requirements and this set of – this specific proposal is focusing on improving our Acceptance Tests based on what we're finding and what actually is identified in the retro-commissioning process as failures, and how can we actually improve our acceptance tests to minimize those failures in the field. So, the Case Authors accessed California Retro-Commissioning Program Dataset that has been collected and populated by retro-commissioning service providers in the state and it looked at over 800 failures across 125 buildings and the criteria for selecting efficiency measures for either improving a test, or creating a new test, was the frequency of failures in the field, the energy savings potential of those measures, and the suitability of developing an acceptance test for that measure. And out of that process – and, again, I would encourage you to go to the Case Report if you want to learn about all of the background research and analysis that was done with those 800 buildings and how they came up with these two tests, I would encourage you to look at that Case Report. The result is two new acceptance tests that will be included in the Code Update, one is for Supply Air Temperature Reset Controls and the other is Condenser Water Supply Temperature Reset Controls. Each of these tests is anticipated. They're both cost-

effective, and they both expect to save, just doing the test and improving compliance and performance, to save $.14 per square foot. So, the Supply Temperature Reset Control test, it will take anywhere from half an hour to two hours, the idea is for multi-zone air handler units to test the supplier temperature, is reset based on outdoor temperature and return air temperature, the test needs to be done at both high and low load conditions, and the specific details of the test are included in the Case Report. The Condenser Water Supply Temperature Reset Controls for water cooled chillers with the cooling tower, it tests the Condenser Water Supply Temperature, is reset based on outdoor air temperature or load, and again, the time required to test is in the range of half an hour to two hours. Did I get that right? I actually think I might have that last one wrong, so the Case Author may want to chime in. I think that's a Powerpoint error, but I'll wait and see what somebody says about that.

Well, actually, now would be a good time because I'm on to the next one already. How do you go back with this thing? So, anyway, that's a minor thing, the length of time that the test takes, I guess I'm just surprised that it's exactly the same for both tests, and so I think I actually copied that wrong.

MR. MCGARAGHAN: Mike McGaraghan, Energy Solutions, yeah, those are – they're not the same for each test, I know that, and I think that they might have to go back and check exactly, but they're longer than those times. I think they range from about four to six hours, total.

MR. YASNY: Here it is, two to four hours for CWST.

MS. BROOK: Great, thanks. Was that Matt? Okay, thank you. Okay, so the next Acceptance Test proposal is to improve the effectiveness in compliance, so this is based on a study that's being done by the California Commissioning Collaborative, and it's a PIER funded study that will have a final report published in, I think, a few months. The objective of this work was to improve the forms, improve the test processes, and to provide outreach and education activities to improve the quality of the acceptance testing that is actually getting done, based on our Code requirements.

So, the key findings, and there was a lot of work done here, again, I would encourage you to look at the Case Report for the details. They did phone interviews and interviewed both Building Departments and Designers and other key stakeholders, and you know, the summary of the findings are that the Acceptance Requirements and

forms are confusing, and the tests are only sometimes performed, not always, like we would hope. There are key issues like there's a financial disincentive to include the costs of the test in a bid when you're competing with other contractors that may not be doing the tests per Code, so it's often not included in the bid unless specifically requested. And nobody knows to ask about the Acceptance Test forms, so that's a problem, and sometimes incorrect forms are used, or the forms that are used are not completed accurately or in its entirety. And on-site verification is uncommon.

So, you know, it's unclear who is responsible to specify the test, it's also unclear who is responsible to execute the tests, but at the same time, people understand that the tests are valuable, that it helps them get functional equipment and that they're better off with getting equipment that meets the design intent and the Code requirements. So, they see the value in the tests, but in practice the requirements are unclear and complex.

So, the recommendations coming out of this work is to make specific changes to the Compliance Forms to improve clarity, to document additional details, to improve functional test procedures, and the documentation processes of the functional tests. So, a lot of work to

refine and clarify the forms is underway, and, additionally, there will be at-a-glance guides developed and added to the Compliance Manual so that, for specific acceptance tests, these at-a-glance guides can be an effective way to summarize the requirements and the steps that need to be taken to complete the Acceptance Tests. So that is actually all I have for the three proposals that we had on the agenda for this morning, and we're here to answer any questions that anybody in the room or online have about these proposals. And then, what we're going to have to do, unfortunately, the way that the workshop day is shaping up, we actually will have to take a long break before the afternoon session because our Technical Case Authors for the afternoon are not here and are not expected to be here until later on in the day. So, do we have any questions?

MR. MCGARAGHAN: Mike McGaraghan, Energy Solutions. I just wanted to point out that Martha just covered the intent of the Acceptance Testing changes. The majority of those changes will happen in the Appendices and are not actually required to be approved by the Commission on the same timeline, so she didn't get into a lot of detail on the actual language of these new proposed tests, but the case reports do contain first drafts of the proposed tests, and we would be interested

in hearing feedback, so anybody who wants more information on the way those tests are actually proposed to be structured, you can find those there, and the Case Author is listed there, as well, and would be glad to take feedback on the tests.

MR. SHIRAKH: Mike, before you leave, you said that most of the requirements are going to be in the Appendices, presumably you meant the reference appendices?

MR. MCGARAGHAN: Yes.

MR. SHIRAKH: And then you said that they will not be adopted at the same time as the standards, that is not correct, they will – the only document that will be on a different timeline are the Compliance Manuals. They will be developed after adoption, but reference appendices will be adopted at the same time as the standards and the ACM Manuals.

MS. BROOK: So, the first two tests, the Supplier Temperature Reset Test and the Condenser Water Reset Test, would have to be in the appendices and be part of the 45-day language and everything that we do in the fall, but anything that goes into the Compliance Manual, the At-A-Glance Guides, Mazi, correct me if I'm wrong, but improvements to the forms? Is that –

MR. SHIRAKH: Yeah, At-A-Glance and Forms are

part of the Compliance Manuals.

MR. MCGARAGHAN: I misspoke. The majority of the changes are in the forms and that's what I meant would not be going through the same timeline.

MS. BROOK: Okay, great.

MR. SHIRAKH: Thank you. Mr. McHugh?

MR. BACCHUS: Hi, happy to share. Jamy Bacchus, NRDC. I have a number of comments and questions, many of which were brought up during the stakeholder process.

MS. BROOK: Okay.

MR. BACCHUS: One of them concerns just enforceability and the penalties or the ability of the authority having jurisdiction to either refuse a Certificate of Occupancy to a building that didn't comply, that – so we have a review process at the permitting phase where they have to sign off and actually do forms, but what is the actual enforceability of the early schematic part, the Part 1 portion of this? And we see the same thing sort of in lead projects where you're supposed to hire a Commissioning Agent early on and do a schematic level design, but often that is just to have the nature of the beast, that owners end up deciding they want to go for a lead rating way late in the design phase, and then suddenly you just end up implementing this stuff as a formality, and it doesn't actually

benefit the projects. I'm curious what the stick is for the early portion.

MS. BROOK: So, what you're saying is that they would just basically be less than honest about the design review checklist completion process?

MR. BACCHUS: Potentially. The second part, I think, where they actually do have to do the review, yes, I think they would actually do that, but you're actually requiring this initial part if you go back to your timeframe, that they would actually be involved almost Day One, is there actually any way of enforcing that, since there's no actual documentation for it? Is it just sort of a general request that they do this?

MS. BROOK: Yes, so the Case Authors should probably chime in and if you want to unmute Karl Stum and Glenn Hansen, I don't know if you can do them both at the same time. I don't know that we have a stick there, so what could it be, right?

MR. BACCHUS: Yeah.

MS. BROOK: That's sort of the Catch 22 there.

MR. BACCHUS: And I don't know if there are any code officials on the line, but –

MS. BROOK: Pull up that schematic real quick.

MR. STUM: So, this is Karl Stum. Am I off mute?

MS. BROOK: You are, we can hear you.

MR. STUM: Hey. So, I think the question was whether or not there is a way to confirm that the early design meeting was held, is that the question?

MS. BROOK: Yeah, so how do we confirm that they actually did the design review kick-off at the schematic design phase?

MR. STUM: Yeah, like you mentioned, I don't think we had a stick for that, I mean, the form they sign in the end at the permitting phase could say something about that, but then what do you do if they haven't done it, you know? So, I'll just back pedal and say I don't think we have a mechanism there. But relative to the – I think the issue at hand is to make sure that the Acceptance Testing requirements are in the bid documents so the contractors will bid them and that will take care of that one problem you mentioned, Martha, from their research, that people were not including it in their bids, it wasn't in the specs. So, the design review, then, later in design, would confirm that, in fact, those requirements are reflected properly in the bid documents and that the Commissioning processes are articulated well, also, so that there's a better likelihood that the tests will get executed as part of the commissioning process, that the AT tests will get done, the traditional CALGreen Commissioning.

MS. BROOK: Uh huh. So –

MR. HANSEN: This is Glenn Hansen. I'm sorry, Martha, do you have something there?

MS. BROOK: No. Please.

MR. HANSEN: Okay, so this is Glenn Hansen, a Case Author for Design Phase. I think you have to be practical and assume over time people are going to learn about this, and I think initially a schematic kick-off meeting will probably be missed, and I think largely what I have participated in Lead Certification submittals is you go back and you make it up. And I think those people are going to be caught not completing that step will have to kind of, you know, fill out the form incorrectly, as if this thing had occurred, and there will be some lost opportunity of not having the initial coordination meeting and discussion that could influence recommendations from the design reviewer, so that's just one step. The bulk of the value of design review will still occur, it's just that you won't get some of the benefits of the schematic design review meeting. And I think, over time, people will learn and will start holding that meeting.

MS. BROOK: Do you have any suggestions, Jamy, to improve that?

MR. BACCHUS: Not off the top of my head, I

mean, we're taking best practices and trying to make them Code, so it is an interesting thing and I applaud the idea, I'm just not certain – is there any precedent currently in Title 24 where we have something that is required, but we have no means of enforcing?

MS. BROOK: Probably more than we'd want!

MR. BACCHUS: So, maybe this is fine, then. I don't know if it leaves our Code Officials throughout the state hanging on, "Well, what do we do? We don't have any means of knowing this." But I'll point out that, in the non-voluntary measures of CALGreen in Appendix A, we have a similar commissioning requirement, or it's voluntary, but it's already written up that we have a commissioning authority who then has to look at the basis of design and the owner of project requirements, very similar to LEED new constructions, so we have essentially – we're kind of duplicating a little bit, so we can look and see if there's anything that's required, any process – go ahead.

MS. BROOK: Well, I was just going to say I think that Karl and Glenn should chime in here because they did look at those CALGreen requirements and came to the conclusion that it did not include design review, so they probably need to chime in here, unless I misunderstood what I think I understood from them.

MR. STUM: Yeah, this is Karl. The CALGreen Departments state that the basis of design and owners part of the requirements are reviewed and that they exist, but it doesn't – that's not a review of the design, that's just a review of some ancillary documents that relate to the design.

MR. HANSEN: This is Glenn. The builder valuable documents – and it's good project information that should be disclosed and given to the design reviewer, so we're not requiring it, but we would hope that there would be sharing of that information. And, to a large extent, we feel that the CALGreen requirements, whoever is going to be performing those duties, would also be active participants and perform the design review functions. So, if I was an owner, I would write a scope of work that would require my consultant to do both – all tasks, but you know, that's a contract delivery issue that the owner has got to work out and we're not going to impose it on anybody. We think there's a great relationship between the different requirements and it would be nice that they do get integrated.

MS. BROOK: So that may be something that we can push on when we look at the Part 11 Update, is to make sure that there's a reference to our design review requirements because it seems like, right now, the

CALGreen very first, you know, baby step into Commissioning, asks for a lot of information, but it didn't specifically talk about design review and developing checklists and really the key thing we're trying to do here is bring the need and acknowledgement of acceptance tests way forward, that's how everybody knows, and like Karl said, it gets into the bid documents, and then also specifically calling out features that you're putting in your performance Code compliance that also need to be part of the bid documents in the – so those are the key things that I see that aren't specifically implemented with the sort of higher level of Commissioning requirements in CALGreen.

MR. BACCHUS: This might be a separate kind of question than the one I was initially asking, but is Design Phase Commissioning then mislabeled? Is this really just supposed to be peer review – design phase peer review? And the Commissioning Review Process that CALGreen currently stipulates is separate? That that's actually how you can operate the building and making sure everything is running properly? But this is more of a peer review to make sure that it's Title 24 compliant?

MS. BROOK: I only got the second half of that because –

MR. SHIRAKH: I was worried he would have to

repeat that.

MR. BACCHUS: Sorry to the people on the phone. Is this, instead of really Design Phase Commissioning, it is more just peer review design phase just for Title 24 compliance? That is, just to make sure that they've picked up everything Title 24 requires and that they're doing it?

MS. BROOK: I think we would be a little bit broader than that in our – I don't know, I mean, I think this is definitely why we're having these discussions, to iron this stuff out. But I would hope that we could make it a little bit broader so that, you know, anything that is relevant to our Code is definitely the focus, but it would be nice to think about ways to allow the design review process to be implemented more broadly, though we might not have any requirements that it's implemented more broadly, to include other non-energy related features of buildings, for example.

MR. YASNY: There was a comment from online, "How about requiring a copy of design review comments with back check on the documents?"

MS. BROOK: Hold on, to answer the one on the phone and, Karl and Glenn, chime in here, but I think isn't that the intent of the checklist?

MR. STUM: I'll take a shot at this. So, I think

the broader design review, you know, the details of selection of equipment, size and equipment, checking for the fire dampers, all of those would be alluded to under the best practices, it wouldn't be linked to a specific Code compliant check, so there will be some general information under the best practice to go beyond just the energy aspects of it.

MS. BROOK: Okay. That was Karl.

MR. THAMILSERAN: This is Thamilseran from California Energy Commission staff. Based on the review that we had done regarding the CALGreen Commissioning Code that is currently being developed since from the March review, there's a difference between what occurred within the CALGreen Commissioning vs. the one currently proposed in this one. If CALGreen Commissioning has a subsection called "Basis of Design," but the part of the requirement is that basis of design document is supposed to be provided to the Commissioning Coordinator or Commissioning Agent. There is no collaboration or design review process at that stage, however, this particular one is going to be requiring that specific item. That is going beyond just submitting the document, to have collaboration or a design review process that actually takes place. Thank you.

MS. BROOK: Thank you.

MR. EILERT: Hi, this is Pat again from PG&E. So, I know that the Commission is considering this sort of document repository going forward and to a certain extent it just seems like all of these are compliance documents, and is there any reason why each of these could not be sort of sent to that repository as soon as they're done?

MS. BROOK: No, I agree with you, I think it's part of the compliance process and we should be including that in the scope of our repository.

MR. SHIRAKH: Yeah, the central repository that you're talking about, the current plan is to actually require all non-residential documents to be uploaded to the repository, includes all acceptance tests in the requirement that you just saw. So, somebody with a license would have to sign those documents and upload them and certify that it's accurate.

MR. EILERT: I think we're clear about this, but at the point the design review kick-off is done, that could be forwarded separately, right?

MR. SHIRAKH: Right.

MR. EILERT: Okay.

MS. BROOK: So, I suppose that – I guess you could potentially think about, you know, a noodle, not a stick, there could be something that we do at that kick-

off where we require a submission into the repository, is that where you're going with that?

MR. EILERT: Just a form, yeah.

MS. BROOK: And then, you know, again, the enforceability then becomes just like all our other enforceability of time and resources, but there's actually something there that you could – thanks, Pat.

MR. MCHUGH: Hi, John McHugh on behalf of the California Statewide Codes and Standards Program. I guess my first comments are about the design review, is that, well, for buildings less than 10,000 square feet, you know, it's self-certification, so the person who is the designer, well, they showed up at the meeting because they are one and the same, and then for buildings that are less than 50,000 square feet, that's someone else in the same company, so you know, that you might actually have two people from the same company show up at schematic design, again, not really that much of a stretch. And so what you're really talking about is that third one where we're talking about larger buildings, actually hiring a third party to come in and do the design review, and my expectation is that, over time, that that can start being common practice. So that's really – those larger buildings are really the only ones, and of course there's more at stake on those buildings to

some extent, there are other designers. The main reason I actually came to talk, though, was about the – we looked at the fairly significant savings from condenser water temperature reset, you know, $.14 a square foot is not bad, so I would recommend that the Commission look at the idea of actually having condenser temperature water reset as an actual prescriptive requirement in the Standard. So, it doesn't currently exist, you've got an Acceptance test for something that someone might install, but we're actually not requiring that they install that –

MS. BROOK: Right.

MR. MCHUGH: -- so that's just my recommendation.

MS. BROOK: Okay, yeah, thanks. We have gotten that recommendation from other Case Authors and, actually, the Case Authors are kind of chasing that down right now because it seems at least preliminarily that – is that a word – that it might – at least we're understanding from some of our mechanical designers that it's harder than it sounds. So, we need to make sure that we understand that it's something that can and should be done more often and it doesn't take an exemplary design team to implement it. So, definitely we need to keep talking about that.

Do we have any other questions about this Commissioning in any stage of the process?

MR. HANSEN: Martha, this is Glenn Hanson. I just want to comment to Jon McHugh's comment there about the self check and check within the firm. I think an important participant in this is the owner and that the owner is going to get value by having these checks, and it is in some sense hopefully a quality check in bringing value to the owner for what he's paying for in design, and I think so much of the industry is lacking in quality because the owners aren't engaged and they're not challenging their designers to do quality work, and I think this is a really good topic for the owner to hopefully get engaged with and challenge his designers to give me close to perfect work.

MS. BROOK: Uh huh.

MR. HANSEN: I see that as an important person and, you know, it's their capital, it's their money, so I think that's maybe something to think about through education is that, you know, this is a step that can bring value to the owner by getting his designers to do a good job in their own self checks.

MS. BROOK: Great, thank you. Yes, Jamy.

MR. BACCHUS: Yes, Jamy Bacchus, NRDC. One comment back on the multiple layers of different review. Some jurisdictions in the state have already adopted Tier 1 levels for CALGreen, others have Leed requirements. If

we end up having a design phase requirement that's mandatory, it may not align with the requirements of Leed for the Commissioning Agent in the Design Review process, so it would be interesting to just take a look at what changes in CALGreen might be coming up in 2012, and what we're proposing, and make sure that we're not adding a separate layer of cost that the owner that's paying for this design review, that also will comply with any Leed or CALGreen requirements, so that you don't have to have two third-parties coming in, so to just look at the different hats people are wearing.

MS. BROOK: Kind of like a sixth party –

MR. HANSEN: Sure.

MS. BROOK: Yeah, that's a really good point.

MR. HANSEN: Because I saw that we're requiring a registered engineer, but it didn't say anything about their Commissioning background. CALGreen has stipulations in that, and so does Leed. On another note, complex HVAC systems in the 50,000 square foot or greater – or anything involving a complex HVAC, requires a third-party, but I don't believe we've spelled out what complex HVAC is.

MS. BROOK: So, that –

MR. HANSEN: Anything with a hydronics system, anything not packaged?

MS. BROOK: Well, actually, Glenn, is that included in the Case Report? I didn't see it, but I –

MR. STUM: That was a question that was brought up at our last stakeholder meeting and I know ASHRAE, IECC, they have definitions for complex vs. simple systems. I don't think Title 24 does. And so that might be part of the Code language is to come up with some additional definitions. So, typically it is exactly what you said, Jamy, is simple system, is packaged rooftop, and complex is anything that is connected hydronically with a boiler-chiller type arrangement. That's a simple breakdown. But we could look at these other definitions that are out there and bring them forward.

MS. BROOK: Great, thanks. Anything else? Anything else on the phone? Okay, so for the rest of the day, then, I have to counsel real quickly with Doug Scott, who is here now and is going to be my technical support for the afternoon refrigeration topics, and if it's okay with him, we could potentially start earlier than what the agenda says, so can you just everybody online just hold on, time out for one minute and I'll be right back.

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

(Back on the record at 11:10 a.m.)

MS. BROOK: So, how come every time you ask a

question, I'm like multi-tasking? I didn't even hear what you –

MR. BACCHUS: It was rhetorical. It was basically, has anyone looked at Appendix A's Commissioning Requirements in CALGreen? Is there a cost-benefit ratio there that's preferable, that it really should also just move into the mandatory section of Title 24 and out of CALGreen?

MS. BROOK: Okay, so that's a good point and actually I thought it already was mandatory for every building greater than 10,000 square feet in Part 11, so we can think about that. I thought the idea of Part 11 was that it was commissioning as in whole building commissioning, it was beyond and bigger than just energy. But are you suggesting that we take all of the Commissioning requirements and apply them to Energy Systems in Part 6?

MR. STRUM: This is Karl. Am I off mute?

MS. BROOK: Yeah, we hear you.

MR. STRUM: I think something should be done, I'm not sure whether – I understood that CALGreen Commissioning was required over 10,000 square feet, it wasn't optional; if that's true, then I think to make things consistent, the design review portion of Part 6 probably should roll into and become part of the CALGreen

Commissioning so that the Commissioning is whole, or take it all the Commissioning and put it in Part 6. But right now, you know, we got off with CALGreen without design review, and so we're inserting it.

MS. BROOK: Yeah, I guess – I mean, I don't want to necessarily move Commissioning out of Part 11 because I see value in Commissioning other things besides energy systems, right? There's lots of reasons why you want to Commission, it's not all about energy sometimes, it's about other services in that building and other health and safety things that you're actually commissioning. But we could certainly add in the design review of energy systems either as a reference in the Part 11 Code or, you know, just insert it there, but I don't actually like having it specifically in Part 6, as well, I don't really want mandatory energy efficiency requirements in anything besides Part 6, it's too confusing. So, I think we do need to talk about that.

MR. STUM: Yeah, I would agree. The question also is, except in testing requirements, are commissioning – really, they're commissioning activities.

MS. BROOK: Uh huh.

MR. STUM: And so it becomes maybe confusing when you look at the big picture and you have CALGreen commissioning requiring commissioning process, but not

stating who the commissioning authority can or should be, other than by suggestion in the compliance reference material, and yet, there is another place, a whole different place in the Code, where you're mandating commissioning activities in Part 6 of the AT stuff. So, it would be nice to have those all in one place.

MS. BROOK: Okay.

MR. STUM: I mean, it would be nice to have Acceptance Testing requirements that are deemed to be important like the ones that currently exist, either by reference from CALGreen, or moved to CALGreen.

MS. BROOK: Okay –

MR. STUM: We wouldn't want, however, is to say, well, we have CALGreen commissioning is required and testing is required in CALGreen, therefore we can just drop the AT stuff.

MS. BROOK: Uh huh, uh huh.

MR. STUM: You get that and then you would end up getting all kinds of commissioning done under CALGreen, most of – well, I won't say most, but much of which may be less rigorous on those energy measures deemed to be so important, and that's why the AT requirements are so – we want to make sure the AT requirements are reflected, continue to be reflected.

MS. BROOK: Well, so right now in Part 11 in the

Energy Chapter, we just make kind of a reference to Part 6, basically saying the Energy requirements are in Part 6. So could we do the same thing in Part 11? For the Commission requirements, we could say “Design review is required,” you know, “Go to Part 6 for the details of how to do that.” And then, also, again for the Acceptance Test, to call them out there as part of the functional testing that needs to be done as part of the commissioning process, but all the details of how and when you have to do it are in Part 6? Is that too confusing?

MR. STUM: Well, that would be – on the design side, that would be good, on the testing side we would have to somehow articulate that the AT requirements in Part 6 are necessary, but not sufficient to comply with the –

MS. BROOK: I see, I see, okay.

MR. STUM: But they are only a subset of what really should be done as far as the testing.

MS. BROOK: Okay. All right. Did you have something to say, Mazi?

MR. SHIRAKH: Actually, it’s about the agenda, but I’ll wait.

MR. YASNY: Yeah, there is a question or a comment online by Tim.

MR. FRYXELL: Hi, this is Tim Fryxell with Guttman & Blaevoet. As a Commissioning engineer and also as an installing contractor, the Title 24 documentation is, you know, pretty on-site, you usually get the blank stare from the contractors when you request the documents and, “Hey, have you done your functional testing yet?” “Yeah, yeah,” “Well, where’s your Title 24 documentation?” That’s like a mind blower for some of them, and some of these businesses have been around for quite a bit of time. How can we do this like an online registry, kind of like how CalCERTS does it with the HERS rating that you enter in your information, you’ve done your tests, you’ve done your verification, and then make it the responsibility of the Commissioning engineer to re-verify that those tests were being performed? Because, as of right now, Title 24 documentation for, say, demand control ventilation is voluntary, basically. The mechanical contractor, “Yeah, I’ve done my job, I’m finished,” but unless you do another functional test on the verification process, you won’t know if that’s actually working or not. If you do an online registry, at least you have a starting point that, if they don’t enter the information correctly, it will be rejected, saying, no, you’ve missed a part or a step in the process, and then if everybody is a part of that team,

everybody will get a log-in to verify what's going on with that project and the results are still kicked in to the CEC registry. Right now, if you hand them in to the City Departments or the Building Departments, or whoever, you're not sure if it's getting sent back. Am I on the wrong page of this? Or making sense?

MS. BROOK: No, I think you are making sense. I think what you're saying is that we don't have enough or any of our Non-Res Acceptance Tests as part of the online registration like the one on the HERS side.

MR. FRYXELL: Yeah and if you do that, it's not a hard process, it's just, "Oh, the contractor, he's filling out the documentation," it's like a checks and balance, if you put in the wrong information, it kicks back as wrong.

MS. BROOK: Right. If it makes sense for residential buildings, then it makes double or triple or quadruple sense for Non-Residential buildings.

MR. FRYXELL: Especially on refrigeration verification, temperature resets, applied static resets, I mean, if your information is not within the standard, you know, it kicks back, "No." And then you have to reformulate it and figure out why. But, on verification, that should be one minimum stipulation of the commissioning is just to verify that the Title 24

documentation, at the very least, has been performed, and test that one sequence, just to make sure that it works, other than just to say “Functional Test,” Title 24 should be at the very minimum at the top of their list to verify.

MS. BROOK: Great, thank you.

MR. FRYXELL: Thank you.

MS. BROOK: Anything else?

MR. MCHUGH: Hi, this is Jon McHugh just wanting to ask a follow-up question from the commenter on the phone. So, are you recommending that there be – the Commissioning Agent actually be a third-party testing agent that actually re-conducts some fraction of the tests that were conducted by – and I’m talking about the acceptance test, some fraction of the Acceptance Tests that were conducted by the Mechanical Contractor? Is that what you were proposing?

MR. FRYXELL: Yes, at the very least because, you know, the contractor says, “Yes, I’ve done my job,” but if when you get into that reality, I’ve checked several of mine, they haven’t been done. God, you push your pencil pushers, “Yeah, yeah, you’ve just done it so you can get the paperwork sent through.” A lot of the Building Departments are not even sure what the tests are altogether. But, at least at the very third-party part,

because we are commissioning and we are verifying building operations, just to verify that the minimum requirement required by the state is completed.

MR. MCHUGH: Okay, and just to confirm, you're not talking about reviewing the forms, you're talking about re-conducting the test, some sample of those tests?

MR. FRYXELL: Yes.

MR. MCHUGH: Okay, thank you.

Mr. FRYXELL: At the very least. Thank you.

MR. MCHUGH: And, I'm sorry, what was your name?

MR. FRYXELL: Tim Fryxell with Guttman and Blaevoet.

MR. MCHUGH: Thank you.

MR. STUM: Hello, this is Karl. I think one of the – another idea there is just to have the commissioning provider execute the tests with the contractors so that, instead of the testing filled out by the contractor, the AT test, since there is now a commissioning provider involved, that they would be responsible under the commissioning scope to do that, like Tim was saying, either a sample of re-test or executing them with the contractor and being the responsible entity for actually filling in and submitting the AT forms.

MR. FRYXELL: Exactly.

MR. STUM: The problem is right now is that the CALGreen is – the strict language of CALGreen doesn't even require a single entity to be in charge of the Commissioning process. So it's like two steps down from independent, it would be nice to say that somebody on the design construction team needs to be the point person for the commissioning process and make sure it gets done. That's not even in there, secondly, it would be nice to say that they have some qualifications and independence – well, they do have qualifications in CALGreen, but not that it's a single person, so you could have – so it's going to be kind of hard the first cycle for people to know what to do unless they follow a traditional commissioning process with Leed or something. But I think once we get that a little more articulated, some of those other problems would go away because you have a qualified and dedicated commissioning provider, they're going to see all that gets done because that's what they do.

MR. FRYXELL: I can hear that, exactly, absolutely.

MR. HANSEN: This is Glenn Hansen, I just want to make a comment that, you know, our observations talk about Part 6 and Part 11 are no different than a building design, we're looking at a design, different systems

where there's some missing information, there's conflicting information, and if you would follow the steps of commissioning, good practice and design review, I think your conclusion would be that, hey, this needs to go through a program design and look at what we're trying to achieve, and bring the two, Part 6 and Part 11, together. I guess that's my recommendation to the staff is that this almost needs to be brought together and really look at the details from a program design perspective, and figure out where the practical adjustments need to be made. Does that make sense to anybody?

MS. BROOK: Yeah, I think so. I think we actually are going to need your help doing that because, you know, we need to understand the implications from the people that have actually been trying to do commissioning in the field, and actually look at Building Codes and try to comply with them.

MR. HANSEN: Uh huh.

MS. BROOK: All right, thanks. Okay, Mazi.

MR. SHIRAKH: Any other questions related to the topics from this morning? Here in the room? So we have about an hour left. One proposal is, because Doug Scott is here --

MS. BROOK: But his stakeholders aren't calling

in until 1:15, so –

MR. SHIRAKH: We're going to have to wait.

MS. BROOK: Uh huh.

MR. SHIRAKH: So we have to adjourn for the morning and then come back at 1:15. And we will talk about Commercial Refrigeration and Refrigerated Warehouses.

MS. BROOK: Okay.

MR. SHIRAKH: So have a nice lunch. Thank you.

MS. BROOK: All right, so for those of you on the Web call, we're going to sign off now. Will we keep the meeting open? Yeah, we'll keep the meeting open and then you can come back at 1:15 for the afternoon agenda. Thanks.

(Off the record at 11:25 a.m.)

(Back on the record at 1:19 p.m.)

MR. SHIRAKH: Good afternoon. We're going to start the afternoon session and this time we're going to be talking about Commercial Refrigeration and, after that, it will be the Refrigerated Warehouses, and Doug Scott is going to represent both topics.

MS. BROOK: Here's how we're going to do it. I'm going to sit up here and sort of introduce the slides, and then Doug is going to chime in and add any technical details that he thinks are especially important, or to

correct anything that I say that's incorrect. So, we'll see how it goes.

So, Commercial Refrigeration, this is the first time that we will be developing prescriptive requirements for refrigeration systems, and these are the size and type of systems that are typically found in supermarkets and big-box retail stores. The Energy Commission is doing this work in partnership with the California Air Resources Board and the Air Resources Board has targeted commercial refrigeration as one of its primary targets for the reduction of greenhouse gas emissions, and so we're working together to look at energy systems that are installed in buildings from both the direct energy usage of these systems and also the direct and indirect greenhouse gas emissions caused by these systems. So, in cases of refrigeration systems, we're looking at both the energy consumed and the indirect emissions from that, as well as the direct emissions from refrigerant leakage, and our time dependent evaluation of energy, our societal cost of energy accounts for both these components because it looks at the energy used and the indirect emissions from the power plants that generate that electricity, and provide natural gas, and then it also is looking at the carbon emitted from refrigerant leakage and assigning a carbon cost to those emissions, so the energy efficiency

measures I will be talking about predominantly here today will go into Part 6, Energy Efficiency Standards, will also introduce direct measures – leak reduction measures that we anticipate will be incorporated into Part 11, the California Green Building Standards. These specific reductions that I'll introduce today don't have significant consequences on the energy side, so they are direct emission reduction measures, and we've discussed that they probably best belong in the green building standards that are incorporated in the California Building Code.

So, what we're going to talk about for the next hour or more are the things that we're actually recommending as Code change proposals. One is a set of definitions that we need to introduce to cover the commercial refrigeration domain and Code, and then we'll be talking about each of these efficiency requirements, floating head pressure, control requirement, condenser specific efficiency requirement, floating suction pressure, control requirement, mechanical sub-cooling, display case lighting controls, refrigeration heat recovery for space heat, and requirement for doors on low temperature display cases. We'll also introduce that we'll be developing acceptance tests for several of these measures, and then I'll also introduce the leak reduction

measures developed by the Air Resources Board.

So the first one, and this is the first time that you see this little draft Code language flag in the upper left corner of the slide, so every time for the rest of the presentation that we have Code language developed, there will be a little flag up there to indicate that this can be reviewed in the context of something we're intending to put directly into our Code Update.

So, we have a series of definitions, I guess I'll just briefly – I'll read these quickly, although I don't expect to really spend too much time on these definitions page, but basically the bubble point is being defined as a refrigerant liquid saturation temperature at a specified pressure, a cooler is defined as a space greater than or equal to 28 degrees, but less than 55 degrees Fahrenheit. The dew point is the refrigerant vapor site saturation temperature at a specified pressure. Saturated condensing temperature is the saturation temperature corresponding to the refrigerant pressure at a condenser entrance for a single component, and the zeotropic refrigerants, condenser specific efficiency is the total heat of rejection capacity divided by the fan input electrical power at 100 percent fan speed, including auxiliary pumps and the power for those evaporative condensers. A freezer is a space

that's designed to maintain less than 28 degrees Fahrenheit and space designed for a convertible between cooler and freezer operation. A micro-channel condenser is an air cooled condenser for refrigeration systems, which utilizes multiple small parallel gas flow passages in a flat configuration, with unitized fin surface between the gas passages rather than round tubes arranged at a right angle to separate plate fins. The total heat of rejection is the heat absorbed at the evaporator, plus the heat picked up in the section line, plus the heat added to the refrigerant in the compressor. So, that covers the definitions and, again, I would encourage anybody listening on the phone or in the room here, if there are terms we're using to describe proposals that you don't understand and aren't part of those definitions we've just introduced, then we'd love to hear comments on additional definitions we should maybe add to the Code.

So, the first set of commercial refrigeration proposed measures are in terms of regulating the efficiency of condensers. The first proposal is for floating head pressure. For variable speed condenser fans, for air cooled, or evaporative cooled condensers, air or water fluid coolers, or cooling towers, multiple fans serving common condensers need to be controlled in unison. The variable condensing temperature set point

control, known as ambient following control, for air-cooled condensers based on the ambient web bulb temperature, and there is a requirement for the minimum condensing temperature set point to be less than or equal to 70 degrees. Do you want to add anything to that, Doug?

MR. SCOTT: So, I think the key issue there is the variable speed on all condenser fans and the fact, for example, on air-cooled condensers, all fan motors would run in unison together at the same speed, so all the surfaces being used at least down to a minimum setting where fans could then cycle off. But the key there is using all the surface all the time.

MS. BROOK: Great, thanks. So, this is the draft Code language, I'm not going to read this because I basically just summarized it in the previous slide, but here it is if you want to read it while we're going through the day, or if you want to make comments on the specific language, and then send them back to us later, that would be appreciated.

The next proposal is for condenser specific efficiency, which as we said in the definitions, is the total heat of rejection divided by the total fan power. For evaporative cooled, we're setting a specific efficiency of 160 Btu's per hour, per watt, and the

exceptions that we've identified for this is if the total heat rejection is less than 150,000 Btu hours, or if condensers are existing and being re-used in a new application. The requirement for air-cooled is for a condenser specific efficiency greater than or equal to 65 Btu hours per watt of fan power, and it has similar exceptions for lower total heat rejection of the system, or for existing condensers. And for air cooled equipment, there's a requirement that the fin density be less than or equal to 10 fins per inch. And the exceptions for this is if you're using a micro-channel condensers or, again, if you're using existing condenser equipment. So there's only one note here that is something that we're working on, and that is that – I guess I should say, first off, that I'm going to present a summary of all the energy savings impacts from all these commercial refrigeration proposals at the end of this section of the presentation. And you'll see that they are all very cost-effective and we're only bringing forward proposals that I think have industry acceptance and show a very compelling cost-effectiveness.

So one of the things on this proposal is that the specific efficiency was not found to be cost-effective in a very few number of climate zones for condensers with non-EC motors, so we're still working on what kind of

exception we should make to this. Do you want to clarify that in any way, Doug?

MR. SCOTT: And the reason for that, in some cool climates, it's cool enough most of the year that the head pressure is already running at the 70 degrees minimum most of the time and I think, in practice, people in those areas would actually accept the minimum pressure lower, so it could actually be cost-effective to most users if they use a lower set point, but we didn't want to have different floating head pressure set points, so, no, this still has to be worked out.

MS. BROOK: Okay.

MR. SHIRAKH: Martha, can I ask a question? Is there going to be a mandatory measure or prescriptive measures? Will trade-offs be allowed?

MS. BROOK: Thank you for asking that right now because these are actually mandatory requirements, we don't have any trade-offs – correct me if I'm wrong, Doug, but –

MR. SCOTT: That's correct. We were looking here at specific efficiency vs. some other factors on condensers, but we reduced it to this one measure.

MS. BROOK: So the idea, just for stakeholders in the room and on the phone, ideally we want to get to a performance-based method of Code compliance for

commercial refrigeration, but we are starting this cycle with prescriptive requirements that are basically mandatory requirements, so we're just getting, we're just kind of setting the floor for a minimum efficiency levels and for these refrigeration systems. We need more time developing good design tools that are used by the industry and good modeling assumptions developed and tested over, you know, lots of design projects, so we can feel more comfortable establishing a performance-based compliance approach, and we anticipate doing that in the 2017 Code Update.

MR. SCOTT: Maybe two additional points. On these numbers, the 160 and 65, are only slightly more efficient than the base case that has been used in the California new construction incentive program for a number of years, so they're not significantly more efficient than what has been used in many stores, but also it's important to note that these condensers are not rated to a particular – or are not published as being rated to particular standard and they're not certified ratings. So, as Martha said, it's a bit of a slow approach to start with.

MS. BROOK: Okay, so this again is the Code language for the condenser specific efficiency and we've summarized all these points in the previous slide, but we

definitely want to hear comments if there are issues with this language. Next, we're moving on to compressor systems, floating suction pressure, control logic for refrigeration compressor systems and condensing units, where it would be a requirement to set the suction temperature target based on the temperature requirements of the attached display cases or walk-ins. The exceptions that have been identified are for single compressor systems without variable capacity for suction groups with design section temperature greater or equal to 30 degrees Fahrenheit, suction groups on the high stage of a two-stage or cascade system, and suction groups that serve chillers for secondary cooling fluids.

Is there anything there that you want to add, Doug?

MR. SCOTT: No, I don't think so.

MS. BROOK: Okay, so this is the Code language for floating suction pressure controls.

Next, we have mechanical sub-cooling, this is "liquid sub-cooling must be provided for low temperature parallel compressor systems with design suction temperatures of less than or equal to 10 degrees Fahrenheit. The liquid temperature must be maintained less than or equal to 50 degrees. The use of Compressor economizer ports or use of separate parallel medium, or

high temperature suction groups, with a suction temperature of greater than or equal to 18 degrees, will be required." The exceptions are single-compressor systems, low temperature cascade systems, or existing compressors. This is the draft Code language.

And now we're moving on to display case lighting controls. So, for lighting in refrigeration display cases and lights on walk-in glass doors, either there is a requirement either to have automatic time switch controls to turn off lights during non-business hours, or provide motion sensor controls on each display case, and reduce the lighting power at least 50 percent within 30 minutes of non-occupancy. And the only exception we've identified are for stores that are basically almost always open, so operating hours greater than or equal to 140 hours per week would be the only exception. And the idea is that there's lots of energy here to be saved during non-occupied store hours.

MR. SCOTT: Now, back up to – the motion sensor option typically would come into play if the store is using LED lights right now in glass door display cases that reduce the light level where you turn off the lights when there are no shoppers present, and if you have those, they inherently meet the needs for the shutting down the lights during stocking hours, and that 30-minute

time period can be a lot shorter on LED lights, but maybe it needs to be longer were someone to use motion sensors on fluorescent lights, so that it's possible that 30 minutes should be reduced to a shorter time period if motion sensors are realistically always going to be coupled with LED lights.

MS. BROOK: Okay, thanks. All right, our next proposal is for refrigeration heat recovery to serve space heating needs, and these are just two schematics of a direct and indirect heat recovery approach. So, heat recovery from refrigeration and HVAC systems for space heating, the requirement is that at least 25 percent of the heat rejection for all refrigeration systems must be used for space heating and the heat recovery cannot use more than 20 percent additional HFC refrigerant charge, or a half a pound per thousand Btu's per hour of space heating capacity, whichever is less.

So, I put this in the slide deck as an example of how we looked at all of the refrigeration measures, we looked at them both from an energy and an emission point of view, and this is one example of where there was some refrigerant cost penalty for the measure, but it is far outweighed by the potential energy savings. So, the numbers you see there in red are sort of cost penalties due to the emission – potential for additional

refrigerant leakage or use, but it pales in comparison to the energy savings that can be realized from heat recovery and so we're confident in going forward with this proposal, and the only other thing to indicate here is that only in Palm Springs, or in that climate, is it proved not to be cost-effective.

MR. SCOTT: Would you back up one slide? Recent input on the second bullet there, the 20 percent additional charge or the half pound per thousand Btu's, we realized the 20 percent charge actually penalizes a low charge system, which is sending the wrong signals. If a system had a very low charge, it might be almost impossible to accomplish the heat recovery and we wouldn't want to imply the charge has to be increased in order to meet this measure, so I think that, if possible, to simplify this and just eliminate the 20 percent and pick a number, probably something lower than 0.5 pounds per thousand Btu's would be a better way to address this, and also be simpler, so I think we need some additional input on how low can we go if we just use a single number, like .30 pounds per thousand Btu's or .25, but I think definitely we want to simplify that because it's sending the wrong signal with respect to low charge systems.

MS. BROOK: Okay, great, thanks. Okay, so here

it is again in the Code language, and this is just to demonstrate that I actually did read some of this stuff, I found a word that didn't make the sentence clear to me, so I X'd it out of there. So, that's the same things we just explained, now in Code language.

Our next proposal is to prevent open display cases in freezer applications, so these types of display cases without doors will now be banished in the State of California. And we'd much prefer to see these types of display cases. So, upright low temperature display cases that are designed for a supply or temperature of five degrees or lower shall utilize reaching glass doors. So, we'd like to hear comments on that if there are any, but we think this is probably what is already always done, or should always be done.

MR. SCOTT: But generally, I don't think we've seen this in new store designs for at least a few years, anyone using open upright freezer cases. However, the situation that would occur would be remodels and expansions that have these existing cases, so in those cases of permitted new construction for an expansion, say, if there were existing open cases, then to comply with this, they'd have to be changed out to door cases or medium temperature cases.

MR. SHIRAKH: So, to do that, I think that's a

great idea, so we have to say something about it in Section 149, probably.

MS. BROOK: Okay.

MR. SHIRAKH: I mean, because 149 has additions and alterations, so we have to make specific reference from there to the section that would apply to alterations, otherwise it would not be captured.

MS. BROOK: Great, thanks.

MR. SCOTT: And stakeholders have had this concern about how remodels and expansions, rehabs, got changes and so forth –

MR. SHIRAKH: The nice thing about 149 is you can actually pick and choose which criteria you want to cover when it comes to additions and alterations.

MS. BROOK: Okay, next is measures that we strongly considered for 2013 Update, but didn't quite make it, but we think belong in Feature Code Updates. So, the first one, we're actually queuing up for the Reach Standard in the 2013 Update, and this is CO_2-based cooling for walk-ins and display cases, so this is for secondary indirect CO_2 cooling and/or cascade cooling that has significant greenhouse gas emission cost savings compared to other technologies. So, this is an example of a requirement that, from the societal cost of using energy and the environmental consequences of these energy

systems, this is the future. We are trying to set a bar in our voluntary standard for equipment that does a better job with greenhouse gas emission cost savings and that's why we're queuing this one up for the Reach standard. It's sort of neutral on the energy side, but again, the emission cost savings are significant.

The second one is the evaporator fan variable speed controls, so we really wanted to do this, it's got a really good benefit cost ratio and we think it's the future of evaporator fan controls, but the lack of experience with this technology specifically in supermarket walk-ins is keeping us from going forward at this time and, you know, ultimately we need to address the concerns for food product safety if walk-ins are not designed to work well with reduced air flow. We think that we can do a lot in incenting this technology and Savings by Design and other new construction programs, and get industry experience with it, so we can promote it in the 2017 update. And then, liquid suction heated changes, this is another technology that saves energy with this, you know, minor little flaw that the heat exchangers leak, so we have to deal with that before we're willing to bring it forward as a required Code enhancement. Do you want to say anything else there?

MR. SCOTT: I think, on evaporator fan control,

the biggest concern there, I believe, is controls and there's worry about circulation rates and product temperatures and how well they work and boxes, certainly, tall, and so on, but I think those can be addressed as part of design practice. The key issue, I believe, is controls and supermarket controls are performed by a few key vendors that focus on that space, but the technical challenge is that variable speed control, just like VAV is going to be the first means of temperature control, but that has to be sequenced with the EPR valves of the liquid line solenoids, and also with floating suction, which is another measure we have, and if this was done without proper control sequencing, then you might be choosing between variable speed and floating suction, and we wouldn't want to do that, so the challenge, I think, is to that relatively small number of control vendors to say how do we add this control integration and accomplish both variable speed control and floating suction without compromises.

MS. BROOK: Good. So this is just a summary of all of our proposed commercial refrigeration measures and sort of just to get an idea of energy efficiency impacts, so it's each of the measures we've introduced, both the ones we recommended and two of the ones that have energy savings, but that we did not recommend, just to get

people to understand, you know, how much energy we're talking about here. It's significant, and one thing to mention on the doors for the low temperature cases is that all the other numbers are a per store estimate and that one is actually a per case estimate, so depending on how many cases you have in your store, that number would change.

MR. SCOTT: That's based on a 12-foot open case vs. a five-door doored case.

MS. BROOK: So, as you see, the evaporator fan variable speed control is very appealing from, you know, energy saving policy perspective, so we're going to be targeting that pretty heavily with our partnerships with the utility incentive programs to make sure we have enough good design experience and work out the kinks with the integrated controls, like Doug mentioned, so that we can knock it out of the park next time. And I think that's all we have. Oh, no, sorry, I have a little bit more.

So, the next step for us to be working on is developing Acceptance Tests for the Control-Related Measures and we'll be doing that, you know, in the next several months. And then I wanted to introduce the Leak Reduction Measures, even though they will probably not go into the Energy Code, they will be in the California

Building Code, and will be introduced and adopted in the same Code update, the Building Code Update, that the Energy Standards will be advanced in.

So, as a background for this, these next set of slides were developed from the Air Resources Board, but we have been working in partnership, looking at measures from both the emission and the energy perspective. So, refrigerator leaks are a significant source of greenhouse gas emissions and the current Air Board regulations cover leak checking and leak repair requirements, only, and not system design and installation, so that's an area where our agencies are partnering in this, you know, design construction phase of refrigeration systems. And good design and installation practices can significantly reduce refrigerant leak rates. So, the measures that we'll be introducing address refrigerant system design and installation to minimize leakage, they're based on ANSI, ASHRAE, IMC standards, as well as stakeholder feedback. Their intended to set a floor and not a ceiling for stores greater than 10,000-square-feet, so they really are just like you just have to be doing this type of design, there's just no reason not to, they are those kind of measures. They don't overlap with the existing ARB regulations and they're basically 12 measures related to the piping and connections valves,

corrosion prevention, and leak testing and monitoring.

These are the 12 measures, I'm not going to explain them in detail, but I will introduce each of them. There's a report that is more comprehensive that was posted this morning to our website under today's workshop, so you can look there for more details. The first one is welded refrigeration piping is required and cannot be threaded refrigeration piping, and these are high level summaries, there's potentially some exceptions to each of these, which the report will go into details on, I just wanted to give you the flavor of these today. Copper tubing refrigeration has to be greater or equal to quarter-inch outside diameter, no flare fittings will be allowed. Pressure relief valves must have visual indicator for refrigerant release, and only Schrader access valves with brass bodies can be used. Valves shall have an internal stem diagram or seal caps with chain tethers to fit over the stem, evaporator coils and deli cases must be coated, and piping and components installed to protect from physical damage, so this is an installation requirement that you have to install your piping and components to make sure that they cannot easily be damaged. And similarly, refrigerator and piping should be accessible for leak detection and repairs. Level sensors will be installed on receivers

with greater or equal to 200 pounds of refrigerant, pressure tests will be required for the system during installation prior to the evacuation and charging, and then the system must be evacuated following pressure testing and prior to charging.

So, this is a summary of the impact, the cost per store, the emission reduction estimated from the measure. The savings are due to the reduced refrigerant usage, the cost effectiveness increases as the store size increases, and there is a small net cost to smaller stores, but the Air Resources Board believes that the carbon reduction costs are still considered moderate and we will be proposing that these leak reduction measures are applied to all store sizes. So, there's additional links to the full detailed report for leak reduction measures at these two links, a summary of the measures, though it doesn't include the cost benefit analysis, is also on our workshop website, and Glenn Gallagher of the Air Resources Board is the project manager for the ARB on this and can be contacted at this address.

Okay, so now we're going to open up the questions for everything you heard about on the commercial refrigeration proposals. And, Mazi, do you want to start?

MR. SHIRAKH: One question related to not

allowing open refrigerated cases. Some big-box stores, they actually have a room in the back that is the refrigerated to near freezing, and then it's totally open to the rest of the space and especially during the heating season, that seems to be a problem. Is that still going to be allowed, that practice?

MR. SCOTT: So there's big-box stores that use walk-in cooler for the shopper can walk inside the cooler with a shopping cart and get their produce or dairy sometimes, that actually have an open or air curtain as opposed to a door, and that is not being addressed, there's no prohibition on doing that or any position taken on whether doors or skip curtains, or air curtains should be used. The arguments are, yeah, the door is inefficient being a wide open space and to a cooler, but on the other hand, shoppers are walking inside as opposed to having an equivalent amount of display cases. The retailers have different reasons for doing that and I'd say it lacks study, where we have looked at that and attempted to analyze that for different chains, and it's very difficult with ASHRAE information to come to any real strong conclusions. Air doors have not been independently tested, so it's hard to refute or prove one way or another, so probably testing would be in order to even say it's necessarily that inefficient for the

purpose, not included, to answer your question.

MR. SHIRAKH: All right. The other clarification I have related to TDV's is that there is a factor to capture greenhouse gas, CO_2, or carbon. You mean like an equivalent, because, you know, the greenhouse gases don't have CO_2, but they have an equivalent index like –

MS. BROOK: Yeah, right. So it's that index – what turns everything into how many units of carbon.

MR. SHIRAKH: Okay.

MS. BROOK: And it's a carbon cost that we include in the evaluation.

Mr. SHIRAKH: Okay, all right. Thanks.

MS. BROOK: Any other questions in the room? Is there anything – nobody – everybody likes your proposals, Doug.

MR. EILERT: Hi. Pat from PG&E. I was just wondering if you could comment on the 10,000-foot threshold in the presentation.

MR. SCOTT: The primary intent was to address supermarket refrigeration, so the refrigeration systems which are predominantly parallel type systems, whether they're central rack systems, or decentralized type of parallel racks, and those are common in stores down as low as 8,000 square foot; below that, usually it becomes an entirely different type of system, split systems,

single compressor units, and so rather than try to address both, we focused on addressing the parallel refrigeration systems, that would leave convenience stores with a large number of sites, and each may have three or four systems. That's something we didn't address, but we think it needs to be addressed in an entirely different way. Does that answer your question?

MR. MCHUGH: So, I'm very supportive of this – oh, this is Jon McHugh – very supportive of this proposal. There's one piece I'd like to see a little bit more study on, which is the lighting controls. We see lighting controls look like they're one of the largest measures when you look at the kilowatt hours per store savings, and I'm assuming those savings are a store that isn't exempted, and so we have these stores that are operating 24 hours, there's motion control case lighting that has been effectively used in some of these stores. My understanding is that, right now, we're heard some negative feedback from stores where they were turning the lights all the way off, and so I would just like us, before the 45-day language, to revisit the issue of whether or not the systems where they're dimming the lights, not turning them all the way off, if that is a reasonable requirement for those stores that operate long hours.

MR. SCOTT: I think a couple comments. It's a fast-moving technology in terms of both the controls and which cases use LED lights that are usually coupled with motion sensors. Initially, and it may be predominantly even now, it's primarily glass door, frozen food cases, whereas this lighting control measure is every display case, and so the technology is a different stage for the different cases, but we are talking a ways off when this takes effect, so point well taken.

MR. BACCHUS: Jamy Bacchus, NRDC. A follow-up to Mazi's question about refrigerant leakage and the global warming impacts. Did you say, Martha, that in a TDV, we are assessing a value of refrigerant leakage direct emissions?

MS. BROOK: Uh huh.

MR. BACCHUS: If so, what is that for, let's say, supermarkets or small grocery stores, or big-box? Are you assuming a particular refrigerant R-404A and 15 percent leakage annually? Can you tell us a little more about that?

MS. BROOK: Maybe you could do that, Doug, since you guys ran the –

MR. SCOTT: Yeah, there's how much charge the system had, what's the leakage, and what's the refrigerant, and the refrigerant was assumed to be 404A

or 507, so that's the 3,000 to 4,000 carbon equivalent, although realize there's alternatives. The leakages rates are different for different system types that are in some of the early stakeholder presentations. I'm not sure they all carried over into the case study.

MR. BACCHUS: Yeah, I think you and I looked at those with Pamela.

MR. SCOTT: It's a fairly wide range and some discussion of how do some of the newer system types have lower leak rates, but there's not enough time that they're persistently lower. Maybe the key thing is we did use the 404A/507 equivalent levels.

MR. RONN: Are you accepting questions from the phone?

MS. BROOK: Yes, we are.

MR. RONN: Okay, I have a couple of questions.

MS. BROOK: Can you identify yourself first?

MR. RONN: George Ronn, SuperValu.

MS. BROOK: Okay, great. Thanks.

MR. RONN: On the heat recovery measure, when you're using distributed systems with about a 300 pound charge, during the stakeholder meetings we were told that we would need to install hydronics systems to recover the heat, to move it to a central air handler –

MS. BROOK: Well, we were accepting questions –

MR. RONN: Did you hear my question?

MS. BROOK: We did hear it and we can still hear you.

MR. RONN: So, I guess the question is, we are going to be required to install hydronics units to recover the heat from distributed systems? Is that correct?

MR. SCOTT: No, you would not be required to do that.

MR. RONN: So if we're exceeding the refrigerant charge amount specified in Item 2, whether it's the 20 percent or the .3 pounds per thousand Btu's that means we don't want to comply with the heat recovery? Is that what you're saying?

MR. SCOTT: No, the heat recovery would be required and it's only 25 percent of the total available heat for kind of that reason. You have a variety of different types of refrigeration systems like distributed systems, and you could also have a variety of types of HVAC systems, and how do you line those up? So, if you have distributive systems, you could use a water loop that goes to each distributed unit and goes to a central air handler, or you might associate a distributed unit with one air handler or a rooftop. You would have to utilize 25 percent of the heat somehow, you could do it

indirect or you could do it direct, as long as it stayed below the charge limit, and that's exactly the feedback we got was, that with a good low charge distributed system, the percentage parameter doesn't make sense, it needs to be a finite amount of charge.

MR. RONN: Well, the other concern I have, though, is by the time you add all the pumps, piping, reservoirs, you know, bladder valves, everything you need to install the hydronics portion of the system, now the cost benefit of any use of the distributed system is pretty much negated and you're basically pushed back into building large DX systems, you know, and you're talking about going from like a three or four percent leak rate to 10 or 11 percent.

MR. SCOTT: Yeah, so we don't think so and we looked at a number of different scenarios, and one thing to note is that, Martha, you might explain this a little more, there is a compliance manual that gets done with a lot of these and we have stated this in a number of meetings that we realize a lot of information needs to be provided about the different options and how this can be done. So we looked at what is the exposure on distributed systems, and that's part of the reason why the initial requirement is only 25 percent, so you could pick those units that, say, are close enough to a rooftop

unit, an air handler that you could go direct refrigerant if you wanted at very low cost, or you could use a single loop that attached to multiple distributed systems, and there are examples where people have done that and that's exactly what we used for our cost justification, was the more expensive approach, the indirect approach with water coils and heat exchangers and a water piping loop was what we attempted to use as our cost assumption analysis.

MR. RONN: Okay, and the other comment I had was on the motion sensors with the case lighting. In many instances, the range of the motion doesn't generally require a sensor for every case when you're looking at a row of 30 doors, for example, about every third case is appropriate for turning the lights on and off in the lineup. So, I don't know if that's something you folks have considered.

MR. SCOTT: That would be perfectly fine for this requirement, which is just to say that the lights are turned off during stocking hours and, currently, most of that is done with a lighting panel contractor and an EMS control point that just shuts it all off or maybe has zoned overrides, or some people – a few people use case controllers and do that, and the simplest approach is the panel contactor, and if you did motion sensors per lineup or for several cases, it would accomplish the same end

function.

MR. RONN: Well, correct, I understand that, it's just that in the wording, you have it per case.

MS. BROOK: It says that on each case, yeah. No, thank you for that comment, that's a good comment. So, just to clarify what Doug was explaining about our intention for the compliance manual, it will be to, you know, have a lot of best practice design strategies clearly articulated and diagramed. One thing we probably will need to do in this case is make a commitment to get that design information at least drafted, you know, before the 45-day language, otherwise it just sounds like, "Well, we promise to tell you later how to do it," right? So the point where the stakeholders want to be making comments about whether the requirement is reasonable, they also need to know that there is actually design guidance for them, not a promise of design guidance. So, I think that's a good comment and we appreciate it, and it will help us guide our schedule and resources for the next several months.

MR. RONN: Thank you.

MR. SCOTT: Sean.

MR. GOUW: Hi, this is Sean from Southern California Edison. A quick question, [inaudible] [00:48:35]?

MR. SCOTT: I didn't hear all that.

MR. SHIRAKH: Sean, it's very difficult to hear you.

MR. GOUW: Oh, sorry about that.

MS. BROOK: There, that's good.

MR. GOUW: I was just asking if it was confirmed that there weren't any Federal preemption issues with the DOE's CRE regulations and the fact that they're about to regulate walk-ins?

MR. SCOTT: I know a lot of time was spent on that –

MS. BROOK: Well, the only thing that I remember where we were really talking about the preemption was that variable speed controller, and we ended up not going forward with that, not because of preemption, but – basically, where we ended up with preemption was, if the measure could be installed in the field, then we thought there was lots of precedent that that doesn't violate preemption, but if you specify a requirement for technology and the only way to achieve it is at the factory, and part of the product manufacture that also gets tested as part of a federal efficiency requirement, then it would violate preemption, so I think where we ended up, at least with our fan speed controllers, was that we felt like that could be a field install

technology, but we're not actually going forward with that particular measure right now.

MR. SCOTT: Right. There's a distinction between walk-ins that have their own individual controllers in supermarkets where the control is in the central compressor, by and large, and that's what would be doing the control –

MS. BROOK: Oh, okay.

MR. SCOTT: -- of the fan as it is currently doing the control through electronic regulator or something, so it may sense that was not probably related to preemption.

MS. BROOK: Okay. Does that –

MR. GOUW: I wanted to ask about the display case lighting controls because I know the Feds are about to sort of try to give credit – I don't think it's in their test method, but they're trying to give credit for lighting controls. I was wondering if there might be any issues there with the display cases.

MS. BROOK: I'm sorry, who is trying to get credit for them?

MR. GOUW: The DOE, as part of the sort of energy consumption metric they have.

MS. BROOK: Oh, I see. Is it part of their prescriptive standard?

Mr. GOUW: It's going to be part of their calculations in the next round.

MS. BROOK: Oh, I see.

MR. SCOTT: This measure applies to non-24-hour stores and the Federal method would have to assume a case used in a 24-hour store, as well, so it wouldn't seem like there would be a conflict there.

MR. GOUW: Okay.

MS. BROOK: Any other questions?

MR. MCHUGH: This is Jon McHugh again. I understand that, in terms of the scope for most of the measures are focused on systems that are supermarket size systems, you know, parallel rack type systems. A couple of these measures seem like they would also be applicable to smaller spaces and I'm primarily talking about, again, the lighting controls, that any space that has display cases that controls would apply to those spaces, so that might be something that might be specifically applied to all spaces that have these display cases. Any thoughts about what would be the problems of expanding it to a broader scope, all the convenience stores, 7-Eleven, all these various places that are smaller?

MR. SCOTT: It's a good point, the distinction in how they're currently controlled is that a convenience store will typically have a big central box and several,

maybe two or three-door freezers and they all have manual switches and the process is to go at night and turn off those switches so there isn't necessarily central wiring. It would require intercepting each of those. So, we did look at cost-effectiveness of anything analogous to that, so I think it would be a different cost-effectiveness study, and how much savings is there of manually turning the lights off vs. automating that, whereas, in a store, there's stocking people and the tenancy in some cases is those have to be left on for stocking, so this is just controlled to turn it off and allow for stocking overrides. So, it hasn't been looked at, but there are some differences.

MR. GOUW: The different base case, okay, thank you, that's great.

MR. SCOTT: Now, to think a little more, Jon, to add to that, the motion sensor aspect which is really a different deal and shutting off at night probably has a very similar applicability, though.

MR. SHIRAKH: Any other questions or comments on commercial refrigeration from people who are online, the phone? Okay, so we're going to move to the next topic, which is Refrigerated Warehouses.

MS. BROOK: Okay, so this is our last set of proposals for the day and, in this case, refrigerated

warehouses, we began regulating in earlier Code Cycles, and so the Code change proposals that we will be introducing today are mostly changes to current code, with some additional requirements. So, either changes to current requirements or insertions into current Code language. There are some additional scope explanations added to Section 126. There are efficiency requirements for exterior insulation of the warehouse, evaporator fans and speed controls, condenser design temperature requirements, condenser fan speed controls, condenser specific efficiency, variable speed compressors, and infiltration barrier requirements that we'll be describing. And we've also added significantly to the Acceptance Tests that are required now for getting credit for complying with the Code and for refrigerated warehouses.

So, exterior insulation, there's basically just a change to the insulation table in Table 126A, R-40 for roofs and ceilings of freezers, and R-35 for freezer floors, and then the new requirement for R-20 for floors with all heating from productive refrigeration capacity. And a few minor changes to the way we name spaces. Do you want to clarify anything here, Doug?

MR. SCOTT: I think an important thing here was to define cooler spaces for refrigerated warehouses a

little better, the 28 degree break point, instead of 32, resolved the potential problem of many meat coolers and deli coolers that are designed at 30 or 31 degrees being called freezers and having to have freezer insulation requirements and floor requirements and some other factors, so this is a clean-up to make it a little more cost-effective and equitable, and we really needed to do that before we increased the freezer roof insulation here, and the R-35 to R-36 is kind of a clean-up because the insulation is available in R-5 increments. That's all on that.

MS. BROOK: Okay. The next requirement is to modify the current Code language for evaporator – fan powered evaporators. So, we already had a variable speed control requirement for evaporators, but we had previously exempted evaporators served by a single compressor, that did not have a moding capability and we've replaced that exception with a requirement for evaporator fans served by a single compressor to utilize controls to reduce air flow by at least 40 percent, three-quarters of the time when the compressor is not running. So, is there anything else you want to explain about these Code changes, Doug?

MR. SCOTT: That last one, the single compressor and cycling fans could be variable speed, running in two-

speed modes, or a two-speed motor. Some of the smaller evaporators now have an almost zero cost two-speed feature, or it could be turning off a portion of the fan motors in a particular evaporator coil, which is available from one or two manufacturers, so there are several ways to meet that requirement. That's all on that.

MS. BROOKS: Okay. Our next requirement or set of requirements are for condensers and the first one sets conditions for fan powered condensers to conform to this table, instead of requiring ammonia systems to be evaporatively cooled, this now allows the ammonia to be used with air-cooled condensing, and there's no inherent requirement to use air-cooled rather than evaporative-cooled, which was happening with the way the previous Code was written. Do you want to –

MR. SCOTT: So, previously, nothing said you had to use evaporative-cooled or air-cooled in a given application, but if you chose to use air-cooled, then you would not be allowed to use ammonia and, as this statement shows, ammonia generally is more efficient than the HFC option, so why, if you're using air-cooled, should you not be allowed to use ammonia is all that this resolved, allowed the use of ammonia.

MS. BROOK: Okay. Our next Code language changes

are in regards to condensers and mostly clarification language. Is there anything significant you want to mention about these Code changes?

MR. SCOTT: It is mainly clean-up has been clarified and explained a little bit in the compliance manual previously, but just brought into the Code language and made more clear.

MS. BROOK: Great, thanks. Okay, the next set of Code language for condensers is adding a requirement for condensing temperature reset and allowing an exemption for condensing temperature control strategies that might be equivalent from the energy performance perspective, but we don't know about them yet, and if those come in for approval, the Commission's Executive Director can approve alternatives to condensing temperature reset if they're demonstrated to provide the same or better energy savings.

MR. SCOTT: Here, again, I think ambient following was required for air-cooled in the Code, but it was vague for evaporative-cooled and was explained in the compliance manual. This just makes it more exacting what was intended for ambient reset condenser control.

MS. BROOK: Okay, and then similar to what we saw in the commercial refrigeration, we have a condenser specific efficiency requirement and this table summarizes

the minimum efficiency in Btu hours per watt for different categories of condenser and refrigerant.

MR. SCOTT: Here for evaporative condensers, at least on the larger condensers, this is a little more stringent vs. the average of what's been used. I think historically the new construction incentive programs used a base case of 330, so it's not much higher than that, but that 350 is somewhat higher than some of the available condenser models. However, on these models, they're all very flexible, it seems, in terms of buying a condenser in this large of size with whatever motor size you want to use, so it's fairly adjustable in these products to meet a particular efficiency requirement, the smaller size, less than 8,000 Mbh, 8 million Btu's, addresses the fact there's fewer products available in the small size, and sometimes in that size range, the condensers have to go indoors, so that it looks at just the realities of some of the installations, as well as the available product in the marketplace.

MS. BROOK: All right, and then finally for condensers, we have a requirement that air cooled condensers will have a fin density no greater than 10 fins per inch, except if you're using micro-channel condensers, and this replaces a previous requirement that single phase condenser motors be either permanent split

capacitor or ECM.

On to compressors, we have – what the big deal here is, the screw compressors shall include an ability to vary the compressor volume ratios – I'm trying to move my thing so I can see the words – in response to operating pressures. And what else is significant here, Doug?

MR. SCOTT: Two issues in that the number three item is the mandatory variable VI or Variable Volume Ratios, so the compressor, as it is operating, reads the pressures and essentially changes its compression ratio, whereas some compressors you have to shut down and do that manually. And this was in the compliance manual, but it wasn't in the Code, so we re-studied this and verified that this is either standard practice or a reasonable cost option, and very cost-effective. And previously, the Item number two is simplified from the requirement that stated if you had less than 60 percent power at 60 percent load, then you were exempt from a variable speed requirement, and that was difficult because compressor ratings were not certified to any rating standard and, moreover, the part load performance of these big screw compressors is arguably less well documented and understood than in their fuller capacity, so feedback from industry said to try to make this

simpler, and we looked at application conditions and found that all current compressors were cost-effective, with variable speed below this application condition, so it turns into a mandatory variable speed on open drive screw compressors below this application temperature. Now, this is only in the case of systems that have one screw compressor for a suction group, if you have multiple screw compressors on a suction group, which most large plants do, then this would not apply.

MS. BROOK: Okay, finally, we are at infiltration barriers. And this is a new requirement for passageways between freezers in higher temperature spaces and passageways between coolers in non-refrigerated spaces to have an infiltration barrier consisting of strip curtains, an automatically closing door, or air curtain designed by its manufacture for use in the passageway and temperature for which it is applied. Any clarifications there?

MR. SCOTT: What you cannot do here, you cannot have a manually operated sliding door where you have to get off a forklift and go close it, so it looks like you can have just about everything, but that’s generally what’s targeted, I guess, a door that could be open and just left wide open.

MS. BROOK: Okay.

MR. SCOTT: With some concern over air curtains, which it's uncertain whether an air curtain really saves more or uses more energy, but it found that passageways, as makes sense, really depend a lot on operations of a facility, so there are all sorts of different operations through passageways, so this needed to be pretty flexible to meet all those different application conditions.

MS. BROOK: Okay. And then, finally, quite a bit of work has been done to complete very thorough acceptance test specifications for electric resistance under slab heating systems, evaporators, and evaporator fan motor variable speed controls, evaporative condensers and condenser fan motor variable speed control, air cool condensers and condenser fan motor variable speed control, and the variable speed screw compressors, and each of these tests include both construction inspection and functional testing requirements, and I would encourage anybody interested to look at the case report. They are very detailed, thorough test procedures specified, much too detailed to go through now, but certainly would like to have comments on the applicability and functionality of those tests, if anybody is willing to provide us those comments, we would appreciate it. And I think that's it for refrigerated warehouses. We would like to attempt to answer any

questions that people have right now.

MR. SHIRAKH: Any questions from the audience in the room? Jamy? Okay, anybody on the phone? Amazing. So there are no more questions. Again, I think the process of the stakeholder meetings has really been successful, in my opinion, in making these workshops go really smoothly, better than I had anticipated.

MS. BROOK: So now we can probably cover two or three times the amount of material we thought we could cover in every workshop.

MR. SHIRAKH: That's probably true. Just a reminder, this was a third workshop we've had this month and we have two more coming up, one on the 27th, which is the Wednesday of next week, and the last one for non-residential topics will be May 5th, and we will be discussing non-residential envelope and more HVAC and some hot water issues, so please look for the announcements and the agendas that will be coming out. And then, following those, we will have three workshops in late May and early June, and during those workshops, we will be discussing residential topics.

MS. BROOK: And the other thing that we just sort of have on the radar is that we'll have our ACM workshops probably also later in June, maybe even July, and also we want to focus our workshop on our Reach Standards, and

that will be in that June-July timeframe.

MR. SHIRAKH: And then later in summer we will publish our Draft Standards and we will have a workshop to present the Draft Standards, and then in the fall, we will go to the rulemaking phase and publish the 45-day and, if needed, the 15-day language. Martha has one more thing.

MS. BROOK: The final slide has my contact information, so anybody who wants to provide comments on today's workshop topics, we would like to seriously consider all comments that are submitted in the next week in order to stay on top of them and to get the comments resolved. Of course, we'll accept them after that, but we'll get direct attention on them early if you can provide those within the week's time to the contact information you see on this slide now.

MR. SHIRAKH: If there are no more questions or comments, we will close this workshop and we will do it again next week on the 27th. Thank you.

(Adjourned at 2:31 p.m.)