BEFORE THE

CALIFORNIA ENERGY COMMISSION

In the Matter of,	)
	) Docket No. 10-BSTD-01
Staff Workshop on	)
Draft 2013 Building Energy	)
Efficiency Standards	)

Staff Workshop

Staff Workshop on Draft 2013 Building Energy Efficiency Standards Revisions for Residential and Nonresidential Buildings

CALIFORNIA ENERGY COMMISSION

HEARING ROOM A

1516 NINTH STREET

SACRAMENTO, CALIFORNIA

FRIDAY, JUNE 10, 2011

9:31 A.M.

Reported by:
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Staff Present:

Gary Flamm
Martha Brook
Mazier Shirakh
Ron Yasny
Martin Ruiz
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Presenters

Ronnen Levinson, Lawrence Berkeley National Laboratories (LBNL)
George Ban-Weiss, LBNL
Dan Suyeyasu, AEC
Bruce Wilcox
John Arent, Architectural Energy Corp.
*James Hoff, Center for Environmental Innovation in Roofing

Also Present (*on phone)

Attendees

Jamy Bacchus, NRDC
Steve Heinje, QUEST Construction Products
Mike Gable, Gable Associates
John Woestman, XPSA Extruded Polystyrene Foam Association
Charles Cottrell, NAIMA
Tom Garcia, City of Fairfield
Jon McHugh, McHugh Energy
George Nesbitt, Cal HERS
Andre Desjarlais, Oak Ridge National Laboratory
Reed Hitchcock, Asphalt Roofing Manufacturers Association
Helene Hardy Pierce, GAF
Ming-Liang Shiao, PhD, CertainTeed
Mike Ennis, SPRI
Thomas Hutchinson, ERA
Jim Calkins, Sika Sarnifil
Matt Barnmore, Firestone Building Products
Jim Baker, Roof Coating Manufacturer's Association, & Roof Assembly Ventilation Coalition
William T. Callahan, Associated Roofing Contractors

Gregory Crawford, Steel Recycling Institute
Eileen Dutton, Malarkey Roofing
Heide Wollert, Johns Manville Corp.
Dan Varvais, Bayer Material Science
Mike Hodgson, Con-Sol for CBIA
Richard K. Olson, Tile Roofing Institute
Sarah Deukmejian, ASC Profiles Inc.

I N D E X

P R O C E E D I N G S

June 10, 2011 9:31 a.m.

MR. FLAMM: Good morning. Shall we get started? I'm a pinch hitter this morning. Mazi Shirakh was going to do this presentation. These are his slides. And I may trip up on the intent of some of the slides but I'm going to try to go through. This first presentation is giving you an overview of where we are in this pre-rule making activities and what the calendar is. Because Mazi couldn't make it here this morning, I'm going to stumble through. Hopefully we can keep this going.

My name is Gary Flamm. I'm a Supervisor here at the Energy Commission.

So what are the policy goals? Please forgive me for reading the slides because I've not given this presentation before and I know you all can read. The goals for 2020 and 2030 for Zero Net Energy. There's a number of policies: The 2008 California Public Utilities Commission and Energy Commission - Energy Action Plan, the 2008 Air Resources Board Climate Change Scoping Plan, the CPUC Long-term Efficiency Strategic Plan and the 2007 Integrated Energy Policy Report, the IEPR, and the 2005 Governor's Executive Order established Greenhouse Gas Reduction Goals in California 2020 and

2050. For 2020 and 2050, 2006 AB 32 codified the 2020 Greenhouse Gas Emission Target Law. The Green Building Standards Code was published in July of 2008 and it's updated for publication in 2010. It has voluntary REACH Standards for energy efficiency as compared with the Base Standards. And then Governor Jerry Brown's Energy Jobs Plan for Zero Net Energy goals. So these are all policies that we're working under in the 2013 update to the standards.

The major collaborators, the Public Goods Charge Funds and Standards. There are case initiatives, those are Codes and Standards Enhancements which are analyses and studies done by the electric utility companies - Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric and Southern California Gas have been working on a lot of these case proposals.

There's some PIER founded—focused research, rather which views standards as a primary delivery mechanism and they've done a substantial amount of research for the 2013 Standards. There's been a public process with active stakeholder input.

Now the public process that we've had so far has not—we're just initiating the Energy Commission public process. Prior to this, there have been a number of stakeholder meetings that were hosted by the

utilities where they are doing analyses, proposals, vetting the ideas and they've had a number of workshops or meetings to go over those.

How many people have seen this slide before? It's been around awhile. OK. So this basically shows that the per capita use of electricity in California compared to the rest of the nation. In the 60s it shows that the per capita use of electricity was going up pretty steeply and then in the 70s we had the oil embargo. And all of a sudden we realized how vulnerable we were to fluctuations in energy prices. And so there was a dip there in the mid-70s and that's when the California State Legislature created the California Energy Commission and there have been a number of efforts, the Building Standards, the Appliance Standards, there's Utility Rebates. So due to a number of ongoing efforts, if you look at the green line, in California we've been able to flat line the per capita use of energy, so that's the amount of energy per person in California. And then if you look at the red line, that is California as a whole—I mean that's the nation as a whole. You see that the nation as a whole had a little dip there in the mid-70s and then they started growing again. It's because of the activities that we're involved in right now that we've been able to,

basically, flat line the per capita of energy use. Commissioner, past Commission Rosenfeld had estimated that if we had not had all the standards and regulations, we would have had to install an electric generation plant every eight miles along the coast of California to support the current population that we have.

I have no idea what this slide is. So I'm going to skip this one. This is Mazi's slide.

So the 2013 Title 24, Policy Objectives. So we want to achieve big steps toward Zero Net Energy by 2020 for Res and 2030 for Non-Res. We're looking for a 15-25 percent improvement in these standards this time. We're also looking at REACH Standards which are Part 11, I don't know if everybody knows this, Title 24 is the Building Code in California but Building Energy Standards are Part Six and the Green Code is Part 11. The timing of when we adopt the standards, of when they go into effect are aligned with the Building Standards Commission Triennial Code Update and that's why the timeline is as it is.

So what we're trying to do is we want to address compliance and enforcement issues. We want to simplify the standards so some of the standards that were prescriptive measures we are migrating to mandatory

such as duct sealing, refrigerant charge, airflow measurement. We want to scrutinize all of the exceptions a lot of the historic language exceptions have been around for a long time. They really cause a lot of complexity to the standards. We're looking at making the compliance forms user-friendly, that's going to happen after we adopt the standards. We're going to be working on that. We're going to look at creating online interactive forms instead of the two-inch stack of paper forms we currently have. We want to improve and increase third-party field verification in acceptance testing. We want to improve electronic record keeping. We have—we started a repository where the HRS raters are taking compliance forms and putting them into a registry and creating a repository for historic record keeping. And we want to consider measures that integrate efficiency with demand response. So there's a lot more demand response so that during emergencies we can respond and reduce load.

We want to include non-energy related greenhouse gas cost benefits in our analysis looking at water saving measures and water costs for power reductions, considering roof deck insulation in residential buildings. Encourage proper building orientation and consider how photovoltaic systems should

be included. And I have no idea what to report to the reg—Okay, so Martha got here and I'll keep looking to her. So I can't read this. All I can tell you is that this is a calendar of where we're going and where we've been. So right now, the utilities already did their analysis, for the most part, they've had a number of meetings. We're now in a series of Commission Staff Meetings, which this is, in which we're presenting what they've been working on and some of the things that we've been working on. We're looking for adoption of these standards in March of 2012 and then they will be published by the Building Standards Commission in 2013. And that's why we're calling them the 2013 Standards and they will go in effect on January 1, 2014.

For the Standards, when we update them we have to do a lifecycle cost analysis based on a lifecycle cost report which was presented November 16 at a Staff Workshop. We incorporated updated weather files, updated time dependent valuation and updated methodology.

In previous cycles, before the 2013 cycle that we're in, we typically held 15-20 workshops. And that took an awful long time. We would have a workshop and often stakeholders; this would be the first time that they would see a measure. So what we asked the

utilities to do it to try to vet their ideas as much as possible before they brought them to us. So they're not circumventing the rulemaking process that we will follow, that we always follow, but we're hoping that measures will have been significantly vetted before we started having our staff workshops.

So I just went over this.

We hope to have 10-11 days of workshops but I think there's some scope creeping on that.

So here's our schedule. I don't know if this has changed any, Martha? This is where our proposed schedule was for workshops. Well, these are the ones that we had already. And so we're on June 10 and that's what we're presenting. June 14 is not going to happen in California because we canceled it. June 21 is looking at the updates to the Alternate Calculations Method Manuals. The—I'm not going to read this. You all can read this. All of the presentations for today are going to be available online. There will be a transcript of this, everything that is said, even the silliness that I say, is going to be posted online eventually.

MS. BROOK: Want me to cover this one?

MR. FLAMM: Please, Martha save me.

MS. BROOK: This is Martha Brook. I apologize

for being late. I thought this started at 10 o'clock. So what we're trying to do in software to support our performance based code in California is move to open source software development and availability platform so we're trying to develop all of our compliance software under open source software license agreements. We have— we're starting two technical support contracts. One for residential software development and one for non-residential software development that will give us the expertise to get our software developed. We're trying to do everything in open source so that the software is available to vendors who want to include it in their design software. We're also trying very hard to get this compliance software completed as close to the adoption date of the standard as possible. That's all I have for that.

You can skip that.

MR. FLAMM: Okay. So if you like what I said, my name's Gary. If you don't, contact Mazi. There's his contact information. The June 7, obviously we can't have—

MS. BROOK: It should say, well, it should say a month from now so July 10.

MR. FLAMM: Okay.

MS. BROOK: One more thing I wanted to mention

is that there's copies of the presentations out on the table now that I brought down, in case you're interested. I apologize for not having presentations up before this morning so if you need to take a look at what you can expect we'll be talking about today you can see the presentation material out in the front.

MR. FLAMM: If anybody has any questions or comments, what we're going to ask you to do is come up to the lectern here, introduce your name every time you come up because for the transcript we want to know who you are and then make your comments, so make your comments into the microphone. So are there any questions or comments about the big plan that we have here? Oh, I thought we had someone coming up to speak.

MS. BROOK: Let's move on to our first Agenda Item which is Ronnen Levinson who's going to talk about Updating the Aged Reflectance Formula and CRRC Accelerated Aged Reflectance Procedure. And we have a stand-in right, we don't have Ronnen we have—

MR. LEVINSON: I'm on the line.

MS. BROOK: That's great.

MR. LEVINSON: With George on the presentation.

MS. BROOK: That's great. Thanks, Ronnen.

MR. BAN-WEISS: Okay. Read to go? My name is

George Ban-Weiss. I'm a post-doctorate researcher at Lawrence Berkeley Lab in the Heat Island Group. And, as was said, I'm standing in for Ronnen Levinson today. He's on travel but he's on the phone. I'm going to talk about a proposed update to the Provisional Aged Solar Reflectance Equation for roofing products.

We're proposing an update to one measure for cool roofs, it's Section 118, Item 2. The goals of the proposed code change are to first use an extensive database of reflectance measurements to update the formula for the provisional aged solar reflectance. We also, in that updated equation, aim to reduce the likelihood that this provisional equation overpredicts the measurements; essentially we want to reduce the likelihood that the equation if overpredicting what happens in reality. And lastly, there are a couple of nomenclature changes which we'll show in a moment.

This is the code. I'm not sure if everyone's familiar with this piece or not. I guess I'll err on the side of giving too much background. In general, the roofing products are—their policies are based on aged solar reflectance. Generally, you get the aged solar reflectance by sending a sample of the roofing product down to the field and letting it age for three years, sending it back to the lab and testing it's solar

reflectance. What we address here is an equation that you can use while the sample is out in the field and you're waiting to see what the aged solar reflectance is. This equation estimates it and you use this while, basically, your sample is aging. What you can see here, where the little hand is, that's the current equation. You can see that you can input an initial solar reflectance here and do a little math and get an estimated aged solar reflectance. So currently, there's this one equation for all roofing product types so our recommendation is to update that equation but replace here, instead of having the .7 factor, have this beta value where beta can change depending on the product type. That way we can customize the formula for product type.

You can see also that there's some nomenclature changes. In the current version here you have an R aged and a row initial. Those are really both solar reflectance so they should probably have the same variable there. We're just recommending that it be row and row. And you would then have a table here that would list beta factors which get inputted into this equation. You list it here by product type. So basically this presentation is going over the basis to this code change here.

So we did a pretty extensive analysis using a database by the—that the U.S. Cool Roof Rating Council has, or CRCC. This database has solar reflectance measurements, both initial and aged reflectance measurements, for over 2,000 roofing products. We did an analysis to look at the relationships between the aged and the initial solar reflectance. We had to do a bit of editing to the database because the database as is publicly available includes some things that would kind of throw off the analysis a little bit.

First of all, we excluded any duplicative values and we also excluded non-measured values. I'm not going to go into a ton of detail as to why those are in the database but just as an example as you're probably aware, there are certain roofing companies that simply take another company's product and sort of rebrand it as their own. In that case, the CRCC allows the rebranding company so simply reference the measurements done by the original manufacturer. So that would be double counting one measurement which we didn't want to do. As far as non-measured values go, there's a counter family program that the CRCC has that allows, in essence, when you go to the public database products that are in this color family aren't always showing measured values. They're sometimes showing default

values and so we were sure to use the measure values for that.

If you look at the pie chart that's showing the relative contributions of—or the relative fractions of different roofing product types in the database you can see that it's overwhelming coating products. So around a quarter of the total products were factory applied coatings and almost 40 percent were field applied coatings. The other products shown on the left side, there were less of them; the product type with the lowest sample size was shingles with 21 or 3 percent of the database.

So I'm going to show a bunch of plots that look just like this one. There's going to be a different plot for every product type. So it's worth spending a minute to kind of orient you to this plot. What we're showing here is aged solar reflectance on the vertical axis, initial solar reflectance on the horizontal axis and what we show is the solar reflectance values for each roofing product of this product type. So each blue circle here is the reflectance value of a different product. You can see up here that there are 173 factory applied coatings and so there are 173 little blue circles. The black line shows here the 1:1 lines so that's where initial solar

reflectance equals the aged solar reflectance. The red line shows the current Title 24 predictive equation and then the green line shows the best linear fit through the blue circles. The equation for that best linear fit if shown here in the bottom right in the green. And then we also show this value of X (kai). I've got a lot of arguments over how to pronounce that Greek letter but I think we came to the conclusion that it's kai. This represents the root mean square error so it's essentially the amount of scatter of these blue circles around that green best fit line.

For factory applied coatings, this plot shows that they are really quite resistant to soiling so this green best linear fit line is very similar to the black 1:1 line so that indicating that after aging the roofing product is—the factory applied coating products in general are not seeing a very big drop in solar reflectance.

Field applied coatings show quite a different story. You can see that there's a lot of scatter in those blue circles. That's showing that first of all that there's a lot of variability, there are some products, for example, that have a lot of initial solar reflectance and then after aging, that reflectance drops quite a bit. There are also products that are up in

this range that have both very high initial solar reflectance and they're very resistant to soiling. They keep their high solar reflectance after aging. The other thing I'll point out is that there's a bunch of blue circles below that red line. That's indicating that the current Title 24 predictive equation is, to some extent, overpredicting the aged solar reflectance of some roofing products. We'll talk a lot more about that over prediction in a few minutes.

For metals, and you can see there's a smaller sample size, but in general the behavior is quite similar to factory applied coatings which is expected. You can see that they're quite resistant to soiling so they keep their reflectance value quite well after aging.

For modified bitumen products you can see that there's a sort of moderate amount of scatter here. There are quite a few products that have been—were the Title 24 equation overpredicts the aged reflectance, especially down in this range. The kai value is in between the factory applied coatings and metals and field applied coatings. You can also see, up in this regime here, that the products that have higher solar reflectance tend to have a larger decrease in reflectance after aging.

This is the result for shingle. You can see here that there's a relatively low sample size, as I already mentioned, there's only 21 shingles. Perhaps more problematic is that all of them are in this very small range of solar reflectance so they all are around .25-.3 on initial solar reflectance. That creates a bit of a problem is we're trying to come up with a best linear fit line or a predictive equation where you want to be able to kind of accurately predict the aged solar reflectance of a shingle that might have an initial solar reflectance out in this regime here. Because of the extrapolation that's necessary, it's not a very accurate situation to do that.

For single ply membrane you can see, again, there's sort of a modest amount of scatter. The other interesting thing is to note that these products, you can see with high initial solar reflectance, tend to have some reduction in solar reflectance after aging but that reduction in reflectance is less than for field applied coating so that is to say that the single ply membrane seem to hold their solar reflectance slightly more than the field applied coatings do.

And tiles are showing here, again, a sort of modest amount of scatter. There are quite a few products that really do hold their solar reflectance

after aging.

So I'll provide a definition now, and I've alluded to it in some of the past slides, we define the overprediction rate or F, the overprediction rate is the fraction of products for which the predicted aged solar reflectance from that provisional formula exceeds the measure age of solar reflectance. So it's probably easier to understand graphically. This is a similar plot that I've been showing, with a couple of lines removed, and you can see that basically the fraction of blue circles that are in this box here represent the overprediction rate. These are the products in the CRCC directory where the provisional equation was overestimating their actual aged solar reflectance.

This table shows overprediction rates for various product types. In our analysis the green row highlights the product typed with the largest overprediction rate of over 30 percent. The next kind of clump of overprediction rates is for single ply membrane which is around 17.5 percent and also modified bitumen around 15 percent and then the rest of them have kind of low overprediction rates. So factory applied coatings, metals, shingle which I mentioned before is problematic because of the sample size and also tile. They have overprediction rates that are around 5 percent

or less. Again, these are overprediction rates of using the current Title 24 equation.

So what we propose then is to take the current equation, which is shown here, and instead of having this constant of .7 we add a beta value which is variable and is dependent on product type. If you want to think about what beta means physically, it's actually the resistance to soiling for that product. So a product that has a high beta value is very resistant to soiling, that is after aging the solar reflectance tends to not drop a whole lot. Beta than is chosen to limit the overprediction rate and I just not that that's a policy decision at that point, so up until now it's been the scientific results and the analysis and choosing the values of beta becomes a policy decision.

This table I'm not going to go through in detail but it essentially shows you the beta value that you might choose for a bunch of different overprediction rates. So, for example, if you wanted to have all of your products to have an overprediction rate of 10 percent, you would go down this column here and you could choose these beta values. So you can peruse this later. It's also in a paper which will be on the website that has a lot more detail than what we're going to discuss today on this analysis.

So when you're going to select an overprediction rate we just want to note that first off minimizing the overprediction rate, having a lower overprediction rates, helps you to insure that the long term reflectance of products are going to meet predictive requirements. On the other hand, you don't want to have too low of an overprediction rate because then you're giving too much weight for outliers which could come for various reasons but one example is a possible measurement error. And the way to illustrate that is to imagine if you had an outlier down here in this bottom right of the plot of where you started out with a high initial solar reflectance and it ended up having a very low aged solar reflectance. That would mean that the red line here would have to essentially go under that blue circle. Your equation then isn't really based on anything physical anymore; it's just having to support that one data point because you have a zero overprediction rate. So that's sort of a limiting case that I don't think anyone would choose. I'm just trying to point out why you wouldn't want to have one that's too low.

So the compromise we're suggesting is to select a moderate overprediction rate and we recommend using the overprediction rate for single ply membrane,

as I showed in that previous table, which is 18 percent.

The logic behind our recommendation then is first off, find the beta values for overprediction rates of 18 percent for each product and that's shown in the table here. So this is the beta value to obtain an overprediction of 18 percent.

Then round off those beta values to the nearest 0.05 and then, essentially, if beta in this table is less than 27, that's the current value, then you would use this new beta value from our analysis. If the beta value is .7 or higher than you would just keep the current value of .7. Physically speaking, that means product types that have low resistance to soiling should get assigned a new beta value but other products that are at least resistant at 0.07 or higher can keep their current beta values. In the end, it's not a big change that we recommend. Field applied coatings would get a beta decrease of 0.7 to 0.65 and the rest of the product types keep their same beta value of 0.7.

What does this new equation look like for field applied coatings then? This plot is the same as I've been showing all along except we add one line here, which is the blue line, that shows the new proposed provisional equation for solar reflectance for field applied coatings. Essentially, the new equation shifts

the red line, which is the current one, to the blue line, which is the new proposed one. So you can see that it's not that big of a difference but what you're doing is you're decreasing the likelihood that the equation is going to overpredict the actual aged solar reflectance of field applied coating products.

And that's it. Happy to answer questions and Ronnen is on the phone too.

MS. BROOK: So if you do have questions, please come up to the microphone. I don't see any— everybody is just wonderfully happy with this revision. So that's great. If you have a question you need to come up here.

MR. BACCHUS: Jamy Bacchus. NRDC. If you go back to that last slide and the large spread, obviously we're trying to narrow that down, are there manufacturers that are being penalized by this that are maybe in the room that would want to speak out and try to figure out a way that they would want to put pressure on the other people, to kind of figure out a way that their products are not going to be de-rated? Has anyone spoken up in that regard?

MR. HEINJE: I have three questions.

MS. BROOK: Excuse me, can you please state your name?

MR. HEINJE: Steven Heinje, United Coatings Manufacturing Company.

MS. BROOK: Thank you.

MR. HEINJE: Located in Phoenix, Arizona. My first question is you have data, I believe, that includes Florida as part of your aged reflectivity here, is that right?

MR. BANS-WEISS: That's true.

MR. HEINJE: Well, my observation of my product line and my company's been in existence for 90 years, we found that the Florida results hugely skewed our aged reflectivity. When we discovered this was going to have an impact on our ratings, we since came back and essentially made tropical grades. One way to get at this is to ask if you've looked at the age of the entry, let's say it was an early entry, a sample that was put in the Coal Roof Rating's database at its inception versus later, I'm fairly confident, at least I know it's true in my case, that you'll find our ratings have improved. I think that explains a lot of your scatter. Unfortunately, if you get a regional manufacturer in California, he's really not formulating for Florida but in fact that is what's suggested in this data. So, number one.

And I guess I covered—that's number one and

two. I managed to get both climate and the age of when that sample was put into the database.

And finally, I guess this is probably outside of your scope, but if you look at a lot of the products in the database, I'm sure this would be extremely tedious, you will discover a great number of them do not actually meet the code. For example, you require ASTM D683 or Table 118-B for a requirement of the quality. You're trying to make sure you don't have paint on the roof; you want to have a good coating. But if you actually look at the literature of a lot of the companies that have data on this Cool Roof Rating website which is merely a rating agency, you will discover that a good third of them, at least, do not in fact meet the energy code.

I don't know that that's particular observation is going to change the results. It is a fact that a great number of the rated products in fact do not meet any of the quality requirements that are outside of just reflectivity in the code.

MR. BANS-WEISS: For Durability?

MR. HEINJE: For durability. This issue I'm very aware of because of our company's long history.

MR. BANS-WEISS: Yeah, that's been raised actually by a couple of companies in particular. And

that's not accidently, that's companies that have products that have very good durability and they think that that's something that should be included. So yeah, the point is well taken that if a coating is no longer on a roof in two years, it's not really doing much. That's outside the scope of this analysis--

MR. HEINJE: But this is something that if asked, I would be willing to offer some of that input because if you're an insider in the coatings business, it's not that hard to figure out. But I would understand completely that, to an outsider, they're all white fluids in a bucket. They all look the same.

MR. BANS-WEISS: Yeah. This analysis is based off of samples from weathering farms, essentially. And to your first couple of points, if you look at the paper, actually, we did a pretty thorough analysis of the site result relationships. So there's a bunch of plots like this one that show results for Florida, Arizona, Ohio and certainly what you've seen is corroborated. Florida results show more aging so you know the goal is to get a representative—some sort of representative sample of what's going on in the real world.

MR. HEINJE: Thank you.

MS. BROOK: Is that it from the audience or do

we have any questions online? Okay, thanks very much. Let's move on to the next presentation.

MR. LEVINSON: Thank you, George.

MS. BROOK: Oh, excuse me. Do you have a question online?

MR. LEVINSON: Oh, no. This is Rennon, just thanking George.

MS. BROOK: Are you going to be there or--?

(Whereupon they set up the next presentation)

MR. SUYEYASU: Good morning. My name is Dan Suyeyasu with Architectural Energy Corporation. We're going to be discussing some proposed changes to the Nonresidential Insulation Standards that are being sponsored by—this is research done for the California Energy Commission.

What we're proposing to do is to add some new mandatory insulation level requirements to Title 24. Just for the people who are not familiar with the difference between prescriptive standards and the mandatory minimal standards – a prescriptive standard is a standard that essentially set the energy budget. If you hit the prescriptive standard, you will comply with the code if you're using a prescriptive path. If you're using a performance compliance path, the prescriptive standard will set what the budget is for doing energy

modeling. A mandatory minimum standard is a standard that every building that is built must meet that mandatory minimum standard. So with prescriptive standards you can trade off using the performance compliance approach but you cannot trade off other energy efficiency futures to offset the energy benefits of the mandatory minimum standards.

So why do we have mandatory minimum standards in the code that's separate from the prescriptive standards. At some point there are certain elements of the building construction that just become fundamental, core, prudent types of construction and at that point we will require a code, essentially, under any circumstances. This has been done in residential awhile in the insulation techniques. Basically, if you have a 2x4 stud raw, we want to see batted insulation between those studs. Really, there's no rational or no good rational to not do that. The other issue is that it makes the enforcement process so much easier on the building inspectors because they know if they see a wall cavity, if they see a rafter cavity, they want to see some type of insulation there. If they see no insulation then maybe after they have to think that maybe this is being traded off through the performance approach through either a higher efficiency HVAC system

or higher efficiency windows. And they can obviously figure that out in the Title 24 reports and get into that but we want to make this a little bit easier on the building inspectors to know there needs to be a certain amount of insulation everywhere in a building.

Two potential ways, there's probably more than this, to set what the mandatory minimum levels should be. One approach that we're using with insulation here is to look at the lowest standards across all climate zones for the particular construction type whether it be a wall or a ceiling or a floor and apply that standard, essentially in the most mild climate zone, as the mandatory minimum for all climate zones.

We're also looking at recent historical standards as the basis for mandatory minimums and this will be discussed in the afternoon when we're talking about cool groups because that's the basis for cool group mandatory minimums being proposed.

Cost effectiveness. There is no cost effectiveness analysis that's being done with these standards because the standard is at or below the prescriptive standard which has been shown to be cost effective so just by default it's cost effective. The homework has already been done on that issue to get the prescriptive standard into the code.

So let's just walk through what we're proposing for mandatory minimums across different assembly types starting with roofs. Roofs and metal building, we're proposing a mandatory minimum U-Factor of .065. These standards, which are the lowest U-Factor in the code, are based on a certain construction assembly type and in this case we're going to go through those construction assembly types just to give you an idea of what we're thinking as a mandatory, prudent type of construction. This will be an R-19 batt over purlins, compressed over those purlins, but with a thermal block at each purlin of R-5 that spans outside the width of that purlin of about one-inch. You can meet this standard through any insulation type that will get you to a U-factor of .065, you don't have to use that insulation type and that's the basis for this. Roof, wood framed and other, all other types of roofs essentially with a U-factor of .075. This is derived from putting an R-19 batt between 2x4 framing, 16-inch on center.

Moving on to the different wall types, walls in metal buildings, we're looking for a U-factor of at least .113. That's equivalent to an R-13 batt laid over the metal girts and compressed under siding, essentially the same as on that metal roof only without the thermal

blocking. And this is in a metal building, not a metal framed building, so it's metal structural elements I guess you'd say. They're also structural but largely metal. And then while metal framed has a U-factor of .098. In that construction we found what's most cost effective is continuous insulation on the outside of the structure and that's derived from an R-8 continuous insulation. Moving to a mass light wall, a U-factor of .44. That's derived from a 6-inch lightweight concrete masonry unit, wall partly grouted with insulated cells. That's just a one extra feature over a regular wall insulation of the cells. Mass heavy walls have no requirement above and beyond the wall. And then wall wood framed and other has a U-factor of .110 and this is 2x4 framing, 16-inch on center with R-11 batts.

Moving to the floor, if its mass floor there is no requirement. If it's a wood floor or some other type of floor it gets a U-factor of .071. This is the same as 2x6 framing, 16-inch on center with an R-11 batt in the floor.

So that is the details of our mandatory minimum on insulation proposal. Are there any questions or comments on that?

MS. BROOK: Come on up, Mike.

MR. GABLE: Mike Gable, Gable Associates. I

think it would probably be useful if you were ever doing one of these presentations again to use the graphics from the Joint Appendices 4 to illustrate which assemblies each of these is referring to because just visualizing this is kind of hard. Thanks.

MS. BROOK: Okay. Thanks.

MR. WOESTMAN: John Woestman on behalf of XPSA Extruded Polystyrene Foam Association. Just a suggestion. First of all, very much supportive of the mandatory minimum as a way to go but one suggestion, like in this document, that it's clear what you're considering as the mandatory minimum in the U-factor. And that the other parts, the R-19 batts are examples.

MS. BROOK: Okay.

MR. WOESTMAN: Acceptable examples. Because I know when I was looking at this, I was thinking, "Wow. That's a requirement?" because from one insulation provider's perspective you want to be able to have all the choices that can be used.

MS. BROOK: Right. And it'll be clear when we post our code language change that we're making changes to the--

MR. WOESTMAN: Sure.

MS. BROOK: U-factor.

MR. WOESTMAN: Yeah but on these, we're

looking and going, “Oh, my gosh.”

MR. SUYEYASU: Apologies about that.

MR. WOESTMAN: I know what you meant. You made it clear that the U-factors are mandatory and there are some examples that we believe to be that.

MS. BROOK: Yes?

MR. COTTRELL: Charles Cottrell representing the North American Insulation Manufacturers. We’re the manufacturers of fiberglass and rock wool products. We are also very much in support of these mandatory minimums. One of the things we would like to have seen considered is instead of just one mandatory minimum, possibly looking at mandatory minimums set by climate zones. The way it’s currently proposed, it really could just set the minimum at something that’s disproportionately in favor of the lower climate zones. In other words, in San Diego, R-11 being the minimum—you wouldn’t go below that anyway and some of the colder climate zones, they’re not as restricted as much so it’s sort of disproportionate. If there’s a way to balance that out.

MS. BROOK: Yes. So we have those differences by climate zone in our prescriptive standards and the way that we’ve developed our mandatory standards in the past is that it’s mandatory means mandatory for

everybody statewide. So part of it is just ease of implementation and communication and getting the building officials an easy way to never have to wonder, they always know. It's always the same statewide and then all of the variability and the issues with climate variation we deal with in our prescriptive standard. So that's how we're dealing with it now.

MR. COTTRELL: Okay. And then, just another point to look at, is as John pointed out, the U-value of being the minimums. Just being aware that some of those values, U-values that have been assigned to different assemblies such as the .065 for R-19, those are in—at least that value that was cited comes from the ASHRAE 90.1 standard. The newer ASHRAE standards have changed those U-values for prescriptive, R-19, has changed somewhat.

MS. BROOK: Oh, okay.

MR. COTTRELL: So just be aware that some of those have changed and that you need to look to the newer standards.

MS. BROOK: Okay. That's a great point and a good suggestion. Thank you. Anybody else? Tom?

MR. GARCIA: Morning. I'm Tom Garcia with the City of Fairfield. Just a couple of quick comments. I'm curious about the compressed insulation, compressed

over purlins and then for metal buildings, compressed against the girts. So, assuming I have a metal building, the manufacturer is going to be okay with their skin being applied and screwed through compressed insulation. And then as far as over purlins, I assume that's not the real intent. The intent is that you're going to cut it and fit it up against the purlins. You're not going to lay it over the purlins and then try to put sheer plywood on top of that. I just think you want to clarify that.

MR. SUYEYASU: What those sample assemblies are, is going back to the (inaudible) tables, we found what was the lowest—the least stringent level of insulation across the row for that building assembly type within JA4 and that U-factor is correlated with a certain cell which was used in the lowest lifecycle cost analysis to develop those U-factors. So we referenced back to JA4 and that cell within JA4 is descriptive of that building type. We have not gone back to sort of second guess what other people were thinking when they decided on that type of construction with lowest lifecycle approach to get insulation on that building type. So we haven't sort of opened that back up, we just looked at the lowest value and that's just an example of what someone was thinking back when they did

the original analysis to put those U-factors and the prescriptive standards. It could have been 5 years ago or 10 years ago.

MR. GARCIA: For language purposes, it might be better to just get rid of the draped over and just put it to the assembly.

MR. SUYEYASU: Okay. Right.

MS. BROOK: Okay. Thank you.

MR. MCHUGH: Jon McHugh, McHugh Energy. I'd just like to go back to the question about compressed insulation. Are we looking at blocking as a potential minimum base—basis for minimum efficiency that there be thermal blocking for some of these assemblies, roofing, etc.

MR. SUYEYASU: If you want to put batts insulated compressed over the purlins and you want to get that value out of the JA4 table, then you have to put that thermal block in there because that's what the JA4 describes as part of that assembly.

MR. MCHUGH: Okay. So you want to—

MR. SUYEYASU: But if you want to get that value off the JA4 to then run it through your calculations and say you're meeting the U-factor, then you have to do that because that's what JA4 says.

MR. MCHUGH: That kind of helps clarify, I

think, what you were looking for.

[Off mic]

MR. MCHUGH: Okay. Okay. And then Charles, I just wanted to understand what ASHRAE standard you were talking about. You mentioned 90.1 and then you mentioned there were some other ASHRAE standards. Where you talking about Addendum BB that's been proposed for ASHRAE 90.1 2010, what were you intending there?

MR. COTTRELL: Yes. ASHRAE. Charles Cottrell representing NAIMA. The ASHRAE 90.1 Addendum BB which is actually not in the current version of the standard but it is being considered and they say the industry is moving towards different U-values for these given assemblies. Just be aware of that.

MS. BROOK: Okay. Thank you. Do we have any other comments on this topic of mandatory minimums? Going once. Okay. Now Dan is going to talk about Nonresidential Envelope Air Leakage. Do we need to run back over there?

MR. SUYEYASU: Yeah. Do you mind just firing up a different PowerPoint if you can find it?

The Energy Commission has recently asked us to look about adding two Title 24 Air Leakage standards for nonresidential buildings. We've just started to look into how to model this question and essentially find

some predictions for how the energy savings will be in the State of California.

We've been pointed IECC 2012, Section 502.4.1, which will add an air variable requirement to that standard and look to add some guidance of what we may do in California.

The target in that standard in the IECC is something less than or equal to .4 CFM per square foot at a pressure difference of about .3 inches. That target, I think, there is a pressure testing methodology that is in that standard as well. There's also a prescriptive path using certain building components to get there. That's what we're using right now as our proposed standard for our modeling purposes. For modeling, we also need to look at how much air do we assume is leaking from a building right now to compare against we're looking at a 1.8 CFM per square foot standard. This is from the Envelope Subcommittee of ASHRAE 90.1. That's the leakage rate that's used in most of the daily standard probing for modeling purposes.

The IECC 2012 requirement is not applicable in climates zones 1-3, ASHRAE requires 1-3, which covers most of California and it's generally been assumed to start with most of the benefits of reducing air leakage

are beneficial in cold climates and zones that have a lot of heating loads for a number of reasons. California with our more expensive electricity and significant cooling rules, it could be that doing an analysis using the [phon.] methodology, we would actually see some more significant energy saving benefits in California even in warm climates. So that's the research we're going to do here.

Key question of this research is just how much infiltration comes into a building while the HVAC system is running. The NACM has always assumed that infiltrations is reduced by 100 percent when the HVAC is running because the building is pressurized. So whatever air gaps you may have in your envelope, air is being pushed out of them rather than coming in. You're essentially just offsetting the air that would otherwise escape through the HVAC system on the roof or somewhere else in the building that controls air.

PNNL has put together a paper on how to model these infiltration issues. They've come up with an assumption that suggests that when an HVAC system is running, it's only reducing infiltration by 75 percent. We're going to look and see the basis for that assumption best we can and we're going to use that assumption when doing our energy modeling to see what

the energy benefits are of reducing infiltration.

So there's two major drivers that we're going to be modeling when we're looking at this proposed standard. One is wind driven infiltration and the other is stack effect. Both of those are very dependent on building height so we're probably going to see much more significant results for tall buildings than for shorter buildings. In terms of how to model the wind driven infiltration, we're looking at a study by Pacific Northwest National Labs as noted from 2009 that basically lays out how we model this as the building gets taller and what other pressure differentials dependent on wind speed as you move into higher heights within a building. We won't get into those formulas today but if you want to review them you can find that paper online.

We're also looking at stack effects and that'll be modeled in accordance with some formulas set forth in the ASHRAE handbook on fundamentals. Here's just some preliminary data we've gotten out of trying to measure what the airflow difference is at the 1.8 CFM per square foot level and at the .4 CFM per square foot level dependent on building height, know the details are a little small on these graphs. On the left is the before case and on the right is the after case if we

were able to implement the standard. The different lines define different heights of the building so the highest and lowest lines in those graphs are the top and bottom floor and the lines in the middle is basically the second floor. There's also a [phon.] part of each floor so that's why you see six floors in a three story building. Across the x axis is the temperature so the stack effect height is dependent on the temperature difference inside the building as compared to outside the building so when you're at a neutral temperature outside, everything kind of converges on the zero point and then the stack effect increases as the temperature differential increases. So this is just preliminary results of what we're looking at that will go into this model. And we'll be analyzing one story, three story and twelve story office buildings.

So our analysis plan moving forward at this point is that we're going to run these energy models just to see if the energy savings in California's climate zones are significant enough to justify doing further research on how to actually implement doing this code proposal. Once we get some preliminary results on how much the dollar savings are going to be and we're going to calculate that in terms of square feet of vertical envelope of the building. Then we'll start to

look at some existing studies on just the cost of implementing these measures to move from a building where there is no focused code drip detailing on air leakage to one where they are trying to comply with this .4 CFM per square foot standard and then we will compare those costs to the energy savings and look to see if we're going to put it into the code.

The air ceiling requirement will likely vary once we're done with it. It will probably vary by climate zone; it might vary by building height. There's some much more cost effective for taller buildings and there may be some different on building type because different building types may have a harder time complying with that .4 CFM per square foot standard than others.

So that's the state of our research right now. It's only just gotten going in the past few weeks.

MS. BROOK: Okay. So the reason we wanted to talk about, or just introduce this, is because we haven't vetted this topic at all in another stakeholder forum. This is a Commission-sponsored topic area for the standards. So if you're interested in this topic, if you potentially have concerns about our proposed analysis approach going forward, we'd love to hear about it now. If you have data that you could provide, if you

have any suggestions for methodology, for analysis, we'd love to hear them because we are trying to get this done in relatively short order so we can come back to you and let you know what our recommendations for envelope air leakages in nonresidential buildings. So anybody want to come up?

MR. GABLE: Mike Gable. Is there any thinking yet on if you decide to discover if it's cost effective in some cases that it would become a prescriptive standard or would it be a performance option to show a credit beyond the default condition, which would be sort of standard infiltration rates.

MS. BROOK: Well, I guess traditionally we would start it as a performance option but it probably depends a lot on the significance of the impact. So if it seems to be a big deal then it'd lead us to want to make it a prescriptive requirement and the fact that it is an IECC, right? So that's the other thing that has been driving our goal to look at this is that the State of California has the requirement to meet or exceed national codes and if this is already in the national code then we really need to seriously look at it, even though it's on national side most of the climate zones in the state wouldn't get impacted we need t know where we are in that kind of domain as far as our standard

versus the national standard. So if the impacts are big we'd want to put them in the prescriptive standard. If we have good justification on the cost effectiveness, we'd want to put them in the prescriptive standard but on the other hand brand new topic would lead us more toward the performance—

MR. GABLE: Just one note, that there's certain retail stores that, small retail stores, that leave their doors wide open. I mean with a big box store it's different. Also, warehouses that are conditioned that have rollup doors that are left open. There's some other occupancy driven issues that we need to think about so—

MS. BROOK: And the other thing, to be honest with you, that will drive us more toward the performance option is if we don't have time to deal with all of these exceptions and figure them out then it would be more appropriate to provide some reasonable conservative credit.

MR. GABLE: Okay. Thank you.

MR. BOZORGCHAMI: We have a question online by George Nesbitt.

MS. BROOK: Hi, George.

MR. NESBITT: Can you hear me now?

MS. BROOK: I can hear you now.

MR. NESBITT: Question would be since multi high-rise, multifamily is in the nonresidential standards, will this apply to high-rise multifamily.

MR. SUYEYASU: I believe it would because those have a lot more heating issues than do traditional, nonresidential buildings so whatever benefits we see for our standard analysis we'll see probably in greater energy savings for high-rise residential motel/hotel. Just because they're operating at night.

MR. NESBITT: I've done maybe close to 400 blower door tests on high-rise multifamily although done unit by unit. Then the other issue how are we going to test the building? It's not an insignificant task to test the whole building at once.

MR. SUYEYASU: That is probably, I should have noted that in our research plan, but to figure out if it's cost effective but exactly how we ride the compliance path for this standard will be complicated. The IECC has done a lot of work on that and we can follow that lead but it may need further review and detail.

MR. NESBITT: Yeah. And I mean most of the high-rise or even low-rise projects that I've worked on are often—they are—the units are under a large negative

pressure because they're continuously exhaust ventilation and then the corridors are pressurized. I've been on projects where the corridor doors are open to the outside and the corridor is being heated. And so there's a lot of—and then you have vents on top of the elevator stacks and the stair stacks so you have a real large pressure driving through the vertical shafts of the building. So the ground floor in the garage is under a large negative pressure sucking in pollutants and the top of the building is under a large positive and the ventilation rates vary floor to floor because there's too many pressure drivers in the units. Most of the multifamily units are far too much leakage unit to unit and probably still floor to floor.

MS. BROOK: So, George, if you could just look at what Dan's proposing for an analysis plan and give us some comments on what you think would be appropriate for multifamily high-rise that would be great.

MR. NESBITT: Yeah. Has this presentation been posted?

MS. BROOK: It's been posted.

MR. NESBITT: Okay.

MS. BROOK: All right.

MR. NESBITT: And the other thing would be HERS raters and doing verification through all of the

utility programs on high-rise multifamily so pretty much any low-rise HERS measure should be a high-rise HERS rater measure but yeah gladly—

MS. BROOK: Okay.

MR. NESBITT: Look at things more and comment and have certain amount of data I can share.

MS. BROOK: Okay. Thank you very much. Are there any other comments on this?

MR. BACCHUS: Jamy Bacchus, NRDC. Have you looked at other infiltration values? For example IGCC's Public Draft Two is using .25 CFM per square foot and I believe ASHRAE 189 is as well. Dan, have you—

MR. SUYEYASU: We have not we're just looking at .4 now.

MR. BACCHUS: Would it be pretty simple just to put in a different value if you find one being ineffective and just redo it or is it not being able to batch the models?

MR. SUYEYASU: Well, it needs to be—that needs to be put into all of the preliminary equations that develop a lot of variables that go into the main analysis so that pressure point comes into the modeling at a lot of different ways. I don't think it can be easily toggled. I would want to get through the analysis at that .4 point, I mean that's a big enough

leap from 1.8 to .04 to see what that does before we think about what is a more appropriate level. Yeah, we just need to see if the .25 is even viable as a standard, I don't know. I would like to get through the process of .4 first and see where that leads us before we start thinking about anything more robust.

MS. BROOK: Are those green codes you mentioned climate specific?

MR. BACCHUS: No, I think that's for all climate zones?

MS. BROOK: So they've just made this call that leakage is important and--

MR. BACCHUS: We could double check but—it may have omitted some of the Southern climates but—

MS. BROOK: Wow.

MR. BACCHUS: It's a good question.

MS. BROOK: Interesting. Okay. If there aren't any other, thank you Dan—

MR. SUYEYASU: You're welcome.

MS. BROOK: If there's no other questions on this item, I think we actually have a process issue here because we started earlier than what our agenda said and some of us weren't prepared for that early start. Now what we have is that we went through the beginning part of the presentations pretty quickly. We can't really

start early because we have people planning on being here and doing presentations after lunch. So—

MR. SUYEYASU: Martha, do you think we should discuss at least the cool roof proposal for unconditioned buildings just because that's at a real preliminary stage. At least move that to right now?

MS. BROOK: Isn't that part of your other presentation?

MR. SUYEYASU: It's certainly tied in with the commercial cool roof thing but it might—that's not—

MS. BROOK: We could definitely—

MR. SUYEYASU: It's just early research.

MS. BROOK: That's going to be another half an hour but we could definitely do that.

MR. SUYEYASU: I don't know if that's useful just for—

MS. BROOK: No, I think that's a good idea because we could easily run out of time in the afternoon. Would you want to find where that is in your slide deck?

MR. SUYEYASU: Yeah, let me do that.

MS. BROOK: Okay so Dan's suggesting that we take the last item on the agenda and talk about it now. It is—that falls under this bucket of it's a preliminary thing that we're not quite finished with but we wanted

to let you know what we're thinking. It's definitely new and different and hopefully you'll be interested in hearing about what we're doing. But then what I think I'm going to have to propose is that we take a long lunch. I don't see how we could—we could probably start at 12:30. It really depends on when our afternoon presenters—Dan's here but Bruce Wilcox isn't here and he's the first up in the afternoon so he told me he would be here at 11:30 so maybe 12:30 is a good restart time.

[Off mic conversation between Mr. Gabe and Ms. Brook]

MS. BROOK: So if everybody's here that we expect for Dan's item, his 2:30 item, would you want to go ahead and do that whole thing now?

MR. SUYEYASU: That's a good idea, Mike. Thanks.

MR. SUYEYASU: I just know that one person sent me an email yesterday when this was going to be on and who was going to dial into the webinar. Sherry Hao with CRCC Energy Solutions. I don't know if other people are—

MS. BROOK: You know what we could do is—

MR. SUYEYASU: Planning to hit that schedule.

MS. BROOK: Okay. So, Payam actually thinks

we need to wait because he's got some people who may also be calling in. So right now what we're going to do is take up that last item, Nonresidential Roofs for Unconditioned Buildings, and then let's figure out when to come back after a long lunch break after Dan's done. Thanks.

MR. SUYEYASU: Okay so this proposal is also sponsored by the California Energy Commission. We're doing some—we're just starting the research right now. We're looking at whether or not to have a cool roof requirement for unconditioned buildings. You may ask why we would want to do that. The benefit is that that cool roof creates something called negative radiative forcing which essentially is that a certain amount of energy from the sun is hitting the roof which is causing the heat issues with roofs. On a lighter roof that energy, at least a certain amount of it, is actually bounced back, not just into the atmosphere, but through the atmosphere back into space. And that energy is essentially lost from the global warming equation with trying to stop global warming and that's one of our key drivers here. We're not just trying to stop CO2; we're trying to stop the heating problem that's caused by CO2. If we can take some of the heat input out of the equation, as opposed to just reducing the blanket above

that heat, then we're doing better. As I was thinking about this issue, it's sort of the megawatts of global warming as compared to the CO2.

This research we're doing is based on some—or at least the analysis we're doing is based on some research from Lawrence Berkeley National Labs and from the California Air Resources Control Board.

The research that they've done at those two institutions has managed to determine for a given reflectance level change if you're moving the reflectance level up a .01 increment how many watts per meter squared average across the course of a year does that save. Those watts of energy accumulate in the atmosphere as heat. So that's where it starts and then you can convert those watts of energy savings at the roof and essentially heat in the atmosphere to an equivalent amount of carbon emissions retaining heat up in the atmosphere. There's some complicated interactions here on the duration because once carbon is released from smokestack than it is there for perhaps 100 years, the half life is something like that. Whereas the negative radiative forcing only continues to benefit the fight against global warming as long as that roof stays there at that reflectance level. So if we move to cool roof for 15 years, you'll get some benefit

but if it goes back to a dark roof that benefit will go away whereas the equivalent amount of carbon is still there. There's some complicated equivalency issues but we think we're starting to get a good grip on how to equate those two things.

As we start to work on this more and more, we're starting to think that it's probably best to add this measure if we decide to make an unconditioned building cool roof requirement in the REACH code. The REACH code is much more specifically focused on taking additional steps to reduce global warming than is the Base code. I mean the Base code is certainly a big focus of it but the reach code is sort of taking extra steps, taking the extra additional responsibility within the REACH code jurisdictions to do what we can to stop global warming so that's probably where it would be added because this measure—Obviously, I think there are some benefits to unconditioned buildings of having a cool roof. It would be more comfortable inside during the summertime but mostly the benefit is pure environmental benefit and then we are valuing it based on the price of carbon and how that equates back to the watts per meter square. We've just got some very preliminary numbers and it's saving more money than I thought it would and could be cost effective using what

your assumptions are based on the cost of using a cool roof. So that is where the research is at right now. We're still trying to dig through the research papers that are a basis for this and figure out what exactly the perfect comparisons are.

MS. BROOK: And the other thing that we can do to help people understand what we're trying to accomplish is post those background scientific papers that we're basing our analysis on.

MR. SUYEYASU: Yes, that would be great.

MS. BROOK: Mike.

MR. GABLE: Mike Gable. I was wondering sort of when, roughly, what timeframe you might have that preliminary analysis done because there's several jurisdictions, maybe you're already aware, of having roof REACH codes. Burbank passed when Chula Vista is going to pass one and I've actually been asked to do some sort of analyses and obviously it would be helpful to see some sort of rational on the global warming side other than the cost effectiveness which is somewhat of a different issue.

MR. SUYEYASU: We have just one hang-up right now which is the ARB research is not published yet so we can't cite it just yet.

MR. GABLE: So you think within six months

though?

MR. SUYEYASU: That's my sense, yes.

MR. GABLE: Okay, thanks.

MR. DESJARLAIS: This is Andre Desjarlais, Oak Ridge National Laboratory. Dan, I wanted to point out to you that the Department of Energy has a cool roof roadmap. And as part of the cool roof roadmap we've looked at this radiative forcing. We had a committee of about a dozen international experts come to Washington and when they studied this topic one of the major concerns is that all of the research done in this area, while interesting, has been done by one group, one organization, one party. This group of experts felt that it really needed some vetting by somebody else before we accept all of this as being fact. So I suggest you get the roadmap and the information in the roadmap. It's not from me; it's from this international group of experts.

MR. SUYEYASU: Okay.

MR. DESJARLAIS: And I suggest you—

MS. BROOK: And we have the same concern. That's actually why one of our Commissioners asked ARB to do an independent analysis of the research and they actually did a completely different type of analysis that Akbari did in his foundational paper and came up

with similar results which was, really for us, why we thought we could go forward because we were in the same place. We weren't willing to go forward with just one source of information. But we definitely need to get that paper published and able for people to review—

MR. DESJARLAIS: Yeah that's news—well, this workshop was held in November of last year so I presume that that wasn't available at that particular time.

MS. BROOK: No and, in fact, one of the things about the Air Resources Board is that they are very thorough and conservative about their review process and they won't publish anything until—I mean they have a whole formal process of review and so it's—that's probably why one of the reasons that the paper hasn't been published yet. So you're not missing anything. It's just that—and so we're in a position where the timing isn't great but we don't want to miss an opportunity if this is a valuable impermanent, we don't want to wait a whole other code cycle. So that's why we thought if we do go ahead and do the analysis now, if there's anything there then we would suggest it for the voluntary REACH code and just kind of start the wheels rolling.

MR. DESJARLAIS: Okay. I presume your definition of an unconditioned building is a heated

building and you are including any heating additions.

MR. SUYEYASU: We are going to look at that and make sure that we aren't causing more energy use in that respect than what we're benefiting in the other respect.

MR. DESJARLAIS: Because you probably are increasing the energy consumption of the building and the question is, is it being offset by environmental benefits, I think.

MR. SUYEYASU: Yeah, we will look at that.

MR. DESJARLAIS: Because it will reduce heating load.

MR. SUYEYASU: Yeah, we will look at that.

MR. DESJARLAIS: Okay. Thank you.

MS. BROOK: Thank you.

MR. SUYEYASU: And the ARB paper, they're not just publishing it themselves. I forget which journal they're putting it in. It might be *Climate Science.* I forget. I don't know the journals in that field. It's going to be published outside of the ARB.

MS. BROOK: Okay. Good. Great. Thanks. Anything else on this topic?

MR. NESBITT: Can you hear me?

MS. BROOK: We can hear you, George. What's up?

MR. NESBITT: I didn't hear anything so. I've been doing residential coolers since '94 and I love them, even in climate zone three. I think the concern about increasing heating energy use is easily addressed by the insulation. So we shouldn't be counting on our roofs to heat our buildings through the roofs because they're fully insulated. Anything we can do to make cooler roofs standard, common and even in non-air conditioned climates because they do help with comfort on houses, especially as they're poorly insulated or poorly ventilated like my house, so. Anything we can do to justify that would be great.

MS. BROOK: Okay. Thank you for your support.

MR. MCHUGH: So my understanding now, that the current standards for heating only spaces, cool roofs are required so as part of this it probably makes sense to look at that whole issue. In regards to insulation under a cool roof, the very same thermal effect of how a cool roof reduces cooling loads is the same effect about cool roofs increasing heating loads. So there is an issue there. There is a trade-off. But this is a really important issue in terms of, especially for REACH codes, is to look at what is the impact. And I'm assuming that you folks are probably going to take the thermal impact, compare that to the CO2 costing that's

currently in the REACH codes TDBs, is that sort of your economic--

MR. SUYEYASU: Yes.

MR. MCHUGH: Okay. And then I guess the last question is, is this research plan you're going to post on your website, is that correct? The CEC website? Something more than just the slides or--

MR. SUYEYASU: Yeah at some point we will have a more formalized scope of work here, put together. We should be able to post that.

MR. MCHUGH: Similar kind of issue for the air filtration?

MS. BROOK: Yeah. We'll do that. Thank you, Jon.

MR. SUYEYASU: Yeah.

MR. MCHUGH: Thanks.

MS. BROOK: Anybody else? Okay. Then what I'm going to propose is that we reconvene at 12:30. That make sense? So you have a long lunch. That'll give Bruce time to get here and we'll start earlier than on my agenda and get everybody out and ready for their weekend before 4 p.m. All right? Thank you.

[Session break. Group resumes at 12:42 p.m.]

MR. SUYEYASU: Welcome back from lunch. As you may have heard Martha announce, we're going to move

to the nonresidential cool roof discussion first and then go to residential after that. I would just, by way of apology, apologize to the roofing community that this topic has sort of come to fruition here pretty late in the process of nonresidential cool roof standards. We got a request to investigate this sort of after all of case research was going on and we said we'd be able to get to it once we cleared some resources internally at AEC and it just took us a while to get those resources free so we understand that we have a lot more vetting to do and a lot more feedback to get from the roofing industry but we're going to jump on that now that have the resources to put into that and we'll take it from there.

Sorry, this slide got a little reformatted as it changed computers it looks like. This is the proposal, just to start with the punch line, of what we are proposing for the 2013 standards. The biggest change is that we are moving to a prescriptive reflectance standard of .7 reflectance aged from the current standard of .55 for most nonresidential buildings. This will be across all climate zones. For high-rise residential construction this is going to move to .7 in climate zones 2-15 is what we're proposing. The steep-slope values you see here may have been

changed just as of today. We are, in the steep-slope category, just looking to match what the research is showing should be done on residential just to correlate the steep-slope to steep-slope across those two standards. My understanding is that Bruce will get into this more later but that may be at a .2 level now so that will just match whatever is on the residential standard.

And as we'll discuss at the end of this presentation, we're looking to put some mandatory minimum reflectance levels into the standards that will be a reflectance aged standard of .55 for nonresidential low-slope buildings.

So why are we moving to a .7 standard from the current standard? For most climate zones, moving from a .55 where it is for most buildings right now there is no additional cost is our understanding to move to the .7 when you're looking at most of the dominant cool roof materials, single ply membranes and field applied liquid coatings. So with no additional cost, all we need to do is see if there's energy savings to see if it is cost effective for the building owner and for the state. And for those climate zones, where we are proposing the .7 standard there's a significant energy savings.

In the climate zones that don't presently have

a standard, that would be climate zone 1 and 16 and more than that for the high-rise residential, there is some additional cost to move from what is a darker roof to a cool roof but for most of those climate zones we are seeing an energy savings offset via additional cost. Also, just looking at product availability why .7 as opposed to something higher, it is our, just looking at the cost effectives analysis, moving to a higher standard can be more cost effective but at the .7 level we believe there is still plenty of product availability on the market to supply the roofing industry and keep installations happening.

So let's move fist to the cost data. We'll go through this for comparison to the aged .55 standard and then for comparison to the climate zones where this is no standard. Looking at the .55 standard comparison, it is our assumption that once somebody is already in the cool roof market they're using the same type of product under this new standard as under the .55 standard, they're just moving to a lighter version. It's lighter singly ply coating, single ply membrane, sorry, or a lighter liquid field applied coating. So this is the data for field applied liquid coatings. As you can see, aged values, there's actually a large clump sort of in the .68-.8 range is where most of the available product

was. This data is just calling distributors and retailers in California and asking what do you have, what's the price point. So this is all the products that's available in California. And actually, as you go toward .55 in the other direction, it gets more expensive so this is sort of backwards to what we see on most of the cost analysis information for efficiency measures.

Notably, toward the darker end of the spectrum, some of those products cost more because they're actually adding tints to the white product, which in its natural state is closer to the .7-.75 range.

And here's the cost data for the single ply membranes, PVC and TPO that we collected shows at least some, at least one data point out there in the .76 area I think, but it shows decreasing costs going toward the .7 and perhaps ramping up past that. So once again, this is showing that as you move toward .7, just on a material basis, this measure is getting cheaper than where the current standard is. This makes the cost effectiveness measure a little easier for these things than it would be for some where you're balancing energy savings against increasing material costs.

And these cost data we're looking at here is

just for the material per square foot, it does not involve labor, because as I said we're just assuming the same installation process with a different material going into that process.

So moving from no standard, what costs are we going to assume. It's a little more complicated. We looked at basically existing studies for this. In 2002, Lawrence Berkeley National Lab did an analysis of the original cool roof standard and that was looking to move to reflectance initial value, not aged, of .70 across all climate zones. Sorry this is a little bit small but I wanted to cut it straight out of its source here. This is from the original LBNL report and it shows cost of moving from a regular roof, standard dark roof, at that point to a cool roof, ranging from $0 per square foot to about $.20 per square foot depending on what your assumption is as to the before and after case.

Just last year, DOE completed a study of guidelines for selecting cool roofs. And part of that study, or earlier work they had done, included a lot of information on the marginal costs of moving to a cool roof from a standard roof. This cost ranged from, there's quite a lot of values that used zero as the price premier, and it ranged about all the way up to $1.50 depending on the before and after case that's

compared.

This is data from RS Means, just a standard database for this industry for getting data and here's thermal plastic membranes. This is one of the dominant cool roof types that we're thinking of moving from a dark roof to a cool roof. This is probably one of the prominent directions that you would go, moving from a built up roofing to a single ply membrane and just looking at this cost data, I don't have the number in front of me now, but I think that we're estimating average across these different types of installations some are mechanically attached, some are fully adhered but on average $175 per square range or $1.75 a square foot for that type of technically according to RS Means.

If you compare that to what RS Means says for built up roofing, you'll see a bunch of different installation types once again, so it's hard to know what your appropriate comparison is here, but across this product type of dark roofing you're looking at an average of maybe $2.60 per square foot. And for these costs, because you're changing product type, we looked at RS Means so that it's fully incorporating different labor and the different processes that go into getting this roof installed which is quite distinct from going from a built up roofing from a singly ply membrane.

And just summing up that RS Means, it's approximately $2.60 a square foot and about $1.75 for single ply membrane. This actually suggestions it's cost effective to move to a cool roof from a darker roof just using this comparison even without looking at the energy benefits. Obviously, we would not put the standard in place if we didn't see energy benefits as well.

MS. BROOK: Uh, on that mic. You're just beating your mic just a little bit.

MR. SUYEYASU: Okay. I'll step back a little bit. So looking at all of these different data points, the original LBNL study, the DOE study, the RS Means data range from that initial one was $0-.$20, DOE was sort of $0-$1.50, RS Means actually showed a negative price premium to move to a cool roof. We're just making a conservative estimate here, about $.50 per square foot to move to that cool roof, it's substantially higher than what was done in the original study for Title 24. But that seems like a good place to analyze it so far at this point just to be safe and make sure we're not requiring something that is cost prohibitive.

So looking at the bars here, they represent the value in savings over a 15 year lifecycle per square foot for moving to a cool roof from the existing

standard. The green bars for climate zones 1 and 16 are moving form no standard which we assume to be a reflectance of .1. The blue bars are moving from an existing of .55 and this little yellow dotted line on there is our sort of assumption of what the cost basis is for the existing roof of the price premium to move to the cool roof. So that's $.50 in climate zones 1 and 16 and it is zero in climate zones 2-15 because those original graphs showed that it looks like the price is actually going down or staying even as you go to a .7 standard.

So all 16 climate zones, the savings substantially exceed the price premium so we are recommending moving to that .7 standard across all climate zones. That should show significant financial savings for the building owner over the life of the building.

This is the same analysis but for high-rise hotel and motel buildings. A different set of assumptions of when the buildings are operating, it's more of a 24/7 operation, and different assumptions as to the insulation levels in the buildings. We used the prescriptive minimums for the building types here.

In this analysis, climate zone 1 actually has an energy impact of going to a cool roof. So we

definitely won't be requiring cool roofs in that climate zone. And climate zone 16 does not quite cross the $.50 per square foot threshold that we sort of established as an assumption of the cost basis. For all other climate zones, they do cross the cost effectiveness threshold. They are saving more energy over their lifetime than the marginal cost to install them and that's a pretty conservative additional cost as we said.

The blue bars are the climate zones that already have a .55 standard so there's no additional cost there to move to the .7 standard. And they do show energy savings of moving to a .7 in those climate zones so we would move to a .7 there as well.

Just looking at the question of availability, that's an important question as obviously this is a very high volume market and there's a significant amount of re-roofing happening every year so we need to make sure that the market is ready to deliver products at that .7 standard.

What we have here is just looking at the average of the cool roofing products that currently comply with the .55 are aged standard, this is just off of the CRCC database, we did not remove the duplicate products where there is one product relabeled as something else, this is just all the listed products.

We didn't go that extra step in this analysis. Of all the products that meet the .55 standard for field applied coatings their average value is actually .7, for single ply thermal plastics the average age reflectance is .67. So average products, of the products that meet the cooling standard, are somewhere around this .7 standard we're looking to move to. So there's a substantial amount of products there. If you break it down by numbers, that's about 134 of the 248 existing approved field applied coatings can meet this standard and with single ply thermal plastics it's 22 out of the 57 coating products that currently meet the standard. And I think Payam was telling me he was talking to the Cool Roof Rating Council about a number of other products that are obviously in between right now and will meet that standard going forward. It won't be enforced until 2014 so I think those numbers will move up quite a bit by then.

Sorry we had a little more reformatting here as it transitioned from computers. This is the—to summarize the code change proposal from low-slope roofs. We're looking at a reflectance standard of .7 across all climate zones for standard nonresidential buildings that are applied through Table 143A. For high-rise hotel/motel constructions represented in Table 143B, the

.7 standard for climate zones 2-15. For steep-sloped nonresidential roofs, we were going to use the reflectance standard that's being proposed for residences. That might actually be .2 at this point so we'll hear about that from Bruce later. We just wanted to keep some consistently in standardization between the two standards so if we've got a steep-slope use the residential standard. It will save more energy in a nonresidential context because there's not as much of a heating question so we know that if it's cost effective for residences then it's probably going to be cost effective for nonresidential buildings. It's also just a very small market segment there, the steep-slope nonresidential market.

Probably not too much of a need to go into this but just wanted to put into the presentation the exact code language change. The SRI is going to move up to an 85, that's derived from an assumed admittance of .85. That's obviously above the code minimum of .75 but that's what the ACM assumes most products will be .85.

Won't go through all of the details here because the really .7 is the important number.

The exceptions that exist in this standard for cool roofs, those will not be adjusted at all for what type of insulation equivalencies are in there for

climate zones 3 and 5. We're also not going to change the thermal mass equivalence. Right now its 25 pounds of thermal mass in roof is considered equivalent to an age reflectance of .55. We're going to keep that equivalence right that is for the age reflectance of .70.

And that is the end of the presentation on cool roofs. Any questions? Or should we go through the mandatory minimums first just because they interact so much?

MS. BROOK: Yeah. I just want to take this opportunity to let everyone know that Mazi showed up and so our leader is back and we missed him as we totally botched up the whole morning because he wasn't here. So.

MR. SUYEYASU: So and just to be clear. That research that I was discussing this morning was sponsored by California's independently owned utilities as part of their case research project. The mandatory minimums are being put forward by the Energy Commission as part of the proposed code change. As most people were probably here in the morning when we discussed mandatory minimums, what we're trying o do is just bring standard building construction practices across a number of building attributes up to what we consider sort of a

minimum prudent level of construction quality. We think that cool roofs are a bear in the nonresidential context. The context that this is something that should be done for ever building. We are looking to set the cooling standard at reflectance age at .55 mandatory minimum. You would not be able to install a cool roof below that level in California, at least for climate zones 1-16 for standard building or 2-15 for a high-rise residential and motel/hotel. The .7 prescriptive standards has been shown to be cost effective and this mandatory minimum would also be cost effective just being implemented in just a slightly different way. And just to be clear that the thermal mass, the 25 pounds per square foot equivalence, would still apply to this as well. So if you do have the 25 pounds per square foot you would not need to meet this mandatory minimum.

And why are we using this mandatory minimum? There would be no tradeoffs below .55 and basically to simplify the enforcement process for building officials so that they're looking for, essentially, a white roof or close to white roof on all buildings and do to need to be concerned about what tradeoffs are being made in other parts of the building if they see a dark roof in a climate zone that otherwise should have a cool roof.

And we covered cool roofs for unconditioned

buildings this morning so. Any questions or comments on this proposal?

MR. GABLE: Mike Gable. I just want to be clear that is the intention, under the current standards, is there a number of exceptions for alterations to cool roofs in the nonresidential standards. Would you probably be taking all of those away for the mandatory measure or would you envision—do we need to look at, maybe for future discussions, where some of those exceptions might still be in place with respect to alternatives.

MR. SUYEYASU: I need to look at that a bit more. I've looked at it—I think—Which exceptions are you thinking off?

MR. GABLE: The whole shopping list. We can take this offline but just to raise the issue of we should look at those exceptions. They may all go away or there may be one or two of them left that make sense.

MR. SUYEYASU: Yeah.

MR. GABLE: Just as a point of play.

MR. HITCHCOCK: Reed Hitchcock. I brought a book, bear with me. I'm the Executive Vice President of the Asphalt Roofing Manufacturer's Association. I appreciate the opportunity to provide our comments, initial comments, to the proposal. In addition to these

comments, I do want to draw your attention to a letter that was sent to Mazi Wednesday this week on behalf of 15 trade associations involved in roofing and insulation. That letter asked for several key pieces of information related to this proposal. We would like that letter made part of public record for this meeting as well, if we could. As I indicated on the, and forgive me for reading, as I indicated on the stakeholder webinar last Wednesday, the proposed changes to Title 24, Part 6 do raise significant questions from ARMA. Of utmost concern to our members is the fact that the very nature of these proposals as presented with the mandatory minimum solar reflectance of .55 would categorically ban asphalt roofing materials, namely built up roofing and modified bitumen from the California marketplace. On the webinar I raised this issue on two points.

One because BUR and (inaudible) bits are a substantial part of the California flat roof landscape and two because there are a substantial number of jobs impacted by a product ban of that nature.

Although I think the concerns were somewhat dismissed on the teleconference because these were not considered “significant products in the market in California” and those workers can work with other

materials. I think it's important that CEC staff and consultants know that in 2010, widely considered a down year in construction and building, asphalt roofing materials represented 250 million square feet of roofing in California, of commercial flat roofing which is about two-thirds of flat roofs according to ARMA and SPRI data. Much of that was produced at one of the 19 asphalt roofing manufacturer facilities located in the state. Those 19 facilities translate to a lot of jobs for workers, workers who would face unemployment at a time that the unemployment rate hovers near 10 percent. Additionally, while some roofing products don't require skilled labor to install, products like BUR do. And the specialized workforce, mainly of them union members, will be faced with a similar situation. Specifically existing asphalt roofing production facilities cannot be easily or inexpensively converted to produce nonasphalt type roofing. While in the roof, roofers will require retraining to be able to install nonasphalt type products. Product availability is a substantive concern coming out of the proposal as well. That was stated that you use the CRCC database to identify what products would be affected and what would remain available in the market. What seems to be misunderstood is that the CRCC database is not a market tool and is not specific to

California. Products like by CRCC are not necessarily available in the state in the California and are not necessarily still produced.

MR. SHIRAKH: Mr. Reed, are you still talking about the mandatory requirement or are you talking about the .70?

MR. HITCHCOCK: The prescriptive. And manufacturers of all types of roofing products can tell you that CRCC requires that all listings be maintained for a period of time as a public service even after products are no longer manufactured. Also in consideration of product availability it should be noted that titanium dioxide, which is the key whitening agent in white roofing materials, is in short supply and has been for quite some time. I would rely on the chemical producers to provide more information on that. We're very concerned with the approach that has been taken regarding life expectancy for roofing products. For example, on the webinar you indicated that the analysis conducted looked at a 15 year payback for roofing products. When question the response was that many of these products, TPOs and coatings, offer 20 year warranties or longer. For legal reasons I can't speak to individual member practices, manufacturers practices, but it should be recognized that limited warranties are

simply one aspect of the roofing product or system being sold. Limited warranties generally sold serve as a sales and marketing function as one of many items considered during the purchasing decision and as such limited warranties should not be relied on to predict service life. Additional concerns is the approach taken with respect to cost assumptions. It appears that the costs for cool roofing materials was gathered from distribution centers and not through a more vetted process through the roofing contracting community who would be far better equipped to discuss costs associated with cool roofs as opposed to simply material costs. It also appears that costs associated with regular maintenance and upkeep required for all roofing systems have been ignored. As an example, cleaning and or recoating of roofs to maintain reflectance do not appear to have been included in the analysis. It would appear that no real consideration has been given to a detailed lifecycle analysis of roofing products. If anything, some of the most durable roofing products currently available would appear certain to some environmental goals that other state agencies may have. The claim of durability is sported by peer review industry publications that address all categories of low slope membrane systems, restricting or eliminating this class

of materials removes products and system with literally decades of proven performance for their intended purpose keeping the interior buildings dry and thus protecting the occupants and the assets. This is not to mention keeping the insulation dry and preserving its energy savings R-value. I'm getting there. Also glossed over was the idea of increasing insulation instead of requiring baseline reflectance. Any building engineer will tell you that in terms of energy savings, insulation provides an all around benefit that cannot be achieved by surface reflectance alone. While in some areas, particularly arid climates with consistent dry heat, cool roofs may achieve energy savings goals. In other areas, such as those with substantial heating and cooling days, or where those were dirt pickup and service growth are more prevalent insulation can be a longer term, more consistent and a more effective means to energy savings.

ARMA understands and respects the goals of Title 24, Part 6 and the California Energy Commission to conserve energy and we support those goals. We also believe that innovation is a driver to make that happen and a roof plan an important part in that effort. That said, it's critical not only to our industry but also to sound science and economics that regulations set forth

be adequately researched and considered to ensure that the consumer, homeowner, building managers, etc. get its true value for his or her value. In order to ensure that, a number of key issues remain to be addressed before a sound recommendation can be made. Once again several of these issues were raised in the roofing industry letter that I referenced earlier and I'm confident many more will come to light after this meeting and after we have a chance to review and analyze the data.

On a final note, six years ago many of those in the roofing industry felt as though there was no real effort by the CEC and incorporate us into this highly important process. At the time it was stated that CEC had no real knowledge of the roofing organizations at the time. We did find out about meetings and began participating and, I think, really started working pretty well together albeit very late in the same but we do appreciate the effort that was made by the team at the time. In 2010, there's a sense that we're been thus far excluded from the 2013 process. In fact about a year ago we were told that low-slope roofing was probably not going to be on the table in this round. Last week we participated in a webinar painting a very different picture than that and last, the comment was

made this morning that utilities were to have vetted the utilities in advance of this stage in the process. Contrary to that, in last week's stakeholder webinar the first we were informed about, the statement was made that the CEC consultants had no knowledge of the roofing industry and did not consult with any experts in the industry.

Once again, ARMA and other industry associations and affiliates have offered to partner with the CEC in the past and today and that offer is once again extended. Working together will results in a better final product that will meet the CEC energy consolation requirements will providing roof statements that yield the long term water proofing to buildings and their occupants. Thank you.

MR. SHIRAKH: You going to give that— electronically please, that would be nice.

MR. SUYEYASU: Reed, may I ask one question? And I apologize, we definitely want to involve you in this and I didn't say we weren't going to involve the industry experts. We just—we're coming to this particular topic late so hopefully we can work through a lot of this together.

But it sounds like the longevity; durability comparison between product types is an important one

here. Do you have a good, objective source for how we make those comparisons to—

MR. HITCHCOCK: We do. That's a good conversation, I think, that several of us ought to be involved in. Not just ARMA.

MR. SUYEYASU: Okay. Obviously. If you can refer us to that—

MR. HITCHCOCK: Sure.

MR. SUYEYASU: Would be very useful for us to make an assessment of ourselves.

MR. SHIRAKH: So it seems like the mandatory requirement that's an issue for you—so you're saying that there's no asphalt roofing products that can be .55—

MR. HITCHCOCK: .55—well, I'm going to let Helene speak to the specific products. I'm not technical so I'm going to let her—

MR. SHIRAKH: What would be helpful for us if when you have a problem with .55 prescriptive requirement, if you can tell us where your products are in relation to this. That would be helpful so then we know.

MR. HITCHCOCK: Sure. And even using some of the tools that you're already looking at, you can paint a pretty clear picture. But do you want to speak to—

Anything else for me?

MR. SHIRAKH: No. I'll find you. I know where you are.

MR. HITCHCOCK: You know where I am. Thank you.

MS. HARDY PIERCE: My name is Helene Hardy Pierce. I'm with GAF. We are a roofing manufacturer, North America's largest roofing manufacturer. We manufacture both asphaltic products and thermal plastic roofing membranes and coatings. So we have a little bit of a dog all the way across all of these product categories and steep-slope.

I'm going to make a couple of points that maybe we need a little education about.

First, I support the comments of Reed Hitchcock on behalf of ARMA. From a cost analysis standpoint, in terms of the materials cost, I would actually challenge that if we want to start talking about 15 year coatings, we're talking about a magnitude of 2-3 times the costs that were probably used simply because Reed couldn't address warranties and I will. When we start talking about long term coatings, we start talking about several layers of coatings with very specific installations needs. The other things in terms of the cost analysis, it's somewhat disingenuous to use

the 10 percent baseline reflectivity. Simply because that's representing less than one percent, from my knowledge, of the low-slope membrane market in the state of California. And they actually low-slope market uses it without a cool roof, has a reflectivity much more along 25-24 percent. So one, I would actually challenge any of the cost analysis that's been done based upon a 10 percent baseline reflectivity.

Regarding product availability, there are 89 membrane products, low-slope membrane products, currently available according to the CRCC database that meet the 55 percent aged reflectivity requirements. That number drops down to 33 products. There have been comments made that well there are plenty—there are a lot of products available. I would actually challenge that of those 33 many are not commercially available in the state of California.

And then, the comment that was made earlier of we're just moving to whiter products. Eliminating two-thirds of the low-slope membrane market is a lot more than just moving to whiter products. It's very convenient to be able to just look at coatings and thermal plastic membranes and it's convenient to ignore two-thirds of the low-slope market today in the state of California.

Moving on, 70 percent aged based on the formulation of what's currently in Title 24 and upon the formula that we saw earlier today. To reach that there are only nine products, by formula, that can reach that. I have one of them but I think that's a problem for the state of California.

The next is speaking of manufacturing a product I'll, maybe a little bit more forcefully reinforce what Reed stated, I can't imagined as an engineer, which I am, taking an asphalt roofing plant and changing it from a probably of like a meter wide machine to a three wide meter thermal plastic machine. Physically impossible. So anyone who thinks that well, we'll just shift that over, has obviously never been in a roofing plant.

So then let's go the realities of roofing plants. Reed said 19 roofing plants in the state of California. That's nice. The single ply plants are 300, 650 and 1400 miles away and those are the closest ones. And so I think that there's a little bit of a problem also with green initiatives that start talking about indigenous materials.

And then, one last thing, is that our industry has spent a lot of time over the last five or six years, and there's a lot of published work on the effects of

installation value and attempting to save energy and energy efficiency. And all of the modeling, as was relayed to us last week on the conference call or teleconference, didn't take into account any variation in thermal resistance of the insulation and just based it on the baseline for the coat. I know that that's difficult and I know that it introduces a degree of difficulty but of all of the topics that the roofing industry has looked at and where you get the most impact on energy efficiency often times isn't with the cool roof but it is with actually looking at the overall envelope that includes the thermal insulation of the roof.

Those are my comments. Thank you.

MS. BROOK: Don't go anywhere. Go ahead if you have some questions Dan and then I'll follow up.

MR. SUYEYASU: I did have some questions awhile ago. One thing is on the—insulation question, is there sufficient product availability to meet the .55 standard that's there today? I guess you're saying two-thirds of the low-slope market will be left out. Does that two-thirds meet the .55 standard or is it darker than that?

MS. HARDY PIERCE: Well, those products—two-thirds of those products are the ones that meet the

current .55. They're meeting it today when you look at the current threshold which is .55 prescriptive. And that's, like I said, to Reed's point that's 250 million square feet of asphaltic products. Those products, for all practical purposes, are excluded when you go to the .7. And let's be perfectly clear. The reason that everyone in the roofing industry focuses on prescriptive is because the performance path in re-roofing is just not realistic. It's very difficult for contractors to attempt to meet it. It's much easier—the prescriptive path is the path of least resistance which is why this industry is choking on 70 percent because you say, well you have these other paths. Stop. Reality is that you're doing the roof, that they're—

MR. SHIRAKH: It is possible to actually have a prescriptive equivalent to cool roof that would include some elevated level of insulation.

MS. HARDY PIERCE: One of the things that we've been hearing, Mazi, has been the even the thought of taking the formulations out for increasing insulation to make it easier and perhaps that won't—and I would strongly recommend against that.

MR. SUYEYASU: Just your suggestion that we look at insulation levels as well. That is one reason we're not looking at insulation levels as well because

roofing is a product that's often installed just by itself and no roofing context. So we're looking at what's most cost effective for the state in terms of roofing. But obviously, some buildings you would like to use insulation instead of more reflectance or at least it's worth looking at on a building by building basis. They can do that using trade-off approaches. We're just looking now at the reflectance level. Sorry, I misspoke there. Reflectance level for roofing because roofing is installed in a very singular way.

MS. HARDY PIERCE: There are a whole bunch of other roofing people in this room but to make the assumption that insulation is often not included in the roof is a gross misunderstanding of the roofing industry, particularly low-slope commercial.

MS. BROOK: I think what Dan is saying that in the reroof application, you don't typically go in and add insulation. Or do you?

MS. HARDY PIERCE: Yes. Yes. Yes.

MR. SUYEYASU: In which case the tradeoff approach—

MS. BROOK: Okay.

MR. SUYEYASU: The materials that can qualify for .55 can still be used because then we can just add the insulation when we're reroofing if you want to do it

that way.

MR. SHIRAKH: What I'm hearing is they say it's a good idea to have additional insulation instead of cool roof and they're saying they can't do it on retrofit basis.

MS. BROOK: Yeah. That sounds right.

MS. HARDY PIERCE: And the reality is that if you look at the market, the majority of the roofing market is reroofing. It's not in construction.

MS. BROOK: It is. It is. It is.

MS. HARDY PIERCE: And so putting in an insulation tradeoff would be a logical, methodological approach to energy efficiency.

MR. SHIRAKH: So I think we're kind of moving towards some kind of resolution for prescriptive but you still have the .55 mandatory requirements if it's adopted. I want to know what kind of problems—what I heard from Reed was that asphalt roofing products may not meet that requirement. Is that true?

MS. HARDY PIERCE: Well, let's go back to the plant investment that asphalt roofing manufacturers have made to be Title 24 compliant and that meets the 55 percent reflectivity and that is putting in inline coatings on top of capshoots that are used and modified and so no, those plant investments are already been

made. And we're compliant today with the 2008 standard which is the 55 percent.

MR. SHIRAKH: And you concern is they would meet the 55 percent mandatory but they would have difficulty meeting the—

MS. HARDY PIERCE: The 70 percent—if the only pathway on prescriptive is 70 percent, you have taken out two-thirds of the low-slope roofing market.

MR. SHIRAKH: Okay.

MS. BROOK: So my final request is that you have a lot of statistics in your comments and if you could actually provide the sources of those that would be very helpful to us.

MS. HARDY PIERCE: Thanks.

MR. SHIRAKH: Thanks. I appreciate it. Good comments.

MR. SHIAO: Hi. I'm Ming-Liang Shiao from CertainTeed Corporation and we are a roofing manufacturer. Just like everybody said here, we are all trying to make energy efficiency and try to help the environment. We (indiscernible) –that come out of the study that it's really inadequate in terms of the data and the message that's presented. To us it's more of an exercise than the actual proposal without thought of practicality. I'm going to illustrate a couple of the

points. For example, you proposed 70 percent aged. Okay. So that means when it's coupled with the formulation that was proposed this morning with the beta formulation you are actually looking at pre applied coatings, with an initial 95 percent initial SR. I don't know if anybody here can say they make that kind of coating. The data that you show is very selective and may be coming from a very small subset of data of specialty type of materials and I don't think that represents the true reality out there. These are all an issue from the reinforcement point of view from these kinds of environments. For example, CRCC texts the samples for aged, you send out one three year aged. When you're auditing you're only testing initial number. So how do you do that? Usually you request 70 percent aged but you don't audit aged materials. You audit initial. So where are you going to put your initial number with your formulation. I think everybody would have problems. None of the listings in CRCC can make that, that's a huge issue. Now regarding the data that you presented, I really urge that the Energy Commission really look at another study from a better point of view because the data, from our point of view, feels like it's biased. Even the data looks absurd. I show the graph to my daughter in middle school and even she is

like, Huh. Is this a smiling face? The scattering of the data is so huge and you can literally put any curve you want in there. So I really feel like we need to look at this from another point of view.

MR. SHIRAKH: We'd appreciate it if you could share specifics on the data rather than anecdotal, if you can respond to specific items that were presented.

MR. SHIAO: For example, the data. If we go back the slides I can show you. The scattering is so much that—going back, keep going back. Next one. For example, that one. I really don't know why we put a curve in there like that. It's so conveniently sitting on the lowest number at 70 percent. I look at it and I feel that I can fit any curve in there.

MR. SUYEYASU: I was surprised as anyone to see that it bottom out at .7 which is where we're looking that that's where there is sufficient product availability. It struck me as highly coincidental as well, I will admit. There's no cooked books here. This is me calling distributors saying, What do you have. Calling ABC Roofing Supply, What do you have. They say, I have this product and this size roll at this cost and then I correlate with the reflective. And that's—these are things people are selling in the state. I wasn't picking specific manufacturers, specific distributors.

I was random about who I called and this is what came out of it. We can populate that with more data. I can certainly call more distributors and suppliers and we'll see if it stays in place but it was definitely heading that direction as I called people.

MR. SHIRAKH: So what I would expect from you is to actually give specific comments on areas where you think there's errors in here and why. And then perhaps give us the information that is correct.

MR. SHIAO: I think we already mentioned a lot from previous—

MR. SHIRAKH: Well, there was no data with what they presented. So, okay. Thank you.

MR. ENNIS: Hi. Mike Ennis, representing SPRI which is the Single Ply Roofing Industry Association. We represent the membrane manufacturers and component suppliers, such as insulation, fasteners, etc. The specific membranes we represent are thermal plastic and thermal single plies and modified bitumen membranes. And we concur with Helene's assessment of the two-thirds loss of the market from going—and our analysis was based on looking at .55 and then going to .7. We think that's obviously a very significant loss. When you look specifically at the number of products, meeting that .7 requirement, you're looking at seven products that do

that. Now there are several that are private labeled and that's what expands that to a greater number but there are actually seven unique products that meet that requirement so we find that to be very concerning. And also, please keep in mind that if you want to move to that level from a manufacturer's perspective to try to develop products to meet your new requirements, we're hung with a three year aged requirement. So if you put that in today, there's no way we could have products ready when this code is implemented, if we could even develop those products. The other option is the option provided by LBNL which is the predictive thing but if you look at that equation that means you would need a .91 fresh initial value. There are no options that would allow you to do that today. So we're kind of stuck in that corner too so with providing you the products, there's really no developmental time for us to do that. And the final thing, and Dan I appreciate you mentioning that, that we really have had very little time to look at this and evaluate the analysis that was done and the various parameters that were used in the calculations and your openness to work with us to evaluate those—if we understand the target, the energy target, that you're looking for, we can evaluate and provide you with various options. And work with you to

do that. And maybe it is a combination of insulation and reflectivity for the reroofing market as I've already heard suggested here. So that's certainly a very good option and something that ought to be pursued. Just a lot of flushing out of the data that we need to do at this point.

MR. SHIRAKH: But that's basically what I want to encourage you to do.

MR. ENNIS: Yes.

MR. SHIRAKH: Yes. To tell us what you think is a solution and what should be the reflectance and the tradeoff should be and provide us with any data. And if you don't think that Dan's data was accurate then—

MR. ENNIS: And that's just what we're looking for and Dan has made that initial move. I would like—instead of us continuing, I would like to come back and work together. Have us work together and look at options once we understand what you're trying to achieve.

MR. SHIRAKH: I think that's the right framework.

MS. BROOK: Okay. So, Dan, do we already have the information on the energy—the magnitude of the savings that we think the .7 provides in order to give the industry that target.

MR. SUYEYASU: These numbers right here are for a standard building, high-rise residential. So $4-$1 per square foot to .7 from .55.

MS. BROOK: So I guess what I am—

MR. SUYEYASU: So, I'm sorry, not $4 but $.40 to $1 a square foot.

MS. BROOK: So that's energy savings? Is that what that is?

MR. SUYEYASU: That is 15 year net present value based on a TDB analysis.

MS. BROOK: So we probably need to work with industry to figure out what metrics work for them to be able to provide analysis to know that they're coming up with alternatives that are in that same savings bucket.

MR. SUYEYASU: Okay.

MS. BROOK: I'm not sure that this bucket does that but let us keep working on it.

MR. SHIRAKH: Agree.

MR. ENNIS: That would be very helpful, thank you.

MR. HEINJE: My name is Steve Heinje. I work for the United Coatings Company. As I said earlier, we've been in business for about 90 years. Also, I am a member of ASTM D-63's task group and I'm on some other committees. Many of my compatriots are here from ASTM.

I'm also a member of RCMA and the representative is behind me. And I also am part of the Reflective Roof Coating Institute and the Spray Polyurethane Foam Alliance.

All of these organizations, I don't think there SPFA member here today, these changes have bearing upon them. Initially it looks like there's 50 percent of—and I'm a coatings producer. I'm the guy, who after you kicked out the black guy's product and maybe the semi-reflective grey product, you finally decide to use a different coating. So I'm delighted at this point, okay. But even I'm having a problem here with this one which should tell you something. So it looks like 50 percent of those coatings are going to comply with that .7 aged but as I pointed out this morning, I don't think that I was quite clear, in Title 24 to do a coating properly, it has to be an ASTM D-683 coating. That's what the building code calls for. I don't think half of those products are ASTM D-683. I brought a little graph I might hand out later on how it looks based on what I know of prime manufacturers, companies who make stuff but not the ones that relabel stuff and which ones meet the building code. And then you also have a nested standard called Table 118B. I don't really want to get into it. I really don't like Table 118B and if you want

to talk to me, I'd love to tell you about the problem with that. And I say that as a member of the ASTM Task Group and ASTM D-683, Table 118B is a problem from a code perspective. But even if I use that more liberal standard, that's why I'm bringing it up, okay. So let's say I've got 70, there's like 400 coatings on there, and I take the D-683 coatings on there and I say, Okay. I'll look at Table 118B which is far more liberal. You still have products that are labeled that don't even meet Table 118B. So you're really not looking at half of the coatings. Really D-683, probably not even a quarter.

And then when you say that you have to ask yourself about the competitive effect you've had in the market because now you have an issue when you start restricting it down to a fourth. Now your cost assumptions could change. Initially, I was fine with .7 as a coatings manufacturer and then I started looking at this closer, looking at my code approved products and looking at the ones that really have the certifications, the ones that I want to promote in the marketplace. By the way the ones that you should only use for your 15 year aging, I mean if you're using Table 118B and you're telling me that's a 15 year coating, I'm telling you that's a problem and I can prove it.

Little ones, I guess I do have to ago—I don't want to nit but putting black, it does not raise the cost of the coating. It lowers the cost of the coating because TI02 is roughly 15-20 percent relative terms but can't give you hard costs or I'd be arrested by my boss. TI02 costs money and in fact I think one of the reasons you do not show a cost relationship to whiter products is what you're buying is paints. You're really not getting waterproofing fluid applied maintenance coatings that last that 15 year period. And that should be common cause for suspicion. Why an agent that raises cost 10 or 15 percent, there would be more of it in there- that's why it's whiter. Why does my cost not go up? Well, that's because you have less resin in your product. Okay.

And then the .7 standard, before I go further I just want to say that I supported the comments in insulation that were made by both Mr. Hitchcock and the lady from GAF, we as a coatings manufacture also sell polyurethane foam and about 50 percent prior to Title 24, about 50 percent of the coatings market is actually applied over polyurethane foam which is often part of a reroof situation. So insulation is part of how we go after it.

Something that was not brought up is that

insulation ages. And insulation often becomes wet and loses R-value over time. So it's standard roofing practice in the polyurethane foam industry, there's even a protocol for this. There's a renew protocol where you survey the roof, you look for wet foam because wet foam has lost its R-value. You rehabilitate that roof, you refoam and then you coat. Obviously, that's a great opportunity to add insulation. So that is practice for coating suppliers as well. So I agree with Reed Hitchcock and Helene Hardy Peirce about insulation and the fact that it works for all zones and insulation is a good thing. So you combine the .7 standard and we brought up this three year thing. Right now if you also move your beta, which was brought up this morning from .7 to .65, right now to get a reflectivity to be .7 for the initial value, there are no coatings that this is true for. You have to have a .975 reflectivity, .975 you do the math and you come out with and you get .7. Well I don't believe that there are any coatings with above a .94. I think that's the top. You might as well not publish the change. Putting the beta as .65 is just not useful to use. It's okay. We'll just have to wait three years. But look at the unintended consequences of this. Prima facie looks like you've got 50 percent of the coatings are going to comply but if you're getting

those 15 year products you're talking about, the quality products, and I really do think that the Energy Commission has attempted to not go down the road the Florida Power & Light did and at least try to get good maintenance coatings put down. That's commendable. But it's really not 50 percent because those really aren't all code approving. And then you realize that a manufacturer can actually not use proposed data to get an aged predictive value that's helpful on a new coating. Innovation is three years. Not counting development. Not counting the rigor moral testing. It's really four. That's it. That's the problem. So you have a less competitive marketplace when you're done. I'm happy. I'm done. Do we have a sense of humor that we're aware of in this room?

MR. SHIRAKH: Actually, a lot of time we do.

MR. HEINJE: I want to thank the state of California and you for producing Maria Bouchard who became Maria Heinje. It just goes to prove that some good things do begin in California. Anyway.

MR. SUYEYASU: Just a question on the darker version of the light products and these are just the people I spoke to in the cost data. There were a number who told me specifically that some of the darker products were just the light product just with extra

tinting added and that does cost more money. Some of it was just talking to a certain roofer distributer, actually supplier, warehouse and they said to get the tinted version, the tan version or the grey version of an otherwise white product, it was essentially the same product. They just said it was special order and that it was going to cost you more just based on the fact that they didn't have it on the shelf. What was on the shelf was the white stuff. I know that's not—that that gets into the chemistry of it, that's just a supply chain question.

MR. HEINJE: Well, no that's a good explanation at the distribution level but at the manufacturer's level, what I'm going to do is I'm going to dial my TI02 back and put the black in because I don't need it when making a grey and my costs will go down quite quickly. The only thing more expensive than white are toy colors, if you're manufacturing. And that's why I made the comment that my analysis is from a prime manufacturer who makes the stuff. I'm not a reseller. I'm somebody who cooks the stuff up. And so yeah, we manufacturer different ones. The only thing more expensive than white is reds, yellows, greens. Things that look like OSHA colors.

MR. SUYEYASU: And then the thing is that we

just can't get cost data from you.

MR. HEINJE: Ask me, you never know. I might surprise you but I'm late to the game. This is the first time I've come to coating hearing. But I will probably return.

MR. SHIRAKH: Good, thank you.

MR. HUTCHINSON: Good afternoon. I'm Tom Hutchinson. I'm the technical consultant for ERA, the EPDM Roofing Association. First off, I'd like to say thanks for the opportunity in being here. Let me also say that we were signature to the letter the Mr. Hitchcock and the roofing coalition and endorsed those requests as well. We also appreciate the current ballast tradeoff of 25 pounds per square foot but we would also urge you to consider going down to 17 points to square foot to match what Oakridge would suggest as an equivalent or what Chicago currently has and they have an environment that's a little more tenacious than California.

MR. SHIRAKH: Can I ask you a question about that? Is the 17 pounds, does that trade up against .55?

MR. HUTCHINSON: Yes. Currently we do have an amendment in that shows that it does lead to the higher ratings as well. I believe it's being reconsidered at this time. But by lowering the weight, it does also

allow for compliance with the current standard building code that requires a structural roofdeck to have a dead load of 25 pounds per square foot. That includes the decking and what not so by lowering it, it allows for general compliance with an upgrade of the structure.

We would also highly suggest, again, energy conservation first starts with insulation that works 7 days week, 24 hours a day, 360 days a year and allow a tradeoff for various roof systems that don't meet the .55 or the .70. Certainly as a designer whose main function in life is to design roof system, I might say that roofs act as systems. It's not a single component. Whether it's energy or performance, you can't just consider the envelope that has caused havoc in the Midwest when single components were considered by designers who weren't encouraged to review systems. So I encourage the Commission to consider looking at the whole assembly as being a performance issue.

We also respect the EPM does come in black and white. But raising the thresholds decides what people are talking about for the aging. Any new products, before you're putting it on a roof the main function of a roof is to keep it watertight. Manufacturers spend years testing these products before they bring them to the market. Let alone age. So by eliminating products

and bringing new products to the marketplace, isn't a quick or efficient method.

I'd also encourage, as mentioned by many others to the Commission, to involve the roofing committee not at a forum like this but as you're developing the standard. I think everyone is showing a lot of energy to come out and participate. But to respond to something rather than discussing it in the process I think would be a great benefit. Durability is the essence of sustainability. Thirty year systems are out there. A lot of them aren't developing new products and we don't know what that's going to be. Replacing roofs that are going to be cool in 10-15 years is not an effective way to produce roofing. I would have clients very, very upset if they were replacing roofs in 10 or 15 years.

I want to again thank you for the opportunity and again encourage, more importantly, the involvement of all the people are have the energy and enthusiasm to participate in this.

MR. BANS-WEISS: Do you have people in mind in your organization that we can interface?

MR. HUTCHINSON: Yeah, I think. Of all the associations here, I would definitely think—

MR. SHIRAKH: We don't want 200 people. We

only want three, four or five people.

MR. HUTCHINSON: Well, all those signatures on that letter is a start. They would have representatives that would be able to participate, provide information and data. I made a little note to send you information on membranes that last 30 years and things like that. It's never LEED or any of these cool issues that have addressed durability and I think that's a very important issue as a designer.

MR. SHIRAKH: Thank you.

MR. HUTCHINSON: Thank you very much.

MR. CALKINS: Good afternoon. My name is Jim Calkins. I'm a local sales representative representing Sika Sarnifil here today. Thank you for this opportunity to provide input to the proposed mandatory minimums for nonresidential cool roofs. Sika Sarnifil has long been an advocate for cool roofing. We're held positions on the Cool Roofing Council Board of Directors and Technical Committee since its inception and we are a charter member of the Environmental Proaction Agency's Energy Star Roofing Program. Our roof systems have been selected to protect many of the state's most well known and important buildings such as the State Capital Building, Stanford Hospital, numerous schools and universities including UC Davis where we currently have

a roof that's over 30 years old and still in use. These products were selected for a specific reason.

Although we understand the CEC's desire to raise the bar within the state's energy code we do not support proposed changes for a number of reasons.

First and most importantly, we do not believe the change is fully justified. We support and are signatories to the industry's June 8, 2011 request to the CEC to provide us the data upon which the proposed changes were drafted. We believe that an informed decision on the proposed minimums can only be made after a critical analysis of the underlining data by all effected industry stakeholders is conducted.

Secondly, assuming that the changes can be justified, and we have serious reservations that they can, according to the CEC's own evaluation based on data from the CRCC rated product directory well under half of the list of single ply membranes and coatings would meet the proposed new prescriptive threshold. The actual number of products meeting the proposed requirement is further reduced when one considers multiple products sold under private labels, discontinued products, products not readily available in California, etc. Although the CEC may be satisfied the sufficient products may meet the proposed requirements such an

assessment is over simplistic as it ignores other equal or even more important criteria such as durability. Imposing new requirements as proposed would eliminate products with some of the longest records of proven performance in the state. There does not appear to be any consideration of lifecycle cost in drafting these proposals. Over the years vendors have invested significant resources ensuring compliance with the current requirements. Providing approximately 30 months notice to allow these manufactures the opportunity to modify these products or introduce new products to meet a very significant change in the requirements is unreasonable and unrealistic. Roof coverings are first and foremost intended to protect the structure from the elements and any change in a formulation of a product, whether it be to improve reflectivity or any other property, can have a significant impact on the overall performance of the material. Therefore formulation changes should only be implemented after extensive, long-term field testing programs. The development cycle for roofing materials is a very lengthy process, even if a product manufacture had a formulation modification ready from market introduction and they submitted it to be rated by the CRCC today, they would still not have the three year aged data by the implementation date. It

is highly unlikely that many if any manufacturers are even in position at this time.

Beyond the time mentioned to move the prescriptive requirements from 70 percent reflectivity for new materials to the same value for aged materials is a seismic shift. Such a rapid dramatic change in the Title 24 roofing prescriptive requirements would have a devastating effect on many businesses which is likely to leave a significant reduction in their presence in the state. This could form some companies out of business.

From a technology perspective, the most effective way to improve on the reflectivity of roofing materials is by increasing their titanium dioxide loading. There is currently a significant shortage of titanium dioxide. The undersupply issue is not expected to peak until 2014 or 2015. This situations compounds the challenges noted above. Increasing the age reflectivity of the code at this time would cause an additional burden on the titanium dioxide usage and undoubtedly would cause roofing product availability issues and raise the cost of reflective roofs for building owners.

To summarize, we have a serious—we have serious reservations about the need for and the benefit of such significant changes. The magnitude of the

proposed changes and the lack of adequate lead time for manufacturers to attempt to meet them will defacto disqualify numerous products, many with the best track records of proven performance in the state from use in California, depriving consumers of many products that have been used successfully for decades or force manufacturers to introduce products with altered formulations without the benefit of any field experience potentially leading to significant performance issues. Thank you for your attention to our concerns.

MR. SHIRAKH: Do you support the insulation tradeoff prescriptively?

MR. CALKINS: Yes, we do.

MR. SHIRAKH: Thank you.

MR. CALKINS: Thank you.

MR. BARNMORE: Hi, I'm Matt Barnmore and I work at Firestone Building Products. I manage the technical services group which covers systems engineering, design services and international technical policy. We've already submitted a letter that either arrived today or yesterday that has some data involved in it and also outlines our position. We've also been involved in the letter that the roofing coalition put together. We do support the statements they made in that letter. So to not go over some of the things that

have already been stated, you started to gather from the different folks that have spoken already, if I could point out a couple of things that I think are a little bit unique and also propose a bit of an alternative to think about that we'd like to ask you to consider.

The slide that is up is actually the one that I was hoping that would be up. By the way, we are the smiley on the right. We're ones that make this smile. We have the one out there that is highly reflective but unfortunately costs a bit. At any rate if you look at the slide, there's a group right at the .7 mark—or column and just to the left of that at just about .67 or .68 ish there's another group. Those folks in that second column represent a lot of products that are going to be not for sale in California if we go forward with a .7 immediately starting January 1, 2014. The cost to reformulate the products in that second column over so they can jump up to .7 is prohibitive. It's going to drastically increase the cost of our own research and development. As you've heard from other folks, it takes four or five years to get a product researched, tested and then you have to submit it for reflectivity which is just one of many, many tests a product has to go through. Let it sit for three years out in the sun somewhere. Hopefully that test started at the right

time and ended at the right time so you get your highest possible rating and hopefully you make the .7. Actually that second column is already within recognized variability that happens between tests and labs. .02 is not unheard of as a mode of variability so when you start excluding folks that are at .68, .67 you've excluded something that could have been—they put the subject test out in the fall instead of the spring and sat out for three years and it just happened to not be real rainy so it ended up with a dirtier test that could have resulted in simply a .02 difference. So you're excluding some things simply based on the CRCC rating may actually give the same value to the building owner in terms of the durability over the lifecycle cost of the roof that a .7, one that currently meets .7, would get. So we actually consider—to acknowledge it there is some variability in testing and that it may be wise to broaden the look a bit beyond just a hard point of .7.

Additionally, as has been pointed out by some other folks and is in the table that we provided with our letter, if you look at single ply only and you look at the 22 products that are listed, actually when you take off the products that are no longer on the market because folks have been gone out of business and you need to look at the resellers, it goes down to about

only three PVC products and four TPO products. That's a very narrow band of competition and I think we all acknowledge that competition is good for the consumer and, frankly, it's good for the manufacture and the seller as well, we push each other a lot in competition and it ends up being a good day for just about everybody. When that's eliminated, I'm not sure that that's good for the folks that are actually buying a roof. The price is going to do what it's going to do and economics being what they are; price is going to go up. As we mentioned, it does take some time to develop those products and what happens in that interim if there's no stair stepping toward this .7 marker. What happens in the interim do we all just have to not make money and go out of business and businesses drop off and there's nobody to make the roofing products but then hopefully somebody can survive to make a .7 or can we have time. And that's what we would like to ask for.

We'd like to ask for an alternative approach. As you look and consider, we appreciate by the way that you've acknowledged that, hey, this all came out when it came out. So we're talking about it now and so that's good and we appreciate the folks like Reed and Mike who have put together the coalition and so we would recommend working with that group. You asked earlier

who should we be talking to. Really that group and if you feel that that list is too big, there are some bodies within there that could probably speak for many of us like SPRI and—

MR. SHIRAKH: That's what I'm looking for because when I pick up the phone, I want to talk to the—

MR. BARNMORE: Sure.

MR. SHIRAKH: I can't call 14 people every time I want to—

MR. BARNMORE: Sure.

MR. SHIRAKH: Bounce some ideas. So if you can give us some representatives that can work with us, we'd be happy to.

MR. BARNMORE: And I think it may be, and I can't speak for everyone and make a group decision as I'm not that guy, it may be that we start following up through Reed. And maybe he's one of your initial contacts and we can broaden that as it goes. But we would suggest a consideration anyway, an alternative approach that allows us to grow toward a higher standard and that gives us an opportunity to do what we need to do in reformulating and try to do it in a way that we can keep the costs down for the consumer so that we can still sell the product and they're still happy with what they have to buy at the price. We've got some, in our

letter; we've got some more information on that. I won't go into detail on that now but we would ask you to consider that second column of folks, not eliminating them immediately, but giving them an opportunity to build toward it. Our general recommendation is that the grouping of products, especially membrane products, from the .65-.67 is pretty large. It may be that the .65 initial would, as an aged value; initial new standard would give the industry an opportunity to—

MR. SHIRAKH: Can you repeat those numbers again?

MR. BARNMORE: Yeah. There's a large grouping in the CRCC document of membrane products at the .65 reflectance value.

MR. SHIRAKH: Is it an—

MR. BARNMORE: Well, it's the initial and aged. There's a lot group at the aged value as well.

MR. SUYEYASU: Well, I guess that would reflective of what I would be looking at as well. Just the average for that group is .67.

MR. BARNMORE: Right. And the new standard is even above that average which is why a lot of us are here today. So it could be maybe—our recommendation is that we start where we're at and go to a .65 with a reasonable amount of time and then beyond that if a

higher standard is still desired, if that still seems to be helpful then, again, give the industry time to respond.

MS. BROOK: I just want to clarify. When you say move to .65 in a reasonable amount of time. Is 30 months a reasonable amount of time? Are you saying that we can't even meet that with our current proposed update?

MR. BARNMORE: There's a number of products that currently do meet that. You're going to exclude, as you've already heard, in the asphalt side and we manufacture asphalt products as well. You're going to lose that market almost immediately if you go to a .65 right away.

MR. SHIRAKH: But I'm confused. Are you advocating .65 initial or aged?

MR. BARNMORE: We would go with aged. We acknowledge that we're going by aged.

MR. SHIRAKH: Okay. Just so we're clear.

MR. BARNMORE: By initial I mean by what we would move to first.

MR. SHIRAKH: For the argument's sake, if we're going to .65 aged and then provide a prescriptive off ramp with insulation, that in my opinion does not eliminate any products.

MR. BARNMORE: Yeah. And the downside though is that most roofers, quite frankly, they are not going to take the time to work through tradeoffs. They're going to go buy the product that meets the standard.

MS. BROOK: Well, but the way that we would propose it- it would be right—it wouldn't be something that you'd have to meet with our performance approach. It would be right there as an alternative—

MR. SHIRAKH: Okay. So you either do .65 by itself or you can do .55 by so much insulation. It would be equivalent prescriptive options.

MR. BARNMORE: Are you talking about between insulation and reflectivity?

MR. SHIRAKH: Right. Trade down reflectance for some amount of insulation and you're going to have to do the performance calculation to do that. It'll be prescriptive. Which seems like everybody else up to this point has actually endorsed.

MR. BARNMORE: We do understand what you mean. Our experience, however, has been that most roofers, most roofing contractors, that are doing this job want to get on to the next because that's where they're going to make the next money. So they don't take the time to want to do tradeoffs. They'll just buy the product. The reflective product that meets reflectivity.

MR. SHIRAKH: We can offer the option. People don't want to take it.

MR. BARNMORE: Well, I'm just saying it sounds like—I understand what you're offering and it does sound good but in practice and how things actually happen on a roof, it doesn't seem to happen much.

MS. BROOK: I would think what would happen that actually they would all learn that the alternative works for them and that's what they would carry forward with them from job to job. I just don't understand why that wouldn't happen but.

MR. SHIRAKH: It sounds like an educational problem. That we need to work with your industry and the roofers.

MR. BARNMORE: It could be and that would also take time to educate folks.

MR. SHIRAKH: We've got three years before the standard would go into effect. Thank you so much.

MR. BARNMORE: Thank you.

MR. BAKER: Hi. I'm Jim Baker with the Roof Coating Manufacturer's Association. I'm the General Manager. Instead of going into a great amount of detail of what we're supporting. We are a signature of the letter. And I'd like to get down to some of the discussions around some of the proposed equation that

LBNL has put out in addition to the reliability of some products in the marketplace. We agree with Mr. Heinje's assessment of the .975 if you're using the initial in the change. Additionally if the Energy Commission is looking at simplifying things at this time then by changing that equation currently, we're actually opening a can of worms with that beta value could be argued for every product category and put even more confusion into the marketplace in the time when we're trying to simplify things.

Additionally we've had some discussions on slides showing a 134 field applied coatings that are available. But field applied coatings are not—are also—they have some regulations that they're applicable to. Including the 2007 suggested control measures from the California Air Resources Board and the Cal Green codes. Where these products are limited by adoption of the different air quality management districts and local building codes by the amount of volatile organize compounds they have in them. I don't know that any analysis has been done on what the VOC limits are on the products put up of the 134 are out there in the marketplace which would be significantly reduced due to other regulations that are pending in California or that have already been passed. In conjunction with our

colleagues that have been signed onto the letter, we do find that there's also, by doing these significant changes, by going up to the .7 we've also banned aluminum coatings in the state of California. Aluminum coatings have a very specific use and a lot of time they are used in specific substrates and we can certainly get you additional information on that. And coatings also are very sensitive to different climatic conditions which is why we also need to look at some of the VOC regulations that are out there.

With that being said, I'd like to thank the Commission today for the ability to come in and speak. We do support the rest of the industry, the whole envelope approach, the insulation tradeoffs, the need for time, the request for data and the requirements to start looking at some of the other regulations that our coatings have to comply with besides just a simple solar reflectance requirement.

MS. BROOK: Let me ask just one question. The aluminum coatings, would they have a problem meeting the .65 requirement?

MR. BAKER: You might lose some of them. When you go from the .55 to the .7 you knock 10 or 12 aluminum coatings out immediately. I just did a quick assessment of it the other day. We could certainly look

at it. It's all available on the CRCC database.

MS. BROOK: Okay. Thank you.

MR. SUYEYASU: Just a little feedback on the VOC question. We did talk to a few when I went through manufacturers they sent me to distribution reps and some of them said we don't sell in California because they don't meet our air quality standards. So we didn't put their cost data as part of the cost analysis for some of those products.

MR. BAKER: But if you're in an area right now like Placer County that's had 73 feet of snow this year, when you're talking about a water based product and they're getting snow last week and you're required to put chains on your car, you've shortened your window of application time for that part of the industry or that part of the application and you're now looking at taking out some of the maintenance codlings that are available to reduce landfill options. So, I mean, if you don't have the ability to coat and you can't meet the reflectance and you can't meet the VOC limits, then obviously you're starting off with tearing off the entire roof and potentially putting it in a landfill which causes other environmental impacts.

MR. SUYEYASU: I guess what I'm just trying to say here is that these products that went into our cost

analysis were for products that somebody was selling in California.

MR. BAKER: There's also 34 air quality management districts all with different levels. I believe, out of the 2007 SCM, there are only 11 air quality management districts that have passed it, including the Bay Area, Kern County, Imperial County and the other ones elude me at the moment. Placer county obviously. But it's something that needs to be considered. That you do have a much larger stake than most areas are looking at and the regulations for VOCs vary across the region.

MR. SHIRAKH: Thank you.

MR. CALLAHAN: Hi. My name is Bill Callahan. I'm the Executive Director of Associated Roofing Contractors. I'm the only contractor representative here today. We actually install the stuff. And we have some concerns about it. And with all due respects to any of the previous speakers, my contractors do tradeoffs. I've written a compliance manual for them. I've had Payam vet the calculations in how I go about doing it and because of that, they're able to give their customers what they want. In two-thirds of the market, as was mentioned earlier, are materials that will disappear with a mandatory minimum of .55. Just so that

we set that record completely straight and don't get confused on any numbers, according to the CRCC database, I looked at this last week when I heard about this proposal for the first time, there are 1,462 low-slope roofing materials in the database. When you ask for low-slope with .55 or greater aged reflectance you get 494. So that means 968, under this proposal, get swept away, 66.2 percent. They're gone. They can't be used. You can't trade off to provide your customers with them. I don't see how that saves energy at all. The idea here is to save energy. I asked about this during the webinar. I asked how does banning two-thirds of all materials save energy and the answer I got was because it "it is our impression that some of these efficiency measures that are projected to makeup the energy use through the tradeoff approach may never actually be installed."

I don't know of a single case of where that's happened and in reroofing, which is the dominant thing, that roofers do in California, particularly union contractors, already in the energy code inspectors should be looking at insulation because it's required in reroofing. Even if a cool roof isn't. The insulation is required. There are no other tradeoffs roofers make. They don't put in high-performance windows. They don't

change the HVAC. The inspector has to look under the membrane or under the deck. That's it. If you can't handle that, that's history. That's his problem, not ours. And it's a very simple thing. In my mind, what works in any regulation and I have a lot of experience in OSHA, a lot, is compliance. Giving people choices so that they can comply easily in roofing, in full protection, eight or nine different ways to protect the worker from a fall. You choose the one that works for you. Same thing here. Save energy in a way that works for you, that works for your customer. The customer that wants a modified bitumen roof because he's had one before, because it's worked, it lasted, it didn't leak, should not have that opportunity taken away from him. If he's willing to pay for more insulation under the roof deck, above the roof deck and achieve the same energy saving, there's no reason to take that away from him. So I would like to see you get rid of the mandatory minimum, continue to allow tradeoffs and along the way of which in itself promotes compliance, spend a little more time educating those building departments. I get more calls about building departments that don't understand the current code. I've never received a call from any building department that said to me that I don't think the contractor installed insulation on a

tradeoff. That's never happened and I'd like to see a case of that. So no mandatory minimums. Let people save energy in the way that works for them.

MR. SHIRAKH: Thanks. That's really helpful.

MR. CRAWFORD: Good afternoon. I'm Greg Crawford. I'm representing the Cool Metal Roofing Coalition this afternoon and I wanted to step to the microphone just long enough to say that we do want to be considered partners going forward. We may have some specific concerns that we'll communicate soon in writing such as perhaps all climate zones being treat equally. There's some different fine points that would apply to metal roofing that we want to take a closer look at so please let us know if you have any specific questions otherwise we'll be following postings on the website.

MR. SHIRAKH: And check in with Payam.

MR. CRAWFORD: Of course. Definitely. So any questions for the metal roofing industry this afternoon?

MR. SHIRAKH: Yeah. What do you feel like the reflectance demand, the requirement?

MR. CRAWFORD: It's going to result in a lot of white roofing and metal roofing can provide that but there's some fine points. Having all the climate zones be treated equally. There's some metal roofing that would benefit in some climate zones the way the code has

been compared to the way code looks like it may be going.

MR. SHIRAKH: So again, please share with Payam your suggestion. We would appreciate it.

MR. CRAWFORD: I'll do it. Thank you.

MR. SHIRAKH: Thank you.

MR. COTTRELL: Charles Cottrell representing the North American Insulation Manufacturers Association. I'm the Vice President of Technical Services for NAIMA and we were also a signatory to the letter as a member of the coalition. There's been a lot of statements in support of the insulation tradeoff and I'd just like to make sure that I was on the record in support of that and let you know, that as an association, we were in support of that issue. Thank you.

MR. SHIRAKH: Thank you, Charles.

MR. BACCHUS: Jamy Bacchus. Natural Resources Defense Council. I could support a tradeoff that's shown to save the same amount of energy by adding insulation but the one thing that hasn't been addressed is the radiative forcing and urban heat island effect. How you trade that off by adding insulation.

MS. BROOK: So we can definitely make a commitment to evaluating the impact of that. Our first blush is that it's going to be minimal for the

applications where there's already some cool roof requirement and you're just changing the level of it. It's—we've already gotten—the state of California has already contributed to global warming because of our cool requirement. So the incremental change is relatively quite small and probably not impactful in our analysis. But we can confirm that.

MR. BACCHUS: Yeah. I'd just like to see that measured. And, I don't know how you take into account the equipment, so if there's air cooling equipment that's on the roof, what is the energy efficiency penalty if you darken the roof surface.

MS. BROOK: Yeah.

MR. BACCHUS: And we don't know necessarily what the—if any air cooling could be put on there. It may not be part of the base building but later on in a tenant fit out it may end up being there at some point in time.

MS. BROOK: So do you know—do you have any analysis of if anyone has done that sort of delta?

MR. BACCHUS: No. Just on—

MS. BROOK: On efficiency of the impact of the air cooler equipment with the dark roof versus a white roof?

MR. BACCHUS: There have been a number of

studies over the years, certainly.

MS. BROOK: Okay. So we could—

MR. BACCHUS: But generally, AHRI, you're testing it at 98 degrees Fahrenheit and at 78 wet fall or something because you're not, the newest DOE rulemaking, you're actually doing it at a dry elevated temperature but most often you're not testing at 115 or 130 degrees.

MS. BROOK: So do you think that we would have the ability to a meta analysis based on—I just don't know if we have the resources now to start a new effort for that analysis but if other people have done the analysis and we can leverage that then maybe we can think to consider it.

MR. SHIRAKH: Again, to reiterate what Martha said, we already have a cool roof requirement, we don't want more cool roof requirements. We just want—

MR. BACCHUS: We're just changing it from .55.

MR. SHIRAKH: It depends on if we want to see the last 7 percent cooler.

MR. BACCHUS: Just reminding you. It's another impact.

MS. DUTTON: Hi. My name is Eilene Dutton. I'm with Malarkey Roofing. We have one of the 19 roofing plants in California. I can say that Malarkey

has for years been involved in energy savings and things. Even from the manufacturing process. We put in a methane recovery plant years ago to fuel most of our plant so. Anyhow, just a couple of points. I would first like to say that I support a lot of what's been said here, including the need for durable materials and I also wanted to talk about bringing new products to market.

You ask if 30 months is enough. If we're looking at a tradeoff formula for .91 to .97 reflectivity, that's 30 months is not three years required for aged testing. Reflectivity involves smoothness. A lot of our materials are not perfectly smooth so no, 30 months is not enough. I would say four to five years is what we need.

Also, if the smiley picture could go up again, the smiley picture is not taking into account whether the material is of .4, .45, .5 whatever thickness the material is. So we don't really know what those membranes are or what the lifecycle of those membranes are going to be.

Also, we don't know how they're put down. There's fleece back materials that are put down with adhesives. There's peel and sticks. And there's hot air welding that's done. So the manner and the

thickness of the materials is not taken into account so we really don't know what these materials are. We're just looking at reflectivity. So I just wanted to bring that point up. We need to be looking at materials and how they're applied in the field to get a final cost of material.

MR. SUYEYASU: The data I collected we got—we collected the thickness as well. When I was done with it, I compared the 45 mil products to the 60 mil products, just on average. The 60 mil, just another one of those things that's surprisingly coincidental, was exactly 33 percent more on average than the 45 mil.

MS. DUTTON: That's not surprising.

MR. SUYEYASU: It was just amazing how precise it was. It was down to the decimal. So I took just the standardized to take a price to reflect instantly where this goes down, I standardized on the 60 mil, I just took those 45 mil price quotes I got and multiplied by 33 percent just to standardize them to a single thickness. So we don't have two different charts so there was some kind of accommodation made in this to make some kind of consistency in reflectance and cost.

MS. DUTTON: So those are all based on 60 mil material?

MR. SUYEYASU: Yeah. The 45s had another 33

added on to them, essentially.

MS. DUTTON: Okay. Because I don't believe that a 45 mil will last as long as a 60 mil would which would last as long as an 80 or 90 mil.

MR. SUYEYASU: There are duration issues there but we were just trying to standardize on cost.

MS. DUTTON: And looking at reflectivity.

MR. SUYEYASU: Yeah.

MS. DUTTON: And that's part of our point. You can't just look at reflectivity. You have to look at a full building envelope and you have to really look, a close look, at lifecycle analysis because on the blush, I work for a manufacturer, I know what our warranties mean. Warranties are a marketing tool. They may have some semblance in reality but they are a marketing tool.

MR. SUYEYASU: Yeah. We're aware of that. And we just felt, or I felt, just a little bit more comfortable doing it this way and just seeing the prices go down as you got to higher reflectivity. If we're going in the other direction, we'd have a lot more questions about durability so you are getting more and more cost just within this data that we're looking at if you go to a higher reflectivity.

MS. DUTTON: Some of that cost may also be, I

don’t know whose material you were looking at, but some of it is also you’ve heard people talk about there’s basically just a very few manufacturers and then other people private label from them. Well guess what. If you’re the manufacturer you can have the material less expensive than the other person so.

MR. SUYEYASU: Yeah.

MS. DUTTON: So you’ll see cost variance.

MR. SUYEYASU: Thank you for your comments. Mr. McHugh.

MR. MCHUGH: Hi. Jon McHugh, McHugh Energy. There’s been a lot of discussion around data of various market share of product of different types of reflectance and I think one of the things that would be useful for this discussion is for—when looking at market share and the reduction of market share or what sort of products are knocked out are looking at what impact is this standard have on essentially products that are in that white product space. So we may be in a situation in California where essentially you can have any color low-slope roof you want as long as it’s white. And maybe that’s what makes sense for the state. That it’s unlike a high-slope roof, there’s not this big esthetic benefit to having different colors when, basically, the only people looking at those roofs are folks who are

doing maintenance or planes flying over. So I assume you all have that information in terms of filtering by color and once you look at color and filter out other colors that, yes, there's a lot of tan products out there but is that really providing the amenity I heard earlier about the issue of waterproofness, etc. What we're really trying to do is have a waterproof roof that's not transmitting a bunch of heat so I would recommend that the groups that are involved in this sort the information that way. I think, maybe, we're all in violent agreement that an insulation tradeoff makes sense to allow tradeoffs between reflectance and insulation. I think that's a good thing. And ways that we can simplify it are also a good thing for compliance.

What was also brought up at an earlier workshop, and I think it's just that we haven't had the time to evaluate that yet, is the whole issue of looking at the equation that we have currently for new versus aged reflectance and that's probably also an area that might be approved that might also enable innovation in terms of new products being entered into the market. Yet still balancing that against making sure that we're not innovating and bringing in products that don't maintain the reflectivity over time. I believe we have a lot of data in terms of initial versus aged and those

equations can be revisited.

We've heard a number of comments about warranties being a marketing issue. The famous quote I heard was, It doesn't have to be real. It's Marketing. But it's some reliable market information on typical longevity of typical products by thickness, by type is of course in everybody's interest.

Anyway, I thank everybody who's participated in this. I just wanted to see if we could answer some of those questions and ideally via email or something like when people are documenting their comments. It's hard sometimes to follow all of this on calls or that sort of thing. It's always useful to have that on paper. Thank you.

MS. WOLLERT: Heidi Wollert, with Johns Manville Corporation. We actually produce roofing as well as building insulation, polyiso foam, fiberglass as well as polyurethane spray foam insulation.

I've been sitting here and I'd like to echo the comments that we've heard already in terms of supporting insulation tradeoffs, taking a hard look at that piece of it, not supporting an increase in aged reflectance, let alone a baseline minimum of 55 percent.

In 2005, we actually worked closely with the CEC. A few faces have changed since then. As a result

of that, we actually ended up, in direct response of the 2005 standards, actually putting in a line. They're all smiling because they all know that transitions have happened. So we put in a line and we invested significant capital in multiple plants to actually meet, in a creative way, our customer's needs for easy compliance and the CEC's standards for energy efficiency. With the new proposals, we're not going—the products that were made, the investments that were made are gone. So that's definitely a concern.

If you step back and look at the process, it seems like every three years we have this iterative process. And in three years, it's almost as if we don't have enough notice in terms of incubation time on product development to actually be in sync with what the new standards going to be. Whether you're at the table, actually invited to the table to understand this or you actually understand in a roadmap. And that would be one of my proposals. Do you have a roadmap that maybe we could all look at that so we're not surprised and then every three years we end up meeting or converging in Sacramento and filling up the hotels to come and get feedback? So it seems a lot more reactive than proactive and I think we could take a different approach for this all the way around.

The other thing that I would encourage is that it's not a one size fit all. We make a whole lot of products. Most of the products actually do comply. The factory applied sheets would not comply, mod bitumen BUR, the ones that are coated in the factory themselves today. But when we sell roofing or building products, the customers do not want a cookie cutter approach. They want options and ultimately they're concerned with performance, not necessarily even the aesthetics especially when it comes to roofs. With Title 24, personally, I've seen roofing come down to aesthetics and less on performance and waterproofing, many times. And the durability, the aging of it, has really gone to the wayside. So some of my feedback on that and my impression is because our timelines are out of sync. So if there is a way for us to come back together to get these in sync, to help us understand what's coming down the pike early on, I feel that would really be a positive move for the entire industry moving forward. That's it.

MR. SHIRAKH: Thank you.

MR. WOESTMAN: John Woestman here, on behalf of the XPSA Extruded Polystyrene Foam Association. Also, just briefly, for obvious reasons we would support the tradeoff options of the cool roofs versus the

insulation, obviously. But I do want comment, there was a speaker earlier who talked about roofs and getting wet and looking at foam insulation boards, the excrete polystyrene products are commonly used in walls. That's the green boards, the blue boards, the pink boards. Those are commonly used in walls. One of the insulation foam boards that's commonly used in roofs is the expanded polystyrene, the white boards. They're a little more susceptible for absorbs tin of moisture so not all of these foam boards are made the same. And polyiso are commonly made with aluminum coated insulation. I know they're used in walls and probably many other applications so I didn't want that roof getting wet to kind of getting applied to all of the foam boards. It's the white stuff that's more commonly absorbed and gets moisture absorbed. Thank you.

MS. BROOK: Thank you.

MR. SHIRAKH: Mr. Desjarlais?

MR. DESJARLAIS: Hello, Mazi. Thanks for inviting me to the cool roof hearing. I guess my comment is, I have two comments. I'm really concerned that we're really focusing exclusively on what energy savings technology, earlier this morning I heard Dan say that we have a mandatory requirement of no insulation on concrete walls and yet we're looking at highly insulated

structures and arguing between solar reflectance of 55 and 70. I would suggest that maybe if we looked at the entire building and focused on the energy savings opportunities, we're really not focusing on the right things. The roof are energy efficient already with the levels of insulation we mandate and our uninsulated concrete walls are a sham and we ought to be focusing on those types of opportunities of energy. I agree with Heidi. I suggest that we have a process, a roadmap, that we look at to building and look at where we can save energy and make changes where we're going to get the biggest bang for our buck. I think this afternoon we're focusing on the minutia and not on big energy saving opportunities. Thank you.

MR. SHIRAKH: For the record, did you mention your name?

MR. DESJARLAIS: I'm Andre Desjarlais with the Oak Ridge National Laboratory. Thank you.

MR. SHIRAKH: Any other questions or any questions online for George Nesbitt—from George.

MR. NESBITT: Yes, George Nesbitt. Good to see the inclusion of high-rise multifamily as well as the inclusion of a standard for the high-slope roofs for all nonres. Jamy, from NRDC, brought up the issue of roof color and the effect on mechanical equipment. And

I can't precisely remember, it was probably somebody from Lawrence Berkeley Lab, there was a talk on it and what I recall is that they found very little difference. Although, I'm somewhat suspicious as I'm not sure that I would agree with that intuitively.

I think that other thing is that we do want to make clear that the mandatory measures is for low-slope only. I think that as far as a tradeoff between insulation and cool roof, I think on new construction, hopefully, that shouldn't be that much of a tradeoff. On reroofs, I would probably, as much as I like cool roofs; I think that we have to have insulation probably so I would probably have insulation first than the cool roof. I think the benefit of the cool roof with the insulation is just (indiscernible) than to the building without insulation. The benefit is to both. I think that's kind of important. So I think that whether we want to consider different rules for reroofs and I think we currently have some language about adding insulation to reroofs currently but I don't know that well enough.

It also sounds like maybe the .55 and .7 numbers are a little bit high and so whether we want to go to a lower minimum reflectance that allows more products but if we tie that into requiring more insulation on a reroof, we kind of balance things out.

So I guess that's about it.

MR. SHIRAKH: Thank you, George. Any other questions in the room or online on this topic?

MR. BOZORGCHAMI: We have, this is Payam, we have Dr. Jim Hoff who wants to do a quick presentation. He's from the Environmental Innovation in Roofing.

MR. SHIRAKH: Okay.

MR. YASNY: So he's online and you want him unmated?

MR. SUYEYASU: Yeah, please. Jim Hoff?

MR. BOZORGCHAMI: He told me that he just wants to talk.

MR. YASNY: The issue is that when he signed in he didn't put in his attendee number and so the only way he can unmute him is if we can recognize him phone and we can't at this point. So if he calls back in, if we can postpone this and do it after, if he calls back in and uses his attendee number we can do it.

MS. BROOK: He might still be online. Can we chat to him?

MR. YASNY: Yeah, we can chat. Also, he's probably hearing this it's just that we can't unmute him.

[Off mic discussions regarding incorporating Mr. Hoff's wishes to speak via telephone]

MS. BROOK: Okay. Moving onto the next item. The next item is Residential Thermal Emittance, Reflectance, and Roof Deck Insulation and this is Bruce Wilcox.

MR. WILCOX: Thank you, Martha. So we're shifting gears here to talk about residential roof measures and a lot of the issues are similar. We certainly do like insulation in residential so we should all be in good shape.

So the background on this presentation. This proposal is based on—this presentation is based on a proposal sponsored by the California Statewide Utility Codes and Standards Program as a case study. The case study primary author is John Arent from Architectural Energy Corporation who's sitting here at the table. So if there are any issues or questions about that, we can consult with John.

The presentation that I'm making is actually substantially modified from John's case proposal in that it focuses on the changes that the Commission staff want to make in the residential standards so we've left out the many options and measures that John looked at that didn't actually turn out to be cost effective or useful for any particular reason and you can, if you're interested in those, you can go back to his case report

which is posted on the case website and look at those.

What we're going to talk about here is a summary of the current code requirements. We're going to talk about some of the research results that John produced. We're going to talk about roof deck insulation that topic that everyone loves. We're going to review the ACM calculations for roofs, attics and ceilings. And the changes that are being made in those. And then we're going to talk about new proposed roof adding prescriptive insulation requirements, roof deck insulation options, lifecycle costs and energy savings and steep-slope roof prescriptive solar reflectance. And then a couple things about changes in the performance compliance options.

So the current cool roof requirements, California floor low-rise residential. So we're talking only low-rise residential here so this is not high-rise, not nonresidential. So there's a division—we basically have steep-slope roofs where the roofing weighs more than five pounds per square foot and that's generally concrete and clay tile, maybe some metal roofs. And the requirement for those currently is an aged solar reflectance of a minimum of .15 with a thermal emittance of .75. And that's a requirement of all climate zones, all 16 climate zones.

And the other class of roofing here is steep-slope roofs weighing less than five pounds per square foot and the primary product here is asphalt shingles, some metal roofs. In those-for those, the minimum aged solar reflectance is 0.2 with a thermal emmitance of .75. And that requirement applies to only climate zones 10-15 which is basically inland valleys, Central Valley and inland Southern California. So that's our starting place.

The other requirements that are relevant here for low-rise residential is there's a ceiling insulation requirement of R-30 insulation prescriptive in climate zones 2-10 which are the coastal and milder inland areas of the state and R-38 in climate zones 1 and 11-16 which are the basically hotter and colder climate zones. We also have a radiant barrier with attic ventilation requirement which requires a combination of a radiant barrier and enhanced ventilation. That's a prescriptive requirement in climate zones, 2, 4 and 8-15. There's a performance compliance credit available who want to use radiant barriers and ventilation. There's also the possibility of doing an unvented attic but that's an exceptional method requiring special approval to do that currently.

There's this item called a raised-heel truss

which we're going to talk about and look at pictures and so forth. In the 2008 standards, they're not required and in fact there's no credit for raised-heel truss. There's the famous roof deck insulation which is in 2008 not required but there is a performance compliance credit available and a performance method for roof deck insulation.

So that's the current standards.

So one of the things that John did was look at what roofing materials are available by reflectance and I don't think we have such an attractive face appearing in this data so it's—this shows the number of products by reflectance that are listed in the CRCC listed products directory again. The blue line here is metal products and they generally have the number of products—the first line here is .2 reflectance which is the current minimum standard so there's a lot of products at that level and then there's quite a significant amount of products with a higher reflectance. The green line is for clay tile. There's some products with pretty high performance from them. The red line is concrete tile and there's a lot of products at about .2 and some at higher levels. Down here are the asphalt shingle products which there are about 35 available at about .2 and some available at higher levels up to about .3 which

there is not much available after that. And polymer shingles are somewhat higher than that. So this is kind of the state of the industry in terms of products that are rated with all of the caveats that people brought up earlier about what that actually means in terms of the real market.

In terms of market survey, John found that there's a lot of tools—of tile products with reflectance in the .35-.4 range and essentially no or very small additional cost compared to the tiles that meet the current standard at .15 reflectance. His conclusion was that cool tile with a reflectance of .40 is cost effective in all climates.

There is a—we're going to talk a bunch about roof deck insulation. There's basically two options for roof deck insulation. One is insulation that's located above the roof deck but which generally means foam insulation, more or less the same thing that was being talked about earlier for nonres. That gives you a continuous thermal barrier at the roof deck so that's nice and efficient. If you're going to put shingles on then you have to have a malleable base for the shingles over the top of the foam so that adds some foam cost.

And then there's the second option which is below deck insulation. One of the things we looked at

was fiberglass batts which can be installed in the top courts of the roof trusses. Or there's also close cell spray foams and various things which can be used at a higher cost. We also have a couple of examples of what might be innovative (inaudible) kinds of products that may be used for roof deck insulation that are up in the front of the room here that are potential options for doing those kinds of things well.

So a little background here on how we treat roofs, attics and ceilings in the calculations and the performance methods for standards development.

Up and through the 2005 standards, the way we calculated the energy impact of roofs and ceilings is by using an overall U-value for the roof, ceiling, attic and everything above the sheetrock in the ceiling and we assumed that was a nice uniform horizontal place and the heat flow is all vertical. That's a very simple approach kind of like doing heat loss calculations for sizing your furnace. It's kind of an oversimplification.

In the 2008 standards, we developed a new model for the attic, locally known as the UZM, which starts modeling interactive heat processes in the attic. We have a separate space up here in the attic and then down below is the house and the ceiling is here but in

the attic we have duct losses with both leakage and conduction, we have ventilation happening, we have solar gains on the roof and reflectance of the roofing and we have this whole roof deck assembly here that's going to have an insulation R-value and so forth. All of this going on in a way that there's a much more sophisticated analysis of what's going on in that area of the house.

However, in that model in the current standards, we're still treating the attic as this nice simple—not the attic but still treating the ceiling as this nice, insulated plane that has this heat flow vertically. And the attic is the space above there but the ceiling is just this nice uniform plane. So unfortunately that's not really what the ceiling is and we've been looking into the issues of what's really going on in the ceiling. This is partly raised by this concept of using raised-heel trusses as an efficiency measure for residential ceilings. This is a detail drawing of an edge of an attic. Here's the attic space over here. Here's the top corner of the truss here and the roofing on the top and then the ceiling of the house is here and here is the exterior wall. So this is the top corner of the room where the roof and the walls meet. And this is the place where we're assuming that there's nice uniform ceiling insulation but really what

happens is that space in the attic gets to 3 ½ inches high at the edge of the roof, one 2x4 height and so there's not very much space for insulation here and you have R-30 and R-38 requirements but an R-30 ceiling insulation and if it's fiberglass, it's 9 inches deep. Getting the full insulation level for this distance we've called L here in this drawing, at that point the insulation actually hits the roof deck and from there on over you can't actually get all of the insulation in there.

So the question is how do you actually figure out what's going on with this. If you assume that this is clear that the heat transfer really isn't going to be going all straight up and that it's actually going to go over to this corner where things are thin. The whole thing is complicated as I shift through the text. We define in the floor area and the ceiling area as extending to the outside surface of the wall studs. So the ceiling actually goes all the way out to this point. Even though the inside condition space starts here. So there's this some really complicated three-dimensional problems going on here in our construction.

So one of the things we did to look at this was to look at a two D finite element program which can calculate heat flow in two directions to figure out how

much heat was going to go through this construction with different amounts of insulation and of different types. You'll be happy to know that I am not going to go into the details of this process except to show you this lovely picture. This picture shows the uniform temperatures. So what it shows is that the blue is the cold and as soon as it gets warm in the house and it's cold outside and so the layers of temperature in the roof are proportional to the heat flow. You can see a lot of the heat flow is actually going out this way. A lot of it is going this way and there's way less going through this part of here than there is through this part of here. So we did a series of these calculations for different configurations of the roofs with different trusses and so forth. We then calculated the heat flow and the equivalent of a flat ceiling U-factor.

So here's your raised-heel truss. So you do have a more complicated truss structure of some point. And I've been told by several people that this is not the way a builder would build raised-heel truss. I hope there aren't too many builders in the audience who are going to get up and say that. We already know that it is already potentially an issue. But the whole concept here is that a raised-heel truss you do some special, different structure in the truss framework to get the

height above the sole plate, the top plate of the wall and the roof sheeting to be some dimension other than 3 ½ inches and we decided on 12 inches as being the dimension of a raised-heel truss. There are lots of structural issues involved here on cost related issues depending on how high you make that so we settled on this analysis on 12 inches high. And then you get lots more room. You can get 12 inches of insulation right here so it really changes the amount of insulation right here at the edge of the roof.

And so based on this 2D analysis, we've recalculated the ceiling U-factors for using the—for doing the analysis of the options of the 2013 standards. These are the values that we've been using in the last versions of our work and the stuff that I'm presenting today. These are the values that are in the current 2008 standard for a U-factor of an R-30 roof and R-38, R-49, R-60 roof or ceiling, it's a ceiling roof combination really. If you do the more sophisticated analysis, the standard roof truss for in R-30 ceiling is not very much different, it's almost exactly the same. If you do a raised-heel truss, you get four percent better performance on R-30. If you go to R-38, the difference starts getting bigger. It's the seven percent effect. When you get to R-49, it starts to get

really significant and at R-60 you'll see that the real R-60 performance is 60 percent worst than the raised-heel. The raised-heel is sort of what we've been assuming in our standard calculations until now. Up to now, we've basically been ignoring this ceiling edge problem in the calculations. One of the things we've done here is just move to take it into account.

So then comes up the issue of roof deck insulation. So, as I said, one of the ways to do roof deck insulation is to put vats underneath the roof and installing them between the top corner of the trusses sort of like you'd put them in a wall. So it's a sort standard insulation very similar to the way you'd put insulation in over a raised floor or crawl space.

One of the issues here, even with the raised-heel truss, that roof deck insulation has to stop somewhere here because you can't put the same insulation in the space that's already occupied by the ceiling insulation. This is a big issue with the standard truss. It's actually—the roof deck has to stop three feet from the edge of the roof and it doesn't actually do anything to change the heat flow at the edge of that roof where things are already strained.

So just taking us back to a standard truss again and you can see that if you were putting below

deck insulation in here, you'd have to stop up here and it doesn't have an impact on this area down here at all.

Whereas the above deck roofing insulation, such as the foam or whatever you want to put on top, you can actually stand to put a continuous layer across the trusses that go all the way to the edge of the roof. So you could actually add R-values here at the edge where on the roof is the poorest insulation values.

So one of the things that we calculated was an effective R-value for the below deck insulation which takes into account the heat flow at the edge of the roof and the fact that the insulation can't get all the way to the edge. And we've used these values in calculating the impact of below deck insulation. So in our standard truss with our below deck insulation, the effective R-value for the entire roof below deck insulation is only 7.8 whereas with our 30 raised truss, you get a full R-13 because there's enough room to get it in there. It's even a more restricted case with R-38 where the effective R-value of the below deck insulation is 6.8. And again you can get almost all the way over with the R-38 raised truss.

The roof deck insulations options that we're considering here, the bats below the deck case, we're looking at R-13 installed with wire supports which is a

similar system to what people use in crawl space floors. The estimate we're using is costing the home buyer $.72 a square foot installed, including the builder's markup and everything.

The one caveat on the R-13 roof is that there may be potential moisture problems in some climate zones because the moisture accumulating at the roof deck level and essentially you have, particularly with asphalt shingles, you have one of those insulated constructions where you put the vapor barrio on the outside and the cold situation the moisture will condense on the outside surface. It may be a problem. We have a pretty sophisticated study that's underway and we don't have a good answer yet but we're aware of that issue and that'll be taken into account with the standards.

The other option is home insulation above deck R-8 which is what's in the current calculation here and there are different R-values that are possible at different prices. But if you install R-8 with nail based shingles—so what that is is—well one way to do it is to take the current roof deck and put the foam insulation on top of that and then you put another layer of OSB down on top of that which you can then nail the shingles to. We calculated that at being $1.17 a square foot to the buyer, again, so it's considerably more

expensive than the R-13 but it actually has, according to our analysis, these two cases are approximately equal in terms of their overall impact. This is because of the issues of how they interact with the edge of the roof and so forth.

If you put the foam above deck underneath tile roofs it's probably less expensive because you don't probably need the nail base and you can probably integrate that into the normal tile system more easily, we think.

And the final thing, in terms of roof deck insulation, is the radiant barrier which has been a prescriptive requirement here in California for a number of years in hot climate zones. And typically that involves an aluminum foil layer that's glued onto the roof sheeting and is glued on as part of the roof sheeting insulation. I think that's on the order of $.13 a square foot but of course it doesn't have an R-value so it's impact is pretty small compared to R-13.

So here's the meat, here's the proposal for changes to the roof attic prescriptive insulation requirements. Here's the 16 climate zones on the left column. Ceiling insulation and truss, roof deck insulation and radiant bearers. To three columns of requirements here. We're proposing no changes in the

ceiling insulation requirement at this point so this is the same prescriptive requirement at in the 2008 standards. And we're proposing standard trusses all the way down here. We looked at the (indiscernible) trusses and at this point we're not proposing to change the roof construction practice with raised-heel trusses but we're proposing to stay with standard trusses.

The roof deck insulation is where the change is. We're proposing a prescriptive requirement for roof deck insulation in all the climate zones except climate zone one and five which are basically the two zones in the current residential analysis which have zero cooling loads. So these are the climate zones where, basically, there are no cooling. This roof deck insulation is a strongly cooling driven measure. What you're doing is largely keeping the solar gain out of the attic by insulating it and preventing heat flow down. The prescriptive requirements we're proposing here is in all the climate zones up through climate zone 10, we're proposing R-13 and bats below the roof deck. And then in climate zones 11, 12, 13 and 15 and 16, we're proposing R-8 foam above deck. This is primarily because to be conservative because the R-8 above deck is more expensive but we're pretty sure that there are no moisture issues so those climate zones where we think

there's potential moisture problems might be an issue we propose the R-8 insulation. One of the nice things about the above deck insulation is that you can still have the radiant barriers. So the R-8 above deck insulation is proposed to have a radiant barrier on the bottom side of the roof deck as well.

So when we do the—so when we use the cost that I just quoted and you do the lifecycle cost analysis we can show a positive lifecycle cost savings for all those zones where we proposed that the roof deck insulation requirements and they range from minimal in climate zones three and seven up to pretty significant net savings of up to $3,000 over the life of the home in climate zones 15 which is the hottest climate zone in California.

And we're getting significant energy savings. This is a significant measure in our goal to get to net zero by 2020 in California buildings. The blue values here are the time dependent valuation energy savings compared to the base case. In this analysis here, we're being kind of conservative in that this is actually a marginal analysis of where we're looking at how the 2013 standards may end up and getting the energy savings for the roof alone by subtracting it from the package. So this includes all the other interactive effects that

always tend to reduce energy savings when you get to the end.

The TDB bar here is blue. The savings are biggest in the climate zones now where the roof requirements are the lowest in climate zones six and seven where we don't have radiant barriers and we don't—and we have R-30 insulation that the relative savings there is the largest. On a statewide weighted basis, which does a calculation based on the projected housing starts by climate zone, it comes out about six percent of TDB savings for those who are old fashioned, if you want to think about it in terms of source energy, it comes out about a four percent source energy savings statewide. So it's a significant overall savings.

Other rated changes in the proposal would be to change—I should say back up one slide here. This lifecycle cost analysis is simple, presenting here is all based on asphalt shingles because asphalt shingles tend to be—because of the need for the nail base and so forth in a more expensive and harder to justify we think application. I think the Title results would be more cost effective in this.

MS. BROOK: Bruce, before you jump off of this slide. Can you clarify are those percent savings for the whole house—

MR. WILCOX: Yes. This is whole house TDB energy savings including the whole—all the regulated stuff that's in the current Title 24 energy budget, including heating and cooling and domestic hot water heating and fan energy and so forth.

MS. BROOK: Okay. So it doesn't—it's not a percentage of the unregulated loads as well?

MR. WILCOX: No. Just the regulated loads.

MS. BROOK: Okay. Thank you.

MR. WILCOX: So this doesn't include the largest green TVs and the bowling alleys and other things. So the associated proposals here is to change the minimum aged solar reflectance, we just put this in because we thought that maybe you guys would get bored at this point if we didn't write in solar reflectance again. So it's to change the minimum aged solar reflectance to 0.2 in all climate changes with the exception that asphalt roofing products in climate zones 1-9 and 16 would be exempt from that. The effect of this would be to change the requirements for asphalt roofing but to change the requirements for all the other roofing products such as tile from their current standard to the .20 reflectance.

This is actually only steep-slope so this doesn't change anything having to do with low-slope.

The low-slope—we haven't exclusively talked about this but I supposed by reciprocity we have to say that we'd use whatever Dan and his team come up with for our low-slope roofs too.

Changes to performance compliance options. In the current standard there's, as I said, when you have a radiant barrier we require you to have one over 150 attic ventilation with a minimum amount at the high in the attic. We actually offer compliance credit for that stuff. The proposal here is to stop doing that. It is to assume that we are going to have one over 300 attic ventilation and to not give credits to attic ventilation measures in the 2013 standards. So that's basically, I think, in response the understanding the there's minimum enforcement of the details of attic ventilation in most construction. For example, building officials and various people are not actually doing any very great job of checking to make sure that you've got one over 150. The ventilation products are actually not rated or certified according to any kind of uniform standard so it's kind of whatever you want to claim them. It's a free area is an academic concept as we heard earlier. It probably has not very much to do with actually ventilation flow. So the move here is to assume one over 300 and we're going to not credit anymore for the

ventilation stuff. And you won't be required to have extra ventilation for radiant bearing cases as you do now.

And then there's the case of unvented attics. There's a lot of people think that these are the way to get to very high performance buildings. We're all very interested in vented attics. One of the issues is that we need further software development before we can fully analyze unvented attics. We need also a bunch of work on eligibility testing and verification approvals and so forth before we can really talk about unvented attics as a compliance reality. I think that there's a lot of interest in moving that direction but at this point we don't have anything to put in these standards. It's certainly not going to be in the prescriptive standards.

So that's my presentation. You can send your comments to Mazi or you can just walk up here and hit him. Payam's bigger actually. So any questions.

MR. SHIRAKH: I just wanted to add one more thing that's related to thermal emittance.

MR. WILCOX: Yeah.

MR. SHIRAKH: In 2008, we ended up with this strange situation where we had in the prescriptive requirement we had an emittance of .75 but in the performance we had .85 and I can't remember we had that

up like that at with a disputative between performance and prescriptive. I suspect it was probably a mistake and we had changed it to .85 but the prescriptive we just left it. I can't remember why it was.

MR. WILCOX: It was my fault.

MR. SHIRAKH: So we're actually proposing to make it all .85 across the board in performance and prescriptive. It shouldn't impact too many products since performance is used more than 90 percent of the time and that was to name requirements. So that's the other thing that we're considering.

So with that, any questions on—

MR. VARVAIS: My name is Dan Varvais. I work for Bayer Material Science. One of the comments that was made earlier was that California has a mandate to meet or exceed federal and national energy codes. We are so far behind the IECC when it comes to opening up attics and our organization has been working for over four years trying to get unvented attics to just be brought to the acceptance level that the IECC has. I think that needs to be brought out and that needs to be recognized. Building scientists have written about it all over the United States, North America and in Europe. We continue to turn our face away from it. It answers a lot of questions about urban wild land interface for us.

It addresses duct leakage and barrier ducts and there's no compliance option for it. So I'd like to suggest that the Commission take a look at that.

And then it seems, the other thing too, the diagram where you had linked L, the assumption is that you can only fix or solve that cap of insulation with an air permeable fiberglass product. There's other insulation products that may be able to address that length as a hybrid approach. You can slide a board in there that would come closer to the R-value than having to insulate the whole underside of the duct or the underside of the rafter. I think that should be considered.

And just one other comment. Excuse me. And also the comments about below deck insulation being just closed foam. I think that both products can be open and closed foam and medium density foam would be accepted in those areas as well.

MR. WILCOX: Can I ask you a couple of questions?

MR. VARVAIS: Sure.

MR. WILCOX: So one of the things I'd be very interested in is finding some unvented California attics, particularly ones that had some—ones that have been studied at some level by somebody. I've asked many

of the utility programs if any of them have unvented attics. Nobody has been building these things for many years. There's a lot of interest but nobody doing that. I think we'd like to—if there is some around, we'd like to look at and talk to people about them.

MR. VARVAIS: There's a lot of them. In fact, the production home manufacturers—this horse has left the barn. They make decisions regardless of what the state of California says, we're going to build unvented attics because it provides our homeowners a better home.

MR. WILCOX: So if you would send us to some people.

MR. VARVAIS: The other thing about mixing the attic insulation, IECC has a technical bullet, in Article 1520 that gives the calculation and the loads to the IECC climate zones on the mixed matching. I concur that we're probably going to have some real good possibility for moisture damage at R-8 and R-13 fiberglass insulation on the bottom side of the roof decks.

MR. WILCOX: Well, we're interested in that for sure. And then were' certainly to all kinds of—there have been all kinds of effort put forward by a couple of the case proposals to more generalize the whole insulation system stuff so there's possibilities,

combinations and so forth of how it could specifically be handled. I don't think there's any reason to say that you can't do combination systems. As far as I can tell, they're generally not the lowest cost option but they're probably the highest performance option so there's lots of possibilities there and we support those as much as possible.

MR. VARVAIS: Okay great.

MR. SHIRAKH: Just to add to that, the requirement is going to be R-8 above deck or anything that's equivalent to that. What's important is performance not so much of if it's above or below or what type of—

MR. VARVAIS: Check out Article 1520 because Article 1520 may not be enough to prevent condensation is what I'm saying. We've been doing this stuff all over the state so there's some guidelines that would challenge this is all that I'm saying.

MR. SHIRAKH: Thank you.

MR. VARVAIS: Thank you.

MR. CALLAHAN: Bill Callahan, Associated Roofer Contractors. Just a couple of quick clarifications, I'd appreciate it. You're referring to steep-slope roofing or do you mean nonresidential and residential in this or just nonresidential?

MR. WILCOX: Well, these guys said they were going to use whatever we use so I suspect it will be applied to both but it's definitely steep-sloped so—

MR. CALLAHAN: And then the anomaly in the steep-slope nonresidential in climate zone one for lightweight products, three's an exemption there. Which I would also assume would be carried forth if you're going to—for the same reasons you're keeping the exemptions in 1-9 and 16 in the low-rise residential.

The second thing I wanted to know is—you talk about an exception for asphalt roofing products. Is that just a shorthand or are you going to get rid of the distinction by weight?

MR. SHIRAKH: We've talked about it. I think the simpler thing, in my opinion, is to just say asphalt roofing and not to make a distinction by weight but there may be other issues involved but the result is that same. We're not really changing anything related to asphalt.

MR. CALLAHAN: And it doesn't make a lot of difference to me in here but if it's going to change, I'd like to know.

MR. WILCOX: We'll let you know if we determine it by asphalt roofing or product density but the result will be the same, pretty much.

MR. CALLAHAN: Thank you.

MS. HARDY PEIRCE: Helene Hardy Pierce with GAF. I just have a couple of quick questions. First is the other credit or options in lieu of the prescriptive requirements. Are those going to remain in place?

MR. WILCOX: You're talking about in new construction or?

MS. HARDY PEIRCE: For reroofing. There's all of the options that are below the table currently in the 2008 standards.

MR. WILCOX: We haven't actually figured those out yet. So we're going to talk about addition and remodel rules at a later time.

MS. HARDY PEIRCE: Okay. Because you have this no credit for enhanced attic ventilation so that's one of seven, I think, different options.

MR. SHIRAKH: Some of those may not actually make much sense once you add the roof decking insulation and some of them might make sense. Obviously, in looking at the current ceiling insulation and raising that, that might make sense. Another one was sealing the ducts. Obviously that would make sense. So we need to look-

MS. HARDY PEIRCE: The ducts not in the attic space. I mean they're—Which then I come to the next

point and that is as you're moving forward with developing the steep-slope recommendations for 2013 I would really, really strongly recommend having industry involved on this fact. Insulation and, yes, energy efficiency. The last gentleman talked about vented versus unvented. When we start talking about adding insulation in different places, there is a huge body of work about the unintended consequences from a moisture control standpoint. While unvented residential buildings have long been—people will tout if it's unvented and if it's designed right, if it's installed right and the sun is in a certain phase everything works well. When those things don't happen, the unintended consequences could be a disaster for the homeowner so I just caution that we make sure that we remember one-that we need to keep water out. That is what the roof is doing. And two, that we don't have good intentions gone awry. And that is with changing dew point temperatures and we'll then have condensation problems because, as we know, homeowners generate a lot of moisture in their homes. So those were my questions.

MR. SHIRAKH: I'd may be like to respond to some of that. We've actually been aware of that moisture problem from day one. As Bruce can probably talk about this a little bit more, he alluded to, we

have this contract going and we have some of the preliminary results, not all of them, but we'll incorporate that and we'll make sure that—

MR. WILCOX: One of the things to make clear is that we're not proposing anything unvented in the prescriptive standards that I laid out. Those are still vented roofs.

MS. HARDY PEIRCE: Vented spaces. Right. Okay.

MR. WILCOX: SO the whole issue of unvented is one that, as I said, we need to be careful moving forward. There's a lot of interest there and some people think that—there's some controversy too about this.

MS. HARDY PEIRCE: Right. Thank you.

MR. SHIRAKH: Thank you. Appreciate that.

MR. BAKER: Hi. My name is Jim Baker. I'm here representing the roof assembly ventilation coalition. The roof assembly, RABC, was formed about three and a half years ago. We've got several white papers. We do have some bibliographies and research on the benefits and the research on the benefits and the research available out in the marketplace on vented attics. The organization promotes the use of attic ventilation for the use of dealing with moisture

accumulation, ice damaging and cold climates and mitigation of heat buildup. And there's also the natural concept that attic ventilation does not take any energy to produce unless you're using powered fans and when you get into some of the sealed attics you do have to put air exchange units in the building which do use energy. The coalition will be more than willing to meet with the Energy Commission and provide any background and support that they might need on this issue. Thank you.

MR. SHIRAKH: Thank you, Jim. Mike?

MR. HODGSON: Mike Hodgson. Con Sol representing CBIA. Just a couple of brief comments since it's a little overwhelming getting the material this morning and coming up and visiting. One that the comment that you're pretty sure there are not moisture issues is very alarming. This is a roof deck that's going to last a very long time and moisture is obviously a key issue here so we don't want to be pretty sure.

MR. WILCOX: We're pretty sure because we don't have the final report from our study yet that's why— that's why it's a preliminary conclusion. We're preliminary sure. We'll put it that way Mike.

MR. HODGSON: The other is that, I guess just the ability of proposing changes having such a

substantial impact on the market. You're looking at something that we don't do right now and you want this to be a construction practice in a short period of time. We've been very, I think, persistent in saying this is an area of when you change a construction practice you need to give warning, you need to encourage it as a compliance credit and you need to then introduce it that way and then three years later as a code cycle, the next code cycle, than it's something that after some experience in the market we can say whether it works or doesn't work and whether it's cost effective or not. So this is a huge change and there will be opposition just based on the amount of change, whether it's cost effective or not. I think a classic example of what you could do is in the raised-heel truss, that looks interesting and that's an excellent example of using that as a compliance credit and you can qualify it and give them a bonus if they do it and see what happens in three years. Just a quick clarification point, I believe in the last blue print it was clarified that radiant barriers can be one per 300 so I don't know if that's a change already in code because we already made that clarification and it's not one per 150.

MR. WILCOX: Well, my understanding, of course I'm often wrong about the prescriptive rules when they

hit the street, was that if the radiant barrier is required and you're meeting that prescriptive requirement that you do have to put in that one over 150 ventilation. But if you're not meeting the prescriptive requirement, then I think you're allowed to disconnect ventilation and the radiant barrier and do whichever one you want at either level of ventilation.

MR. HODGSON: So if you're doing a performance approach, like a production builder would do, then you can do the one over the 300?

MR. WILCOX: That's my opinion.

MR. HODGSON: That's not the clarification that was in the blueprint, pretty much carte blanche that that was one per 300 for radiant barriers so we should talk about how to make sure that the intent is correct and the building science is correct.

MR. WILCOX: Okay.

MR. HODGSON: And that was the most recent version of the blueprint.

MR. SHIRAKH: One point is that as far as offering this as a compliance option, he's available. Nobody has taken it and this is actually one of the biggest energy savings in the standards.

MR. HODGSON: And, Mazi, my retort to that and I'm not being critical but if no one is doing that and

it's such a great energy benefit, maybe there's a reason. So you're changing—I think the number one or two concern of homebuilders in a 10 year water is water intrusion. And the majority of that either comes from your roof or your windows. Now you're potentially introducing something that may have an impact on not only moisture levels but potentially introduces other types of leaks into the building. Not sure. I don't understand the construction practice. It's not common. So to be repetitive is that we're concerned about big changes in building practice in a short period of time, potential problems, problems lead to liability.

MR. SHIRAKH: Thank you.

MR. OLSON: Yes. Rick Olson with Tile Roofing Institute. We represent all of the manufacturer's of concrete and clay roof tiles. I just wanted to go on record to state that we kind of want to have a little place card to be able to respond back. Some of this was new information today. Obviously, the foam beneath tile is an above deck insulation. It's not a common practice. I'm not sure that the data you had on the cost, and I'm not saying that it's right or wrong, but we'd like to have the ability to take a look at that and respond back.

My other question is in the previous code

there was the alternative option to have that air space in there and I've heard nothing in the presentation so far about the air space. I was curious if that goes away, does not go away, is that coming later?

MR. WILCOX: Well, I'll take a stab. See if I know what I'm talking about here. I don't think anything is going to change on the airspace.

MR. OLSON: Okay. Fair enough.

MR. WILCOX: That's my position.

MR. OLSON: The only other thing is that I would raise the concern that if we start looking at above deck insulation properties, that while we're here talking about the value that's brought be the energy and reflectivity, in California you also have a huge fire issue. I think that we need to be looking, as we look to alternatives, that we're taking into consideration that you don't want to go specifying a way to save energy, especially in these wildfire urban interfaced areas, that turns around and creates a fire issue because it's kind of moving a problem to another side of the road that may not have been thought of.

And the final thing is that the exceptions that are in there. I can tell you from our standpoint, as the builder looks at it, he sees that tile has to be compliant on all 16 zones. He looks at another product

that may not have to be complaint in all 16 zones. I think it gets misconstrued as to why the exception is there. Either one, we should take the exception away and make all products say what they'll do whether they provide a benefit or not that's find. At least it states what it does. Or if you're going to put the exception in, put in better clarify as to why. It makes the presumption for our products that they must not perform, hence they're having to show compliance in all 16 areas and I don't think that's an intent. So I just leave it there and we'll get back on the other.

MR. WILCOX: Thanks.

MR. DESJARLAIS: Andre Desjarlais, Oak Ridge National Lab. I just have a couple of questions to make sure that I understand what you're proposing. I'm presuming that all of the insulation going up into the rafters is to reduce distribution losses. Is that a fair question?

MR. WILCOX: Well, distribution losses and loads on the house and so forth. For example, one of the things that happens in California houses. We've begun some survey work since we last met in this room three or four years ago, whatever it was. We found that about half, in a typical California house, about half of the infiltration leakage is in the ceiling and so what

that means is in the summer time when your air conditioner is on, most of the infiltration comes from the attic.

MR. DESJARLAIS: Okay.

MR. WILCOX: And so it's not simply the distribution losses it's also we're taking that super heated air into the house.

MR. DESJARLAIS: I see. So dropping the attic temperature is recuing both the distribution loss but also the air infiltration loss?

MR. WILCOX: Right.

MR. DESJARLAIS: I guess my question is have you looked at the more obvious, or the more direct, lines of attack which are more distribution insulation and maybe doing a better job of sealing as opposed to adding insulation? I think that I agree with the gentleman who spoke before which is putting insulation in two places in one component hasn't been done before. I'm interested in what your further study is but we can talk about that offline. That would be—attacking a problem directly, in most cases, is a better approach than indirectly.

MR. WILCOX: Part of the background here on this analysis is that we proposed also to require tested infiltration leakage measurements for ACH 50 for new

homes in most of these climate zones. And that's what's in this climate analysis already is that the houses are a lot tighter than what you would expect from a California house in the past.

MR. SHIRAKH: And we're also requiring R-6 or R-8 on the ducts, radiant barriers.

MR. DESJARLAIS: Right.

MR. SHIRAKH: I don't know how much more insulation we can add.

MR. DESJARLAIS: Well, when we were doing these micropas comparisons, the distribution losses were in order of a magnitude higher than the ceiling losses. And so in your proposal, and I'm sitting back there, that was the issue—

MR. WILCOX: Well, it's definitely true in terms of conduction but, although, part of what we've been working on here has been trying to get a better handle on what the ceiling losses really are. We've been optimistic on how well the ceiling works in the past. So it's good to be more realistic too.

MR. DESJARLAIS: Thank you.

MR. SHIRAKH: Thank you, Andre.

MS. DEUKMEJIAN: I'm Sarah Deukmejian. I'm Vice President of Marketing and Engineering for ASC Profiles Inc. We're a metal roofing and siding

manufacturer with four plants in California. I just wanted to point out that some metal roofing products, particularly in the residential market, are attached directly to the substrate so there isn't room where they're currently designed to allow for some above deck insulation. And also, along with, personally, I'd suggest the removal for an exception of a specific product as opposed to what that perceived benefit that that product brings.

MR. SHIRAKH: And we have an online question from George.

MR. NESBITT: Yeah. A couple of things. Bruce, can you confirm. I thought in the current code of ceiling insulation we are debating for the fact that there is less insulation in the eaves. Is that correct or not?

MR. WILCOX: The numbers are what they are. John Arent wants to say something.

MR. ARENT: Yeah. There is a very small amount of debating that is built into the current U-factors that are in there. I think it's very small. I think the assumption was that for those calculations that roughly seven percent of the roof area has a condition of compressed insulation so we believe that this two dimensional analysis is an improvement on those

calculations.

MR. NESBITT: So we're not proposing to increase that or are we?

MR. WILCOX: What we're proposing to do is change the U-factors from what's in the current JA-4 to something like the ones I just showed which will give you a bigger deduction for a standard roof truss, particularly when you get to insulation values that you're interested in.

MR. NESBITT: Yeah. Although those numbers didn't see that different. Even if raised-heel is not cost effective, I think having it as a compliance option for our really higher performance projects that are trying to improve higher levels of performance would be a good thing.

I was going to raise the issue of low-slope roofs and reflectance. I think we should be including something for that. There's definitely, especially in older buildings, a lot of low slope roofs. Although not as common in newer buildings.

And then if there are lots of tile products with higher reflectance, removing the high mass exemption seems like a good thing to do.

Just a comment on modeling knee walls. Micropas does it but Energy Pro does not appear to allow

you to model attic knew walls properly unless I'm missing something or you can only make it up to 60 degrees an angle.

And on the roof deck insulation, the IRRC has, I think, pretty much has that right as far as vented and unvented and what insulation products you can and can't use. Joe Stiebert from Building Science Corp. spoke a couple of weeks ago and what really material you use below a deck is doing more by whether it's permanence of the roofing above and whether it's ventilated or not is the primary driver more than climate.

Currently we define roofs as either having an attic or it's a rafter type roof. And what the different between an unvented attic and a rafter roof? Is there a—I mean we can model. I imagine that we have products that have complied with unvented roofs because they model it as a rafter roof and included the attic in the volume. So what's the issue there, I guess?

MR. WILCOX: I think there are probably issues with—the whole thing with the unvented roofs typically is to make them a conditioned space and that's different than what you would do with a rafter roof. We're a quasi conditioned space. So I think there are issues there that go beyond that sort of, George, so that's things to be done.

MR. NESBITT: Well, I imagine the roof rafters are actually assuming there's ventilation space. And so the real different—I mean, when you define a roof that's like a sloped roof. You've got a cathedral ceiling you define it as a roof because there is no attic above but it's whether if the roof is vented or not is the different. I guess we don't necessarily recognize not having the vent space.

MR. WILCOX: That's right. So I think moving toward having a way—I think there's a general agreement, probably, that we should move to account for those kind of constructions and allow them to be done correctly and support that. I think we're all—I'm in favor of that as well.

MR. NESBITT: Yeah, agreed.

MR. SHIRAKH: Any other questions online? Any other questions in the room on this topic? Jon?

MR. MCHUGH: Jon McHugh. McHugh Energy. Bruce, are we planning on having an unvented attic for either REACH code or compliance options for this code cycle?

MR. WILCOX: I would say that not for the REACH code probably but maybe as a compliance option.

MR. MCHUGH: Okay.

MR. WILCOX: One of the problems—certain

progressive developments in the community have pushed this really hard to start using real sites of air conditioning equipment as part of the compliance calculations. As far as I know, there's no provision for calculating loads if you have a sealed attic in any of the standard sizing systems. So one of the things we have to do, in terms of thoughtful enhancements, is figure out what to do if you have a sealed attic and how do we deal with that in the load calculation part.

MR. MCHUGH: I see.

MS. BROOK: So, this is Martha, from the software perspective, I'd say that we—I don't see how we have the resources to develop new algorithms to model vented attics. It could be that if the industry wanted to contribute to that development that we might be able to pull it off. With a true compliance option, where they come in and say this is how we think you should be modeling unvented attics. But to think that we could do that now under the constraint that we have to try go get software completed as close to the adoption date as possible, I don't see it happening.

MR. MCHUGH: Okay. Thank you.

MR. SHIRAKH: Any other comments on roof deck insulation? Or do we have a presentation to go back to?

MR. BOZORGCHAMI: Yeah. I think Dr. Jim Hoff,

are you ready to present?

MR. HOFF: Yes, I am.

MR. BOZORGCHAMI: Let's get your presentation up real quick if you could hold a minute.

MR. HOFF: Let me just ask quickly will you be moving the slides then?

MR. BOZORGCHAMI: Sure. You're on slide number one now.

MR. HOFF: Okay. I see the slides. That's great. First, thank you very much. I apologize that I had misunderstood the instructions and didn't put my attendee name in the telephone call. But I do appreciate the opportunity to talk about this and I hope that this very brief presentation will provide some additional balance. Many of the commenters are on one side of the equation of the issue of the incremental benefit of moving from a standard of .55 to .7. We would like to take a look at that on the benefits side instead of the cost side. Just to be sure that we are paying equal attention to the rigor at which we are calculating the benefits as well.

I represent the Center for Environmental Innovation and Roofing. The Center was organized three years ago. We serve the entire roofing industry as an information resource and focal point of all issues

involving the environment and energy and their relationship to roofing. Our membership consists of a wide variety of the leading roofing manufacturers, leading roofing contractors, roofing consultants and designers and material suppliers to the industry.

If you would go to the second slide. Essentially we are interested in looking at one specific piece of this at this point in time. And that is the issue of incremental savings that can be obtained by moving from an aged solar reflectance of .55 to .7. And we believe that an effective analysis needs to have a certain number of variables and should have a range of those variables and values to provide the best information to the Commission.

First, we should focus on incremental savings only. The increment of savings, the increment of cost savings and energy savings, provided above. 55 up to .7. We should look at that for different California locations and climate zones. Also, look at that across the range of roof view and R-values. And also finding it to look at today's electrical costs for commercial facilities. And do all that using a recognized calculation tool.

The study that I have here is a preliminary study. We've been working on this the last few days

since we received the original workshop materials. But on slide three, we present the basic methodology. The calculation tool that we use—the Department of Energy and Oak Ridge National Lab's cool roof calculator. It is a very rigorous calculator. It's been very well vetted. It's been in use for about 10 years now. It, of course, includes both non cooling load days and solar loads for each location. The locations that we looked at in our plenary analysis are in three different zones in California – San Francisco in zone 3, Las Angeles in zone 6 and Sacramento in zone 12. We looked at all of those locations and utilizing three levels of solar reflectance. The baseline comparison is .05 reflectance. I know that some previous studies were done on .01 but the default value within the Oak Ridge calculator is .05. I think that if you look at the sensitivity analysis later, that it's really not a very big issue.

Secondly, we looked at .55 which is, of course, the current Title 24 prescriptive standard and proposed to be the mandatory minimum. We also looked at .7 proposed to be the Title 24 prescriptive standard in the next version of the Title 24. Then we also looked at those comparisons at two different R-values so we could at least begin to establish a range of R-values.

One R-value was R-13.3 which corresponds to a U of .075 which is the mandatory minimum proposed in Title 24 for wood framed and other roofs. The second U-value we used was .05 which is an R of 20. That is currently ASHRAE 90.1 and the International Energy Conservation Code prescriptive minimum for all climate zones in the United States. That's also a prescriptive minimum that would lead many of the climate zones within the current Title 24. So we thought that would at least provide a reasonable range to take a look at the incremental benefit.

Slide four just has some other assumptions that are important. We used cost of electricity based on $.126 cents on kilowatt hour. We utilized our source at the Energy Information Administration's 2011 average retail price for the California Commercial sector. We assumed .8 and an air conditioner co performance of 2.0 and we did not include heating loads in the analysis. In most cases that isn't very important. There are some cool, cloudy areas where it is important but we addressed that in the sensitivity analysis later.

The next slide shows a typical comparison utilizing the DOE cool roof calculator. The two figures there are essentially mock-ups of screenshots of the online cool roof calculator. Utilizing a paired

comparison of reflectivity of .55 versus reflectivity of .7, and an R value of 13.3 for the city of Los Angeles which would be zone 6. There was a minor mistake. I made the screenshots part of the final analysis but we show a summertime cost of living with electricity at $.12. We used $.126 cents in the actual analysis. Both of these allow us to calculate what the net cooling savings is for a reflective roof of specific reflectivity versus the black default roof of .05 reflectivity.

In this case, in Los Angeles, with an R value of 13.3. A reflective roof of .55 will save approximately two-and-a-half cents a year. A reflective roof of .7 will save approximately three-and-a-half cents a year.

The next slide, slide six, I won't dwell much on. This is simply a summary of all the paired comparisons for the two different R values and for the three different climate locations that we looked at, determining what the net energy savings for each of these areas was, for each of these situations. And we also lined the chart with the cooling load with both the black and reflective roofs that are used to generate that savings.

The second chart then takes those paired

comparisons and summarizes the incremental energy savings between a reflectivity of .55 and a reflectivity of .7 for the three cities at the two different R-values. I think most importantly, of course, the incremental savings in a cloudy, cool area such as San Francisco are not surprisingly very low. In Los Angeles, probably the most important incremental comparison is at the R of 13.33 which I believe is the current prescriptive minimum for Los Angeles. The savings, utilizing the Department of Energy calculator with the assumptions that we put in it, is just a little under a penny a square foot a year. In Sacramento, a little different situation with Sacramento I believe has a prescriptive minimum standard of .039 U-value which would be an R of 25. The R of 20 would probably be closer to real practice within Sacramento. And again, at that level, the U savings are a little over a penny a year.

So we wanted to present this first today to provide a transparent model that allows all of the variables to be seen. And for those values to be varied to look at the different situations and opportunities but, I believe and certainly we believe at the center, that these values very clearly reflect what Andre Desjarlais said earlier. This may be much more of a

very minor issue compared to other issues and other opportunities for ongoing energy savings.

The last slide, again we don't need to spend that much time on slide eight, provides some information about sensitivity analysis. What happens when you change the cost of electricity and the sensitivity is pretty linear? What happens if you change the relationship of a roof view or R-value? It appears to be very closely correlated to .55 and .7 reflectivity to 13.3 to an R-value of 20. The sensitivity of the roof is pretty minimal. And air conditioner efficiently can vary to some degree and we provide the upper and lower limits for typical air conditioner efficiencies.

And finally, adding heating to the analysis has little or no effect in many areas of California. Especially hot, sunny climate zones which are probably the focal point of this initiative but there could be a significant negative effect in some of the cool, cloudy zones such as San Francisco.

So this is a preliminary analysis. We would be more than happy to change this because we really think that there's an opportunity to using the Oak Ridge tool to be able to provide a level of transparency in the value, levels of transparency in the algorithms that really helps build a longer term consensus.

So I appreciate again the opportunity to speak with you today and I'd be happy to answer questions that you might have.

MR. SHIRAKH: Any questions? Jon McHugh.

MR. MCHUGH: Jon McHugh with McHugh Energy. The results from this calculator, can you export them in an hourly format?

MR. HOFF: I guess I'm not sure. I think, I believe, we could work with Oak Ridge to do that. Simply for this analysis, I used the online version of the calculator but I believe that that could be done. Perhaps Mr. Desjarlais could comment better than I could on that.

MR. DESJARLAIS: The answer is no. This is a family of curve fits and compares a serious of experiments that were performed at ORNO to predict the energy loads in the building. It's clearly different from the analysis that Dan has done. This analysis does not include a building. It has no building. It's looking simply at the energy flowing through the ceiling. Clearly the difference between your analysis and our analysis is that you selected a building and your building has a family of internal loads. This has no internal loads. So the tool was designed to demonstrate what the minimum potential benefit of a cool

roof is. I think you selected a building where you can get any answer you want depending on the building you select and the loads you put inside. I was going to ask, and it's part of Reed's request, I think you need to tell us a lot about the building that you've used to model and then we need to decide how typical that is of buildings in assessing your calculations. Our analysis shows this is the roof flow and whatever you're doing inside the building obviously varies that. But this is, effectively, a building that has no internal load. So. It is just a family of curve fits and algorithms and so there is no hourly data per se.

MR. MCHUGH: That was extremely helpful.

MR. HOFF: I apologize too. I must not—I did not completely hear the questions. I'm sorry that I may have misled you.

MR. MCHUGH: No, no. That's quite alright. What I think I'm hearing is that you've got a tool that gives kind of an absolute minimum savings from a cool roof. And I agree with the comments that Dr. Desjarlais brought up which is there's an analysis done using a more refined tool, the hourly tool, and I'm sure the AEC would be quite happy with sharing the assumptions, the internal loads and those sorts of things. So you're looking at a simulation that has no internal loads,

which is extremely atypical for commercial buildings, a COP of 2 which is the same of an EER of 6.8, energy costs of $.006 which might be fine for looking at average costs but since we're looking at air conditioner loads, actually the TVs have—they're looking at the 15 year projection of costs. Those average costs, I believe, are $.18 and for an evaluation of air conditioning you're probably looking at costs that are maybe double that if you actually look at the TDBs for the hot times of year. This is useful but probably less useful than the initial analysis that's been done. I think we'd all welcome your review of the assumptions and a more detailed analysis. Thanks.

MR. SUYEYASU: This is Dan. I have put together a package that includes the modeling information of inputs and outputs of using the standard cost methodology with TDB. And hopefully we can share that information in the next week or so and will circulate it. And you can start reviewing that as far as what the inputs are and resulting outputs. But the TDBs are going to make an obvious impact. The numbers that I shared were 15 year numbers so.

MR. DESJARLAIS: Jon, I want to point out that the choosing of a very low COP you're increasing the energy consumption. So effectively, making that

selection makes the calculation show more energy savings for a cool roof than you would see. One thing that I'd like to point out, which I think is important, is that this model, this tool, has been compared to more experimental data than Energy Plus ever has. There's been no envelope comparison in Energy Plus to real experimental data. I think you're part of the E Plus development team, are you not?

MR. MCHUGH: I am.

MR. DESJARLAIS: Okay. Well you ask them, well we compete it to other models. Well, great. And I'm not sure that I agree 100 percent of your comment on what is a typical commercial building. I would suggest in a warehouse, a conditioned warehouse, the internal loads are probably closer to zero than the loads that were selected here. Clearly, in an office building we're substantially underestimating the loads. And you're absolutely right about TBD. We assume a flat rate of electricity costs and that's not captured in this particular tool. But I wanted to defend my tool because one, I developed it and two, I think it has been compared more rigorously than Energy Plus has. I think that that's an important feature that Energy Plus is really weak on.

MR. MCHUGH: So is your tool being compared to

some test cells that don't have any internal loads? Because you said there's no internal gains in your tool. So you've got a good comparison to something that doesn't have internal gains which, yeah, for warehouses that's probably pretty useful but of course warehouses, many of those are only semi conditioned so we wouldn't have—the main benefit of course is for air conditioning savings so we're really looking at schools and offices and retail and that sort of thing. I think it's great that there's this tool but nonetheless we have a methodology that requires sort of an hourly analysis because of the severe impact on demand costs, which are substantially higher, so I think it's great that there's tool. I just wonder if it's really going to be that useful for what we're trying to evaluate. Thanks.

MR. SHIRAKH: Reed, did you have a comment?

MR. HITCHCOCK: I appreciate the comment about pulling the package together in hopefully the next week. While we're on the topic, I just wanted to ask the question that when you and I had corresponded and you received the letter from the roofing and insulation group, you had indicated that you would extend the comment period. Originally you told us you'd do June 30th and we said we'd need data, etc. Do you have in mind what—

MR. SHIRAKH: We have July 7 on the slides. We realize that we didn't give you guys any head's up or any information up to this date so we're going to be flexible on when. We don't want to be September but sometime mid-July would be good, if you can.

MR. HITCHCOCK: It'll partially depend on when we get those data.

MR. SHIRAKH: It's also summertime, vacation and all that. But we'll work with you on that, though.

MR. HITCHCOCK: Okay. Thank you. That was all.

MR. SHIRAKH: Any other questions? Before we go, I want to go back to the roof decking solutions. I want to drive everyone's attention to the two seat panels upfront. Both of these would meet our recommendations for roof desk insulation. The one of the left, especially, because that could be used in any climate zone for any product. And that one does not have any moisture issues involved with it. Once you put that in from the outside, it actually looks like traditional roof. You just treat it from that point like you would with any other product. So you may want to stop by and take a look at these. The point is that the industry would work with us; they can be very innovative and creative in responding to these

requirements.

So with that any questions or comments related to anything that was presented today? Alright then. Thank you all for participating. I guess our next workshop is going to be on the 21st on the ACM Manual Groups.

[Meeting is adjourned at 4:00 p.m.]

REPORTER'S CERTIFICATE

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

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

IN WITNESS WHEREOF,
I have hereunto set my hand this 8th day of July, 2011.

PETER PETTY
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