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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION

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FILTERING STRATEGIES RULEMAKING AND ORDER EA-13-109

PUBLIC MEETING

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WEDNESDAY,

JUNE 18, 2014

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The meeting was convened at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, Rockville, Maryland, at 9:00 a.m., Aaron Szabo, project manager, presiding.

PRESENT:

TIM McGINTY, NRC, Director, Division of Safety Systems, NRR

AARON SZABO, NRC, NRR

PHIL AMWAY, Exelon Corporation

RAJ AULUCK, NRC, NRR

JONATHAN BARR, NRC

RANDY BUNT, Southern Nuclear

JAMES CHANG, NRC, Office of Research

ROBERT DENNIG, NRC, NRR

HOSSEIN ESMAILI, NRC, Office of Research

PATRICK FALLON, DTE Energy
ED FULLER, NRC, Office of Research
JEFF GABER, ERIN Engineering
RAO KARIPINENI, NRC, NRR
STEVEN KRAFT, Nuclear Energy Institute
DOUG TRUE, ERIN Engineering
MARTY STUTZKE, NRC, Office of Research
RANDY SULLIVAN, NRC
SHAYNE TENACE, Exelon Corporation
RICK WACHOWIAK, EPRI

C-O-N-T-E-N-T-S

P R O C E E D I N G S

9:03 a.m.

MR. McGINTY: Good Morning. Thanks to all members of the working group, the industry, the staff, the participating members of the public as well. There have been already many meetings and a lot of progress made in this area over the course of the past year or so.

We're looking forward to a productive day and a half of meetings at this point. Just yesterday at the Commission meeting for the Operating Reactor's Business Line, the Chairman inquired directly of Tara, about the fruitfulness of the exchange information that we're having with the industry in this regard.

Tara did mention that in response to our move to be more formal in some of our exchanges of information, that detailed cost information was provided back on March 30th or 31st. And we look forward to continuing to receive information with respect to the non-proprietary versions of major assumptions and plant specific information that was requested by letter by us.

This day and a half meeting of course is key to that. I understand that today that we'll be discussing the filtering strategies, rule making, focusing on the preliminary MELCOR and MAAP analyses and the event trees. And tomorrow, I believe industry will be presenting concepts, deliverables, and milestones for the phase two of the order.

So once again, I really want to thank all of the participants and look forward to a productive meeting.

MR. SZABO: Hi, this is Aaron Szabo, the Project Manager for this rule making. A couple of quick administrative things. First if you're on the line, please make sure your phone is muted. Telecommunications in the room we happen to be in today is very good. So we will pick up everything.

I also want to mention the speakers do pick up a lot, so please make sure that you omit your sidebar conversations as this might get picked up. Just so that you know, anything you might not have wanted to say to the public might end up being heard by everyone.

As Tim mentioned, this is a day and a half meeting. If you can move to the next slide Fred. The purpose of this day and a half meeting is to first we're going to discuss the detailed cost estimate information as provided by NEI on May 31st. They're going to be providing a presentation on that later this morning.

And then we're going to spend most of the day discussing the PRA event trees and accident analysis. That's going to start with a presentation by industry after the detailed cost estimate. And then we'll follow that up with the NRC presentation.

And then as Tim mentioned, tomorrow there's going to be a presentation by industry on the concept, deliverables and milestones for EA-13-109 Phase Two. And then either the end of today or the end of tomorrow's half day, depending on how we're running on time, we're just going to provide some additional thoughts on qualitative factors and where things are in relation to that. On to the next slide.

And since here's the agenda, the day one, we've mentioned that industry is going to present, we're going to have some breaks, lunch. And then I have it that -- I don't know if we're going to finish the industry presentation in the morning. We'll try to keep you guys until 2:00 today. Just that we will at least have three hours, almost three hours for the NRC presentation.

But of course, you know, I know you guys love this topic. So if you're here until 8:00 you know, while the rest of us might leave, you guys can stay and talk.

Moving on to the next slide. Just the

second day agenda, which as I mentioned is the industry presentation. And then some comments and conclusions. Next slide.

This is a Category 2 public meeting. Comments during presentation should be only on the material being presented. We do have some spots for general public comments at the end of the morning and afternoon, and kind of throughout.

Also to note, this meeting is being transcribed. I will try to mention this as much as possible. Specifically those four on the phone, please make sure to state your name clearly so that we can make sure that it's properly transcribed.

This is just some restatement of the teleconference number and the webinar information. And the actual ML number where this presentation -- the NRC presentation can be found is in ML 14168A as in apple, 251. And I'm in the midst of putting the industry presentation material into ADAMS as well. Next slide.

At this point I would just like to go around the room, state our names, and please make sure to speak into the microphone, especially for those in the audience. And then after that, I would like to go to the bridge line for people to introduce themselves.

However, I also ask the people on the telephone, please send me an email at aaron.szabo@nrc.gov just letting me know that you attend, just to make sure that I can -- the meeting summary reflects that.

So at this point, I'm going to -- we'll go around the room.

(Introduction of Participants)

MR. SZABO: If the people in room one introduce themselves. If not, you can just introduce yourselves at the time. Anyone on the phone?

(Introduction of Telephone Participants)

MR. SZABO: Great.

MR. KRAFT: Can I just make an observation. Steve Kraft.

MR. SZABO: Sure.

MR. KRAFT: The people on the phone, other than the gentleman from Certrec, are on our task force.

MR. SZABO: Okay.

MR. KRAFT: So they should be in the Category Two aspect of the meeting. I would expect they could speak up.

MR. SZABO: Okay.

MR. KRAFT: Thank you.

MR. SZABO: Sounds good. But as I said,

please send me an email. Also I would probably, likely, horribly misspell your name. So thank you for that.

On to the next slide. This is just a list of meeting summaries and other related documents. To note, there's a June 12 teleconference between ERIN Engineering and the Office of Research. We're in the midst of just developing a summary for that. We'll be just -- Research will be discussing as well as I believe.

Jeff you mentioned you'd also kind of be talking about, just mentioning what do you guys mention there as things come up. As Tim mentioned, on May 31st, NEI responded to an NRC letter earlier in May on the detailed cost estimates. There were some issues with the pdf and ADAMS accepting it. So I'm working through that to try to get it through.

MR. KRAFT: Have you sorted that out yet, or?

MR. SZABO: No.

MR. KRAFT: Now have you heard from Joseph Creed from Iowa?

MR. SZABO: I had words from.

MR. KRAFT: Okay, so that's in flight. Sounds good.

MR. SZABO: And yes, I will have that in the meeting summary, just what that ML number is for everyone. And then just moving on to slide eight. That's just, I like to have a list of everything that we've done. It's just easier for people to find.

And then slide nine is more of meetings. As you can see we've had quite a few public meetings and interactions. On to slide ten, that's just my contact information. At this time we'd like to open it up for any opening comments that anyone would like to give.

MR. KRAFT: Yes, thank you Aaron. Steven Kraft from the Nuclear Energy Institute. It is traditional in the industry to begin meetings with a safety minute. I would like to point out that Montgomery County, Maryland, just issued a heat advisory.

It is supposed to be in the mid 90s, with a 55 percent humidity, which is a prescription for not good things if you have any heart related illnesses, asthma, or if you are elderly like myself and need to take care. So please if you go outside, appropriate precautions.

We appreciate the meeting. Tim thank you for the introduction, catching us all up. We have been trying to be responsive to the data request. And we do greatly appreciate the formality. I think it helped us a lot with that.

We did send in on May 31 as Aaron noted, the cost estimate. And my sincere apologies, it was not in quite the right pdf. Who knew there were different pdf formats. Okay?

These are mysteries beyond my ken, so we are getting it into the proper format to be able to post it. Apparently there are people at NEI that fully understand how to do this. It all happens in the background. And who would have thought.

At any rate, so our first presentation this morning, which I will turn to Phil Amway to lead. Just a note about one procedural thing. And Shayne Tenace who introduced himself sitting over here, was the author of the cost estimate. So we asked him to join us today for the purpose of questions and details.

Understanding it was a -- what do I call it? An account of work that -- well the former Constellation, now Exelon, folks at Nine Mile Point were kind enough to do on behalf of the industry. And so they have the greatest knowledge of how this was done.

And then this afternoon, we will turn over to ERIN Engineering, EPRI, for the discussion. If you're research people, and as we discussed tomorrow morning. We scheduled it that way because there is the joint steering committee meeting tomorrow afternoon, and it's a matter of who's in the building at what time. It was more of scheduling of these -- of the content of the meeting.

Lastly, we note that there's a break at 2:30 in the afternoon. A few of us request that we stick to that break. Because I have to leave to take a call. Randy has to depart. Maybe others. So let's do our best to -- if we stick to one time period, let's stick to that one.

With that, any other opening remarks from the industry side? I'm seeing none. All right, Phil over to you.

MR. AMWAY: Okay. Sorry, as Fred moves the slide. They're all in the file on the desk top. I just have one more administrative thing to mention. And it's about the formality of the requests.

We did receive some concerns from OMB about Paperwork Reduction Act issues. Our attorneys are currently talking to their attorneys and trying to resolve any possible concerns. However for the sake of completeness and to ensure that there is issues, we are issuing the Paperwork Reduction Act within the FRM which should be coming out Friday.

It may not be until next week. But there will be a similar Paperwork Reduction Act type Federal

Register Notice.

MR. KRAFT: Well we are all for reducing paperwork burden, and I'm not quite sure what that entails for us. Probably nothing. That's something you have to abide by.

But we did attempt to go about collecting that data with the least burden possible on our members through a variety of different data collection methods and use of existing data. Use of the existing NRC data. So I think we have got it down to the point where it's a minimum burden on us.

MR. SZABO: I just warn people, I'm sure you guys will, if you hear something let me know, or see something coming up, just to be aware.

MR. KRAFT: Thank you.

MR. SZABO: Thank you.

MR. AMWAY: All right, I'm ready to begin. This is Phil Amway, Exelon Corporation. And what I'll be doing is going through the PowerPoint presentation for the cost estimate we've performed. The PowerPoint is based on the submittal we made on May 31st.

So on the first slide, the cost estimate, the things I'm going to cover today, the objectives of doing the cost estimate. Some of the details of the cost estimating process in terms of consideration to scope of the cost estimate and assumptions.

We want to go through some of the non-hardware items and cost estimate. You know those costs being a substantial portion of the total cost of installation.

We'll review some of the plant to plant cost variability that we considered in the estimate process. And then we will look at the cost summary which is the actual dollars and cents for each of the line items that comprise that cost estimate.

And a time for questions. I don't want to imply that you know, if you've got questions on the slides as we go through, please stop me. And we'll go through those at the time. But I just want to make sure in closing that that's an opportunity for any remaining questions.

Next slide, cost estimate objectives. The process that we used to develop the cost estimate are based on you know standard licensee processes for performing cost estimates. These are similar type cost estimates that we've already done for phase one of the ACBS order implementation.

The 049 of spent fuel core level instrumentations. Where we have a requirement or we have a desire to modify the plant, the first step in there is to come up with a conceptual cost estimate, what we call a Rev 0, which tries to identify all the known cost that would go into that modification of the plant for use in business planning purposes.

To develop this estimate, we tried to stay away from a site specific application. We're looking at this as an industry wide cost estimate. You look for input from the various representative plants that are involved in Mark I/Mark II containments. And we did receive input from about two thirds of the Mark I and Mark II plants.

And so we think we have a fairly good representative sample across the industry of what the expected cost would be. At the same time, it's a representative cost estimate, we did not try to establish a high and a low estimate. It's what we would expect the greatest majority of the plants to fall within.

It built on the cost estimate information that was already provided at the September 19, 2013 meeting. And then again on April 30, 2014, this year. And as I said this cost estimate presentation is really based on the submittal we made on May 31, 2014. Next slide please.

The cost estimating considerations. As I stated, we used our typical licensee process for doing cost estimates. And that process is based on generally accepted project management cost estimating estimates to develop the cost estimate.

It's the same process used to estimate other projects. As I noted, we had the other orders and I don't want to leave you with the thought that we do it differently for regulatory required orders verses you know, the plant decided to implement an extended power upgrade for instance. We would do the same type of Rev 0 cost estimate, looking at all the factors that feed into that total cost of a project.

Consider the current conceptual stage of the project, we did a 50 percent contingency to the total overall cost estimate. That falls within the range, if you look in the details, of the cost estimate paper we sent in. The range of accuracy is anywhere between minus 25 percent to plus 75 percent. We used 50 percent as a median based on you know, what we would really expect to find out when we did the individual line item cost estimates.

There's no contingency built into those. But as you'll see as we go through this presentation, there are numerous assumptions that we made to develop the cost estimate. And as we get into the design details and the guidance that we actually have to use to implement whatever the requirement is, we are going to have a much better understanding as we go forward what the actual costs will be.

As I stated, the baseline elements of the cost estimate do not include contingency. We wanted to make it clear in this cost estimate what we expect to be, I'll say the bare bones cost to do the modifications would be, versus what we're actually putting in in dollars for contingency.

And in closing on this slide, it is the same basis we use for other business decision making and financial planning for a four or five year budget planning process for the plant. Next slide please.

Cost estimating scope. As was requested, we had three major cost structures in here. One looked at the cost of severe accident water addition. Another one for the small filters and one for the large filters.

And what that really pairs up with is we've done several rule making analysis scenarios. We've seen it in past public meetings. We refer to those as scenarios 2 Alpha through Delta, 3 Alpha through Delta, which is the water addition analysis. And we've done them both to the RPV and to the containment.

For the small filters, that's aligned with a rule making analysis scenario 4 Alpha and 4 Bravo. And for large filters, that would be associated with rule making analysis scenarios 5 Alpha and 5 Bravo.

These are incremental cost estimates. So it does not include anything, and I'll summarize anything that we are already committed to do under either Order 13-109 or the FLEX orders, since there's some ties in here, and we'll look at for water addition, we'll go over in the next few days.

Anything we're already committed to do from other regulatory requirements are not in this estimate. It's only those costs in addition to those particular items which are Deltas from where we're at today versus where the rule making is headed, for either the water addition or filters.

That's correct. And that's a good clarification for the Order, it's 13-109, page one, the wet valve vent portion. It does include installation and commissioning costs. And the commissioning costs would include things like your initial training for the systems that are installed or modifications and also the initial procedures.

It does not include things like ongoing pre-qualification training, procedure maintenance going forward. Maintenance to the additional components that are added to the plant. And does not include decommissioning costs.

The basic reason for that is not something we typically do in a Rev 0 type budgetary estimate. And I had realized that was part of the information request. If that's something that's desired in the future, we'll have to work out the details of what that need would be, so we can you know, strategize to figure out how we would come up with an appropriate estimate to cover those particular items.

Next slide, slide six. Cost estimating assumptions. Modifications to a single water addition source accessible for a severe accident conditions. And what we're looking at there is you know, mechanical modifications to those systems.

We all have injection points to the RPV that we're looking at putting in for Order 49. Some of those existing systems would require entry into the reactor building to make hose connections, et cetera. Those connections may or may not be accessible during severe accident conditions, so that's one of the things we would be looking at, is what would it take to make that injection point accessible during severe accident conditions.

So that's the first two bullets there. If we went down, the load of the filter installation, we assume that filter would be installed at grade level as opposed to having to excavate and put the filter underground or conversely having to elevate the filter. There are some plants that have minimal available space to actually be able to put a filter and may have to consider an elevated filter above something else. For this estimate we had estimated it would accepted to put at grade level.

For the small filter and these details for the small/large filters are based on some preliminary discussions with vendors that can provide a filter. The small being a seven foot diameter, 20 foot height, 20 tons total just for the filter. And for the large filter, it's 15 feet in diameter, 30 feet in height and 60 tons.

We would expect to have to provide some concrete shielding around the filter itself. And we assumed a three foot height density concrete shielding structure to enclose the actual filter.

We assume that the qualification requirements for the filter portion of the system would meet the same requirements as Order 13-109. We also assumed that the filter would have to include an inerting system for hydrogen control. And that we would have to put a bypass around the filter to support anticipatory venting.

The reason for that is the filter, any filter we would put in would create some back pressure on the vent system, which would interfere with the pre-core damage flex scenarios where we'd want to use RCIC and maintain the containment type material below the point which RCIC would be expected to run.

We also assumed that the filter would have to include a make up system where the K heat was. And the inventory that's lost in the filter would have to be able to provide a makeup source for that.

On the next slide, continuing this cost estimate assumptions. We assume that it includes valve position, effluent pressure, water level in the filter and additional radiation monitoring instruments.

In the next slide, in the filter make up pump, that is different than what we would use for the water addition strategies. This would be specifically for being able to make up to the filter to make up for inventory loss in the water contained in the filter.

What the cost estimate does not include in the assumptions, is the separate local control building just for the filter controls. Containment parameter instrumentation, we're assuming that the existing containment perimeter instrumentation would be acceptable for the purposes of the filter.

Any portable generators, we did not include costs for those items. Or for portable pumps for water addition. And I have a parenthetical, the RPV and containment, that is a different pump from what I noted for the filter make up pump. We also did not include any cost estimate for any e-tracing that may be required for northern climates.

The next slide is not hardware items included in the cost estimate. That includes project management and oversight of the project controls. Installation support, engineering, installation equipment.

And what I'm talking about there is any heavy equipment needed for excavation cranes, lifting and ranking equipment, typically we would rent for this type of installation. Scaffold and labor, tools and consumables, laser scanning to confirm pipe routing, and the contingency costs. Well, contingency on the overall costs. Not just on these items.

Next slide, Plant to plant cost variability. Just to recap the cost estimate is based on the most likely installation details, based on the input we received from like I said, about two thirds of the impacted plants.

The range of cost certainly vary from plant to plant. Some of those examples, you know I talked about the footprint that the actual filter shield building would take up. Some plants may be able to put that relatively close to the reactor building.

Other plants are not going to have that option. They're going to have to locate that at a potentially significant distance aware from the reactor building, which is going to impact their costs, particularly in terms of total length of piping they need. Number of fittings and valves in the system. Pipe support, and the additional engineering that would go along with those longer piping runs.

For the particular shield building that we select used to house the external filter, there's some variability in terms of the seismic design requirements for that structure and the wind missile protection. And it's important to put in there the wind missile protection.

One of the things that we're finding out for like the FLEX storage buildings, not the same, but a similar concept, concrete constructed building. It's the wind loading and the wind generated missile loads that tend to define the thickness requirements of the concrete and the structural requirements for that type of structure, that tend to drive the costs.

The design of the HCVS system being installed is per the Order 13-109. And what I mean there is the routing of the piping to meet the order and to get to the required release point for the HCVS system, may not be the same as if you had to put a filter in the system, may require a different piping routing.

Okay, so all the stations right now are looking at installing their HCVS systems to meet the requirements in the Order. And obviously they're going to do that in the most efficient manner possible to get those pipe route. So that may be impacted if a filter is added at a later date.

And the design of the water and electrical infrastructure being used are installed per NRC Order 12-49. You know for plants that are close to a reactor building that exit the length of additional hard pipe needed, might be shorter then another plant. So there's definitely some variability there.

As well as the electrical infrastructure. Most plants will be using portable generating equipment that's located away from the HCVS piping and may not be you know, much of a concern from the radiological aspects. Other plants may be closer and would have to look to modify that connection point.

The next slide is the cost summary. And this is cut and paste directly out of the submittal that was made on the 30th. But then this shows for all those different line items that I went through on the previous slides, what the dollar values are associated with that.

And if you see the bottom line here, the total with 50 percent contingency added, that is what we are recommending as input into the cost estimate. It's what we would include for what we would expect the cost to be for installation of either the severe accident water injection, water addition, the small filter with the makeup, and the large filter with the make up.

Both the small and large filters include the costs for the water addition, because right now our analysis is showing to make the filters a successful, possible successful outcome, you would still need a water addition source. So we have included that as a separate cost. But you can see the line item in there is severe accident capable injection. And the cost associated with those.

MR. KRAFT: Before you go to questions, a couple of observations. We were asked in the previous discussions about stand alone filter. Okay. You can take the injection costs and simply deduct it.

It's not exactly one for one because there are certain engineering costs, higher/lower portions. You think within the size of the estimate and with the contingency, that you're good enough on that one. And I don't think it's worth anyone's time to try to refine a separate stand alone filter estimate. It would be within the ballpark and you're fine.

Secondly, I want to bring to your attention on filter -- the line item filter vendor where we have you know, in the far right column at $13 million figure. Recall the ACRS meeting where we talked about SECY-12-0157 when it was in draft review at HRS. But we questioned the use of the $15 million number that you had and there were these other costs that were missing.

And I recall that I made a statement from the floor to the ACRS along those lines. And this is the demonstration of that. I asked Shayne to purposefully call out the filter by itself, that $13 is equivalent to the $15, within you know, the ballpark that I was thinking.

These are the other costs that I meant. And no disregard, no disrespect for our vendors. They can't know these internal costs. They try, they talk to the prospective client, they try to understand. But at the end of the day, it's the utility that understands their own costs.

For example, and it's not included in here, it's all part of the variability, is if some plant in order to comply with the filter requirement, if there ever was one, might say I can keep it in the building. Or I have to move things around.

Or I can put it in a separate building outside, or I don't have room for that. Those are cost members just as much as they try to understand the walk down.

So I just wanted to point out that was -- this is the embodiment of that comment. And the reason that we knew that the $15 million, we had not done these estimates, but experience, we are very experienced in the industry of looking at estimates and saying okay, what does it turn into our cost.

And so if your gut feel told us it was a lot higher number. And it was -- there was a reference in the final SECY to, the exact number was like $45 million. It was at least noted that it was there. And I just wanted to go ahead and point that.

MR. AMWAY: Right, and to Steve's point, there on the water additions costs being included in the small/large filters. You'll see we didn't take the total cost estimate you know, if it was a stand alone item, and transition that directly into the small or large filters.

Because we do acknowledge that there would be some economies of scale in terms of the engineering and the project management of doing those things concurrently that would reduce the cost. So you'll see that you know, that's why they're different there in each of those items.

MR. KRAFT: That would be cost measures.

MR. AMWAY: Yep.

MR. SZABO: So just to dig in a little bit, this is Aaron Szabo. So that filters came from the vendor? Those numbers?

MR. TENACE: There were multiple vendors that were polled. And there was a range. It's actually in the document that was submitted, there's as footnote. There was a range of values provided to different vendors, between $10 and $15 million.

And so that's why $13 was selected. Not knowing which vendor would be selected and vetted to the process in terms of you know, again one vendor versus the another.

MR. SZABO: Right.

MR. TENACE: And those were arranged

similar as there was for --

MR. KRAFT: Right. That was Shayne Tenace by the way. And also not knowing in an individual case, as we pointed out in our letter, this is a generic estimate that binds no particular utility. So faced with the need to comply with the requirement if there ever was one, then the utility begins doing its own preliminary designs. And produces a request for proposal.

What might be in that varies from utility to utility. There are different philosophies as to how you can administer to the location. Or there are different ways you do radiation protection. And those things result in different requirements for vendors that would vary from utility to utility.

There are large fleets of standards. And each fleet has its own. It's all within the ballpark of what they may be shade one way or another. But Shayne tried to kind of level all that out by doing it the way he did.

MR. SZABO: Understanding this is an order of magnitude estimate, and based on what you kind of provided us, minus 25 plus 75 rate, why are you recommending that we go with the 50 percent contingency as our mean instead of using the actual number and then putting a low and a high on the minus/plus -- well and understanding that the 50 percent is industry practice, but?

MR. TENACE: Well I can use that. The last 25 -- again Shayne Tenace. The last 25 plus 75 is the range of uncertainties that you'd see from say the American Association of Cost Engineering. I've been doing major projects for a number of years. And I've seen precisely one project out of a hundred that's ever been less than the phase zero estimate.

Where I've seen many that were in the 50 to even 100 percent based upon the unknown unknowns. So that's really the recommendation. And that's where you know, typically is I would go from a phase zero to a phase one. And I'd take that 50 percent, and identify specific risk items, you know and apply contingency for that.

But based upon you know, the experience base, and what we've done in the industry, that's where we ended up with the recommendation for 50 percent.

MR. FULLER: This is Ed Fuller from the Office of Research. Your slide six, you mentioned as one of the assumptions, a three foot high density concrete shielding. Is that around the building where the filter is? Or does it also include piping that goes between the containment and the building?

MR. TENACE: The three foot thick -- again Shayne Tenace. The three foot thick shielding is around the filter building. Part of the assumption relative to the piping, and this is one of the unknowns, that I didn't have a good feel for, for the routing.

The assumption was that we may be able to route the piping in a way that either blocks behind the building from where it exits the reactor building. Or we may be able to have a beneficial you know, shielding just from the shield you know, from the filter building itself. So --

MR. FULLER: Yes, but shielding to protect people that might be in the yard.

MR. TENACE: It's again, you know depending upon the location, if you look at the, well actually since you don't have the 11 page document that I was provided. You'd see that the piping length of say for a small filter was 210 feet of pipe. That would assume that filter was located pretty close to next to the reactor building.

So the assumption was that you could do it a breach right near there to where again, you wouldn't be exposing the piping, because you'd be using the nuclear reactor building, or the filter building as a shield in between folks in the yard. Again, that's one of those things that would tend to drive cost up. And --

MR. FULLER: Well let me just explain why I'm concerned. I'm not just concerned about what would be going on during the accident. I'm concerned about what you would do in the long term after you established your safe, stable state. And when and how you protect and/or dispose of the fission product inventory invaded into the filter building.

For example, would you want to try to pump it back into the containment? Or would you want to come in and remove it somehow, or decontaminate to the extent you can and then remove it?

In any case, you need to protect the workers from high dose radiation.

MR. KRAFT: No question, Ed. The few designs that I've seen, some have a drain that goes back into the suppression pool, for that purpose. Which doesn't mean that you under up with an uncontaminated filter. But you get a lot of it to move back.

Some of it has to be cleared out within every 24 hours. I mean there's all -- vendors will tell you different things from their designs.

I think what you're asking about is first covered in the contingency. Because there are things we don't know about. And also carbon variability because it varies from plant to plant to plant to plant to plant.

And lastly, a lot of what you're asking about is recovery.

MR. FULLER: Yes, exactly.

MR. KRAFT: Right, well these -- all the post-Fukushima work we're familiar with, does not include the carbon reactions. Carbon will come if we have to. Because you don't know what you're going to face.

MR. FULLER: But I'm just suggesting maybe you want to plan ahead with these consignment systems.

MR. KRAFT: Well I'm sure we will. I'm sure we absolutely will. But that doesn't --

MR. FULLER: And by the way, you might ask people who work at the Ric -- in Hanford, pumping radioactive sludge is not exactly an easy job.

MR. KRAFT: Well, it's one of the reasons we don't want to move it out of containment in the first place, Ed. I mean understand, you've got one. You know what you've got.

MR. FULLER: Okay. Absolutely.

MR. KRAFT: Okay, so let's bend that topic into design criteria if we ever have to come up with guidance for a filter. That's the best place to put it with the recognition that it will increase costs.

So in a cost estimates, you guys want to put an entry in for that, we're fine.

MR. SZABO: So I guess going back to like SECY-12-0157, the basis for our estimate for generally from European design costs you know, costs we were provided, and basically kind of inflating them, very generically with the CPI understanding that's not. I guess if you can get into some explanation as to why that would -- why we're still talking about a factor of two difference you know.

I mean understanding this is an order of magnitude estimate. And you know.

MR. TENACE: Sure and on the things -- again, this is Shayne Tenace. One of the things we looked at, we looked at the Swedish design, and there was a range of costs from 1988, where it was between $9 and $13 million. And I decided to look just at escalation. I actually came up with numbers between $31 and $44 million.

Another difference is, as you know, as we've progressed through the years, our standards in the industry in a number of ways has gone up. As that has occurred, it makes it -- it's a lot harder to get the quality force and to get the work done.

I mean even in the last 20 years I've seen that progression. And this is significant impact on installation costs.

And one of the other things I'd noticed, and there was some deviation as I looked and compared the Swedish design and say the Liebstadt design, is the location of the buildings and where you make a little bit to install. I'm not familiar with that -- with everyone, but one of the key inputs that I asked the Science Board, was their location and how close they could get.

And looking at the building locations and then also looking at the potential impact on the foundations, there is one of the European plants that have any -- didn't have any shielding. I don't remember. The Swedish design had a building. The Liebstadt design I believe, they talked them into two buildings.

Certainly under today's standards, I couldn't see that being acceptable. So looking at a combination of those things, you know obviously escalation, increased costs and design features, that's where I see the order too.

MR. SZABO: All right, so this I'm trying to visualize, this -- the assumptions is that -- the assumption for this would be that the filter is next to the building?

MR. TENACE: That's cor -- well, for the -- for example the small filter, and it will help once you, I don't know if you've been in to look at the informal document, but once it's close to that is there's three pages where the assumptions from where they're at.

But also material quantities, it shows what the number of values slack was, which gives you insight into it in the range. But for this cost, it's kind of close and next to the building.

MR. SZABO: And I guess one of the comments we got from the Europeans was whether an additional penetration point would be necessary. Is one of your -- into the containment. They said that the one that we looked at, they did not need it, and they actually said had we have needed to add an additional penetration, it would have skyrocketed costs.

And so I was wondering in your assumptions, are you guys assuming that? Or are you guys assuming that you have existing -- an existing unused penetration for it?

MR. TENACE: Unused penetration.

MR. KRAFT: Well you have the vent line, in Mark I the vent lines are already there. So that penetration. The one penetration you'd have to find or make, and I agree with you, you walk through what's required to penetrate the containment, it's remarkable what you have to do.

The question Ed raised though, I talked about the one design I saw that had flow back into it, you'd need a penetration for that. So you're right Aaron.

The other thing I would just observe, and I'm certainly no expert in international finance, but you're talking to utilities in Europe who are financed entirely differently. They're largely owned by governments, even though it doesn't quite look that way sometimes.

They have a -- you know it's possible that they do estimating on somewhat different basis because their accounting systems can be different. I really don't know.

But I agree with Shayne, I recall when the group from NRC staff that did the research in Europe. They went to Europe and looked around, I don't know what you'd want to call that. They made a public presentation, the number I recall was like $50 million in 1988 dollars.

Well it's a simple matter of applying an escalation formula to get your ballpark. And you hit $44 million. So I think from that standpoint, I was comfortable in thinking well it can't be that far off these days. And not to mention all the factors that Shayne just raised.

MR. KARIPINENI: This is Rao. Shayne did you make any attempt to contact any Canadian installations for more recent?

MR. TENACE: No, I ran out of time. I had planned to, but I did not get an opportunity.

MR. KARIPINENI: That would be more representative of what's happening. At least in North America, if we had some numbers from them too.

MR. KRAFT: Well yes and no Rao, I mean their containment systems are completely different.

MR. KARIPINENI: You want to just make an effort to look at. You're looking at 1988 and estimating versus looking at two years back and then escalate that and see what happens is what I mean.

MR. TENACE: Well, I can tell you that I did talk with some folks from TEPCO. And looking at their conceptual designs, and they were -- now obviously that's in Japan where you know, costs are higher at the construction rate. They were mentioning $100 million per train there. Now that includes you know, their vent system and the exhaust system.

You're talking a $100 million per train versus $50, I think it goes a little higher. I tried not -- I created a you know, a bottoms up first, and then did a sandy check comparison as opposed to trying to fit a model.

MR. BUNT: Randy Bunt, those figures here that's not in this estimate, is -- this would be a capital addition for many plants. And a capital addition will carry overhead. It will carry cost of money. All those things would make this number even higher.

And again, as was mentioned, the 50 percent goes to what Dr. Fuller was talking about, and the difference in penetrations. All that is unknowns that are the variabilities.

That's -- at our site we -- at our plants we use a 50 percent in our conceptual design estimates. And then reduce it down to like a 35 percent contingency and walk it down as we get closer to the finalized design process.

And typically, the number continues to keep going up, even though you're dropping the contingency number. That's the way our nuclear projects typically run.

MR. AMWAY: Yes, that's -- they eventually come down to it.

MR. KRAFT: This was explained in our letter where we describe how the utilities use this kind of estimate for exact use comparison. Every major corporation, and I hope small ones, maintain strategic risk profiles. Not an NRC requirement, but it's something that they do obviously at the corporate level. And you know, the fact that there might be a filter requirement is a strategic risk for those plants. And they are carrying something on their risk profiles. And this is the kind of estimate they would look at for doing that. So that's what we were comfortable in thinking. This is the sort of estimate that would be comparable to the -- what would be used.

MR. SZABO: And before I go on to some of -- to some cost questions I have, I just want to touch on that a little, the decommissioning costs. We are going to put, because we understand it's a non-zero number. So we are required to assign something to it.

Of course we'll be talking with our technical staff in relation to what kind of -- once again, at the regulatory basis stage, if we decide to even -- well even the water injection, or any of the requirements, what type of maintenance or course incremental maintenance there would be.

Understanding that might be rather minimal like especially for like an external water injection point. Considering you know, the inspections might be while we already have the inspectors doing everything else, so it might just be a couple more hours of inspection. You know, that understanding that.

And then the decommissioning costs, understanding that if you don't use this --

MR. KRAFT: Decommissioning costs are handled as I've learned, different ways. Everyone has to have a decommissioning estimate, if for no other reason I mean it goes into your risk profile. But if for no other reason to meet decommissioning role.

And what typically has happened and those estimates were done, and then you create percentage adder. And every time you do a capital addition, you don't separately estimate decommissioning that addition. You take a factor based upon your gross estimate and just kind of add it on.

Some companies embed that in these costs. Some companies add them on. You know the accounting books in the end, it's buried.

So what I think we can do here is make a commitment to you to say okay, we'll give you a percentage that you could use Randy to come up with something for me.

MR. BUNT: Yes. I mean we've got -- this is Randy Bunt. We've got one that we use that encompasses all of the accounting dollars, the cost of money, the overhead, the decommissioning, all those features when we put into our accounting system once we get the engineering estimate.

So the engineering estimate would be the $54 million. Then you put into the accounting system and it would put it in which years are you projecting. And then based on what the estimate is for escalation, for overheads, for all the things embed in there.

The one thing that we don't do even in that process though, is we don't put in post-use decommissioning for this type of system. Now for a normal system it would be post-use. For a system that's going to be running and operating.

But for this one, we don't -- we would never put anything in assuming that this was a contaminated used filter from a severe accident standpoint. So that's -- we don't have that cost anywhere in our system or any estimate on how to do that piece.

MR. SZABO: Yes, I was -- I've done some initial thinking about that also. My previous position here was heavily involved in decommissioning funding. I'm trying to think about how to best go through that. About what type of levels of radiation we would have post use. And whether there's some sort of -- we have waste burial numbers.

I'm trying to think of some -- a way to quantify, understanding it's a non-zero number.

MR. BUNT: On an application there, is we have done chemical decoms. All the BWRs have done that. It would be much more complicated than that. But at least we give a baseline to start from. Some of the decom costs. Especially early on.

And we could share some of that experience from chemical decoms. Of the research piping or those type things over the years, as to what the costs would. Spent fuel pool clean ups and all. And it's not going to be a one for one, but at least give some basis on where that number can be.

MR. SZABO: Do you guys help with standards you're cleaning up?

MR. BUNT: Correct.

MR. KRAFT: Well the disposal standard is different than standard from continuing to operate the plant where you want to go to cleaner levels for the sake of radiation control in the plant. So those are all good first order kind of estimates.

It would be interesting to see what kind of number you come up with to compare to the magnitude of this number because that would tell you how important it is.

MR. SZABO: Yes. It might be negligible. It you know, like I said I think O&M off the top of my head, is probably negligible. But you know, it's still a cost, so we would at least would.

MR. KRAFT: Well a lot of that depends on what requirements NRC, if you have a filter, what are the requirements? Is there stuff in the maintenance rule for example?

MR. SZABO: Well that's what I'm saying. It's I've built that into the assumptions that I'm making within the cost estimate. And we would discuss that as to whether those costs. And I have discussed that with my group as to whether those are legitimate where of course only at the req basis stage, without having all the guidance and rule, or anything like that, where we'd be.

MR. KRAFT: And right now we don't see the filter based on the technology that I'm aware of. And

I mean other people that there's any exotic type product in there that's going to be extremely exorbitant and has to be replaced at a short lift time period.

There are things that have to be replaced and replenished. But chemicals and all -- but they're not like palladium percentages and another element like some of the zinc injection type stuff for noble kin that are extremely expensive that we know of today.

Not that technology's not going to change in the next few years. That that becomes the most beneficial product. And then that may become a factor, but we don't anticipate that at this time.

MR. SZABO: Good. We'll get down to this cost question. And this came up, like I think I want to say with your original cost estimates that were provided. Which had a I once again, going off the top of my head, like for instance the external water injection into the RPV.

I think you said there was as low a basically a zero cost for some because they had already done it as part of FLEX.

MR. KRAFT: Well I don't want to --

MR. SZABO: I think not zero, but there you know, much less than for instance the $3.7 million here. And I guess I didn't know if that was -- my other question was is that an outlier? Or is that a hey, we surveyed two-thirds of them, half of them have this, you know, just trying getting into that.

Especially in the difference between a requirement to go into water injection of the RPV versus water injection to the drywell, whether there is a you know, if there is some -- you know if it's some -- and it also shows for beneficial load at a drywell.

However the cost is zero for almost everybody for the RPV, and the benefit isn't that much. You know that might change it.

MR. AMWAY: Well one of the nice things is it's -- I mean our analysis is showing that RPV injection is marginally preferable to the containment. But the you know, as far as water addition that we did under Order 49, is the RPV. I mean there's P5B that says you have to have a containment injection point, but the dots in between there and where we want to go is bigger then it is from Order 49 with RPV infections and where we want to go.

MR. BUNT: And we haven't done a survey yet. But based on conversations an involvement with the industry, I would say anyone that would have a zero or a negligible cost, would be an extreme outlier.

MR. SZABO: Yes.

MR. BUNT: Most people will have to do something because the assumption is that you have time availability under FLEX to be able to do multiple actions. They're not prioritized in a critical nature that they're done as fast as you can get them done, that would eliminate more operator actions.

Whereas this would be more -- if that was the case, then this would be a more negligible cost. But right now, most of the FLEX actions or most of the FLEX connection points are after you've used installed equipment for a period of time, such as batteries, such as RCIC, et cetera. And those give you a time line to be able to do and to have more personnel available to do actions.

So FLEX was not geared or set up to be as hard piped that a zero cost would drive you to.

MR. SZABO: And I guess my other question would be, this is coming from something I heard second hand of one plant, and this was pre-piping for if a filter is going to be built, basically they decided that in fulfilling EA-13-109, they were going to pre-pipe just in case -- you know, just as a -- for the regulatory risk. I guess they did their analysis and said look, let's have it pre-piped just in case.

Is that -- is that once again, the one plant that I heard of, is that an outlier?

MR. BUNT: What I've heard is that one plant, if it's the same plant I heard about, turned away from that idea now. I want to say down to the cost of everything else.

MR. SZABO: Oh, okay.

MR. BUNT: It was again, when they were doing these type of cost estimating, they were laying out all the different options available to them. And then looking at the nominal $100 piece of pipe, was not going to be $100 addition by the time you added all the other inherent cost in it.

And when you went and looked at the benefit and the cost to it, is in the unknowns, unknown about what that connection would be, it was decided that they weren't going to do it that way. I know of no one that's doing that currently. Not to say there aren't any. But I don't know of any. I don't, know -- Shayne?

MR. TENACE: I don't know of anybody. If you looked at again, the assumption would be of it's happening outside of the reactor building. I did not find anybody that committed to doing that under the FLEX order.

But one was where there was a significant range. And certainly when presented the initial $2.5, you know, based on before contingency, you know there was some give and where others said we're pretty adamant that that number should be larger, shows that the plan based upon some of the plants it could be less.

I think the $2.5 before contingency, the $2.7 represents a median value for the majority. You know again, as Phil said, not expected to be the lowest nor the highest. But there would be more than that in the estimates.

MR. SZABO: Could you speak into your microphone.

MR. FALLON: Yes, Pat Fallon from DTE. We might be the outlier. But we wire hard piping from outside the building to inside the building to RHR. But it doesn't relieve us, operator actions on the first floor reactor building.

So we still have actions, no matter what. And there's just -- I can't think of any way that you could have somebody go outside your secondary containment and not have valve protection inside, protect the secondary containment and function that you have to have. And you're going to have to send people down into the reactor building to operate those.

So there is no escape for anybody from the severe accident aspects of operation.

MR. BUNT: I think what was said was when we get to a severe accident condition, that the intent is to design, if we have to design a system to not require heroic actions. But it's going to be an uncomfortable day. People are going to pick up those. People are going to be hot and sweaty. They're going to be in places that you'd rather them not be, under conditions they'd rather not be in.

But the intent is that we don't want them to be in heroic activity that they have to do. But it's not going to be a good day.

MR. SZABO: Okay, and thank you for all of this. By the way, I wanted to thank you for the submittal. It was very detailed.

My last question is actually on, my test question was what was the cost for modifying guidance, if we were to put a filter in. This doesn't need to be necessarily addressed today, but let's get somebody that we consider when we're doing our analysis.

And I know you mentioned onsite training. But is, from my understanding, is part of that as well as guidance. I don't know if the guidance change is just on site, or is it also at --

MR. TENACE: It was not at the BWR street level. It was at the site and so --

MR. KRAFT: So you're asking about like if you had a requirement, how would we modify, for better or worse, NEI 13M2, and the comparable ownership documents. Now you would be on these, and if you wanted a cost estimate.

I have no idea how to cost that. I don't know what the hourly rates are, I mean how do we come up with that estimate?

MR. BUNT: We did not include in here, the cost for REV 10 and APG stag cost for if you're running for your type activity to go forward. Type activity here. We did not include those institutional costs. EPRI to run another set of analysis, because this is now possibly something else that you want to include in a basis document.

Those type of industrial or institutional cost across the fleet have not been tried to be incorporated in here. This is strictly to incorporate what has been provided.

MR. SZABO: So I guess my question is for the training then, or the guidance development and training. Is the assumption that there would be a base document -- so you know, from my understanding is you know, you take the ownership document and they do apply it --

MR. TENACE: You'd modify it for a static change that we'd then forward. And I would expect for something like this, that ties into severe action water addition and management more than the filter. The filter itself I think can be a site specific or a guidance change.

MR. BUNT: Right, but there's a Rev. --

MR. TENACE: There would be an industrial level document.

MR. BUNT: There's going to be an industry level document that will address it and how to bring it in, how to incorporate it in. I would envision that type of topic is I would say is not included in here. But it would be included in how that got changed at the plant site.

This number is nowhere near the number that it would be if you included the hours that the people are going to spend training. This is the development of the training. And the giving of the training. This is not all the crews going through the training to be qualified. This would be incremental and to supplement something else.

So it wouldn't be considered an incremental cost. Because we would offset something else in their training. But there is real cost associated with that. But there's something else that didn't get training in that cycle because we're not going to train them how to operate a filter or how to run a filter. We're going to train mechanics on how to do the works code, the INC techs.

That is not included in that 175 number that's up there for procedures and training. That's really the development and the cost of the training people, to give the training and to establish it. Not for the people to attend the training.

MR. FALLON: It'll be on the cost anyway, and it's something you're going to be doing on a continuing basis. An operations expense.

MR. SZABO: Yes, I was looking more the you know, as a part of the implementation cost. I mean we might consider that. You can even theoretically call that break guide development if you really want to. In relation to the well it might not be your industry wide you know, your new owners group doc -- you could just say that it might not be that for the reg guide, but some, you know, I'm trying to insure that we're just -- or if we're not making sure that, I'm just characterizing that problem.

MR. BUNT: That's not in here. Yes, that

would be above and beyond what's in here.

MR. SZABO: Excellent, thank you. Fred Schofer looks like he had some questions.

MR. SCHOFER: This is Fred Schofer. I have a couple of questions just on the project duration for each of these alternatives. That we expect what, a one to three year time frame to implement these?

MR. TENACE: The assumption is that the severe action water addition was approximately one cycle, 18 months. Whereas both the small and large filter were three year duration.

MR. SCHOFER: Okay. And would these require outages to implement?

MR. TENACE: I do not believe that would require -- well the severe action water addition, you may have to tie in during an outage. I don't believe based upon the guidance that we're having for an event, the availability and duration for the final tie in's I don't think that you would need an outage for the filters.

MR. SCHOFER: And would the sever action cable injection, which would require the outage, would you expect that an outage would have to be extended because of it? Or would it be able to be performed within you know, the standard is 15, 20 day time frame?

MR. TENACE: I would probably get back to you on the information on that, since the tie in to the next outage is part of our FLEX going into the RHR system. And our windows in an outage for RHR are probably like 10 days or less, for developing a time line to do that at DTE were our time is --

MR. BUNT: This is Randy Bunt. Typically for our sites, if you're going to do this as a fast track project where you want to do it in one cycle, it probably is going to impact your outage duration.

If you're going to do this as a five year window where you've got time to plan it and you can move other work around and find the right window to put it in, then I would say this type of tie in typically would not impact your outage, or drive your outage plan. Just in general terms.

So if we're going to try to do this in a really quick, fast track method, then I'd say it probably is going to impact it, especially because you're looking at the duel trains, type of functionality. And trying to find the right window to do those tie in's and to do those functional testing.

And it's probably a 50/50 chance on whether the large filter would require an outage depending on what your post-maintenance functional tests would be, and where you had your tie ins. We would try very hard not to make it an outage activity like Shayne mentioned.

But then again, it could end up being that's the best place from both industrial and inter-safety to do that. To get a functional designation.

MR. AMWAY: And I'll just add to that, typically the way we structure our outages is you know, you have divisional maintenance windows. And one outage will have a major window for DIV 1. And then the next outage you would rotate that, and your major divisional window would be DIV 2.

So you know, like Randy said, if it's fast track and you need to go in DIV 2, but it's not DIV 2's turn, that's where you might look at having to extend the outage for it. But if it was a you know, multi outage type situation, then you would put the actual modifications that require outage during that Division's major work scope. That's the way you should manage that.

MR. SCHOFER: And I imagine that I should assume that it wasn't included in the cost estimate either? That would be another adder.

MR. AMWAY: Now it was assumed that there would no outage extension due to this work activity. Because that's been another line item we would have added. Because it would have been a significant player in the numbers.

MR. SZABO: Does anyone else have any questions? Well, why don't we take a -- just a 15 minute break, come back at 25.

MR. AMWAY: Aaron, just before we go on break, just in closing, it looks like we've taken an action for the industry to provide a percentage of decommissioning cost. And that's the only action that I can take out of here. Is there any --

MR. SZABO: The only -- just, that would be for both non-use and use. And I know use would be based on some chemical --

MR. AMWAY: We'll have to put our heads together on that use.

MR. SZABO: Yes.

MR. BUNT: And give you -- we'll definitely give you the one for non-use decommissioning. Because that's pretty straight forward. And we may want to prefer to have a phone call or something with you to talk about brain storming. Where would we go get the information and what type of information would you rather see. As opposed to just giving you a rock, and it not being anywhere close to what you need.

MR. SZABO: I don't -- yes. I don't see

that being a huge cost issue.

MR. FALLON: But Aaron, you did want us to capture the full O&M cost of designs, right?

MR. SZABO: Yes, that would be the other thing, is the O&M costs.

MR. FALLON: That would include any training, --

MR. SZABO: Yes.

MR. FALLON: Examples, any other stuff.

MR. SZABO: As well as when it kind of when it would occur. So if you're talking about immediate training, immediate you know, like years, because we have to discount how -- just because we are required to discount back when the training would occur. Or any O&M costs would occur is helpful.

Which is also why the decommissioning cost is kind of a huge thing, since that gets shot 40 years or to --

MR. BUNT: 20 to 40, depending on the plan.

MR. SZABO: Yes, so. All right, so yes, let's -- let's just make it 10:30 now. And if you're a guest and need any escorts, please find someone with a badge.

(Whereupon, the above-entitled matter went off the record at 10:12 a.m. and resumed at 10:28 a.m.)

MR. SZABO: All right, so now we'll begin the industry presentation. Just make sure to introduce yourself before you start.

MR. KRAFT: So before we do Jeff and Rick. Jeff Gaber from ERIN and Rick Wachowiak from EPRI and Doug True from ERIN, we'll largely view this presentation. I think the rest of us might have some comments.

We went over them yesterday. We tried not to set the world record for number of slides in a deck. We'll leave that to -- but one thing that -- one thing I think you'll see here, there's some innovative ways to present the data that I thought were quite interesting.

We're not finished meeting Aaron, but I would like to engage across the table at some point, perhaps maybe later in the summer, maybe the meeting in September, on how do we get to the end? What steps are being taken? And the reason for that is we want to identify where the gaps are and then how we can help provide info for those gaps.

That's what I'm not seeing a big enough -- a complete enough picture, right. And I'm not asking for it now. I'm just think at some point, maybe it's education on my part as to how these processes go. So

I just put that out there for your consideration.

MR. SZABO: All right, sounds good. All right.

MR. KRAFT: Okay, over to you guys.

MR. WACHOWIAK: Okay, this is Rick WACHOWIAK from EPRI. We're going to go through the status of where we are on our analysis at this point in time. Doug's going to present probably most of what's in the package.

Just want to make sure that when we get to the results, everybody realizes that these are preliminary results. We're still tweaking our input and making things more consistent.

So we don't expect big changes to what we have here. But there may be some small changes in the final output. And it certainly will be more complete because we only have a couple of the alternatives to present in detail today.

So with that, Doug?

MR. TRUE: Okay. Yes, this slide actually Jeff Gaber actually presented in the last meeting. Just to remind everybody that everything sort of started with SECY-12-0157, went to add FLEX credit in it, and we're trying to do our best to align with our assumptions of yours. And as we see places where we've got some differences, we're trying to bring back information to make sure that we get aligned.

And one I want to talk about one particular subject there too, the -- we're trying to make sure that we've done an explicit analysis of all the scenarios. In the analysis I'm going to go through kind of how we set that up to be able to do it.

And then we're looking not just at risk numbers, and outside consequences, but also events in depth considerations. Ultimately, the EPRI work is going to lead into industry work on cost benefit analysis. The EPRI work is going to stop short of actually doing the cost benefit analysis. Just focus on the -- basically the benefit side of the analysis.

But we're trying to do this in a manner that investigates not only our base case set of assumptions, but also sensitive in our assumptions from phenomenological, probabilistic as well as plant to plant variability.

So this is a very ambitious project. We started thinking about what our ultimate product looks like. And this is going to be a monster of a report.

MR. KRAFT: Doug, could I interject. Doug mentioned where the EPRI work is largely likely going to end. We have to talk internally about NEI then picking up the results of the EPRI work. And preparing a short cost benefit analysis. There's a line between regulatory and R&D work, and that's where the line is.

I don't expect that to challenge in some to the EPRI document obviously. But it's not like we're not going to plan on giving your our thoughts on that It's that where the EPRI work ends and where the NEI work begins, and you know, because we've got three organizations involved. We're got EPRI, the owners group and then NEI.

And we have our swim lanes and we try to stay in them. Just so you know.

MR. TRUE: So we've got the owners group doing the cost information, which changes present, talk to you about and Phil. EPRI doing the reaction analysis and the benefit analysis. And that comes together, then NEI combines it.

MR. SZABO: Sorry, I don't want to interrupt too much. Are you -- does anybody not know the answer yet? Is NEI planning to any non-quantified analysis within their cost benefit analysis? Or is it going to be purely just a quantitative analysis?

MR. KRAFT: I don't think we've gotten to that point yet.

MR. SZABO: Oh, that's fine.

MR. KRAFT: No, no, no. You're raising an excellent point. But I happen to have about the use of qualitative factors, we'll have to do some thinking about that.

MR. TRUE: The EPRI report will present information on the events in depth as we've characterized it. And other metrics that fits into the NEI. And we're anxious to hear about what your guys thoughts are on this qualitative factors too.

MR. KRAFT: Yes, I will --

MR. TRUE: And we're going to watch -- I didn't attend -- physically attend the meeting, but I called into the meeting on that. So we're trying to keep tabs so we know that we're providing the right information.

MR. KRAFT: On the qualitative?

MR. TRUE: Yes.

MR. KRAFT: Well I personally had to miss that meeting. I think you were paying attention to it. I am mindful of the paragraph in our letter from January 25, 2013 where we talked about what we believe to be the appropriate use of qualitative factors. And I think that we would be obligated to kind of stick with that notion.

And we -- I'd like to be intellectually

honest in the work we do, so.

MR. SZABO: Okay, I just wanted to make sure.

MR. TRUE: And the -- and in recommending to you, but the intention as I understand it is that the EPRI report would be a public report. So it will be available to everyone.

Okay. I put this slide together in preparation for this meeting for a number of reasons. One is to sort of lay out for people who haven't been watching, listening to this, how we're actually going about this analysis. And then also to kind of bring in some of the Mark II approaches that we're going to take.

So basically in a lot of our discussions, we focus on the core damage event tree, the action and progression of entry. But the way we set this up is we basically have a completely coupled analysis. So the core damage event tree feeds scenarios to the accident progression of entry, which identifies those scenarios.

Those are tied into MAAP runs. The MAAP runs are tied into MACCS runs. So every scenario through core damage event tree, through an accident progression of entry, actually gets its own MAAP analysis and MACCS analysis that then ties into our -- the EPRI benefit model, which would look at the probabilistic results as well as the deterministic results and turn that into dollars.

Basically any other non-compliance type benefits.

MR. FULLER: And just a quickie is this MAAP benefit model developed yet?

MR. TRUE: Yes. Except for we're waiting on the conclusion of the WinMACCS delivery to EPRI. So we have preliminary WinMACCS results. We're waiting to get the EPRI functional on WinMACCS so we can actually have it all functioning.

MR. FULLER: The conclusion of -- I thought that was done already.

MR. WACHOWIAK: Not done yet. Not done. We have information that the code was going to be delivered today.

MR. FULLER: Today?

MR. WACHOWIAK: Today.

MR. FULLER: Okay. Is Jon Barr going to carry it over to you?

MR. WACHOWIAK: I don't know what the method of delivery is.

MR. TRUE: We've done some preliminary work, but EPRI, we've gotten a lot of benefit, tremendous amount of benefit that EPRI's high powered computer, being able to run these. It runs very quickly. And so getting WinMACCS to them so we can do this. And this couple of form is central to our approach.

So I have a preliminary benefit model. We're still today going to talk in terms of relative results. Because we want to wait until we have official runs to show the absolute values of those results.

But this process basically is functioning right now. And it's kind of coupled together for them. But Jeff and his guys have figured out to actually automate this whole process. So we go right for a MAAP run into the MACCS analysis.

And so -- and in the alternative, we made in feedback changes into the APET, or MAAP runs, or MACCS runs, depending upon what alternative we're looking at. And then some of this instead of parameters, we'll do the same things where we'll change either a MAAP or a probabilistic input. Some of those will even also effect the core damage event tree.

So it's a basically we've done it all in linked Excel spreadsheets. And then the MAAP and MACCS data just gets pulled in the form of spreadsheet results that allows us to very quickly re-quantify. So if Jeff gets a new set of MAAP runs, all I've got to do is past those into the Excel spreadsheets and we get answers back, essentially instantaneously.

So on the Mark II side, we're just beginning to turn our attention towards that. We're doing basically two parallel analysis. As we have discussed previously, maybe quite a bit previously, the Mark II's and severe accident conditions, some of them have a certain susceptibility to severe accident damage to the interface between the drywell and the wetwell airspace, which can create a bypass condition.

And so we're going to have a -- we're setting up a model, and I'll explain a little bit about how it's set up, that's going to look at a case where we don't have bypass protection, we just have bypass occurring when the -- at the right point in the scenario.

And then we're looking at another, which essentially amounts to an alternative where if plants can install some protection for that bypass threat, then we don't have a bypass and we see what the results look like with that.

So it's sort of an alternative. But in the Mark II space, it's a binary thing. So it's either we have a bypass or we don't have the bypass susceptibility. And so we're creating two kind of parallel analysis to proceed with that.

Anyway, that's -- this is the basic framework that we're proceeding down. And like I said, it's functional so far. Next please.

Alternatives, this slide we keep tweaking every meeting. Based on some of the discussions we had in the form meeting we had two weeks ago, we added two new scenarios which we have not analyzed yet, to look at a passively actuated drywell filter, which I think is akin to the analysis you guys are doing in Option 6.

MR. SZABO: I think we're calling it 6, yes.

MR. TRUE: Yes, it's 6 for you guys. Maybe and that's a better way for us to do this, is you call it 6. We didn't know you were going to call it 6, but I think that's a good way to -- a good way to break it out. And I think I also did a little bit of renumbering just to make logical in the fours and fives. So that the two is A, alpha, and three is Bravo.

I think when Jeff presented it we had it backward, the other way around. Just in the long term it seemed to make more sense to put the lower number with the earlier letter. So I don't think there's a lot of news there. Next slide.

This is one thing I think we need to have some conversation on. Because we need to get aligned on our thinking on this. It has to do with the deployment of the portable equipment. We've had a lot of conversations in the previous meetings about FLEX and the OIPs and the time lines that are provided in those documents. That explain the capabilities that the plants are going to put in place as part of implementing EA-12-049.

But those time lines were set up for a compliance basis essentially to meet NEI 1206. And so the deployment schedules that are laid out in those OIPs are based on providing a time line that gives them margin to when that equipment is needed. And it's not actually based on a best estimate deployment time, depending on what the plant conditions would be.

So the example is that for the referenced plants that we've been using for the Mark I, that the pump deployment -- portable pump deployment begins at around six hours and the OIP says it will be completed around 12 hours.

That's because that pump isn't needed until well after 12 hours as a suppression pool make up source. Not a necessarily an RPV make up source or a drywell spray or drywell injection source.

So that time line, and you can understand from a licensee's perspective, when they lay out that time line, they're going to be measured against that time line. They want to set that up so that's a safe a time line as possible, to give them margin to be able to meet this.

MR. FULLER: Excuse me, Doug, this is Ed Fuller. Given that particular time line, and given the kinds of scenarios that we're looking at in this particular rulemaking activity, one other important time in the time line is that they estimate that with load shedding, this is the same plant. With load shedding, one could expect the batteries to be completed in five and a half hours and by that time you need to have a battery recharger ready.

Okay, and down here at your bottom bullet, you say accelerated deployment can be completed within four hours. So if you're going into it -- if you have any lap and you're going along, and you're doing your control depressurization and then keeping the pressure between 200 and 400 psi, you would also do anticipatory venting in this same plant at about 4.8 hours. Which is about eight psig, if when you do a MAAP run, that's what you get is eight psig.

So it would seem to me that until batteries are depleted, they wouldn't necessarily be rushing to deploy the portable pump.

MR. TRUE: Assuming RCIC's right.

MR. FULLER: Hum?

MR. TRUE: Assuming RCIC's right.

MR. FULLER: Yes. The assumption that RCIC's running and if you get to battery depletion, that's one reason to fail RCIC. So they would have to start running like hell to change their direction to -- instead of getting ready to perhaps make up suppression pool water later. And then all of a sudden they would have to focus on getting drywell flooding set up, or in vessel injection set up.

MR. BUNT: But they're going to work hard to -- this is Randy Bunt They're going to work hard to get that diesel connected to get the battery charger running so they don't lose their batteries. And that's why the others are lower for our thing.

MR. FULLER: Yes, the only thing about it -- but yes, I understand, but for some reason they don't do it. You have to look at the time line and say if you follow the time line that's laid out, you're not going have core damage. And that's the success path that this particular plant has laid out for itself.

MR. BUNT: But if you lose the batteries at five and half hours and that's when you lose RCIC, then at that point, you would then take all effort to get your pump up and running within a two to four hour window, not at 12 hours. Because it's going to then become a high priority because you longer have an injector source.

MR. FULLER: Yes, well you're getting to my point.

MR. BUNT: Okay.

MR. FULLER: My point is that you're going to have to change your strategy and divert from the original time line because you're not going to be taking that suppression pool water right away anymore. So now the question is how do you justify an assumption that you could do this accelerated deployment.

MR. AMWAY: This is Phil Amway. And just from my previous experience being a licensed SRO and going through these types of things in a training environment. If you get to a point where RCIC failed, the first things is the anticipatory venting override no longer applies because the whole purpose of that is to prolong RCIC.

So if I no longer had that, I would terminate my plan and then complete the automatic depressurization. Because with no injection source, now I'm challenging adequate core cooling. And the procedures are going to have me complete the depressurization, which is going to take you know, the focus of the operators to try to control a band of 200 to 400 pounds.

Now the SRVs are just open, the vessel's depressurized. And then going to divert resources into hooking up the portable injection pump for RPV make up.

MR. FULLER: Yes, but at the same time, if you're -- if you haven't been able to continue your DC power operation, those SRVs are going to close. And you'll repressurize the vessel.

MR. TRUE: I think the main message here is that this is very scenario dependent. Extremely scenario dependent.

MR. FULLER: Yes, that's exactly right.

MR. TRUE: And the way the plant operators are going to respond is going to be a function of what tools they have at their disposal, and how their procedures would have them implement things.

So what our main message here was that you can't take the 12 hour deployment time as the first time that you ever have the pump available. It may under certain circumstances, you could move that way forward, if that's the only option that the operators have, they're going to deploy it.

And well, I'm just stating, what we did in our analysis was that we assumed that within four hours of loss of RCIC, they would be able to get that pump up and running. The plant people say we could probably do it faster than that.

And I think the owners group is working on some information to help explain that. Maybe it's only two to four hours. But I'm thinking, and one of the reason I wanted to bring this up is I think we need to know what you would need to help you do your analysis so that you -- we have a consistent set of assumptions here.

MR. CHANG: Okay, this is James Chang. From the perspective, I'm looking for when the decision is made and then how long does it take to perform the action? For a reference, plan that ELAP was declared at one hour.

And then at the one hour they stopped decision making to deploy the FLEX generator. And then the generator was connected to the PC valve in fifth hour. So that take four hours for that action.

MR. BUNT: No. That's an incorrect assumption. They're allowed to have four hours because their batteries lasted five and a half. That's the disconnect here is that it didn't take four hours to do it. They had five and a half hours before they needed the battery.

MR. CHANG: Okay, so let -- that's I need from you, so what -- how long does it take to connect the generator that's using. And then from the pump, that's the first time that the decision was made at the sixth hour. And to me it's the connect ready at 12 hour. So to me it takes six hours to deploy the portable pump.

And when the decision's made, that's at -- that's six hours. That's something that I still don't know.

MR. AMWAY: the other thing I want to bring out too right, is that integrated plan was written that the first thing they were going to go after is hooking up the generator to recharge the batteries. And then the FLEX pump, because for the time line, that's the way it went.

If I lose RCIC back here, well then that priority shifts. You know I got battery power for a while. I'm going to bring back the portable injection pump and prioritize that ahead of the generator if I have no injection source.

MR. KRAFT: But the FLEX strip, what's that called the FLEX -- I'm sorry, guidance, whatever it is. What do the conductors call them, FSG? Is that going to have those kinds of?

MR. AMWAY: Well let's remember, it's at the base, right. So the symptoms will drive me to do that. You know if I've got low water level, then my actions are to establish an injection source and reservoir water level.

If I've got high pressure, my actions are going to drive me to do something to bring down reactor pressure. I mean they're just set up that way that that's the way it works. If a symptom arises that says now this is the top priority, then the resources and the equipment are re-prioritized to match what that symptom required.

MR. CHANGE: So this priority is being judged by the operator, based on their experience and training.

MR. AMWAY: That's right. And that's you know, something that you typically routinely train on.

MR. TRUE: Based on the EOPs, not just judgment. The EOPs guide you to -- if you don't have RCIC, then you go with the alternative list of injection sources. And on that list the portable pump.

MR. FULLER: Well one of the things that I was leading to but didn't quite get to is, in book level logic, and you guys are all exactly correct as well. You come up with the insight that if things go wrong and you can't divert core damage, a large fraction of the time, that's going to happen with batteries depleted and RCIC failing beyond let's say four hours, okay. Maybe five, six, seven, eight, ten hours.

And that -- so you are looking at a series of cases, some of which you will keep repressurize the vessel, and some of which you won't repressurize the vessel, but this particular regime is as far as I can tell, one that's not been properly appreciate by either the industry or the NRC staff so far.

MR. TRUE: Why?

MR. FULLER: Because we were up until now too tied into the assumptions made for doing the MAAP and MELCOR analysis.

MR. TRUE: I want to --

MR. FULLER: And now not so much on the time line. And now you're discussing, and this is great.

MR. TRUE: Yes, I guess I was wondering why you felt the industry was not aware of that?

MR. FULLER: Well because it seemed to me from the discussions we had even last week, or week before last at the drop in meeting, that you had things going to hell in a hand basket most likely in the first four hours.

MR. TRUE: We had a good chunk of it going to that. And I'm going to explain.

MR. FULLER: And I'm saying, there are something to that, but there is more to getting into trouble after four hours and before -- well before six hours.

MR. TRUE: There's a portion from that too, yes.

MR. FULLER: Okay, that's good to hear.

MR. TRUE: And in the cases where you didn't deploy FLEX and get power, DC power re-energized, you wouldn't be able to depressurize -- manually depressurize, vessel wouldn't repressurize.

There's some chance it might, an SRV might stick open, there's a chance you'll have a pressure melt. And all of those things are accounted for I think in the analysis framework that we put together. And I'm sure it's in Marty's from what we have seen so far.

So I think the thing that has not been clear is this deployment timing. We've been accounting for it. And I realized after we had our drop in that we weren't accounting for it the same way I think you are. And that's why -- and so I'm back to my question is what do we need to give you to help you understand -- account for this.

And James you said you wanted criteria for the decision to deploy. And then how long it takes once -- that's something that.

MR. AMWAY: We'll look into that. Now I want to make sure it's clear, it's not like we're restricted to doing any one particular task at a time. The actions that we would take to load shed to preserve the DC power is something that we do today under standard station blackout.

And we're not going to wait an hour before we decide okay, it's time to go shed loads. That happens as soon as you know you're in you know, the old fashioned station blackout. And those activities should be largely done by the time you declare ELAP.

So to extend the -- you know, the typically battery coping time from four hours to five and a half or whatever the number is in the OIP, you should be able to accomplish that within that first hour or so of that from T-zero. And we're not trying to jamb all of that up together at the same time we're trying to hook up a portable injection pump.

MR. TRUE: Okay, so what we owe you --

MR. SZABO: I have a list.

MR. TRUE: Okay, we owe you that. I think that's a good one to get ourselves aligned on.

Jim you said something about original

response scenario. This might be a good time to touch on that.

MR. CHANG: Yes, in the NEI 12-06 talks about it, Osaka crewmen arrived 24 hours. By the time say that 24 hours when stuff occurred, and stopped leaking, that's issuance like on reference it didn't happen that way, for 24 hours equipment arrived. But if that should not be the request for equipment start and then it takes 24 hours to arrive.

MR. AMWAY: The time zero for that clock to start is when the RRC is notified by the plant's point of contact that the equipment is needed. Which is typically a declaration of ELAP.

When can be anywhere from 45 minutes to an hour and 15 depending on the plant site. But also, it has through evaluations and table topping, it's very likely that most plants will get equipment before the first -- before 24 hours. 24 hours is the extended, the last time period that you have to be able to get it by 24 hours.

So many plants will get it ahead of 24 hours.

MR. CHANG: Yes, this like 95 percent confidence that you will be able to within 24 hours that you will be able to get equipment in. So ELAP, again, is that -- the current ELAP is the indicator to call for the outside equipment.

MR. AMWAY: Correct. But outside equipment for most plants, off site equipment is only an extension of the need to continue on with their existing equipment that's on site. That they already have redundancy to.

So every sites going to have plus one sets of equipment on site. So they have a spare on site. And then only -- and then typically the regional response center is providing equipment to extend the duration of that equipment in case it fails. Not to replace it and require you to go do something different at 24 hours.

And many plants that time that they would ever get to the point where they would want to come off any and they got with their own site equipment is going to be much greater than 72 hours.

MR. TRUE: Especially the BWRs.

MR. AMWAY: Yes, especially the BWRs. There's not a different piece of equipment that's going to change any of the functionality. The pressure pump that's on site, the generator's on site. All those for Mark I's and II's are capable of extending out for an extremely long period of time.

And like I said, every site already has that redundancy of that on site. And then the off site becomes an additional redundancy as well as other units that are similar that are at a further away distance that can provide equipment too.

MR. CHANG: An additional question that any of the sites that lease the equipment providing a table top was one that had two sets. One set was delivered to within 24 hours, have access greater than 24 hours. Is that particular reason for these two sets of assets?

MR. AMWAY: Well the further clarification on that is that each site is going to have an individual site response plan that is going to define the equipment delivery requirements for that site. And they'll say we need, you know, these pieces of equipment within 24 hours. We need these between 24 and 72. And then we need these pieces beyond 72.

So there's further definition to that based on the individual plant needs that's in those site response plants.

MR. BUNT: An example of that would be that there's a particular plant that wants water purification equipment. But they don't need it until like hour 42. So that's going to be something that comes from a regional response center. It's going to be required to be on site at hour 30 or so, so it's available to be up and running by hour 42.

As a typical type example. That's not -- I'm going to say that's a type of equipment that would be in that second column that's not at 24 hour piece of equipment.

MR. KRAFT: But just to put that in perspective. So after they exhaust a source of pure water for injection, they don't have to inject non-pure water? If somehow, that portable SKID never shows up, they're not going to stop injecting. They'll just take the risk of injecting non-pure water.

That's really the essence of the backup nature of what's at the national response centers. And I wouldn't call them national response centers.

MR. BUNT: And that example is not for a BWR either. No BWR is looking at water purification as a regional response center, or a national response center piece of equipment.

So that was one that came to mind first. That was a good example of something that somebody needed at that time period. That's what most BWRs, regional -- or national response center equipment is needed post 72. And it's really not even needed then.

It's just to have a back up in case something else -- they have multiple failures.

MR. TRUE: And that they can begin to enable recovery.

MR. BUNT: Correct, give them more options.

MR. CHANG: Do you mind answering another question related to this. In the actual, this I would assume this is a seismic event that was a point 17 maximum saturation rates. In the -- so NEI 12-06 was saying that this caused the severely damaged, it was not specific.

So to me that assumed that the non-seismic as one structure would be severely damaged. And that included what is referenced including the downstream bend. In the NEI 12-06, section 3213 initial condition, item four it say this. No more access to the ultimate heat sink is lost. But the water inventory in the ultimate heat sink remains a variable and robust piping connected to the current heat sink footprint system, the making cast.

To me that's a big fail. That's ultimate heat sink in this reservoir will be gone. But here the 12-06, assume that the water's still there.

MR. TRUE: When we take our next break, at lunchtime I guess, I'll find the place in 12-06 that says a non-seismically robust downstream dam is to be assumed fail. I know it's in there, I wrote the document. I just got to find the section that clarifies it.

But I'm sure it's in there. So I'll find -- it's not in section 3. I'm pretty sure it's in section 5. But I'll find that reference for you.

MR. BUNT: But the way sites address that they basically are not taking credit for their installed intake type structure pumps and all. And I know several plants are planning floating suction items that go out further into the water give them some flexibility on how far away from the normal water supply, the water may have diverted to.

Even though it's not a requirement in 12-06, there was some consideration when people were designing and installing, or purchasing their equipment to be able to have that variability in their suction sources. To be able to say that the water may be in a different configuration as a lessons learned.

MR. STUTZKE: Yes, this is Marty Stutzke. One of the things I'll throw out is the staff is considering opening a generic issue on downstream, down failure. Independent of some things like this.

MR. TRUE: Yes, that's why I put it in FLEX, because that's been a topic we talked about post-Fukushima. So I need to -- I'll find that and when we come back this afternoon I can point you to it. Okay, anything else on deployment or operator actions?

Okay, Mark II, APET. This is a little bit of a non sequitur for the day, but I wanted to kind of just explain to you briefly how we're approaching this. And what I did on this slide was I took the Mark I APET description that Jeff presented in previous meetings, and basically changed it to be the way we would characterize the Mark II.

So we don't have a line of melt through issue, so that goes away as an early containment failure mode. But we did add steam explosions as a consideration. I know you had question I think in one of the requests for information on steam explosions.

So we're putting that in to the early containment failure. And then the molten core concrete action scenario that we put in the Mark I isn't as relevant. So we're basically going to use that branch point of the entry and replace it with the suppression able bypass question. It's a bypass for non-incident. Like I said it's a binary on/off analysis that says we protected or we didn't protect that bypass condition.

So it doesn't change the entry structure at all, it just changes basically what Jeff's -- Jeff's MAAP analysis are going to use as inputs to the MAAP analysis. And it allows us to keep the same structure through the process.

The next slide just shows on the APET, what the change is. It's not very readable. If it would be helpful, we can email you a pdf of the actual APET so you can see it.

MR. FULLER: Excuse me Doug. Because my eyes are so weak and I don't have my magnifying glass with me, can you read me what the top event of the only change.

MR. TRUE: It says DW-WW, drywell-wetwell interface intact. So the upgrade would be the bypass is avoided, the down branch is the bypass occurs.

MR. FULLER: Thank you.

MR. TRUE: Okay, so that -- this next slide, Jeff basically presented. I'm going to go and it's the full result of our core damage with event tree highlighted in yellow. A handful of them, they're actually summarized on the next slide.

And it may be that -- can we have the next slide. So this is what we found were the major contributors. And probably merits some discussion. We have some slides that help try and explain all of this some more following.

But basically the break down of ours is that we end up with RCIC failing early, which is anytime between zero and four hours in over two-thirds of the cases. There's a split on whether or not the operators would emergency depressurize the vessel, or whether that they do depressurize the vessel, that is the difference between those first two scenarios.

In cases where DC is lost, or there is some other significant infrastructure impact, the operators wouldn't. And then there's of course the human error probability associated with -- to pressurization. But basically those are all early failures of RCIC.

Let me go to the next slide. And this slide we actually used in the drop in to help explain some of this. And so we wanted to put it on the record here in this meeting. This is basically a plot that shows the RCIC probability of failure versus time. Where the left tracts this as RCIC failure probability and the right axis is over the first four hours.

And we broke it basically into three regions. The first bottom region there are failures that are induced by the external hazard that basically lead to an infrastructure damage or loss of DC. And I pulled that out of RASP Handbook on Limiting Seismic

Fragility for Electrical Components.

Basically something that goes beyond the FLEX assumptions of the infrastructure remains intact and says okay, we had a condition that was bad enough that that infrastructure is not intact. And that becomes basically a constant through the whole analysis.

So those are scenarios that are not going to be recovered by any means throughout the analysis. We realized that's an assumption, and so as one of our sensitivities, we're going to look at well what if that goes away, how does it change our vision of what the -- how the scenarios play out. But it's basically the condition where we don't have the ability to deploy equipment the way we would intend to.

The next -- the middle band there is RCIC itself. It's the first increment at time zero is RCIC pump itself fails to start. Or it's in the maintenance condition at the time the event occurs. That's a couple of percent contribution.

And then consistent with NUREG CR 6928, we have the RCIC fail to run probability, which is a little bit higher in the first hour. And as we get an inflection point there right at that arrow, one hour.

And then it's a very slow increase. It

actually does increase between one hour and four hours, which you can't really make it out on this graph, as the probability of failure to continue to run accumulates.

The upper kind of pink region is step up and relief valve contribution. And what we did there was Jeff ran a series of MAAP runs to determine how many times an SRV cycles during the first hour. And then after the operator takes control and begins manually cycling the SRVs at the lower pressure, how -- what the frequency is over the continuing hours.

And then we took the NUREG 6928 failure probability for an SRV fail to re-close, given it's been opened. And basically we just multiplied times the number of cycles.

And so in the first hour there are more cycles. And as the operator takes control and reduced pressure in the RPV, the rate of cycling goes down, drops by the factor of three in our analysis. And what the MAAP results said was that we got like 50 cycles in the first hour and then another 50 cycles in the next subsequent three hours.

MR. FULLER: Excuse me Doug. This is Ed Fuller again. As you may be aware, we use as one of the RCIC failure modes, excessive suppression core temperature. And we use 230F, but people have said we only could expect RCIC to run for quite a bit higher temperatures for that. Have you considered that failure mode at all in any of this?

MR. TRUE: We are -- we look at that. We monitor the suppression able temperature. But the temperature we're using is 240 degrees based on the work that the owners group has done. And Jeff will have to give you the details. But we haven't seen cases where we've exceeded 240, as long as anticipatory venting occurs.

If we don't have anticipatory venting, then we lose it on high suppression able temperature. That's part of our core damage event tree structure explicitly.

MR. GABER: I actually think we might -- this is Jeff Gaber. We might get a small contribution from only drywell venting. Because if you recall, our drywell vent is smaller than our wetwell event. And If I remember, I can confirm this, but I'm pretty sure that some of those cases where the wetwell vent fails to operate, and we use the drywell vent, we may exceed the 240 in that one. But not until many hours into it.

MR. ESMAILI: One question. When you're running the 240, do you run the RCIC for the full -- coming from the suppression, for the full 16 hours, or does it fail at some point?

MR. GABER: We can run it for -- we'll get to 16 hours in our counts. And I think Ed, correct me, you get to 12 or something, or 11?

MR. FULLER: Well it depends on when you do the anticipatory venting. The sooner you do the anticipatory venting, the better off you are. And if you do it at 15 psi, then it's shorter, yes.

MR. GABER: So we normally get to the 12 -- or to the 16. Again, with the wetwell vent, the early wetwell -- the anticipatory venting through the wetwell path as we define.

MR. FULLER: And I've also done calculations to show that you're worse of if you're trying to vent through the drywell then through the wetwell. You get to higher temperatures sooner trying to vent through the drywell.

MR. TRUE: So just to kind of close out this figure, so about half of the failure probability of RCIC is at times zero, going back -- you want to go back. About half of the failure total probability in the first four hours occurs times zero. About a quarter of it occurs during that first hour. Forward one please. When with the SRV cycling. And then the other quarter occurs over the remaining four -- three hours.

And so those failure probabilities are what leads to the frequency that goes with those first two scenarios that we talked about. Let's go forward to the next one just briefly.

This is something that while the industry POA folks were confounded by when we first started talking about the result. They were like no, but we know from our PRAs that long term core damage and the station blackout is the dominant contributor.

And which is true if you don't look at conditions where you've credited FLEX. So this is basically a cartoon that basically says look, if you assume you have an ELAP, this is an input condition. You have no DC power and you look at a PRA. What you're going to find is about 85 or so 90 percent of the scenarios, are late core damage scenarios.

That's because there's a relatively small probability that RCIC fails. And eventually in an ELAP, you're going to get some core damage because you don't have any options.

Once we add FLEX, then FLEX only reduces those longer scenarios because it can't be deployed necessarily in time to responds to those early RCIC failures. So what happens is your perspective on what's contributing completely changes when you've taken account for FLEX's impact on core damage.

And now we have a picture here on the right hand side where the majority of our core damage scenarios in our results are the earlier RCIC failures and a smaller fraction are coming from the longer term failures.

So if we go back now Raj, a couple of slides to that other breakdown, yes. That's why my explanation for why we see this characteristic of, we've got a majority of our scenarios are the early cases. And the longer term scenarios contribute a smaller amount.

Once we turn to the longer term scenarios, the next largest contributor is we didn't get FLEX deployed at the time we expected to have it deployed. We didn't get the DC in place. We didn't get the portable pump in place at the four-ish hour when we needed to make that transition off of the batteries and on to other capabilities.

And then we have some longer term contributors due to failure to anticipatory vent properly. And failure to control vessel pressure and those kind of things.

And so that's kind of an English explanation for why we believe our results are coming out the way they are. That the benefit you get from FLEX, suppresses the long term scenarios.

And then the biggest issue is do I get FLEX deployed early? Because if I don't, then I'm -- you know when I'm expected to, then I'm in trouble. And then beyond that, it's only the operator managing the scenario. Once you've got the resources deployed and it's all about just the operator continuing to respond.

So those are the -- that's the way this 99 percent of our core damage breaks down. Any questions on that? Because I think there was -- in our last meeting when I wasn't here, there was some confusion about why we ended up with the results that we did.

MR. FULLER: It makes sense to me.

MR. TRUE: Okay. And then we go to the next one. This chart unfortunately in the last meeting, I had kind of short-cutted and didn't break out the timing very well.

This one sort of takes that RCIC failure probability thing and breaks it on the right hand side, the three slices of RCIC unavailable at time zero, RCIC fails in the first hour, RCIC fails in the fourth hour. And then the other transitions.

So this is another way of looking at the timing of the loss of core cooling. So it's just another. And then this slide, as Jeff presented last time. It's just -- it gives you a little different cut through that same data to say what's going on in the background?

How much of this is loss of infrastructure and how much of it is installed equipment didn't work to enable FLEX to be successful? How much of it comes from human errors associated with deploying FLEX? How much came from the FLEX equipment itself not working when we demanded it?

So and I did break the human errors into cases where we had limited time and not limited time. I was a little surprised in that it's not -- doesn't seem that our results to be totally time driven. It's a little bit of a judgement on how you count for time impacts. But that's just another characterization of the contributors.

MR. SZABO: Your percentages are still above 100 by the way.

MR. TRUE: We can all thank PowerPoint for that. I guess I'll add a -- I didn't know you had made that comment before. It would have added a significant figure so we get back down under 100.

Oh, yeah, we're over 100 -- we're way over 100.

MR. SZABO: Make sure it's not decimal points, it's the closest number available.

MR. TRUE: That's interesting. I wonder how that got. I'm going to draw, because those labels are automatically generated. Okay, so we'll fix that. Sorry about that.

APET results is an eye chart, not something you can really track. This is the base case. Basically it's a dry case, so it's pretty uninteresting. Another thing Jeff run through this before. We do get some fraction of SRV seizure events. Both of them are dry.

There's a small fraction where we credited deployment of the FLEX equipment in that time window, where RCIC ran for awhile. But eventually failed and before we could get everything fully deployed. So we got core damage when we got RCIC there -- or got FLEX equipment there in time to mitigate. And then the release pathway in almost all minor matters.

I think from the discussion we had a couple of weeks ago, that is relatively consistent from what you guys have seen in your analysis. So we go to the next slide.

This just is the results for the alternative 2A, 2 Alpha. And then most of the rest of this, we're going to talk about alternative 2 Alpha as our focus for the results. So I just put this in there. I think we presented this last time.

I want to go to the next slide first so we can spend some time with this. As we were progressing down this path, one of the things that occurred to us was that the SRM had talked in terms of when you look at alternatives, you need to look at dominance contributors. Dominance or accident scenarios I think is the actual term that the SRM uses.

And we haven't had any conversation about what's dominant and want's not dominant. And we looked at our results, in particular for alternate 2A to see well what makes sense for in terms of characterizing something as dominant? And what we've done in this -- further in this presentation is focus on the individual APET instincts that contributed more than about a half a percent.

And if you -- just to tie that back to this alt 2A condition, if we looked at, that brings in 29 unique APET instincts, which is a combination of core damage event, and APET. There's a total of 507 possible outcomes. 29 of those are brought in. And those 29 scenarios cover about 90 percent of the core damage frequency. So it's 90 percent of the total of frequency.

We looked to using one percent, which initially we felt was more really dominant. But it only bought in about 80 percent of the total. And so we felt like going a little bit lower, made some sense in order to capture the 90 percent of the core damage frequency.

So there are a couple of ways we could proceed. You guys I'm sure aren't ready to talk about this. But I think as we look at other APETS, we're going to get different answers. There's going to be different number scenarios, we're going to get different scenarios that contributed.

But philosophically I thought it might be worthwhile to have some conversation about whether this kind of thinking, this both a scenario contribution as well as a cumulative contribution of the total results, is the right way to look at it. Or we want to -- another way to do it would be to set an absolute threshold and say you know, we're not going to look anything less than ten to the minus X. We're not going to look at anything you know, we're going to not consider dominant anything less than the frequency of ten to the minus X.

We explicitly analyze every single scenario, so it doesn't matter to us where we draw the line. But I think -- I guess I'd just be interested in if you have had any thoughts about how this dominant notion gets considered. And whether a severe accident scenario means the same thing to you? Is it really an APET core damage end state, or is it a plant damage state? Or is it a release state? Or any -- any thinking on this?

MR. STUTZKE: This is Marty Stutzke. How has this been gearing on the pump release category frequency?

MR. TRUE: Well the problem I have with that, I mean I understand why that is an option. From how that is that within that release category, there could be a whole bunch -- you could have in vessel retention as well as --

MR. STUTZKE: Exactly.

MR. TRUE: As well as ex-vessel retention. I mean you get a mish mash of scenarios that in terms of decision making don't always -- aren't always obvious how to make those decisions. So it's --

MR. STUTZKE: You know the challenges in our event tree structure we see, if I remember right, 139 realized plant damage sites out of a possible sweep. And throwing that against the 84 pay cut sequences in the tree, leaves you --

MR. TRUE: Right, do the math.

MR. STUTZKE: Yeah, with this enormously big metrics.

MR. TRUE: Yeah, I like --

MR. STUTZKE: It's easy enough to highlight them like you've done in here. And it's like I wonder what that means. You know, but it's too much information.

MR. TRUE: it's too much information, which is why we wanted to narrow it down to a more modest set of actual scenarios so that you can get your head around what's this reaction response look like. What kind of timing does the operator need to have? What kind of capabilities do we need to have for mitigation?

And we felt like 29 was probably at the high end of what we'd really like. And we probably would really like more like 12. But we wanted you know a context for decision making and communication to the industry on what the key insights were.

So anyway, I know I'm springing this on you here. Maybe it's something we can talk through at as future time.

MR. GABER: I guess kind of leaning more in Marty's direction maybe, clearly the 29 could be bid from a consequence or from a source term perspective. So it could likely collapse down into 12 or some number like that We just -- like you said, we don't do that, we don't have to do it. But it could be done I'm sure.

MR. WACHOWIAK: We'll be collapsing them down to some things, but they're not release categories, they're attributes of what's going on with those scenarios. So we'll have that later.

MR. STUTZKE: I need to collapse at the match up with the MELCOR MACCS runs.

MR. GABER: Right.

MR. ESMAILI: And when you said arrest exits with tension, you only mean new line of melt, right?

MR. TRUE: Yes. I was just picking at Marty's terminology, which I love to do in the afternoon presentation.

MR. SZABO: Why don't we present in the afternoon. Maybe we'll cycle back to this and determine whether -- I mean I will come to something today. But maybe it will be better after we pick up -- yes. But you just threw it out there. Yes.

MR. TRUE: I'm throwing it out there, this is kind of the way we're thinking about it. We're thinking it's one of those things where we should try to find some kind of alignment on it. We're looking at something that's dominant that you're not, or vice versa. That's not helpful as we go forward.

So that's why I specifically bring into this is to say okay, this is what we're thinking, let's talk about it. And we can go forward.

Well this next one, next couple, we don't need to spend time on they're both eye charts in terms of details, but the first one, go back Raj. The first one I just highlighted in pink the ones that met the criteria. And so it shows you that it's a matrix of core damage instinct and APET instinct that match up.

MR. WACHOWIAK: One interesting thing here is if you do get your magnifying glass, there's a whole lot of zeroes on that chart.

MR. TRUE: Or less than zeroes.

MR. WACHOWIAK: Less than zero point zero. Yes, they just don't make, so.

MR. TRUE: Or a few that are actually zero too. At least in the way we quantified. I'm sure there's a probability. But okay, and then the next slide is important because it's going to come back -- it's going to have to key basically for some subsequent slides we're going to present.

This is the 29 scenarios that ended up being in our dominant category, sorted in decreasing order of likelihood. So from most likely to least likely.

And so the top one is that CD-019 APET 15, which was about 19 percent down to CD-017 APET 1, which was about half a percent.

MR. WACHOWIAK: And this was for two way alternative two ways.

MR. TRUE: This was just for alternative 2A. This list --

MR WACHOWIAK: Well 2A and the five one that you're going to be -- four that you're going to be talking about later. They're the same. But we could get some reorganization of these when we go into different alternatives.

MR. TRUE: You absolutely will. Because like 3A, also we're not injecting into the vessel, we're not going to have IVRs. So anyway, this is important because as you look at some of the subsequent results Jeff's going to present, these description are to tell you what that result ties to. So it's your roadmap to the subsequent one.

The next one is a new tool that we came up with in preparation of this. One of the challenges in this whole thing is that there is a lot of data. And we're looking for a way that can kind of try to communicate what all's going on in here.

Kind of all of the points I've been making in the past set of slides here. Building up to the result that says, okay, what are our important core damage of entry states? And basically the way this works is that once we get to core damage, it's the same basic set of probabilities all the way across. It's just a matter of where it's going.

So the width of the bar in each column is the fraction that's being contributed by that entity, whatever it is that we're looking at. So on the left hand side, you see the CD-019 is the top contributor. It's one of the largest of the fractions. It ties into an early RCIC failure. That's just the nature of the sequence, we just tagged it. Along with CD-020 as being an early RCIC failure whereas 017 is an early failure to implement FLEX. And the others tie to a late implementation of FLEX.

Those can then be related in general terms to core damage timing, just another set of information you can get out of that. And then each of those feed into different APET instincts. And you can see kind of based on the widths of the paths, which ones are contributing the most to which APET instinct.

And then finally on the far right hand side, what the outcome looks like in terms of the release pathway. Whether it's through the wetwell vent, through the -- due to over pressure failure of containment, or use of the drywell vent or liner melt through.

And while there's a lot of data there, we think this kind of gives you a way to look at individual interim states that we've never really had before. And provides a pretty good visual. And we can even, when we get to the benefit side of things, we can even extend this to look at it in you know what's contributing most to outside consequences. What's contributing most to averted costs. I mean all those things can be tied into this.

And you know, so but we did one with all of the results. And we added all the core damage scenarios and all the APETS. And it's pretty busy. It's -- you get the same basic message from it, but it's pretty busy. So folks down on the dominant ones actually helped us be able to get a little bit better focus on it.

So anyway, we're going to try and do this for each of our result cases as a way to readily get access to what's driving the results. Because some of our sensitivities are going to vary, even the CDT proportions too. And we'll see how that effects the output on the far side.

So anyway, it's just a tool I found on the internet and you just have to feed the data the right way to it and it will.

MR. STUTZKE: It kind of looks like a map of the Capital Beltway when you think about it.

MR. FULLER: Yes, I was going to say, did you use Google Maps for this?

MR. KRAFT: Actually what utilizes it is the methodology for predicting the outcome of the world cup. I spent a good deal of time yesterday in our pre-meeting doing it. If you want to know the answers come see me later.

MR. TRUE: There is some truth to that. But there's a widget on the internet about predicting who's going to win that led me to a thought of wow, this would be a way to present the report, so.

But the next one is a different slice through this, that I think will also carry forward. Which is basically a point up chart, which just means it's a sorted list of contributors.

It's basically those same core damage scenarios that were in the mostly unreadable table previously, now sorted in decreasing frequency. And but then we've identified them by color in the bar, which ones are what release mode.

So the first blue bar there is the first line of melt. Then way over to the right we end up with some relatively small contributions from over pressure failure and a drywell event. In this case, this is where the wetwell vent failed and the operator was the first to use the drywell vent as a release pathway.

So it's another way to kind of communicate some of the results that are coming out of this. And speaking of results. Jeff I think you're up.

MR. SZABO: So I guess the question is do we want to stop now for lunch?

MR. KRAFT: That's not a bad idea.

MR. SZABO: The other option, I just want to put it out there, just because Steve I think you said you and a bunch of other people might be --

MR. KRAFT: Leaving at 2:30.

MR. SZABO: Leaving. I just wanted to say, do you want our initial thoughts of -- we can do our initial thoughts on qualitative factors in the next 20 minutes. We can save it -- or save it for trying to put it in.

MR. KRAFT: That's not a bad idea.

MR. SZABO: Because it's just more a very high level discussion.

MR. KRAFT: Then let's get the discussion on that.

MR. SZABO: It's just a reiteration of what was said in the public meeting the qualitative factors. So I'm going to start out with some of the less -- this is Aaron Szabo by the way. Some of the lessons learned from SECY 12-0157. I'd say that in relation to describing what the qualitative factors were, we did a rather -- there was a rather extensive discussion of each qualitative factor.

I think one of the places where we could have enhanced our discussion was how does qualitative factors relate to the quantitative information? There was not much discussion there and really I think that was one of the issues with some communication issues and some maybe misunderstanding. Or really trying to interpret how much -- how the staff did really judge qualitative factors within that paper.

Therefore, the idea for right now for at least first thoughts for qualitative factors, the use of them, within this rule making is that we would use some more -- we would use some enhanced tools that would help relate the quantitative information with the qualitative factors.

This is of course assuming that the commission does not provide us any explicit direction from the qualitative factors paper that's going up this month I think to the commission? This month or next month to the commission. That would say something very different. For instance if they came out and said we don't want you to ever use qualitative factors for cost benefit, you know, very for impact cost analysis again. Clearly our rule making would not have a discussion on that.

Assuming it does not come out that way, some of the tools we're looking at using, which were discussed in the public meeting, one -- which we use enclosure one was the break-even analysis, the idea would be even more to enhance that more user breaking analysis to go into some further discussion as to how to really apply that within the situation. How the commission would apply that. How members of the public could apply that.

One of the other major thoughts that we had, which was -- is using a Kepner-Tregoe decision matrix type tool, where one could say that we had a very basic form of that with the SECY-12-0157 within at least the qualitative factor we had, with the regulatory announcements, it was high, medium, low. There was no weighting as to how important each one was.

I think in the interim one it might have been pluses or minuses or check marks, or something like

-- check marks okay, is that what we ended up with. But you know, there was no weighting immolation of them. Much less a weighting in relation to the quantitative information.

There were overlaps, like we had defense in depth, and uncertainties, they weren't necessarily independent of each other. So there was the question as to how to treat them.

So the idea would be to develop a decision matrix, which we would go through significant public interaction with, to try and provide at least for information purposes, some sort of comparison, some weighting, as to kind of how the staff is evaluating qualitative factors, one amongst each other as well as how they relate to the quantitative information within the analysis.

And we think that this would help enhance not only the commission as decision makers, to know where the staff was coming out if people internally or externally have disagreements, they can say we think the weighting should be different. If the commission has a disagreement with how the recommendation -- the staff recommendation, it helps them to more easily point that out.

And while it's not providing an objective analysis, it provides a more objective analysis, at least in my opinion of how we're going about it. And my goal is to at least at first establish weighting before we do scoring among the alternative. And then have a scoring based on that.

And just because one weight is greater than the other, that of course does not necessarily mean the staff would end up that necessary way. It would just be used as for information purposes. And even more important than necessarily even the scoring itself, is the discussion that the staff is going to incorporate with why we're weighting it one way or another and why we would be scoring one way or another.

And I know that this type of analysis is used in many other areas. When trying to put kind of a quantitative number on qualitative information. I'm picturing it, it's not going to be that kind of detail. It's not going to be should this be weighted as, we'll say it's a one through 50 band, it's not should this be a 39 or a 40. It's more of should this be a 40 or a 10 type mentality.

So it's not going to be that exact precision because of the amount of in my opinion, subjectivity as well as the uncertainties around the whole thing. I just don't think that that type of precision is necessary at this time. Of course that might change.

But that's kind of the initial thought of where we're going. You of course still do the full quantitative analysis. Present all that quantitative information. But this is how we were kind of thinking at least at first, including qualitative factors within this rule making at least.

MR. TRUE: So both break-even and the Kepner-Tregoe weighted scoring kind of a scheme?

MR. SZABO: Yes. And then you know, I don't think cost effectiveness really makes sense here. It depends on kind of how we come out. I mean as applicable cost effectiveness. I think maybe we might if we're going to a DF, we can say what's the most cost effective way to get to this DF I guess.

Assuming that -- I mean it could be thrown in. I mean at this time I don't see how cost -- because they're restrict enough. I don't know how we would really be doing that. Maybe between a small filter and a large filter you might be able to do a cost effectiveness.

But as I said, that's kind of what we're thinking right now.

MR. TRUE: So you're -- I shouldn't be the only one talking at this right now.

MR. KRAFT: I'll relieve you of that responsibility. I have yet to study the outcome of that other meeting. And I think this is a far broader question for the industry, Doug that we need to chat with the industry leadership on.

I'll tell you my gut reaction to all this. And maybe because I'm just you know, getting to be elderly here. It all boils down to what people think you put the number for. Right, so all you're going, all these methodologies, while they might look as though they're distancing the decision for the decision maker.

In other words, quantitative is pretty clear. I mean you -- assumptions can drive quantitative. You can have you know, shenanigans with those as well. But let's assume that that's not happening okay. People who look at what you're doing in these qualitative areas, right, will always suspect that the individuals selecting the weighting, selecting the scoring, has an outcome in mind, and is selecting numbers to drive the outcome. You will never walk away from that.

And the reason you don't, is because human being are involved. And we learned decades ago, that decisions are not made in an ivory tower, based upon analysis that MBAs are taught to do. That's input to a decision maker, who ultimately has to look at his or her gut and say how do I -- you know, with all this information, how do I now make a decision that makes sense.

And the fact that you said just because the scoring is high in a particular factor, doesn't mean the staff would drive itself in that decision, tells me that you understand that. That at some point, a judgment gets made by someone somewhere empowered to make that judgment.

And all this is doing I think is giving it a patina of an analysis that has to be -- can only be, I'm trying to think it out. But only the quality of which is driven by the inputs. Much like quantitative analysis to quality of the assumptions.

And so I think that's where we're going to be looking very, very carefully at this. And I'm very concerned about where this is going to go. Not just for this decision, but you know we've got to think about the broader, the other industry.

MR. SZABO: And one of the reasons for at least trying to use this, I think we've thrown around the word before, semi-quantitative analysis, is that it's supposed to help drive the conversation, and help that point to where there may be disagreements or differences of views in relation to -- into what the weight should be.

Because if you look at implicitly, I mean SECY-12-0157, the staff recommendation was qualitative factors outweigh the quantitative analysis. That's essentially you know you can say that whatever the weight might have been, the weight was greater for qualitative then it was for the quantitative.

The idea of this is to try and help present or explain the reasoning as to why the staff you know, I'm just going to use SECY-12-0157, why the staff felt that way, other than just a very long description of you know, what the qualitative factors were trying to say you know.

I mean because you get the question of let's say these things cost -- a filter cost $2 billion. Where do we -- and that was something that was brought up by the ACRS trainings meetings, as well as by others, as to where would you stop. And this at least tries. And it helps.

MR. KRAFT: Well if we go back to the NRC work that we quoted in our letter of January, 2013 about the use of this qualitative factors, we make the point which was more or less quoted out of NRC guidance, is that you use qualitative factors when the needle is close enough to the decision that it pushes it over.

And our view wasn't in SECY-12-0157, you really strained that question. So where I would be interest in, and I you know, I'm not suggesting anything being done or corrected here, but. So you have the quantitative result that ends here. And you got to get all the way over to you know some place further to the right, and it's called to get a yes to the decision.

Okay, how much quantitative -- qualitative factors works is the way we understood it is you've got to be awfully close to start with. And then you see whether it tips it over, okay. Now what you're going to do is you're going to take a quantitative result, and you're going to add to it these other methodologies that have the appearance of being quantitative, and they're not.

They are, even though they involve numbers, because there's weighing and there's scoring, all of this math involved. They are qualitative. They shouldn't allow you to get a quantitative result closer to an answer an then make some judgment that tips it over. You following what I'm getting at? It's the same test.

MR. SZABO: Yes, and I mean there is a difficult in communication that comes with doing this.

But at least my opinion is that it's easier for us to craft that image then trying to define what is close. I mean it's actually what we're trying to do is define what is close.

I mean it is a way to think about it. Is you know, if you want to look at what the staff's determination of close is using SECY-12-0157, they would say with the large uncertainties, that an order of magnitude or two is close. I mean that's kind of implicitly stated.

But this at least would help to try and define what is -- what that close is. Once again, this is just initial ideas. Kind of just the thoughts of where we're going, relevant to feedback. I mean basically.

MR. TRUE: Two things. Is the SECY that's going up, I know you're not -- or I think you're not directly involved in that.

MR. SZABO: I know.

MR. TRUE: Oh, you are. Is that SECY going to kind of outline at some level, how these processes might be used by the staff and what they would look like. Or is it going to be much higher level than that. I mean what I'm trying to get at is in July, are we going to get some more insight as to what you're thinking is on this in writing?

MR. SZABO: Well our current guidance allows for us to use these methodologies. They're just not very prescriptive.

MR. TRUE: It's silent on it.

MR. SZABO: It's not very prescriptive on it. Not prescriptive at all one could say. This paper -- I don't see this paper going into the depth, the type of details that you are talking about with specifically how this would be applied. Or how it has, or retroactively trying to apply this to something else. You know, like the mock example or something.

So I don't know how -- I think there was a -- you know whenever we do any options paper, there's always a discussion of what's the narrative really bearing down to something that the staff is merely recommending where just the commission says don't do that. Then we just waste a lot of staff resources.

MR. TRUE: So then, I'm just trying to get an idea in the next couple of weeks, how much more we would understand that. And the next things is I guess you're -- what you're also saying is there going to be some public interactions on this qualitative approach. Is that something that's going to be coming in the later summer, early fall kind of time frame?

MR. SZABO: Yes. So we've just started kicking this around in the working group meeting like a month or two ago. It was a very difficult thing.

We want to make sure we're aligned vertically as well internally, as well as you know, we don't want to go too far down this path as I said with this SECY paper coming out. And when the commission comes, I don't want us to have to spend four public meetings, you know 30 hours going through this, and then it turns out the commission said don't do it.

But the idea is that we would just be discussing this in the future.

MR. TRUE: I think Steve said at some point we're going to talk about schedule on how this all comes together.

MR. SZABO: Yes.

MR. TRUE: But probably at that point, the SECY's going to go up and be there for a long time. Just wondering how that all fits into the schedule, so.

MR. SZABO: Okay, let's take a break for lunch. And convene at 1:00.

(Whereupon, the above-entitled matter was in lunch recess from 11:53 a.m. until 1:02 p.m.)

A F T E R N O O N S E S S I O N

1:02 p.m.

MR. GABER: Okay. This is Jeff Gaber. We're going to spend a little time talking about some of the MAAP5 results. An you please make sure to mute your phones if you're calling in please. Can you please mute your phone. Thank you.

So we had some questions at the last meeting the 30th, April 30th. And request to come back with MAAP results. So here they are. Good luck reading it. Actually you can you know, I'm sure you can expand this and get into the details. I clearly am not planning to go through each one of these cases.

But as Doug pointed out earlier, these are the top 29 I'll call them. The end states that represented greater than a .5 percent contribution to all the end state frequencies. But I'll get into some of the elements of these anyhow.

So if we go to the next chart. This is the first thing I kind of wanted to demonstrate is the importance of as Doug said earlier, the importance of focusing in on some kind of subset of dominant scenarios. If we just look, as we said, that each one of our alternatives represents 507 unique end states. That's a combination of the core damage and core damage state time versus the entry information.

And so what I did here was just kind of

created a kind of dumb histogram. So all this is is looking for example, the blue bars are just taking all 500 end states, looking at the overall decontamination factor, and bending it in these bins. 1 to 10, 10 to 1,000, so on and so forth.

So if I do that, if I just bid all the instincts without any consideration of frequency, I get the blue bar distribution. And you can kind of see that the kind of the large fraction of the DS are in the 10 to 1,000 range.

MR. FULLER: Excuse me Jeff, this is Ed Fuller. Is your second set actually 10 to 100?

MR. GABER: Yes, I think so. Yep, good catch.

MR. ESMAILI: Am I too late to ask a question about the previous?

MR. GABER: Oh, the previous slide, no. By all means.

MR. ESMAILI: This is just for clarification. All the cases that you had no water.

MR. GABER: Yes.

MR. ESMAILI: You don't vent? Because it just says --

MR. GABER: Yes. Good comment. What I did in that table, is it's not in order. Unfortunately, we're going to show you some. They are the top 29 cases scenarios. But I didn't put them in order. What I did is I grouped the cases without water. So if you go back to our APET, you find out that the down branch on the water injection. This is the severe accident water.

The down branch, I just bend all of the down branches together so we can see. And you'll see later, kind of the significance in terms of the DF, in terms of the temperatures, so I grouped them together. In this case, they didn't involve venting in terms of the dominant contributors, they didn't include venting. Because without water, we go to liner melt through.

MR. ESMAILI: So then it's still -- you still vent?

MR. GABER: It could be considered, but liner melt through is the dominant release path.

MR. ESMAILI: Oh, okay.

MR. FULLER: Is this a noble gas breeder reactor?

MR. GABER: Pardon me?

MR. FULLER: Is this a noble gas breeder reactor?

MR. GABER: No.

MR. FULLER: A couple of these have noble gas release fraction greater than one.

MR. GABER: Yeah. I thought I took those -- wait a minute, I don't see -- oh, 1.01. Yes. Actually --

MR. WACHOWIAK: As I said at the beginning of our presentation, these are preliminary results. And we are still working on little anomalies like that. Thanks for point that out. We'll figure that out. That's probably some sort of rounding error somewhere. We know what the problem is, it just needs to be fixed.

MR. GABER: So, again, the histogram with the blue bars is just representing, and you can see there, they're scaled by the fraction of scenarios in each of those bins. So of the 507 for example, there are 45 percent in the bin of a DF from 100 to 1,000. That's all that is. It's not the greatest way to look at your results obviously.

But if we then just plot on top of that, what -- if we just look at the top 29 cases or the cases end states greater than a half a percent, like Doug said they represent around a 90 percent of total core damage. You can see the distribution is fairly different. In fact we're skewed much more towards the 100 and above range in that case.

So the only point of putting this up is it's important to focus on the dominant contributors. If you don't do that, you can be misled. Okay, next chart.

So in this case, what we did is you can see that we listed all of the top 29 end states in decreasing frequencies. So the case on the left, which in this case is CD-019, APET-015. That's going to be a case as Doug explained earlier, that's one of our dominant contributors where RCIC doesn't operate in the short term.

It is a case where the operators did successfully depressurize. So it's a low pressure case. APET-015, I can't even remember what that one is. There's so many. So is it an IVR? Yes, got you.

So, obviously the cases with in vessel retention tend to -- we tend to see higher decontaminations, because the fission products are transported to the pool through the safety relief valve. In this case they would be slightly different if it was a main steamline break, which we do have some of those. But they tend to be -- I think there's one or two on here. And you can figure that out by looking at Doug's previous chart that lists all the 29.

So I think there's one or two where we did have main steamline. But the SRV seizure cases are clearly the dominant cases. So you can see the DF's for these in decreasing frequency. And we tagged the cases with no water addition as we were talking before with a red color.

And obviously in those cases, they typically go to liner melt through. They have a much lower decontamination factor because we bypass our vent line. We bypass the wetwell vent which of course provides scrubbing at a much higher DF.

You know looking at the left side there, there's only a couple of the dominant cases that have DF's less than 1,000, and they're in the range of 500 or 600. You see the third one and the seventh one I guess are slightly -- and we could go look at the details. You could see the details in the previous table for that scenario.

Those are the ones if you remember, and if remember back to the EPRI report, where we just put water -- in those cases, I think we were just putting water in containment. These are cases were we're actually putting water in the RPV. But if you remember, we did see about a factor of 2 RPV something like that increase when we did the vent cycling.

So when we get around to analyzing the what is it 3 Charlie, 2 Charlie, Bravo, or I forget which one. But the other alternative where we actually cycle the vent, we'll expect to see those go up.

But again, overall the blue lines fairly significant DF's clearly in the range of 100 to 1,000 or more.

MR. ESMAILI: So this is only for RPV injection. And you said that the drywell injection you're expecting the same?

MR. GABER: It will be similar. It's like Doug --

MR. FULLER: There are going to be lower DF's for the drywell levy. I done enough to know that.

MR. GABER: I think Doug mentioned earlier, you know we see some events in here on the left side at a high frequency, just as reading ahead at Marty's slides, you get some of those in vessel retention cases. Obviously we're going to see more of those with invest -- without our source of water going to the RPV. When we now make that reliable water to go to containment, those will disappear and be replaced with other ones.

MR. ESMAILI: And any time you get such a benefit compared to the red line is because is it dominated by re-vaporization, so when you inject water, you're actually arresting re-vaporization so you can have a way?

MR. GABER: I think it's two things. One

is don't forget, in the blue line cases, our preferred path for the majority of the radionuclides is through the wetwell. So we're getting pool scrubbing. I mean even if the pool's saturated, you get DF's of what, 50 to 100.

MR. ESMAILI: Which is?

MR. GABER: The blue lines.

MR. ESMAILI: But you also get the same thing in the red lines, right? You still go through that.

MR. GABER: Prior to vessel breach.

MR. ESMAILI: Prior to vessel breach, right.

MR. GABER: You're right. Good point. But after vessel breach, we can continue that pathway with water. And when we have the dry cases, we assume that they progress pretty quickly to liner melt through.

One of the sensitivities, we'll talk later, I think our last slide, is we're going to look at potentially, some sensitivities on liner melt through assumption.

The next slide I think Rao specifically was interested I what kind of temperatures do we get in the drywell for these scenarios. So again, we've got our top contributors, or dominant contributors. And in decreasing frequency order, I put a little picture up there to show what the color scheme is. The sphere of the drywell is in blue. The cylindrical part next to the biological shield in red. And the upper head area in green.

What we also did on here is like we did before. We couldn't quit do the magic with the colors. But we tagged them with the scar to show that these are the end states that had no water addition. In those cases without water in the containment, we expect and we get much higher temperatures in the drywell.

In fact you can see that the highest temperatures that we get are in the sphere, which makes sense because the core degree is on the floor. It's going to heat up the spherical part first. And then the heat will just transfer on up, all the way to the drywell head.

There's mixing calculated in the code. There's density driven flows that we're keeping track of. But you can see the blue line, the sphere part is always the hottest. These temperatures, I got to tell you too, are max values. Sometimes a little bit confusing, or a little misleading to just look at a max value because you don't know what the duration is.

Rick actually recommended that we think

about maybe providing, since the purpose of these temperatures is to get a handle on is there a challenge to the head, or to the drywell penetrations. We got ample heat sinks in the drywell that we could use to better represent that. The beauty of using the heat sinks, is they're a little bit less susceptible to these spikes that might happen in the gas volume.

But nonetheless, this first go around, I just kept track of the peak gas temperature. I flagged the one case there, you can see it's not the dominant case, but it's CD-019, APET-018. Again, that's a case with no RCIC. Vessel's at low pressure when we fail the vessel. APET-018 is again a case where we got SRV seizure, but we didn't have wetwell -- successful wetwell venting.

MR. FULLER: You did not?

MR. GABER: We did. We did. So you -- and again, I keep talking about wetwell venting. I forget to continue to explain that when we say it was wetwell venting, that means that was the preferred path. But as you guys know, when water level exceeds 21 feet, we have to isolate that vent path, and then we switch over to the drywell.

So initially I should say it's wetwell venting. But in all these cases, we can double check, in fact you can see it in my table, I'm pretty sure that the drywell vent did open up late.

And I think we've talked about this before, and in fact I think Rick and I showed some of the release plots, I think it was one of the -- from the EPRI report, it was during one of the ACRS presentations, that when the drywell vent opened up, typically what we see, is there aren't a lot of airborne aerosols, and fission products to be released. So that --

MR. KARIPINENI: There are not?

MR. GABER: There are not. They are relative contribution. Now the one exception to that is if we would get later re-vaporization, obviously having the drywell open, we'd expect to see a higher release. With RPV injection, we tend not to see that late re-vaporization.

That might be something, that as Ed I think has seen. That we do the drywell injection, if there are fission products remaining, or core material remaining in the RPV long term, we'll likely see temperatures high enough to cause re-vaporization and a later release.

But we typically don't get that with these cases. It's one of the advantages of injecting in the RPV post core damage as you can reduce that pretty significantly.

So just going Raj, to the next chart. I just tried to elaborate a little bit more on what that temperature looks like. This the sphere for that case. Here in fact I think if you go back, you see that the peak temperature was closer to 700. Interesting things, when we plot in MAAP, we have limited data points and a lot of times we'll miss a very short duration spike.

We can go investigate that further if needed. But you can see generally the temperatures here remained below 600. Obviously below 600 for the majority of the time, well below 600.

MR. ESMAILI: I have some questions. Okay, so these are gas temperatures.

MR. GABER: Yes.

MR. ESMAILI: Do you model these structures?

MR. GABER: We do. That's what I was just saying. We do have the heat sinks. I think it might be better to display those. Because it's more indicative of what penetration --

MR. ESMAILI: And with the leg of course, right?

MR. GABER: And with the leg, yes.

MR. SZABO: Jeff, are you guys planning -- got a time frame as when you would present this information for I guess alternative 2C, when it's?

MR. GABER: I hope the next time we get together. I would hope that we have all the alternatives. Unless you say we're getting together tomorrow. But yes.

MR. SZABO: Well because my understanding from what, I think one of the things that Rao wanted was you guys just wanted to see is when there is no drywell -- you know others preferred wetwell to see what the number. I don't want to speak for you Rao.

MR. KARIPINENI: Yes, that's right. We asked for that also before. But I guess I'm not ready to --

MR. GABER: For the drywell objection cases.

MR. KARIPINENI: Right, right.

MR. GABER: Yes, we actually have those results. We didn't prepare, like Doug said, it's a lot of data. But yes, we can definitely make that a priority for the next time we get together.

We also think there's value in looking at some of the obviously since we are also include filters as a potential strategy, to start looking at those cases as well to see what actually is the benefit from a filter.

Because you know, much like some of the NRC results, there are as you see, there are contributions from cases that were water just didn't work. And in those cases we get liner melt through. And they obviously provide less benefit for an external filter, because you end up bypassing the filter.

MR. SZABO: I might not have been clear. I just wanted to clarify, because this ties also into the order, like the phase two and the nexus between the two. What I was -- what I meant was just the water management idea. And what the temperatures are, and the drywell gas temperatures in relation to that. I just wanted management.

MR. GABER: Yes.

MR. SZABO: And that was what I think the --

MR. GABER: Yes, I mean it would be my intent to have -- it's the one before this Raj. If you go back just before it. One more, sorry, my mistake.

So it would be my intent to have one of these for each revised alternative, okay.

MR. SZABO: I got you, okay.

MR. GABER: And Doug will find a way to make his crazy chart where we can put them all on one for you.

MR. SZABO: I just wanted to make sure that you know, next meeting, we're --

MR. GABER: Yes, yes.

MR. FULLER: Excuse me Jeff. Something about this I don't quite understand. Are we on this chart?

MR. GABER: Yes, yes.

MR. FULLER: Oh, I was on age 27.

MR. GABER: 27. You're moving ahead to hydrogen?

MR. FULLER: I thought that's where we were.

MR. GABER: Just getting ready to do there.

MR. FULLER: Oh, okay.

MR. GABER: So that one. So --

MR. FULLER: I'll let you explain it then.

MR. GABER: I'll just start it then, if I don't answer the question, you can ask.

MR. KARIPINENI: I still have one question to ask.

MR. GABER: Yes.

MR. KARIPINENI: You said there is some cases where you have liner melt through even if water enters. Did you say that?

MR. TRUE: No, I don't think we get that.

MR. GABER: I don't think -- it's probably a non-zero probability, but I doubt if it's in the --

MR. FULLER: Right Rao's asking what you just said. But I heard something along this same line. So I think maybe you misunderstood the question.

MR. WACHOWIAK: Say the question again.

MR. KARIPINENI: I thought I heard there is a liner melt through for a -- even if water injection for a case somewhere.

MR. WACHOWIAK: So our case, all 2A for water injection says we've installed the option to put in water injection. There are still cases where the water injection fails in our event tree. Because it didn't get hooked up in time, or because the pump failed. So in those cases, there's no water, even though we installed the system.

MR. KARIPINENI: Okay, got you. Thank you. Okay. I was thinking water injection succeeded, but the system --

MR. WACHOWIAK: It's not typical one.

MR. TRUE: I think there's a tip in this for you. So whatever vehicle this works in. With water there's still a probability that you get liner melt down.

MR. WACHOWIAK: When the water works. No depressurization you don't get. But when the vessel fails you get depressurization, so. It's a probabilistic part that takes care of it.

MR. GABER: Okay, I'll move on to hydrogen. Also, Rao at the last meeting on the 30th asked us about hydrogen. I'm not sure if we gave you want you wanted, but this was our first attempt. So what I did again, I didn't unlike the last two -- few slides where I tried to write things by frequency, I didn't do that here. So you kind of have to go put your own frequencies on.

These are again the top 29 end states. But I in this case, I grouped all the cases without water on the left, and the cases with water on the right. And when I say with water or without, I mean as identified in the event tree.

So like Rick said even if -- because this is defined as the two A cases, which is a reliable water source, there is potentially some likelihood that that doesn't operate. And those would be those left eight cases.

So the left eight cases, and what I tried to show on here, which it, okay, it's not cut off. The blue lines are cases -- well what I did is I tallied up, I summed up the integrated hydrogen flow through each of three release paths. One through the wetwell vent, which is red. The drywell vent which is blue. And then I basically lumped anything else that could get out of containment, liner melt through, drywell head, I think I even included normal leakage in there. I just lumped those together and calculated what the integrated hydrogen release would be.

These are all over a 72 hour transient time that we were analyzing. And you can see on the left, the green color just indicates that that's a hydrogen term to the building, not through the vent. So that's going to clearly pose a challenge to the reactor building environment from a combustion perspective.

And those are the eight cases that didn't have successful water injection on the debris. They most likely ended in high temperature failure containment or most likely liner melt.

And then the right case, Ed I'll just state, the right side are the cases with water. We prevent liner melt through. We tend to prevent high temperature failure containment. We're dominated by releases initially through the wetwell vent. That's why the red lines are all higher.

And then we do switch over to the drywell vent at 21 feet, then we now have a release path through the drywell vent. And I just totaled those up separately. And you can see.

And the one case on the right there shows some green, its' CD-019, APET-017. It's one of those cases where both the wetwell vent and the drywell vent probabilistically failed. And in that case, we fail on an over pressure. We had water. So the temperatures are okay. But we have to relieve pressure at some point.

It relieves through the drywell and using the SORCA kind of drywell hand release model. But that is a release in green that's going directly to the reactor building. It's not a lot as you can see. It's not a lot of hydrogen, but it is going to the reactor building.

MR. BUNT: Okay, just a quick question. You cleared up what I was going to ask you for. But does this include carbon monoxide?

MR. GABER: It does not right now. I just used hydrogen.

MR. ESMAILI: Is there any way to figure out from this slide that what is the amount of hydrogen that is left in containment? Or we have to do a separate guide for that?

MR. GABER: Separate graph, yes. Yes,

that's a good question. In these cases, the -- you know there's hydrogen generated in two places. In vessel during the core mount phase. And then ex-vessel, you can see a slight, I won't say a huge difference in the red and the green magnitudes. It looks like the greens are around a little, 6,000 pounds or more, the reds are 4,000 pounds.

That difference is due to the cases with water on the containment floor. We get less CCI. We get less core concrete attack. So less hydrogen ex-vessel.

In the model that we're running right now, the MAAP502 model, even in the presence of water, we get continued core concrete attack. We have as Doug showed in our APET, we do have the capability to try to distinguish between a scenario where water is more effective at quenching the debris versus one where it's less effective.

Perhaps the less effective would match up closer to the melt core -- typical melt core analysis. In the old MAAP4 days, if we put water on debris, we'd normally quench it pretty quickly. With MAAP502, that doesn't seem to happen quite as frequently. And we've tried to look at some of the sensitivity parameters a to see well what do we have to change to try to augment that cooling process?

Now as we've learned recently from work at Argon, there's some new physics involved with core concrete attack. And how these volcanoes or eruptions are actually enhancing the cooled building the debris. This is the latest work from Mitch Farmer.

And we're going to try to get if we can, you know, and we're trying to represent that as an enhanced cooling mode. We tend not to see big differences in those branch points. So MAAP, MIM and MACCS.

MR. ESMAILI: Jeff, so you go to core. So as far as in vessel hydrogen is concerned, at what point do you start injecting? That the lower -- because we assumed at low --

MR. GABER: The same.

MR. ESMAILI: So you had the same in vessel hydrogen regardless of with our without water, right?

MR. GABER: Exactly.

MR. ESMAILI: And so that's why we were discussing this about you know how much hydrogen goes out. Because you are going to vent before lower vent failure anyways, right?

MR. GABER: No, not always. Some of these cases, because they vent at vessel breach. They could vent at the time of vessel breach.

MR. WACHOWIAK: Well, they tend to be a few minutes after. Not long after, but --

MR. ESMAILI: I think our results show that we are going to you know, vent -- you know we would get to that 60 pcpl before lower head failure. The point is that you know once you are in the venting, you know, what does it matter how much hydrogen goes out in terms of you know, like if you want to look at you know, the benefit of the drywell versus wetwell venting.

I think you should look at you know, from the time core damage starts to the time you know, that's what I was thinking, to the time that lower head failure, which one is more effective in getting the hydrogen out. Rather than looking at you know. Because right now we don't do that water, you know this thing core concrete interaction is occurring, and you know, things are going out.

So I cannot decide whether wetwell venting or drywell venting is -- has any benefit.

MR. GABER: So, just so I'm trying to understand what you might want to look at in terms of output. You seem interested in knowing how much of the hydrogen generated in vessel gets transported out of containments prior to vessel breach. Is that what your focus is?

MR. KARIPINENI: Right. Let me ask a little bit more. What we're thinking is when you close the vent, just sometime before core melt down, whatever. You have -- you still out to be -- the SRVs are still relieving some hydrogen into the vent, into the suppression pool.

MR. GABER: At what time?

MR. KARIPINENI: After you close the wetwell.

MR. GABER: Okay.

MR. KARIPINENI: So you go into the suppression pool, and you are pressurizing the pools, and the vacuum breakers would re-use that hydrogen at some point back into drywell. I would have a tendency to go over that to the drywell. And then we're going to go, it's going to say there now? Or for the rest of the accident, it's going to be always filled with hydrogen? Or at what point, how much is left there?

MR. GABER: Okay. So it sounds like there could be some -- it sounds like this isn't really what you wanted to see. You wanted to see the fraction of hydrogen in containment as a function of time.

MR. KARIPINENI: But can you calculate stratification? I mean you are setting up a circulation inside the driver, right? So you probably not getting stratification that you're making.

MR. GABER: The MAAP model will calculate buoyancy driven flow. So as you say, with the vacuum breakers open, introduce hydrogen, lighter gas into the bottom, they'll be nesting.

MR. WACHOWIAK: We've got to set that -- it will mix, but I think what he wants to see his how much is kind of retained. Or reused.

MR. KARIPINENI: Do we have hydrogen filled top coats in the drywell that are going to be there for a long time.

MR. GABER: Okay.

MR. WACHOWIAK: We can set that up as a supplemental.

MR. GABER: Yes, next time we'll work on coming up with the fractions in the different locations. In the drywells function of time. And it sounds like that will be more meaningful to you.

MR. FULLER: This is Ed Fuller. You know I think you could get pretty good handle on it because the CCI production doesn't really start immediately. In the MAAP calculation, you've got five contributions to the hydrogen generation. And two of them are before a vessel failure. One is at the time of vessel failure, or two of them actually, at the time of vessel failure, which are DCH and the -- when the jet is coming up.

The fifth one is from the CCI. So you can look at the time from when the vessel fails until when the CCI starts. And you can get a reasonably good handle on how many kilograms of the hydrogen that were actually produced in vessel in that vessel failure.

And then look to see what was released during that period. You'll get a fairly good handle on what Rao was asking for.

MR. GABER: Good. Understand. Okay, I guess I'll turn it back to Doug if there aren't any other questions on the MAAP results.

MR. TRUE: Okay, then the next set of slides are the same slides that Jeff presented on April 30th. Only one minor tweak on them just for visibility purposes. And we're bringing them back in case there were residual questions that Jeff couldn't answer because I wasn't here. So we don't need to spend a lot of time going through these unless you want to talk about them.

So let's go through these one at a time. So this was our conditional continuing failure probability. So you have a condition that's imposed at the beginning of this, rather than nearly a 1.0, the water addition brings that down in the .3'ish range, almost independent of the scenario across all the different alternatives that are included here. Next one.

This one I had these little dash lines only to give you a little bit better ability to see that there were some differences across the results. This is IDF and LCF risk across the cases. And so I put on the alternate 2 cases, I included one at each of -- on the blue bar, and the red bar is for 2 Alpha, and then you can kind of look across and see there are some differences, but they're pretty small.

And the reason for that is that we got a trunk that's all these liner melts that kind of occupy that bottom part. And then we're talking about changes of some amount of percentage to the release on the remaining ones that are left. And there just isn't a whole lot of wiggle room left there on the bars.

But it gives you a little bit of a perspective on this. Next one.

MR. ESMAILI: Excuse me, just a question Doug.

MR. TRUE: Yes.

MR. ESMAILI: This is an outside consequences measure here. Now the question I have is when you did your max calculations, if you of course included all radionuclides, not just the cesium and iodine, correct.

MR. TRUE: Correct, correct.

MR. ESMAILI: So a lot of the -- this is coming from CCI, and it doesn't matter whether you had in vessel injection or drywell play, particularly and especially when Jeff just said that you get CCI for quite a while, even after the water is put on.

If you were to translate this into a release fraction to the environment, you take out the off site consequences, do you have any feeling for what the differential and the release fractions would be between in vessel injection versus drywell flooding?

MR. TRUE: They really are a strong function of the scenario I think. One of the reasons that the 2, the alternate 2s show lower releases then alternate 3s is because we get a big chunk in vessel retention and we get really high DF's for those. So that's why you see the 2s are lower than the 3s.

MR. ESMAILI: Okay, so that's really where I was going.

MR. TRUE: And once it gets ex-vessel, I don't think there's a huge difference in the release fractions we see.

MR. FULLER: This I think starts -- will

probably start the discussion that we'll have some day on the metrics that we are going to be using. And whether they out to be tied to -- to what extent they ought to be applied to release fraction, which more directly relates to the filtering strategies themselves versus off site consequences.

Because really the off sit consequences, a lot of that is due to the radionuclides released in the CCI.

MR. SZABO: This is Aaron Szabo.

MR. FULLER: But I'm talking about cerium and barium, things like that.

MR. GABER: I guess and to some extent you can see that on this chart when you go to the large filter all the way to the right. And Doug drew the line there. You can see there you know, it's not a huge difference, but there is a Delta there. For the large filter, not the small.

But for the large filter, those kinds of radionuclides would be scrubbed in the large filter. And you can see it's lower. But again, this is all rolled up into the consequence analysis in the you know, LCF and IEF.

MR. SZABO: This is Aaron. And this kind of gets to what Steve mentioned earlier about the end game if you want to call it that. You know we have these performance criteria -- various performance criteria that you know right now I think we have around four is kind of what it was. It was like a DF, we had like this 50/54 HH, we have the mar -- what you guys were originally calling margin to the safety goal is kind of what this is. And then you had the one earlier, the earlier slide, the conditional containment failure probability.

I was wondering if you were planning to propose a preferred performance metric, or not only criteria, but also a metric, or would you --

MR. KRAFT: I know at the very beginning of the discussions on the rule making, we did propose those. And I guess we have to think about how we're going to from our own work, how we're going to kind of combine it all.

I will renew our request that you respond to something that we asked you at the very, very beginning, which was what's the goal of this rule making? We asked you for a -- I don't know what we called it, a statement of purpose, I forget what we called all those. You proposed some.

You know a lot of that drives thinking, right. And it can help us thinking what the metric might be.

I just throw that out there because I'm not quite sure how to answer the question.

MR. GABER: I think ultimately we can look at those things. And we're trying to show a lot of that data. But in my personal opinion is that ultimately we do the cost benefit analysis.

And we calculate what the true benefit of these different options is going to be. Because that captures the off sit impact, which is really the goal. Maybe that's not the end game, but that's one of our key figure merits.

MR. SZABO: Yes, within the regulatory analysis model, you do have the numeric value. Essentially what I'm going to have to do is not only compare ever alternative to each other, but also how alternative -- how good it is against whatever performance -- each of the various performance we're looking at right now. Depending on once again, not really, kind of you know the Mark II and the DF kind of ended up with, the DF as well.

So it seemed like those were really similar though they had different starting points, at least initially when the initial talks, and I know we need to circle back to that. But when we started getting to the CCFP.

MR. KRAFT: I don't necessarily agree with that. I think as I recall, we were trying to demonstrate the relationship between where we were relative to the QHO, and how that could be used to show how the DF performed. They're not the same factor.

Am I getting this right? I don't recall us saying that they were the same factor. Or that they -- we were trying -- you all were focused on DF. And we were focused on how far below the QHO. And we were trying to show they related. That doesn't mean they're the same factor.

MR. SZABO: Okay. I mean and if that is the intent, I mean we -- I would at least like to hear what the intent.

MR. KRAFT: It does to the question I asked you before, how do we get to the --

MR. SZABO: The resolution of what the problem statement is. I mean --

MR. KRAFT: Well then how do you get -- right, and how do you get to solving a problem. I mean you know you're told this is what success looks like.

MR. TRUE: Yes. I think we're still tracking all of those same metrics that you mentioned. And so, but we haven't finished. So we haven't gotten it all pulled together into the picture we think it paints.

MR. SZABO: Okay.

MR. TRUE: I mean there's some early indications for example, and I think you guys have seen this in your MELCOR runs through that putting water in the vessel, that might be even preferred in some respects. Put water in the drywell, as other benefits.

MR. ESMAILI: Yes, I just want -- this is very, very sensitive to the assumptions that we make. When you actually start injecting into the vessel. I think there is also going to change, I'm not sure how much it changes in MAAP, probably somewhat. I know that it's going to change in MELCOR, exactly when you start.

But not everything goes through this pressure port. You still, you said have some material inside the vessel that could re-vaporize. So you catch those earlier, but not be able to arrest, you know, the amount melt inside the --

Yes, at some point it might be the RPV injection would be better. The results that are showing right now is that -- and we don't see that much different either. In my cover, I will show you, is that because it's very, very sensitive to a certain assumptions that we have made.

So it's become very, very difficult to you know, to come up with some numerical work.

MR. TRUE: Yes, I think that coming down to a number is going to be difficult. We did work at this one point we had this idea of well let's compute some kind of frequency weighted DF. I will tell you don't bother. It doesn't work. Because the really high DF cases can really swamp out all the low DF cases. And it's completely misleading.

It would be great from the stand point of trying to demonstrate we get average high DF, but it's not meaningful, because the DF span over four or five orders of magnitude, and the frequency spans over maybe one order of magnitude or two. So you get these spikes that are not helpful in the overall frequency weighting.

You can look at it, but I think you will find the same thing I did. It doesn't give you a meaningful metric. So we're still looking at different ways with --

MR. SZABO: Yes. No, that's fine, and you know, part --

MR. TRUE: And I think at some point we should figure out how to.

MR. SZABO: Part of the reason why we held off was because until we know what that sequences are and map that all out, and try to figure out a performance goal is to not necessarily kind of the cart before the horse. So, but thank you.

MR. SULLIVAN: And Doug, if you don't mind, from the back bench here, while we're talking about metrics, this individual early fatality metric, I would have to question that. I mean I believe I've seen the scenarios you're working against. And this place is evacuated by the time any kind of release happens. We have a six hour evacuation time at this site.

MR. TRUE: We have core damage in an hour.

MR. SULLIVAN: Core damage, but what about release?

MR. TRUE: Then release will be four or five hours.

MR. WACHOWIAK: So these are relative numbers here?

MR. SULLIVAN: I understand the relative numbers. But it's a deterministic metric. And below 200 REM or so, you shouldn't even report it. Because it doesn't exist. So I'm a little bit flummoxed that you would use individual fatality at -- first off it would be a very small number, which is very difficult to do it relative to anything. And being deterministic, there would be a cut off.

So unless we're delivering 200 REM or more to somebody in the field, and that's got to be a very small number of people, especially with an ongoing evacuation, this is a very small number to actually publish a metric on. I would submit to you for your consideration.

MR. TRUE: I think that's a fair comment then.

MR. ESMAILI: But these are based on the results of consequence analysis that you've done?

MR. TRUE: Yes, MACCS

MR. ESMAILI: You've done MACCS already and did you see individual?

MR. GABER: Yes, now this isn't for the representative site. This is for a different site, and again, we're still in the process. We did get the -- we did get the Peach Bottom reference plant from SORCA, but we still had the problem with getting a WinMACCS on EPRI's computer.

MR. ESMAILI: Okay, so these are not --

MR. GABER: So they haven't been rerun yet.

MR. WACHOWIAK: And I don't remember what the absolute values are here on this, but you know, because it's relative, going from base case to 2A, it's probably like comparing 10 to the minus 9 and 4 times ten to the minus 10. So, good luck with a very, very small.

MR. BUNT: Another point I was going to make is that these curves, while they look like it's just a reduction in two-thirds, it's still a large number because you're going to put it on the chart, is this is a large -- this is representation of a really, really, really small number so far arranged.

MR. TRUE: and the only reason we included it, was because we didn't have absolute results we could present. And so we'll look at the absolute results when we get them.

MR. GABER: Once you give us a copy of WinMACCS, we'll be able to do these. I didn't put that on the slide. But once we get a copy of WinMACCS that we can run on EPRI's computer, we'll be able to bring absolute values and deal with that.

MR. BARR: EPRI submitted a request for it and the NRC approved it. It's in the process, I believe the request was proved, a non-disclosure agreement was signed. So I would say I think they probably would have access, we'll need to download it and install it probably a week or two ago. Was I wrong?

MR. WACHOWIAK: No, we were told it's going to be today. We think we'll get all worked, out, it was just kind of bumpy.

MR. TRUE: But it's been soon for a long time.

MR. GABER: But we'll get there. We clearly don't -- I guess we don't expect the relative kind of characterizations to be that. But at least it gives us the ability to come and talk to you about specifics.

MR. TRUE: And these charts were originally set up to sort of make the contrast on the value of water versus all the other alternatives we've been talking about. Not to draw final conclusions about the decisions on two or three strategies. That's not it at all. So we can keep going.

This one just over took the cases with filters, and I don't think there's anything new here. Just in principal focus in on those. Next one.

MR. GABER: One thing I was going to add, and I don't know if you guys have done any calculations considering the small and the large filter, but I did just -- and hopefully at the next get together, we'll be able to bring you more results for the filter cases.

But I did notice just kind of spot checking the results for the small filter, that we did exceed the aerosol loading in many of the cases in that case. I think it was 30 kilograms or something, whatever you gave us. But we have -- we provided it at the April meeting.

We do see that that can be exceeded. The large filter, I don't think I recall any of the cases exceeding the threshold for aerosol loading.

MR. FULLER: Jeff, when you look at the loading, you included all of the aerosol sources, including non-radioactive, and including those from CCI?

MR. GABER: Correct, yes.

MR. FULLER: Okay.

MR. GABER: there's a heat limit and a mass limit.

MR. ESMAILI: Just one observation, because you know looking at your releases, I don't think it's any worse than SORCA releases. We know form SORCA what the results were. So if you run -- so that the red might disappear, I mean if you put it in an absolute, I don't think it's going to be any worse then -- or so it's going to go away. It's just you're trying to normalize very, very small numbers.

MR. TRUE: Yes, that's it. Again, Jeff presented this last time. It's just shows the difference in why the 2 Alpha ends up with some differences. The ultimate 2 because have the in vessel retention cases in there. I think this is roughly similar to what it looks Marty will present when we get to it. If I ever get done.

So that's one chart we presented last time.

This just divides it up then further into what happens ex-vessel. And then last. This is MACC, you know this is heading us towards the benefits side of the calculation where the benefit would be the differences in the cases.

And again, when this is not a direct to the plant, that's why we did it on a relative basis. Next one. Yes, so where we're going from here. So we saw once we get the WinMACCS thing worked out with EPRI and NRC, then we're going to do the -- using the SORCA, Peach Bottom WinMACCS text to write on all the scenarios.

I guess I'll just pause on this -- there was some conversation about you guys potentially making some other changes as far as this project, to the WinMACCS model?

MR. GABER: Input, standard input.

MR. BARR: Yes, changes based on current, you know models, best practices since SORCA, and on currently available information.

MR. TRUE: Is that something that we could be presented, so we would know what the Deltas are?

MR. BARR: Perhaps at the next public meeting, if you guys would prefer.

MR. GABER: That would be good.

MR. TRUE: Yes, not now. I think that would be helpful. And that way, we're going to proceed I think with what we have. Assuming that -- unless you tell us that there are significant Deltas you think in the results, we'll proceed with what we have. You think? Yes.

MR. GABER: The sooner the better.

MR. TRUE: I think we should proceed.

MR. GABER: Yes, I think we have to proceed.

MR. TRUE: And then if it turns out you give us information that says that this was submitted --

MR. GABER: Doug will show that we have a couple sensitivities, dollars per person-REM averted, things like that, that we're kind of aware of, that there's some sensitivity to.

MR. SULLIVAN: The changes that I think we're talking about, are based on the publically available DTE from the reference site, which is shorter than the ancient DTE that we used in SORCA. I guess it might be easier for you to just load the SORCA data since the cohorts and everything are powered. But it's the same cohorts, just different travel times, due to a shorter ETU if I'm not mistaken.

MR. TRUE: Yes, we just had heard there were going to be some changes and didn't know what the nature of them was.

MR. SULLIVAN: Yes, the new ETE is just --

MR. GABER: For the reference, the level three reference sites.

MR. SULLIVAN: No, not level three separate. We're talking the reference site for this one. There's a new evacuation time as to for every site that came in December 12th.

MR. GABER: Okay, got you.

MR. SULLIVAN: Yes, December 12th. And this site was a little late, but it's in and it's shorter then what we had in SORCA. It's just the evacuation time estimate, you know the travels of the population, et cetera.

MR. GABER: Yes, if we could -- of you have the -- we should have.

MR. TRUE: We can get it from the utility.

MR. BARR: It's publically available.

MR. SULLIVAN: It's a publically available thing and but I mean you'd have to -- I mean you're parsing the cohorts anyway. So it looks like you set up the cohorts with the new evacuation time estimates.

MR. GABER: You think that's pretty much the difference?

MR. BARR: Updated data bases like census, land use, economic values. And some other small things like that. Things that are probably not worth getting into right now. But maybe discuss a little more in the future.

MR. GABER: Okay.

MR. TRUE: Okay. So then we're also going to be starting in on the path on Mark II as I explained kind of the way we're going to approach that. So we'll have those results soon. We got a MAAP model set up for that.

Then we got all the ensuing analysis to do, and I'll talk about those in just a second. But to get to the bottom line in this slide, both literally and figuratively, we shooting to have the analytical work done by August. And then EPRI is going to what a publication in the fall, and hope to have that report publically available in December.

So if realizing that you guys are shooting towards the end of the year to be done too. Probably public meetings would be the best way for us to communicate results before the publication of the document. Which is why we're shooting for August.

MR. SZABO: and the way I -- this is Aaron. The way I see this going forward is essentially that way we would refer as appropriate to the document, understanding that it wouldn't be final until probably we'd be done with our whole -- for the draft regulatory basis by the way. Which of course has its own comment period.

And you know even though we're not required to respond to comments, we would still consider comments. We could you know, this would likely be treated as one or whatever, I mean as final document would be, and you know. But yes, this -- we'll make sure we handle that.

MR. TRUE: So can you -- since I managed to snare you in this trap, can you explain to me your general schedule for completing your analysis, issuing something for comment, and just remind me of those milestones.

MR. SZABO: So pending commission approval, we still have not gotten commission approval on our nine month extension. Assuming that they approve that, the draft regulatory basis would be December of this year. We would then have a two month comment period, that takes us to about February.

As I mentioned, we're not -- while we're not required to respond to comments formally, we would still consider them in fulfillment of the final regulatory basis. We have an ACRS briefing, February I want to say, tentatively. Or it might be more then tentative these days, but, in February.

We would then be responding to comments, still having public meetings and then I believe September of next year, the exact dates are in the last public meeting slides. But yes, September would have the final regulatory basis, which is an information paper, so it merely states the commission, how the staff is moving forward to the proposed rule stage.

And then we would have one year to develop -- that's when we would begin the development of the draft regulatory guild. Initial proposed rule language, preliminary proposed rule language and so forth.

MR. KRAFT: So in the original SRM Aaron, wasn't there a point where the commission reserved for itself whether or not you go beyond the regulatory -- what they call the technical analysis stage? Am I right about that?

MR. SZABO: No, it's merely an information paper. Now the staff theoretically could say at the end of the regulatory basis stage, the staff is stopping this accounting, but that would probably need to be another paper, if we said we were stopping the whole process. But they did merely ask for an information paper for the regulatory basis.

Now of course the commission can always choose to turn that into an options paper after the fact.

MR. KRAFT: So you don't have to wait for them to -- you don't have to wait for them to say that's fine, now continue. You can continue without the commission telling you to do so.

MR. SZABO: Yes.

MR. KRAFT: I'm not anticipating they would stop you. I'm was just trying to remember what the steps --

MR. SZABO: Yes, no, it is an information paper that would look very similar to an options paper, except for it wouldn't happen, this is me, how I picture this right now is -- and of course you guys would see this in the draft Reg base as well. It would be here's all the alternative options we've looked at. Here's performance measures we looked at. Here's what we're moving forward with.

Not we recommend to move forward. It would be here's what we're moving forward with. And there would be no formal recommendation. It's kind of how I picture it right now. As me as my lowly staff member. Of course I may be redirected, but.

MR. AMWAY: Let me ask one more time, the proposed rule is September of '16. The final rule is 12 months after that?

MR. SZABO: December, 2017. Yes.

MR. KRAFT: That's all in the April 30th slide.

MR. SZABO: Yes.

MR. KRAFT: Do you anticipate a problem with commission approval on the changes scheduled?

MR. SZABO: No. I don't -- I mean I haven't heard anything with any issues in relation to time. I don't know why they -- we haven't received formal, it's just --

MR. KRAFT: Not something that they've spoken to us about.

MR. SZABO: Yes, and then there's of course if they didn't grant the extension, whether we can meet the original dates even. Which I think the draft regulatory basis would have had to have been out in March, so.

MR. TRUE: Okay, let me give Marty his three hours. So this last slide is sensitivity. And this is for update of what we -- Jeff had shown before. We continue to evolve this as we learn things and decide we want to look into the sensitivities.

One thing that I did do here is I changed my little bullet shape based on whether it was just a probabilistic analysis, which is a check mark. Or whether we actually have to do new MAAP and MACCs runs to support that. So you can see most of them are going to be more probabilistic.

And it doesn't mean that results aren't going to change significantly because we pushed more frequency down different pathways, you get different answers and different dominant contributors. So you know just to know what we're looking at.

And then I did have a question on cost benefit sensitivities. We're looking at the 2,000, 4,000 person REM sensitivity. We'll do the discount rate sensitivity is typically done. And I understand how it's coming under replacement of power, but it doesn't sound to me like that's going to be available in a form to adopt -- for us to adopt, but you might be able to adopt it.

But is there anything else on the cost benefit side that you think would merit inclusion?

MR. SZABO: So the intent is to get the draft of the dollar per person-REM update, and their price and energy cost done by the end of this year. As we said in the last open investment attempt.

MR. TRUE: Right.

MR. SZABO: And Another place where energy costs, I'm pretty involved in with that, and it kind of been through with this stuff. I'm trying to think.

Other sensitivities off the top of my head, we have the one, I mean I'm just thinking about what we did in SECY-12-0157.

MR. TRUE: I can look at that.

MR. SZABO: Yes. I mean you might just want to look at the sensitivities were there.

MR. TRUE: Is that the analysis that you think is lurking out there because of other ongoing actions?

MR. SZABO: The appropriateness of some of those sensitivities I'll leave up to whether you guys wish to do those. You know, but we ran them just for more complete information.

MR. TRUE: Okay.

MR. FULLER: This is Ed Fuller. I'm intrigued by one of your phenomenological sensitivities, namely the delay of drywell shell failure. Are you going to be using MAAP503 to do that particular calculation?

MR. GABER: No, we'll do it parametrically with 502. Since we're not mechanistically calculating that now, we can just parametrically look at the sensitivity.

MR. FULLER: So you have some thoughts in mind on how to do that I take it?

MR. GABER: Yes, some thoughts. I mean your analysis provides the melt core analysis provides some input to that because you can see -- we can see some of the different --

MR. FULLER: But it doesn't give the degree of spreading though.

MR. SZABO: All right Steve, do you want to just continue or do you guys want to do this topic? Okay. But there's still a hard stop at 2:30.

MR. KRAFT: Well it's convenient for you all, but at 2:30 I do have to go. But it would be good to hear at least the beginning.

MR. SZABO: All right.

MR. ESMAILI: Okay, I am Hossein Esmaili, I'm in charge of doing the MELCOR calculations. This is just an update to the public meeting that we had at the end of April. I presented you some results. I'm going to show you more results. Basically fill in some of the cases that was not done.

I think all of you know there is an option one, you know we assumed that the vent is in place, you know the RPV pressure control anticipatory venting, this is all the initial and bound conditions that we all agreed on. Back at the end of April we had options 2A, 2B, 2C, this is RPV injection with vent cycling. B and C are vent cyclings.

And what we added was option D, that we would travel, that the water, so it would not go above 21 inches. The results I showed you before was we would always go though from if you fill it up, it would go from wetwell vent into the drywell vent. So these are the cases to be added. Next slide.

The RPV injections, same assumptions 500 gpm, the injections at vessel breach we assume there's an option to inject prior to vessel breach. The results I'm going to show you, we didn't do that because we pretty much know that you know you're going to arrest the core in vessel.

Then the drywell injection. Again same thing, it's to containment sprays. This is flow rate control to prevent better venting, so at 500 gpm, you know once we get to 21 feet, that I would reduce it probably to somewhat less than 100 gpm so that the water does not go up.

MELCOR considers initial break of build up of water in the drywell phenomenal leakage. This actually turns out to be important, because you know by the time the lower head fails, you still have about you know, between one and two feet of water inside the drywell.

So when you start injecting water at the time of lower head failure, so you have some time. Because you know so you don't get to a liner melt through because of the existing water. So that is important. Next slide.

They asked me to put this slide in, so I guess everybody knows about the fission pathways here This was another slide so we just -- you know MELCOR models all of these things you know, transports for the RPV, as it turns out main steamline, going thorough SRVs, drywell and main vents, we do consider core containments direction as you do.

The drywell head leakage, here the assumption is that's because all of the cases are wetwell venting. You know we assume that the drywell head starts leaking about 700 Fahrenheit and just kept open, it's not, you know it cannot close.

We do some -- we do have some cases, especially main steamline break that the pressure is so high that you -- you know that you also lift it based on pressure because the pressure goes above 100 psi.

MR. GABER: Excuse, me is that with -- did you say that's with venting?

MR. ESMAILI: Even with venting.

MR. GABER: Even with venting. Even your main steamline ruptured?

MR. ESMAILI: The main steamline cases, even with venting, it's not enough to relieve the pressure.

MR. GABER: So in those cases, you're using the SORCA model that's kind of the pressure cooker, that just releases --

MR. ESMAILI: That model is there, but more importantly, the model of exceeding 700 degree F is there. So you always get at 700 degree F, so you don't receive that. You just -- you know, you leave it open.

So we do have the liner melt through, we have venting. There are I think a number of penetration leaks through the containment and through the reactor building, those are a model.

Bellows ruptures I think it's just something that was postulated for the Fukushima, we are not modeling that, so.

MR. GABER: Your other penetration leaks are normal --

MR. ESMAILI: Normal leakages, based on.

MR. GABER: Half percent per day stuff?

MR. ESMAILI: Yes, very little. Okay, so here's --

MR. KARIPINENI: The 700 degrees you're about is gas temperature?

MR. ESMAILI: Gas temperature.

MR. KARIPINENI: And you have a structure temperature also calculated in all of those cases, right?

MR. ESMAILI: Right. We do and then we provide that one. But the assumption's at 700 degrees F, this is what we agreed on back in December, that 700 Degree F, we say that the seals are gone. And once the seals are gone, we open the flow path from the upper drywell head. I think it's about 21 feet square. And it's just open.

MR. KRAFT: Excuse me, how rapidly does that happen? Once you have the steamline rupture do you get the lifting of the dome, how quickly does that occur?

MR. ESMAILI: It's almost immediate.

MR. KRAFT: Almost immediate. That's how I would have thought that the violence of the --

MR. ESMAILI: It's almost immediately that you have a very hot -- it just fills up the upper head, you know whatever is inside that steam dome is just going to come out.

MR. GABER: I don't want to steal Marty's thunder, but if looking ahead, which we all do, it looks like those main steamline ruptures are lower frequency cases.

MR. ESMAILI: Oh yes, okay, so this is what

I didn't say. I'm going to say that. The main steamline break, you have to work very, very hard to get a main steamline break in those cases.

So here I'm just showing you the matrix, and looking at it it's really small, so I guess we are racing to see who can produce the smallest 1,000 and put it on the.

But so option one is that these are the cases that have no water injection. Based on our discussion back at the end of April, there was some discussion about the anticipatory venting for 15 psig versus 5 psi -- they have one sensitivity we did at 5 psi.

And so some of the differences between the last public meeting is that for the cases where the RCIC fails, we do not -- if the RCIC fails, we do not do anticipatory venting. Whereas the results I showed you before, there you know, even though the RCIC failed, we did anticipatory venting.

But here in some of these calculations, I don't do anticipatory venting if the RCIC fails. But the whole purpose of that one was to.

And so some of the cases you see the B cases, these are traveling cases. We do have sensitivity to 240 F. More results are actually in a back up slide.

Then we have a number of cases that you see at the bottom that we assume basically either no RPV pressure control and you the operator does not do anything so that it's cycling at a set point. Or there is some time about four hours of PRV pressure control.

And then in terms of RCIC, we have some cases that the RCIC availabilities were four hours or 16 hours. It doesn't mean so for four hours, RCIC can run for four hours. They cases that have 16 just means that it's available. I'm not going to run it. But it's mostly the cases are going to fail before 16 ours unless it's a section for CSD.

Okay, so I think -- and then I changed that band you know from 10 psi band for the one cycling cases to 20. And we have two cases, I think it's -- maybe I can look at this, at 49 and 50. I think it's 49 and 50 represent your CD-017 and 19 cases. So we just ran those cases.

And you see, we have some internal discussions. So we ran some additional cases assuming that wetwell venting is not available. Now what happens if you do drywell venting. Just wanted to see you know, whatever type of result we were going to get.

MR. BUNT: Okay, this is Randy Bunt. Can we go back, you said that you did not do anticipatory venting for some things when you didn't have it. Are you not venting until you get to PCPL, or are you venting --

MR. ESMAILI: No, no, we vent. We vent. We do vent. When we --

MR. BUNT: But you said you weren't going to vent because RCIC wouldn't be available and you reran the cases not doing an anticipatory venting. But there is venting ahead of the PCPL as long the vessel's not breached.

MR. ESMAILI: That's right, that's right. In all cases -- in all cases we get to 60 psi and at 60 psig so you do vent.

MR. BUNT: But some of those cases, in practical sense, we vent early, we'll vent around 30 pounds if the vessel's not breached yet.

MR. ESMAILI: I have a sensitivity to it, we do it at psp that you see that much sensitivity, because what happens is that this pressure build up is so rapidly that it can --

MR. BUNT: You go right through it.

MR. ESMAILI: You go right thought it. So it doesn't matter when you do it, it may be at half an hour.

MR. BUNT: Yes, I just wanted to clarify that.

MR. ESMAILI: How we do have the -- yes, that is marked great number 6 I think.

MR. AMWAY: But what's the reason for having pressure control for a period of four hours and then not?

MR. ESMAILI: I think this was we had batteries on it for four hours.

MR. AMWAY: Oh, it's the batteries, okay.

MR. ESMAILI: Yes, most cases we assume the you know, and the other reason is that again, this is goes back to, I wanted to get a main steamline break. If you go and do pressure control, if you have battery, you're to drop to 200, 400 psi, you're not going to get that main steamline break.

So we had to do calculations to show that whether we get main steamline breakage, to see what the margin is. And so some of those cases that -- well let's go to the next, I will show you. The next slide.

So here are the releases. So I just categorized in terms of the options. So what you see is that you know, one is obviously no water injection. So 2A you start injecting into the RPV. So in general the releases are going down. And you go to the vent cycling, vent cycling helps overall.

You know you get additional benefit from vent cycling. But the number of cycles is excessive. I don't know how many cycles you get, but we get a lot of cycles when you do over the 32 hours.

The other thing is that you know, going from PRV injection to driver injection, we don't see much of an improvement. And this is because again, the assumption is that no, we vent. No you get to the PCPL about ten hours before we get to the lower head failure. It takes a long time to get to the lower head failure.

So there is enough time for some of these re-vaporization to take place before that. So by the time you start actually injecting you know most of this stuff has either gone out, or they have re-vaporized, they have condensed on other parts of the vessel, you know upper. So it's not having that much of a influence.

MSRV cases, you see that I showed them that they're of course the highest because you know MSRV cases that the upper head fails, you get a hydrogen explosion, you know, and that blows the panels open. So you get a very large releases in some cases.

The main steamline break cases. When I -- the cases that I ran before was as I said, you know you try to keep the vessel pressurized. That's the only way you can get that main steamline break. And even then, it's very likely that you either are going to have to cycle this thing so many times, you know, because our assumption in the number of cycles is around 270 MSRV cycle, this was the assumption that was used in SORCA.

And we are you know, you have to cycle a lot of times before you get to the main steamline break. What we did was that in one of the cases, in case two from the previous slide, is that we tried to run MSRV open, it still opened not full, but you know at 50 percent. Even then we couldn't get a main steamline break.

So at some point I said that if we're not going to get a main steamline break, let's just close it and see what happens if you get a main steamline break. So the probability of getting a main steamline break is pretty low.

And you know --

MR. GABER: Mr. Esmaili?

MR. ESMAILI: Yes?

MR. GABER: Question. What -- when we tried to find a way to display all these results, you know, we tried to list the releases, or the DF, or the temperatures in order of dominant scenarios. I'm struggling a little bit to make that connection between these MELCOR results and what Marty's results show.

MS. ESMAILI: This all had a probability of one. Because right now these are just the MELCOR results. I think at some point Marty's going to talk about each one of these.

MR. GABER: Which ones are used and -- okay.

MR. ESMAILI: Yes.

MR. GABER: How they're getting pulled, how you select them.

MR. ESMAILI: Yes. We have a lot of criticisms say oh, you're showing this. But the fact is that these are just conditions where everything is one. But in reality, they are you know.

MR. BUNT: I know you're doing a representative plan here. But my experience in looking at most of the plants is that their battery lives are more in the eight hours or longer time period with a low stripping and everything else that are being done.

So I mean we understand that the four is being used for that. But many plants have much, much longer than that. So I mean that needs to be factored in I think the probability needs to be these other possibly.

The other thing, I think if I heard you right, that you were saying that the injection was going to start at 12 hours, the secondary injection? Are you assuming that there's not secondary injection in those?

MR. ESMAILI: There's no injection no. All of these cases, I wanted to get some release.

MR. BUNT: Okay.

MR. ESMAILI: If I started out. And then as far as the batteries concerned, I don't care about how much battery I have because as far as the calculations are concerned, it just controls the SRV you know.

MR. BUNT: Right, well for four hours and some of the stuff that you're driving to, I keep hearing that that's driven because of the battery life. And that's really not what we're really seeing at the plant sites. Because the plant sites have a much longer battery life than that.

So we understand that it's typical, but.

MR. ESMAILI: That's right, those are upsets of the calculations, correct.

MR. FULLER: I believe, tell me if I'm wrong Hossein, but most of the cases that he's done, have a 16 hour release.

MR. ESMAILI: We have 16 hours and then --

MR. FULLER: And the battery continues to be available.

MR. ESMAILI: Previous calculations -- previous slide shows that it says availability of RPV pressure control, and say 72 hours that means that I have. Not that I'm going to use it, but I have it here.

MR. FULLER: The capability is there if

something fails.

MR. ESMAILI: Okay, so next slide. So the next slide is how we right now are doing the calculations for the Mark II. It's the same initial and boundary conditions so whatever we learned from Mark I, they're just putting into the Mark II analysis in terms of you know, for head failure, you know RCIC operation, initial boundary conditions.

Our Mark II model is somewhat more simplified then the Mark I because the Mark I went through a lot of you know number of years of you know, improvement. But the Mark II has not achieved that. And we also condensed our own matrix.

So we are not repeating all of these calculations that I showed you before for Mark I. Just showing you know where we saw important stuff. Because some of these calculations show basically the same release.

So these are about 12 of these calculations that we are showing that right now we are going to be trying to run and get results. So it's Mark II it's a condensed version.

MR. GABER: A couple of questions on the Mark II's. Are you -- is your representative Mark II account for the potential bypass?

MR. ESMAILI: Uh --

MR. GABER: Full bypass?

MR. ESMAILI: it does if there is -- it's representative of a case is that if the drain line fails, and I think once that the peak gets injected, I just have to remember, there's some time delay between once the peak gets injected and when does it go to the --

MR. GABER: Bypass.

MR. ESMAILI: Yes.

MR. GABER: And then you're representing to me that --

MR. ESMAILI: I will have more information in just a minute.

MR. GABER: Okay. Then another question would be is your representative Mark II have water under the pedestal?

MR. ESMAILI: No.

MR. GABER: It's dry?

MR. ESMAILI: Under the pedestal it's --

MR. GABER: No, I mean in the wetwell part. In the lower pedestal.

MR. ESMAILI: The lower pedestal, no water.

MR. GABER: No water. There's only one of the Mark II's like that. Of the five.

MR. SZABO: You're still asking two

different questions.

MR. GABER: Oh, I am. Below the floor in the pedestal, in the compartment before the floor, within the wetwell.

MR. ESMAILI: Yes, within the wetwell, there are a number of designs, and I think that the design that we have does not have the water there.

MR. GABER: Okay. You're not going to show your backup slide?

MR. ESMAILI: No, the backup slide is just the numerical value up there, the slide that I showed you, so it isn't necessary.

MR. SZABO: I guess why don't we just take a break now. We'll come back at 2:35. Thank you.

(Whereupon, the above-entitled matter went off the record at 2:22 p.m. and went back on at 2:37 p.m.)

MR. SZABO: All right, so we're now going to continue with the NRC presentation. This is going to be on the risk evaluation status, which Marty Stutzke and James Chang are going to give.

MR. STUTZKE: Well, as usual, the PRA folks get to talk late in the afternoon when everybody's kind of sleepy. But I guess I'm getting used to maybe you save the best part for the last part.

Anyway, next slide please. We'll talk about where we are within the PRA and the actual risk evaluation to date implied here about what needs to be done by the end of the calendar year.

I would remind you that the purpose of the risk evaluation itself is to look at changes in risk from the various filtration and severe accident mitigation strategies that we're talking about.

The reason why I point that out is that when we did the original analysis, everything that was prior to core damage was compressed under one of them, mainly the calculated, the estimated frequency of core damage crediting things like FLEX and stuff like that.

As a result of trying to do something more detailed, there's now core damage event freeze that has grown, probably it's the largest logic model I've ever personally worked on before.

So anyway, I want to talk to you a little about how I've estimated the ELAP frequencies, some of the results and the assumptions and the ground rules that have gone into developing the core damage event that creates the CDETs as well as the accident progression trees, the APETs.

Okay. So ELAP, as we all know, has been defined as the frequency of station blackouts with the duration that's longer than the coping time required by the station blackout rule itself.

Right now there are two contributors considered so called internal events. These are plant-centered LOOPs, switchyard loops, grid related and weather related LOOPs because weather related loops could be things like tornados rolling over a transmission corridor that causes the loss of offsite power.

It does not include damage from the tornado, for example, directly on the site, so no missiles, wind loadings, things like that. Also, we've tried to estimate seismic ELAP frequencies coming in.

And I'll talk to you in a little bit in a slide or two about what's considered in there. What I'd like to point out is that there are other types of external events that we haven't included yet in the model.

And we may not include them at all, again, things like high winds, tornados. Tornados are on my mind because Nebraska sent out a couple of days ago like that. I'll call them or characterize them as at the edge of the current PRA state of practice.

People have done high wind risk analyses, not only tornados but hurricanes as well, which includes storm surge as well as the wind related effects. The other types of external events identified in NEI 12-06 in extreme low temperatures, extreme high temperatures.

None of those are included numerically on the model reg now. They could be significant. I've done some work in estimating tornado induced core damage frequencies using data, the latest tornado hazard model from NUREG/CR-4461.

And, as you would expect, depending on where your site's located, the tornado hazard is larger than the seismic hazard, not surprising. So I point this out. It's what PRA analysts call incompleteness on certainty.

So you have a numerical result, but it's lower than maybe it should be because you've just simply omitted things out of the model. Aaron would call these qualitative factors.

The other note that occurred to me right when I was sending these slides off to Aaron is we've also tended to fixate on the benefits of these filtration and sphere accident mitigating strategies for accidents, for ELAP related accidents.

But they may also be beneficial for other types of accidents as well, and those are certainly not in the model like that. Again, another source of incompleteness on.

Now, I have to believe, having all this

equipment and procedures lined up, that if people feel they're going to need it, they're going to use it.

MR. AMWAY: And to reemphasize that point, I mean the way this will show up is the equipment will be in a list of options that the operator has at his disposal, that he's going to go down and order a preference.

And if it's available he'll use it. If not, he'll check it off, go down to the next item. So if that piece of equipment comes up for a non-ELAP event, and that's the next thing that's available, that's what he'll go use.

MR. STUTZKE: Absolutely. I firmly believe that. The plant won't go down without a fight.

MR. AMWAY: Right.

MR. STUTZKE: Okay. So ELAP frequencies are, in fact, site-specific. There's three reasons why. One is general plants have different SBO coping duration, whether four hour sites are eight hour sites.

The number of onsite emergency AC sources will affect the probability that you actually enter a station blackout like this. And, of course, seismic hazard is site specific as well.

I need to, in the analysis, update the use of the latest seismic hazards that came in response to the

50.54(f) letters that went out on, net term task force recommendation 2.1. I have that information.

I just haven't had a chance to pump it back into the model. So we'll see that. In addition, okay, the ELAP frequencies are considered, of course, random equipment failures, common cause failures and various seismic failures, so batteries, the diesels themselves and of course offsite power wiped out.

MR. AMWAY: If I can just ask a question on the seismic hazard roll update to NTTF 2.1 submittals, also consider the fact that we, for plants that have the GMRS that exceeds their SSC, they're going to do the expedited seismic evaluation program and identify any of those components in the mitigation strategies that may be susceptible to failure in that range and potentially upgrade those or select alternate paths.

MR. STUTZKE: Yes, I understand that right now we're using seismic fragility information that's generic. It comes from our RASP Handbook that the senior reactor analyst used to do this.

Again, I'm fully aware that those hazard estimates have a number of assumptions that are built into them and hidden about the shape of the spectral response and things like that, that may no longer be valid like that.

To do a full job, of course I'd like to have a nice Level 3 seismic PRA for every one of the sites, and that isn't going to happen or schedule and monetary concerns. So yes, I will be paying attention as the information comes in and try my best to incorporate it and credit it.

But one of the things that I would point out here is in addition to a seismically induced ELAP, the earthquake itself can fail other equipment in the plant that we're interested in, notably the RCIC pump and the DC switch gear itself, like that.

They all have comparable seismic fragilities, and you can see the effect on the next slide, Slide 24, like that. So these are my estimates from the internal hazards, the seismic ELAPs.

The last four columns are my seismic portion of the sequences in the core damage event tree. So if you read across the top, it says DC is working and RCIC short term is working.

It means the earthquake did not fail RCIC or DC power. And so you get those sorts of frequencies, and that applies to Sequences 1 to 224 in the core damage event tree.

The next column there is DC is working but RCIC short term has failed, and you see that's not nearly as likely because the hazard and the fragilities being the way they are.

And finally DC has failed but RCIC short term is working and finally both have failed. So you can see the different contributions that way. Yes, that's probably all we need to see here.

MR. TRUE: For the internal hazard ELAP, since you've defined that as longer than coping time, did you credit offsite power recovery?

MR. STUTZKE: Yes. It does, in fact, credit offsite power recovery. You begin to, in order to build the correct probabilistic model there's a deviation from what we were asked, but says assume it's externally initiated and there's no chance of recovery.

But it's unreasonable to think that internal events might be recovered --

MR. TRUE: Right.

MR. STUTZKE: -- rapidly.

MR. TENACE: But the case of this chain stands, the philosophy we see RCIC operating, was there any subdifferentiation, whether that's the electrical power infrastructure or just say, batteries associates --

MR. STUTZKE: Right now it's modeled rather simplistically. It is, there's a switch peer failure assuming they're all seismically coupled and the battery failure's put in there.

So it is conservative in the sense, in other words, it's possible to fail one of the DC switch gears and the other would be perfectly fine in providing the power that you need.

MR. FALLON: Yes, Marty, you got path valve for the DC failure and RCIC, are you assuming a black stir?

MR. STUTZKE: I'll get to that. In fact, it's on the next slide. So the core damage event tree, as I said, it's kind of grown from the one that we had talked about a couple of meetings ago.

Right now, to jump to the bottom and correct an error, right now the tree has 340 total sequences on it, 340 of which 280 are core damage sequences. It models use of the portable flex pump for suppression pool make up as well as RPV injection like this.

There are worries about connecting the emergency generator to recharge batteries when it's needed to. There are, in fact, two core damage event trees. One is for the so called, first venting the case.

That's the one that we normally talk about that says the wetwell is the preferred path. We understand that the wetwell could get flooded out in which case there would be a transition to the drywell.

Alternatively, the wetwell vent may simply fail to open on demand in which case they would be forced to use drywell vent. The other case we have is a drywell first case, nominally through a ruptured disk.

The tree considers reclosure of the containment vents upon core damage. I believe that's in accordance with the EPG SAGs. Extensive consideration of local manual actions upon the loss of DC power.

The reason why I'm interested in DC power is that it affects the human reliability. I give credit for things like RCIC blackstart and black run if DC power fails. I understand the guys will run down to the room and try to get the pump working.

They have to. Similarly, looking into the EPG SAGs I give credit for local, manual SRV operation to depressurize the reactor. They talk about sticking your hands in and lifting the solar mark valves.

I'd have to think twice about that, but it's in there, same way about local manual containment vent operation. If you need to, go crank down on the handwheel and get it open.

So those are in there, and again, the loss of

DC power probabilistically is a conditioning event. It changes the probability of human error like this. Speaking about human error probabilities, right now I have some preliminary values I've used to run through the model that say if it's a control room action, it's set at 0.1.

If it's outside of the control room, I set it to 0.3. I understand those numbers are certainly for the in control room action when DC power's available. That's a pretty conservative number, okay, because operators routinely operate SRV's and depressurize things.

Remember that the purpose of these is to help us focus our attention on what sequences we think are more likely than others for the MELCOR. And these are not the final numbers that James will be working on like that.

I would also point out there was a commission meeting a couple of weeks ago about human reliability in general, and the subject of filtered containment venting came up.

And it's created all kinds of interesting discussion among the staff about whether people can actually estimate these types of probabilities, so forth and so on.

The net result of that is James and I are going to go have a chat with Commissioner Ostendorff later this summer.

MR. CHANG: August.

MR. STUTZKE: August. Like that, we're going to have a chat with the ACRS about these sorts of issues.

MR. TRUE: Marty, any idea of order of magnitude or rough guess, how many human errors you got, you have in the model? I mean is it ten? Is it 50? Is it --

MR. STUTZKE: It's probably about ten.

MR. TRUE: Okay.

MR. STUTZKE: It doesn't have all the nuances in it that it really --

MR. TRUE: Yes, that's my --

(Simultaneous speaking.)

MR. TRUE: -- I was trying to get a sense.

MR. SZABO: I do recommend everyone watch the commission meeting that is available, the transcript if you want to read it is available. But you can also watch the video, especially the Q and A at the end between the commission and the staff will help.

As I said, as Marty said, this rulemaking actually came up a lot more than I wanted it to, so it may help inform your thoughts for later, what might be coming down the road.

MR. STUTZKE: So, as I said, the 280 core damage sequences, realize that 139 plant damage states. So we'll talk about the plant damage states again. These haven't changed, but I guess I want to clarify the evolution of this.

Basically, the plant damage states, let's go to Slide 26. It's a five chunk for the five attributes of the plant damage states. The first one gives you an approximate time frame.

The second one gets you an approximate RPV pressure, containment vent status, DC power status and a FLEX pump status. The latter two are there because they impact the accident progression of event tree logic.

In other words, if I know the FLEX pump is already mechanically broken, and its backup is mechanically broken, it's not available post core damage. It's that sort of thing like that.

As far as, let's work our way up, so, from the bottom. So the FLEX pump status, it's either it's okay, which means it's always working. It's mechanically failed. The hardware's broken.

The operate didn't get it aligned in time to avert core damage. That means there's a chance that it gets recovered post core damage.

MR. BUNT: When you say hardware has failed, that's both the N and the N plus 1?

MR. STUTZKE: Yes. The rationale here is if the first pump breaks, you'll try to use the second one to prevent the core damage from ever occurring like that. So I know by the fact that core damage has occurred, you used up your available resources, that sort of thing.

DC power you have a long term, is an indication that it's an unrecovered battery depletion like this. And I realize the plants have various amounts of battery depletion time.

We talked about four hours. It could be eight hours, load stripping, different plants. For the tree it doesn't matter. All I'm trying to distinguish is did it go away because it was unrecovered as opposed to the short term attribute, which means it was broken at time zero and can't be fixed.

So the short term is really a seismic failure of DC power, non-recoverable. If the long term is, it worked during FLEX Phase 1. It didn't get working in FLEX Phase 2, so I will allow some credit to try to get DC power recovered post core damage.

MR. BUNT: And once again going back to the EDM, there is EDM methods of restoring DC for SRV operations. Were those considered?

MR. STUTZKE: In a broad sense, yes. A containment vent status merely tells you which vent is open, if any, at the time of core damage like this. RPV pressure gives you a rough idea of whether the SRV is cycling.

That's important because that's one of the conditions necessary for main steamline creep rupture. It tells you if you're medium pressure, which means there's a 200 to 400 pound control bound to optimize RCIC pump.

Or if I'm totally depressurized below the FLEX pump at time of failure. Okay. Timing, and you'll see I carefully put down zero to four hours, four to 16, at 16. The original idea was this.

I got FLEX Phase 1, and I got FLEX Phase 2. So I need a way to distinguish did I fail in Phase 1. Or did I fail in Phase 2? So that was originally early and late, that simple like this.

The MELCOR guys needed to know well, how long, in order to run the simulation. Fine, we'll pick time zero plus as an early failure, and we'll pick five, eight hours, something for the longer term MELCOR time.

Thinking about it a little bit more we realized there's a way to get in trouble if you don't supply suppression pool make up. And those are much longer sequences. So okay.

So I'll take the long term one, and we call it middle term and redefine long term as suppression pool make up failures. And that's all that's intended, whether it's actually 16 hours, 23.

Again, it's immaterial in my concern. So the obvious, if you notice, this thing moves around from presentation to presentation.

MR. GABER: Hey Marty, a question on the pressure. So, I know we talked about this. Maybe you answered it before. If I have RCIC, and I'm controlling at medium pressure, does your modeling account for if I lose RCIC I depressurize?

MR. STUTZKE: Yes, it does. I can go back and check that. It should be in the tree structure.

MR. GABER: Okay.

MR. AMWAY: The human reliability failures that you were talking about in the control room, and you mentioned something about pressure control. Is that you start the depressurization, and you fail to terminate it and end up losing RCIC? Or what types of --

MR. STUTZKE: That part of the logic is very similar to EPRI's logic model. Those branches are basically the same. So you have the case where you depressurize, and you just don't turn it off.

And you turn off your RCIC pump as a result of it. Or there's cases where, for example, in the medium pressure, they want to get, they got the FLEX pump hooked up and they forgot to get down below to shut it off, so it's just running dead headed in the system for whatever reason.

MR. ESMAILI: Do you do that, Jeff, in your map calculation? Do you depressurize after RCIC fails?

MR. GABER: We do.

MR. TRUE: We have cases where we don't.

MR. STUTZKE: Yes, I may have one or two. I need to go back and investigate, but I did look at it.

MR. ESMAILI: I think we have two cases --

(Simultaneous speaking.)

MR. STUTZKE: Because what was triggering me was the EOP that says it's the last resort, blow it down.

MR. AMWAY: On a RCIC failure, if that's your last injection source that's what you're going to have to do before you transition the --

(Simultaneous speaking.)

MR. STUTZKE: Yes.

MR. FULLER: There is one thing though if RCIC fails because battery depleted, you'll repressurize. Marty says he credits the possibility of manually opening up an SRV. But I don't know what the chances are you're actually going to do that.

MR. STUTZKE: 0.3.

MR. FULLER: All right. The thing is if you don't do that, and you go to core damage at high pressure, the whole issue, but on the other hand you're able to make the connection to inject into the vessel.

Then you're dead headed until it depressurizes. And that would most likely occur from a failure of an SRV, probably at high temperature seizure. So you give yourself a chance for injection, which in this case probably would happen around the time or even slightly after significant relocation of core debris into the lower head.

So, it could be sooner, too, or stochastic failure of an SRV. So there is a certain probability of being able to avert vessel failure although you have core damage.

MR. GABER: It shows in your results, like it does in ours.

MR. WACHOWIAK: But you have to remember, when RCIC quits, just because it quits doesn't mean you're immediately uncovering the core. There's time between.

MR. FULLER: No, there is time, probably an hour or two, whatever.

(Simultaneous speaking.)

MR. FULLER: You run this thing with MAAP though, MAAP says as soon as you deplete the battery you pause RCIC.

MR. WACHOWIAK: And then you start losing water.

MR. FALLON: I just have one. This is Pat Fallon. The SRVs, by their characteristics, if you're manually depressurizing, they will cut off at 50 pounds if you're in manual mode.

They won't stay open at 50 pounds, and RCIC can run as low as, by design, 150 pounds, so I you have a 100 pound difference in there. If the SRV closes, loss of driving pressure through the mechanism by itself, you'll get some repressurization on that.

MR. GABER: Right. That's what I'm talking about.

MR. FALLON: Yes, this operator mechanism will over depressurize and killing RCIC may be temporary. We may get it back and may go back and forth.

MR. GABER: Right.

MR. FALLON: Is that covered in the analysis?

MR. STUTZKE: Not right now.

MR. FALLON: Okay.

MR. STUTZKE: But I don't think it's a big contributor of what we're seeing.

MR. FALLON: It would be a couple hundred gallons.

MR. STUTZKE: So Slide 27 lists the --

MR. CHANG: Earlier you said the loss of the injection, loss of RCIC that were not vent containment. But they are both still will bend to the containment when you reach through the containment pressure.

MR. GABER: Yes, it's just the anticipatory venting won't, is no longer required once RCICs finished.

MR. AMWAY: Or allowed.

MR. GABER: Or allowed.

MR. AMWAY: As soon as you no longer have RCIC has a viable injection source, you lose that permission and the override to do something.

MR. ESMAILI: Can I say something?

MR. AMWAY: Yes.

MR. ESMAILI: Anticipatory venting is not that bad even though when you lose RCIC because if you can, before we made some calculations that show that we shouldn't because we lose RCIC. But we still get anticipatory venting.

Generally, we find out that the releases are smaller, and the reason is that because you're starting from a smaller base pressure. And so you're releasing. For two hours you have been venting.

I know that it's not, but I'm just saying that there is some benefit even when you lose RCIC. There is some benefit to doing some pre-core damage venting because you are reducing your base pressure, which affects when you are going to do the venting.

So there is some natural processes that can reduce that. It is important in that respect.

MR. WACHOWIAK: And you might find that you won't fail the drywell on the main steamline if you do that venting first.

MR. ESMAILI: Yes, so it is, it's not only for prolonging RCIC, but there is some other benefits.

MR. GABER: The updated technical basis report, which is not reflected completely in the EPG SAG rep three because it was coming out at the same time, I think, does say that.

It does give some guidance to reduce, maintain pressure. I think it says below a couple atmospheres in anticipation of core damage and dynamics that occur in core damage.

Again, I don't think that's been completely factored in yet, into the --

MR. ESMAILI: It can reclose upon entry to core damage.

MR. GABER: Yes.

MR. ESMAILI: So you're still doing core damage venting, but it's just going to be out there probably --

MR. GABER: By some margin.

MR. ESMAILI: -- by some margin, yes.

MR. STUTZKE: Okay, so Slide 27 shows the significant plant damage states, significant in the PRA sense. So I just drew the line at 95 percent like that. One of the things that you'll notice is that there's only a few of the larger sequences like this.

Then you rapidly get down to 1 percent, something like this. It pretty well flattens out in the risk profile.

MR. WACHOWIAK: If you cut it at half a percent, you get 31. You got 29.

MR. STUTZKE: There's always uncertainty.

MR. WACHOWIAK: Just trying to compare these results to yours shows pretty reasonable agreement.

MR. TRUE: And you have a little bit lower early contribution or quite a bit lower early contribution.

MR. STUTZKE: Right.

MR. TRUE: I think some of that is because of your screening value is on AGPs, which will tend to make bigger failures more likely. But what I was just trying to look at was whether your, because there should be two contributors to the early failures in the way you set up your model.

One is RCIC failing, or three contributors, RCIC failing, safety relief valve and the DC induced by seismic. And those are only totaling out to about 3 percent of the total.

Just seems a little low to me as compared to our 70 percent. But yes, I think overall you were in the same ballpark other than that. I think some of that's because your later ones are of a higher likelihood.

MR. STUTZKE: No. They're higher because of the turning --

(Simultaneous speaking.)

MR. STUTZKE: -- preliminary values.

MR. TRUE: Yes.

MR. FULLER: Another interesting observation is that with respect to DC power status, you add up all the frequencies or the contributions, rather, 43 percent of all of these have a long term DC power status, which means battery depletion late.

And 45 percent or so have the okay DC power status, which is getting more into long term RCIC failure or perhaps the chance of no core damage at all. So this whole DC power status is really important to pay attention to.

MR. FALLON: Marty, just a question.

MR. STUTZKE: Yes.

MR. FALLON: I noted that on the 42, 14 of these cases have an operator's fail to align FLEX prior to core damage. Is that because you used the 12 hour alignment time?

MR. STUTZKE: No, it's just merely, that comes in at the 0.3 failure probability. That's what drives it.

MR. FALLON: So it's a combination of operator and time.

MR. STUTZKE: Right.

MR. FALLON: Not just --

MR. STUTZKE: It's all operator.

MR. FALLON: Okay.

MR. STUTZKE: At this stage of the game, the HRA model is crude when you pick a preliminary number like this. Looking at additional core damage probabilities on Slide 28 they break down like this.

You're running somewhere between, FLEX is buying you a two thirds reduction or so. It's very comparable to what you guys were calculating out of your model. And then you see some slight variations, probably not enough to worry about.

The other thing I would draw your attention to, as you see roughly an order of magnitude spread between the minimum and the maximum for the different plants. Again, that's driven strictly by the ELAP frequencies going.

At this part of the analysis, rather than to propagate each plant individually through the APET, which would have been an enormous amount of effort.

MR. GABER: You need Doug's graph and program for that.

MR. STUTZKE: Yes.

MR. SZABO: And also it just occurred to me.

MR. STUTZKE: It's not the first time I've generated a PRA so complicated I couldn't understand the result. You begin to border on it, so at that point in time what I did was take an average overall the plants.

It's a simple arithmetic average to calculate plant damage, late frequencies, and those are what got propagated into the APET, a simple variation. Okay, so Slide 29 on the APET development itself.

Now that we're into the two core damage event trees, we have to have four accident progression event trees. And they're broken down into whether we are considering RPV injection post-accident or drywell injection post-accident and/or the wetwell first or the drywell first strategy.

So to be specific, there's an APET that says RPV injection post-accident and wetwell first running, that sort of thing. Again, extensive consideration of local manual operator actions if DC's not available, the SRV operation, the containment venting operation.

The same sets of preliminary estimates for the human error probabilities, 0.1 and 0.3, depending on in control room or out of control room. I should also point out, these numbers are very consistent with what we're using in our site level tree project for the Level 2 portion right now.

In a Level 2 PRA we're doing for our site wide study. Basically we have three numbers, 0.1, 0.5 and 0.9, and those are true screening numbers. So we're not too far out of that.

Of course the branch probabilities depend on the specific plant damage state that's input to the model. That's the whole point of it. Those are conditional on it. There's a total of 72 sequences in the accident progression event tree.

And the number of release categories you get, of course, depends on what analysis option. There are large numbers of sequences that just zero out depending on what you're talking about. So it makes sense like that.

As far as the release categories and Slide Number 30, I'm using the same scheme that I understand you guys are using, so there's three attributes indicating the mode of reactor vessel pressurization.

Whether that's coming through an SRV, that's either the operator opened it or failed open, stuck open, reactor pressure vessels at high pressure cycling or it depressurizing because of the main streamline creep option.

Containment vent status, these are a little bit perhaps different than yours. I wanted to isolate the status of the vent from where the core debris actually was. It's always been a pet peeve of mind in Level 2 PRA.

In reality, you can have multiple containment failure mechanisms. You can have a vent that's open and a liner melt-through. You can have an over pressurization and an in-vessel retention like this.

And so I wanted to try to get at that a little bit and distinguish them. So I would call the second one, the containment vent status realizing the third one is the actual over-pressurization failure.

The core debris location, that's either in the vessel itself, in the drywell itself or not retained at all so the liner melt-through sort of phase.

MR. GABER: Hey Marty, the containment vent status, so I guess the question is at what time because what we would call wetwell venting are actually earlier wetwell venting and then followed by a late drywell vent.

Is your drywell more your drywell first kind of representation?

MR. STUTZKE: My drywells are drywells first.

MR. GABER: Okay. So they all go in that bin?

MR. STUTZKE: Right, and when the wetwell vent has failed.

MR. TRUE: But, and then likewise on your wetwell vent that could actually be in the direction of that event you're opening the drywell.

MR. STUTZKE: That's correct.

MR. TRUE: Okay.

MR. GABER: So your drywell-first case that you run, will there be, maybe this is what you just asked, could there be a component where that didn't work and you manually open the wetwell?

MR. STUTZKE: I'm back in the wetwell journey again.

MR. GABER: Which we all treat that, we look at drywell first. But we might think about, no we can't because asked this last.

MR. TRUE: We have to restructure it. We have a way of doing that. We'll probably push the regular fanning mill until --

MR. GABER: Overpressure.

MR. STUTZKE: Okay, Slide 41, which is my contribution to illegible slides.

MR. GABER: Yes, you win. This will do me no good here.

MR. STUTZKE: Yes, it's hard enough to read when it's printed on a large piece of paper, but the intent here is to show at least my understanding of what the different analysis options or alternatives mean.

I'm certain the slides will be available so people can print them out and blow them up and --

MR. SZABO: Yes, in case you want the ML

number again, it's ML 14168A251.

MR. TRUE: Are those print to a page or full size?

MR. SZABO: It's a PDF, so you can --

MR. STUTZKE: You can blow them up.

MR. SZABO: -- make it larger on the screen.

MR. TRUE: Is it printed two to a page or --

MR. SZABO: Well you can print it however you want. That's just the electronic version. It's just an electronic PDF. No, they are not printed two to a page.

MR. TRUE: Okay.

MR. SZABO: Yes, I realize it could be that problem. No, they're not. They're one a page. Yes.

MR. TRUE: One slide per page?

MR. SZABO: Yes.

MR. TRUE: Great.

MR. STUTZKE: The reason why I was trying to make a point out of all this was that I found myself terribly confused as people would discuss options and alternatives and cases and things like this.

So let me try to point out the source of my confusions. We have SECY paper 12-0157, which was original discussion of containment venting. So we have the options in 12-0157.

And Option 2 basically says don't consider filtering strategies like that, so that's kind of our regulatory analysis option in case alternative one. That's the do nothing. It's what you guys call Alternative 1.

So Option 2 is now one. Then we have the Option 3 cases which says think about drywell venting. So those would correspond to the drywell-first cases in all cases. We'll talk about that, and those are down at the bottom of the table.

And the bulk of the options are these performance based criteria of wetwell-first that would include anticipatory venting that's needed, includes vent cycling, includes its water management.

All of those seem to fall under SECY paper Option 4 despite the fact that we have called them alternative options 2A, 2B, 2C, et cetera, et cetera. So this was my attempt to try to sort them all together.

And then on top of it, I'd been going through the various view graphs that Ed and Hossein and Jeff had provided to make certain I understand what was anticipatory venting.

Oh, that means open at 15 pounds and leave it open, right. And then we get these discussions. No, well maybe it's 5 pounds, so things like that. Again, reclosure, the post-accident injection pathways fall down to either the Option 2s or straight to the reactor pressure vessel or to the drywell like this.

In addition, the measure may not include the so-called water management strategy. And water management is to prevent flooding the drywell out, so you can always vent, or excuse me, the wetwell out.

So you can always vent through there. So when I finally did this, and I put this in front of the mirror while I brushed my teeth every night I came to realize there was a pattern.

Okay. So when we talk about options 2A and 3A, we're talking about let the FLEX pump run and open the vent, period, whereas Option 2B says let the FLEX pump run and cycle the vent.

Option 2C says cycle the vent and water management on the FLEX pump and 2D is, oh water management but no vent cycling, which isn't the way I would've laid them out, but I understand the evolutionary nature of how these options grew.

So it finally began to make some sense that way. Now, down at the bottom, what I think's important is we have the SECY paper Options 3, which I have labeled 6A, 6B and 6C.

It's late enough in the afternoon. A couple of days ago, these were called Larry, Moe and Curly just to try to keep them straight. But the 6A is a passive vent, so it's a drywell-first.

It says when that passive vent blows, leave it alone. Keep it open all the time and flow the drywell, nothing more. So it's enough to try to minimize the amount of operator action.

6B and 6C say no, we're going to continue anticipatory venting, which of course has to be a wetwell-first strategy like this. Then once we get to the point of core damage, think about drywell flow like this in either a passive case or a manual case might come.

MR. TRUE: So 6A, we still have the ability to vent and do anticipatory venting?

MR. STUTZKE: No, it's a drywell first, so it's just a passive disk.

MR. TRUE: So all vent pathways go through the filter, and it only opens on high pressure?

MR. STUTZKE: Right.

MR. TRUE: So you have to feed that all the way back into your core damage event tree?

MR. STUTZKE: Yes. It's why I had to draw the second --

MR. TRUE: I get it.

MR. KARIPINENI: We are doing the analysis that way, but it was true. It would be anticipatory venting eventually coming off in that case.

MR. TRUE: Is that B and C?

MR. STUTZKE: That's B and C.

MR. KARIPINENI: Well, for the drywell-first only case also our plan is to have an anticipatory venting line but if you eliminate that and reduce the possibility of additional operating venues, we are doing that case. What comes out of it, the analysis?

MR. AMWAY: So in that case you're assuming then after RCIC fails, the operator has to close that vent line or the bypass around the --

MR. KARIPINENI: That is true.

MR. TRUE: That's for B and C.

MR. KARIPINENI: For B and C we are, but I'm saying 6A and A we are doing assumes that only a drywell vent first when they pass through rupture disk failure, rupture disk operations.

But in the back of our mind we're still thinking on that analysis, if it ever comes to that, we should have it, anticipatory venting line, a separate line.

So you would always have that feature. And if you can continue to operate those valves, even after post-accident, you could operate it that way. You never may have to open the -- the reactor just may never have to open.

But if those valves, if you close them at the time before the onset of the accident and they never reopen, you got this feature. But the analysis is only being done, drywell-first with no other operation actions.

MR. TRUE: Why are you analyzing something you don't intend to actually install?

MR. KARIPINENI: I was trying to see is there really a benefit.

MR. ESMAILI: These are the cases of 50, 51, 52, 53 that we do drywell venting. This is trying to answer some of the questions, is that we go to 15 PSIG. We vent. And we never close the vent. So this is going to core damage, vent and keep the vent open. You cannot close the vent.

MR. GABER: Will those cases pretty much ignore all of the EPG SAG Rev 3 updates?

MR. KARIPINENI: You are still a pretty flexible state of thinking. If you have anticipatory venting line, you still can't always close it at the onset to the accident.

And the purpose the rupture disk if you can't reopen that line, this was automatically going to venting this way, but the design partial. We start at design partial plus some margin. Some just going to be natural, just drywell the analysis.

MR. GABER: I guess I was, well I think, what I questioned, Doug was asking what kind of core damage gets you to these events. I mean will you not control pressure when RCIC operates such that when you hit HCTL you blow down and potentially lose RCIC.

Will you lose RCIC on high pool temperature? Just curious to how that's going, what kind of core damage will feed those.

MR. KARIPINENI: We need to feed FLEX.

MR. GABER: That's what I was kind of asking if they have none of the EPG.

MR. TRUE: You don't have anticipatory venting. You fade the FLEX. So your core entry is going to go up. You'll have undermined the order --

MR. KARIPINENI: That is true, yes.

MR. TRUE: Seems like an ill-advised option, but --

MR. KARIPINENI: The way the analysis is being done if you don't open that anticipated vent it looks like an ill-advised --

(Simultaneous speaking.)

MR. KARIPINENI: Right. But what we are

trying to think in our mind is actually if you don't do any anticipatory venting which is like you're saying, you put that line.

You're not saying anticipatory venting, the line being open when you want it to open, for instance. What happens then? How does this play out?

MR. TRUE: So is 6B the case when you have the bypass and the passive rupture disk, Marty?

MR. STUTZKE: Yes, so 6B's the case where you are anticipatory venting through the wetwell to the time of core damage in which case the vent gets closed for the APG.

MR. TRUE: Okay. So you do have the logical case?

MR. SZABO: I think A --

MR. GABER: B is that case.

MR. STUTZKE: Yes.

MR. SZABO: I think A is more of just a, for completeness which just checked this and make sure, once again --

MR. GABER: It's crazy.

MR. SZABO: Make sure it's crazy, okay. It's just to hey, if we're evaluating these, let's check to see that just in case who knows.

At first glance, everyone might say hey, that looks like a terrible idea. And then it, I don't want us to never run it and then we get a situation who knows, five, ten years ago for some reason someone ran this and said why did you guys never run this.

It turns out this is the greatest thing ever. I'm not saying that's how it's going to end up. I'm just saying for completeness.

MR. GABER: What's C then?

MR. STUTZKE: C is a manual drywell vent versus the passive rupture disk.

MR. GABER: So it's an anticipatory vent, wetwell mainly drywell.

MR. STUTZKE: And then drywell first.

MR. GABER: Yes, that's what it says right here. Good. Thanks.

MR. STUTZKE: Yes, the reason why I did that, and one of the things that I threw around but I guess these guys all noticed is the passive rupture disk may not buy you the reliability you think it does because there are manual valves in the way. It could be misaligned.

MR. TRUE: Well, you've got to shut valves in order to enable the passive one to work on the other. So, our fearless leader is gone, but it seems like we should do these three cases, too, just for parallel purposes.

MR. WACHOWIAK: Well, I don't know about all three of them, but at least the last two.

MR. TRUE: We have the last two on my list.

MR. STUTZKE: The last two are what you have, so now we're getting nomenclature.

MR. GABER: We'll change it.

MR. SZABO: I'll send it out after this. I'll take an action item. That'll just, I'll talk to my group, and we'll just send an email to Steve saying hey, if you guys are okay with this, let's go with these as our options.

And, for instance, I know you guys switched the, what Mary's calling 4-3A and 4-2A. He switched those around, and that made sense to us. We were just following what you guys did. So yes, I mean we'll --

MR. TRUE: At this point we should make this decision soon, but I wouldn't even be opposed to moving 2C and 3C to 2D and 3D, which to me makes more sense. But it's the, B is controlled venting.

C is water management and D is both because right now we have both as a C. If you want to reorder them, that's fine. We should do it soon so I can just keep my files straight.

MR. STUTZKE: Me, too. I'm content this

way. It's like I said, I memorized this.

MR. GABER: Why don't we adopt this? That's probably easier.

MR. TRUE: That's fine. You tell us what you want and --

(Simultaneous speaking.)

MR. TRUE: All I'm doing is opening the door. If you want to reorder anything else, that's fine, too. We should decide because we're about to launch a whole bunch more analyses here.

MR. WACHOWIAK: It'll be harder to do.

MR. TRUE: It gets exponentially harder as we go forward.

MR. STUTZKE: If you end up fiddling with it, if you're like me, you mess it up a few times.

MR. TRUE: Yes.

MR. WACHOWIAK: We might get an error if that happens.

MR. TRUE: Okay.

MR. STUTZKE: Just like I had a mislabeling problem when I knew the cases should generate identical results, and I didn't. And it's like is there a bug in the model? No. I just mislabeled it.

MR. AMWAY: 30 percent chance of error.

MR. TRUE: That's right.

MR. STUTZKE: Tell me about it. Okay. So flipping to Slide 32, I've estimated three sequence frequencies for all of the 16 analysis options that were shown before here. And I want to point out, I did that.

And let's say a way to minimize the amount of effort, so we have Option 1. We have Option 2A, which is also a surrogate for 2B, 2C and 2D because the only thing that changes, it became an error.

So when I'm doing vent cycling and/or water management and given my preliminary screening numbers, it's no reason to run separate cases. If you wanted me to, I could copy the file three times and be done with it.

Same thing for Options 4-2A and 5-2A. That doesn't change the event tree structure. Those are the filtering cases, and that's a MELCOR MACCS thing when they reduce it.

So similarly for Option 3A, then becomes the surrogate for the other ones at this level of analysis.

MR. TRUE: I think we actually, at this point, have been using the same human error probabilities for 2A and 3A, figuring that water is water and --

MR. STUTZKE: Yes, it doesn't matter whether you hook it up to the --

MR. TRUE: Jeff gives a differ MAAP result, and then whether we get in-vessel retention or not changes of course.

MR. STUTZKE: Sure, it all makes perfect sense --

MR. TRUE: Okay.

MR. STUTZKE: -- like that, but anyway, so before I show you another set of numbers that's probably not legible, I'll show you some graphs.

Okay. So the first one tries to show you a breakdown by the location of core debris so the solid black is liner melt-through.

The ex-vessel retention, so it's somewhere in the drywell but no liner melt-through and then finally the in-vessel retention for the various options.

To our logic, the base case always results in a liner melt-through because there's no post-accident injection of any kind. 2A is the post-accident RPV injection.

And so you see a substantial chance of in-vessel retention like this given that you don't retain an in-vessel though additional possibilities such you probably go through the liner. You won't capture it in time to retain it inside the drywell itself.

MR. TRUE: Marty, yes, that's not intuitively obvious, especially for your guys' cases where you have a time delay to liner failure.

MR. STUTZKE: It all has to do with the conditional probability.

MR. TRUE: If you have the water all lined up, and you just didn't get it there in time to prevent vessel failure --

MR. STUTZKE: Let me check. I'll flag that.

MR. TRUE: I would more have expected those to be kind of equal, like 50/50, that you kept it in-vessel versus ex-vessel. I don't know what our --

MR. STUTZKE: Let me check that out. I understand the concern. For the other cases, 3A, 6A, 6B, 6C these are all drywell injection cases. So again, you're not seeing a chance of in-vessel retention.

MR. WACHOWIAK: So in your ex-vessel retention, you can still have containment failure, or is all of your containment failure modes over pressure, over temperature, liner melt-through --

MR. GABER: Or venting?

MR. STUTZKE: It could be venting even though I'm retained in vessel.

MR. GABER: In-vessel or ex-vessel? I'm looking at the 2A bar, that liner melt-through. Are they really all a liner melt-through, or is that all your containment modes lumped together into one?

MR. STUTZKE: It's all lumped together. I'll show you the breakdown.

MR. GABER: So that's the same that we have, just unlocked.

MR. STUTZKE: In other words, you can't tell on this graph of this melt-through. So many of them are vented versus over pressurization failures.

MR. GABER: Right, because they're smeared together.

MR. STUTZKE: That's the next slide. I'll show you that. These are just by the venting status, so if you compare the slides on Picture Number 33 and 34 and you look at SA, it says there's a good chance that you're going to be vented to the wetwell and retained in-vessel.

If there's some chance you'll be vented through the wetwell and have a liner melt-through as well. I'll actually show you the breakdown in a couple slides here.

MR. TRUE: Just on the human errors, I realize they're all preliminary, so this is sort of a nonsensical question. But so I can interpret your results here, when the operator, when the wetwell vent failed because the operator failed to open it and then you had to go to the drywell vent, you treat dependence in that, or did you just put another 0.1?

MR. STUTZKE: Right now it's just another 0.1.

MR. TRUE: Okay. That explains it. Okay. Obviously there would be, when James gets done, there's going to dependence.

MR. STUTZKE: Oh yes.

MR. TRUE: I get it. I understand. That helps me understand some of the results you present next.

MR. STUTZKE: Okay. So the next series of slides are some detailed numerical results. This is for Option 1. Again, it lists just by release category frequency, so I haven't done the work done by the specific core damage sequence that's contributing to the specific APET sequence.

These are just all rolled up like that. But you can see most of the release category, most of the frequencies concentrate in a very few release categories here.

The point I was trying to make earlier is the upper right hand table here that shows you which percent of the total are broken down by the location of the core debris as well as containment failure button.

So, for example, in this case you get 85 percent are liner melt-through, and the wetwell vent is open. Then down in depressurization modes by whether it's safety relief valve, the higher pressure melt scenario or may seem like pre-pressure.

We talked earlier today. We're not seeing much contribution from the steamline creep rupture here. It's not too surprising. Okay Option 2A in Slide 36 shows you the same format of the result. It reflects the actual option like this.

Again, you can see liner melt-through has been substantially reduced. We do have the in-vessel retention pretty good, and I wrote down your comment about why is the ex-vessel retention higher than this.

MR. GABER: So, Marty on this so the, what you're calling liner melt at 49 percent total, if I go back to your bar chart, does that really mean that most of those were not liner melt, they were wetwell venting?

MR. TRUE: They're delayed. Delayed liner melt, they would open the wetwell vent because they hit PC fill first.

MR. GABER: I see. Okay. So it did have a liner melt late, but an early dominated then 34, Slide 34 says it's 80 percent wetwell vented before liner melt. Is that how I interpret that? Okay.

MR. TRUE: You need --

(Simultaneous speaking.)

MR. STUTZKE: I'll get the link from you. This upper right table kind of tells the story.

MR. TRUE: Yes.

MR. STUTZKE: As compared to the pure bar graphs. I call them bar graphs, you know, management education tools. I like the two way table, personally, on Slide 30. Okay.

So we have these other cases here. We won't, at the risk of straining people's eyes, go into them unless there are specific questions, considered preliminary results for 6A, B and C there.

MR. TRUE: Yes, that was on, could we do 3A for just a second?

MR. STUTZKE: Sure.

MR. TRUE: On 3A we've got 64 percent chance of liner melt, whatever else is going on. In 2A you had a 50 percent chance. For some reason in the 3A case you're less likely to prevent line melt. It seems not obvious to me.

MR. STUTZKE: Yes, and I think it's a reflection of the question you had posed earlier is why don't we see more ex-vessel retention scenario.

Because the implication is it took all of the in-vessel retention scenarios that were possible in case Option 2A because we were injecting into the reactor vessel.

Now we're injecting into the drywell, and that's not possible. But it's almost as if it threw it all into liner melt as opposed to giving some credit for retention instead of drywell.

MR. TRUE: Yes.

MR. STUTZKE: I see your point, and I need to drill down on that.

MR. TRUE: Right. And then that carries over into 6A.

MR. STUTZKE: Sure.

MR. TRUE: And it a little bit, too, for the same reason. But I did notice that the EVR grand total value, upper right most is actually lower than the 3A.

MR. STUTZKE: A little.

MR. TRUE: Yes, and that just seemed like that should be the same. Then when I went to B, your 6B and C, they're more like the 3A. It looks like there's something else going on in there.

MR. STUTZKE: Yes.

MR. TRUE: Those are like 36 to ten and that's pretty much the same as what you got.

MR. STUTZKE: Yes, I see your concern.

MR. TRUE: Yes. I don't think it's a big deal, but just something to --

MR. STUTZKE: No, it needs to be logically consistent.

MR. GABER: Are you guys going to, and maybe this is more for Hossein. Are you going to look at any sensitivity to the liner melt assumption because the SORCA analysis pretty much had most scenarios go to earlier liner melt, where with the changes you've made in the SECY and now with the rulemaking analysis, they seem significantly delayed?

Are you going to look into that?

MR. ESMAILI: We don't have minor melt-through. MELCOR shows we don't have liner melt-through for the cases where there's water. So that's the, I think I discussed this with Marty.

I'm trying to understand. It doesn't matter how many times I ask this. So when Marty says that there's liner melt-through it's because there is no injection. There's no water.

It doesn't mean 2A doesn't mean that there's water in there. At some point you don't have water in there. The MELCOR calculations show as long as you have water, whether it's pre-existing water and then you come in a little bit later with, you don't have liner melt-through.

None of the cases I have water it shows liner melt-through, and this is consistent with the Mark I study that shows that the probabilities is going into the -5 I think or -4, I can't remember.

MR. FALLON: So you're still using the condition that you have the reset CLV?

MR. ESMAILI: That's right.

MR. FALLON: Two to three to four hours, whatever.

MR. GABER: But what he's saying is that unless he has continued water, he'll get liner melt.

MR. FALLON: Right. So it's pre-existing on the floor after the override.

MR. ESMAILI: In one of the cases that we did, okay let me go back to it. Actually, I don't get, even though one of the cases that we did that originally we just didn't want to, we stopped FLEX injection.

We stopped injection. At some point when the water level reached 21 feet. Even then, it takes some time for the debris to heat up and start moving again. But it's not enough to cause it to spread all the way to the liner.

It heats up. It moves a little bit further, but it doesn't stay further. If you have some water, and you can cool it for some time, you're not going to get liner melt-through. So none of the cases with water would get liner melt-through.

MR. FALLON: So we're assuming that leakage for the recirc is vetted out. Is that what we're assuming?

MR. ESMAILI: No, the leakage from the circ is there because we start injecting at the time of lower head failure. I haven't run the calculation.

MR. TRUE: I mean it's there before that.

MR. ESMAILI: Yes, it's before that. So by the time lower head fails, by the time you start injection, you have about one to two feet of water.

That's going to keep it until you start, once you, had I not, I don't know if we didn't have the existing water and start injecting right at the time that the core debris got, I don't know whether it's going to make it all the way to there, but it helps that the existing water helps not to --

MR. TRUE: That's because most of your cases ran RCIC for at least four hours, and most of them are at 16 hours or until you reach --

MR. ESMAILI: Enough time to build up enough water --

MR. TRUE: For the earlier failures in the first zero to four hours, it wouldn't be a lot of water necessarily.

MR. FALLON: I mean the number we were given for the --

MR. ESMAILI: Actually, I think --

MR. FALLON: 200 gallons an hour into the drywell floor.

MR. TRUE: That's all.

MR. FALLON: And 200 gallons an hour going to the drywell floor will actually get seven inches of the drywell floor in the first hour. So once you've run out of RCIC, you're dumping water back into the --

MR. ESMAILI: Yes, let me look at some of the cases that I don't have RCIC running. RCIC failed at time zero. Even though RCIC fails at time zero you still have water from the reactor itself that's coming.

MR. MCGINTY: It's still condensing on the drywell floor.

MR. ESMAILI: Right. And it's just a matter of 500 gpm can build up relatively quickly to the lip of the --

MR. GABER: I guess I want to talk about the no injection cases. I'd like --

MR. ESMAILI: No water injection you're going to get liner failure.

MR. GABER: Okay. So my question is if you have no liner, if you have no water injection, I understand you'll get liner eventually. The question is how long will that take.

MR. ESMAILI: It takes about, from the time, maybe six, seven hours. So it takes, you have one to two feet of water, lower head failed about 24 hours and you don't get to liner failure until about 31 or 32 hours.

MR. GABER: Wait a minute. So I guess where I thought Doug was trying to go, that, I understand that's what you get when RCIC runs for a long period of time.

For the case with RCIC running, not running, either lost at zero, you have the two cases. Would you still get that six to seven hour delay for liner melt?

MR. ESMAILI: I actually don't get liner failure in those cases because, as I said --

MR. GABER: They had water.

MR. ESMAILI: Because they have water. I don't have that case if you don't have water.

MR. GABER: I understand.

MR. ESMAILI: You either have pre-existing where you start injecting. 500 gpm's a lot of water, too.

One thing I want to make clear, Jeff, I mean you asked me this one last time. There is, once the debris gets to the liner, we just have a time. I mean this is based on I don't know, ten or 15 minutes.

There's no mechanistic modeling because we assume that it's hot enough to cause the liner to fail. So we don't do heat transfer, but that's consistent.

MR. GABER: Again, do you think you'll look at any sensitivities to that because as you're away, the crosswalk that we did between MAAP and MELCOR and the work that Argonne has done, we see a pretty significant difference between the state of the core debris when it exits the RPV between MELCOR and MAAP.

You're simplifying it. MAAP core debris comes out with a lot more energy and a lot more heat that makes the spreading more efficient where in the MELCOR results, because of what's happening in the RPV your material comes out of the vessel close to the melting point and, as a result, doesn't spread. Will you look at any --

MR. ESMAILI: But SORCA showed that it doesn't take, the long term station black out showed that it doesn't take long to --

MR. GABER: Spread.

MR. ESMAILI: -- spread and go to the liner melt-through. So I don't feel I need to --

MR. GABER: But early on you guys talked about, maybe it wasn't you, but somebody told us that they changed some of the parameters.

MR. ESMAILI: We did change some of the parameters, but still --

MR. GABER: Yes, the solids and liquid is --

MR. ESMAILI: If we change the solids and liquid temperatures, but again the debris is hot enough to get to the liner. I'll look at that.

MR. GABER: Okay.

MR. ESMAILI: So right now I don't remember.

MR. TRUE: Before we turn this into James --

MR. ESMAILI: Sorry, that's not the only condition. If you have a massive relocation from the core, which we do in most cases, there's enough heat for this debris to just keep going also. So there are a number of --

MR. GABER: Even in the presence of water?

MR. ESMAILI: Even in, but the presence of the water will stop that. The presence will cool it sufficiently so it will not. We are trying to --

(Simultaneous speaking.)

MR. GABER: I guess it's different than what Theofanous did, right? I think it more represents what

Argonne's done. And that is, again, if the debris comes out with little super heat, and there's water on the floor, it doesn't make it to the wall.

If it comes out with more energy, more superheat, it will make it to the wall even if there's water.

MR. ESMAILI: I just don't remember. It was such a long.

MR. WACHOWIAK: But what Theo said was that if there's water there, it will make into the wall but it won't melt the wall.

MR. ESMAILI: Yes, I think you need two scenarios. One was based on the MAAP actually calculation, and the other one was the BWOSAR core calculation that showed different.

BWOSAR shows mainly metallic coming out initially and long term. But I think that the overall conclusion was that if it's dry, you are going to fail it regardless. If it's wet --

MR. WACHOWIAK: What does dry mean though?

MR. ESMAILI: Means that there's no water.

MR. WACHOWIAK: No water is zero or no water is five inches.

MR. TRUE: Or no continuing water.

MR. WACHOWIAK: Or no continuing water.

MR. ESMAILI: I think his calculation was based on the fact that dry for him was that there is no water.

MR. WACHOWIAK: Who him?

MR. ESMAILI: Theofanous.

MR. WACHOWIAK: Theo considered two cases, one where he had no water and one where he had nine inches of water.

MR. ESMAILI: Okay. So no water or nine inches of water, right, so the dry and wet, right.

MR. WACHOWIAK: Right, so anything in between, we don't know. Yes, so 8.9 doesn't mean it's going to fail. 8.9 inches doesn't mean the liner will fail, and 0.1 inches doesn't mean it won't fail. You just don't know. There's a transition between the two that we don't --

MR. ESMAILI: Again, I think you said it best. As long as you have some water in there that can, especially initially, that can actually cool it from the top, it doesn't matter whether you have 9 inch or 18 inches.

MR. GABER: My only point was these are all uncertainties. That was my only point.

MR. TRUE: I have one other MELCOR related and probabilistic related question. Marty, do you remember the number of SRV cycles you used on their RCIC or however you handled that?

MR. STUTZKE: It varies. I want to say right now they're screened at about 50.

MR. ESMAILI: We talked about this at the last meeting . So right now you are predicting about 50 in the first hour and then another 50 the next. We are predicting about 25 during the first and an additional 25 cycles later on, about half.

And actually when you look, I mean you see from the previous slide, you see that we are citing about maybe the open every half an hour. So we are modeling the steam extraction from the steamlines.

It depends on how much pressure you have. So some of the steam is coming out from the main steamline. I mean I think it's about, at high pressure it's about maybe about 4 kilograms per second.

And then it drops as the pressure goes down, but you get substantial steam extraction from the steamline. And so that could explain, but I think you are modeling that, too. You're modeling the --

MR. GABER: The question we asked during the drop in is if you were throttling the steam extraction to control the pump, or if you were using a bypass line to control level.

And what we can do, we can do this offline. What I suggest is that we find a way to communicate a few details related. If we can just pick a simple scenario one where RCIC runs for four hours with our depressurization scheme, I think it was what, 20 minutes or ten minutes between 800 and 1000.

I forget, Phil, what we assumed, but it's part of our assumption in our base case. And we'll give you the details of the extraction steam, the injection, the amount injected, because this is simple.

This is just thermal hydraulic 101, and we ought to be able to figure out why there's a factor of two in the SRV because it does affect the failure.

MR. TRUE: It's a significant infraction in large failures.

MR. ESMAILI: Or, since they're cycling the SRVs, right, I mean that's another thing. You can assume that we are, I think there about ten, 11 SRVs in there.

MR. GABER: You only need one.

MR. AMWAY: But typically what you'll see is you're going to only open one at a time, and you're going to rotate through however many you can add.

MR. GABER: But again, I open two to get from 200 to, 400 to 200, it doesn't matter if I go from two or five, I'm going to relieve the same amount of steam.

MR. ESMAILI: That's right. All I'm saying is that maybe we just decide to --

MR. GABER: We can figure this out.

MR. SZABO: Yes, we'll take that offline. We're coming for our favorite at 4:00. James will give his presentation and wrap it up. And then we have tomorrow morning as well.

MR. TRUE: Aren't we on schedule, or are we not on schedule?

MR. SZABO: We're only two slides behind. It's until 5:00. You're right. My mistake.

MR. TRUE: We're ahead.

MR. SZABO: Yes, we are. We're ahead.

MR. CHANG: What Marty talked about is the initiating vent could be caused by the seismic or weather incidents. So the HRA doing this need to be more specific. So here it is assumed that the condition is a seismic event. We have an assumption here. NEI 12-01 and 12-06 provide a very comprehensive assumption.

We pretty much use these assumptions, and then there is a set table is not explicitly that's in my assumption I'll point out. That's including that this morning we talked about the site-wide, what mean the site-wide advantage.

That's now seismic, that's one. Seismic will be severely damaging. The second is the offsite equipment, coming to the sites, the timing. The other one, too, is the staffing. In the NEI 12-06, Section 3213, they talk about what's this initiating event.

No additional event or failures assumed to occur immediately or during the events including secure the events. So, but this to me, where I can study this thing, especially the first six hours, the study here about using the emergency planning minimum seven.

On the reference trend there, the submittal indicated there's two units in 23 positions, including security staff. But there's eight position. That could be one person has double head.

During the two position or the other plants supporting, so the personnel could be as minimal as 15 people, so 15 to 23 people. This position there is the fire brigade. So, to me, I'll assume that fire brigade is doing the firefighting not included in the response to the seismic events.

And then, in addition, I do not assume that there's a personnel injury. So basically was this position explain the fire brigade responding to the seismic event. That's a standing assumption. That's the only thing that I want to talk.

MR. AMWAY: So you're assuming that the fire brigade, our number, my plant is five. I'm not sure what it was at the reference plant. You're assuming that the fire brigade cannot be used for the event response?

MR. CHANG: Assuming that the fire brigade will be occupied by firefighting, so this has become a --

MR. FALLON: I mean, it's kind of a catch-22. The fire brigade is to fight a fire. They have to have fire water and agent to put on it. They really don't, so they can't really do a lot.

MR. AMWAY: If we adhere to the true assumptions of the ELAP, at least for 12-06, I've got no pumps that tie into the alternative heat sink. They don't have fire water.

MR. CHANG: By water, these here this reference plant is not also is the piping that this is not seismic plus one, so I assume that fire systems are gone.

MR. AMWAY: Well, the fire system's okay, but you can't use any pump that's attached to the heat sink. It's a base assumption of 12-06.

(Off microphone comment.)

MR. AMWAY: No, we did not.

MR. TRUE: He's in another space than 12-06. He's saying probabilistically you could have a fire, or you have a fire.

MR. FALLON: Yes, and then it's going to be a value judgment.

MR. TRUE: How does the control room decide about fire brigade doing something versus getting a portable pump if you need it.

MR. AMWAY: Well, as far as your minimum staffing goes, you can't have a fire brigade member also doing plant operator functions, but I mean it doesn't mean all they could do is just sit there and wait for a fire.

I mean they can do other activities. It's just if a fire event happens, then that is your designated team to go respond to the fire. So this type of event, if there were no fire, they would definitely be employed to do whatever was needed to respond to the event.

MR. FALLON: And the fire doesn't take them out forever. Realistically, say the fire marshal was, they respond within 15 minutes. If the fire's not out in 15 minutes, they're calling for help because there's nothing they can do to really put it out.

So they would be out of the equation for at most between 35 and 45 minutes. Really they aren't going to, you can't take five people and have them fight a fire for five hours, just doesn't work.

It's not realistic. At the 30 minute point after they've mustered and gone to the fire, if they haven't put it out, they're calling for help from somewhere else and backing away from the fire.

MR. TRUE: So would it be fair, just thinking out loud. It's risky, but would it be fair to say that by the time they declared the ELAP that those resources would be back available?

MR. FALLON: Yes, I would think so.

MR. CHANG: Firefighter, they could be available.

MR. FALLON: And either they put out the fire, or they back away from it. One of the two is going to probably happen. If they can put it out with a portable extinguisher, which they do that.

MR. TRUE: Okay. That seems like a good way to handle it. Experience has shown, just so guys know, that in large earthquakes it's not uncommon to have a fire.

MR. FALLON: I've been on the earthquake ride at Universal Studios all the time.

MR. TRUE: Yes, Universal Studios has that.

MR. FALLON: One of the things, like you said Doug it's, in an earthquake you have hydrogen and coolant on the generator and the loose seal oil. You get a fireball out of that pretty easily.

It's quick, and there's really not a lot you can do about it at the fire brigade other than go look at scorch marks and go back because it's all burned down.

MR. TRUE: Okay. All right, so I understand.

MR. STUTZKE: I filled this in when we were making the NRC working group like this just to confuse people on PRA sensitivity analysis. And the basic notion is here is as we change one of the inputs, we want to see how the output varies like this.

So the example that I have here is for Option 3A, which is a drywell injection sort of option. And I want to look at the sensitivity of the result and the probability if the operator does not align the drywell injection and the time.

And the figure of merit, which is the Y axis because we don't yet have the MACCS calculations. I'm looking at the fraction of the sequences that end up in liner melt-through like this.

And in this case, I mean first of all you'll see it's linear. There's reasons why it has to be linear like this. The intent is to help you judge the impact of the uncertainties on the inputs when you do this.

In other words, when you do a sensitivity study, deep down in your heart you hope to see a flat line, that it's not sensitive, which means I don't need to guess or hone in on the number on the X axis so well because it doesn't change the answer like this.

The reality is though that the result you see here is contingent on every other number that's put into that analysis. So by only looking at them one by one, you can easily be misled as to the pure impact of the sensitivity.

In other words, if I said, suppose I want to reduce all the human error failure probabilities by an order of magnitude, you would see a much different fraction like this.

But that's the basic idea. So I drew the red dot. It's at the current screening value of 0.3 for the Option 3A where you're getting about 64 percent of the sequences going to liner melt-through.

And the interpretation is even if the operator behaves perfectly, you get a 50 percent chance of liner melt-through, so it's not super sensitive.

MR. FALLON: Yes, that's the operator aligning the reactor with water. That discounts the fact that the operator does nothing about the drywell seal leakage things and puts the water in there.

MR. STUTZKE: Right, because it's treated independently.

MR. FALLON: It's in the back. Okay. Good.

MR. STUTZKE: It's considered independently, but it's representative of the sorts of sensitivity studies that we'll probably need to complete like this. Moving on to the bigger picture --

MR. TRUE: Are you doing this all in Excel, or are you doing it in --

MR. STUTZKE: Excel.

MR. AMWAY: The failure probability at 30 percent, is there any consideration of that, whether the operator has procedures and training on it versus --

MR. STUTZKE: Yes, James, we'll properly account for things like that.

MR. TRUE: The 30 percent is just a placeholder, so the --

(Simultaneous speaking.)

MR. SZABO: Doug, you presented something a while back. Is that, I assume that, is that still where you --

MR. TRUE: I haven't changed anything.

MR. SZABO: Okay.

MR. TRUE: I'm going to do the same kind of sensitivities. I don't know. I hadn't thought about doing this format, but I was going to do some sensitivities to look at what happens when you change the linear rates.

I think I'm probably more going to go to make them perfect. Making them always fail doesn't --

MR. STUTZKE: It's the same thing.

MR. TRUE: It's not very meaningful.

MR. STUTZKE: I was afraid to speak in terms of risk achievement work and risk reduction work.

MR. TRUE: It's essentially the same thing, just not, if you always fail the different alternatives, you could write out the base case.

MR. SZABO: Exactly.

MR. TRUE: Because the alternative fails. So I was more thinking of maybe doubling their rate and going to zero is my sort of bounds.

MR. SZABO: Yes, I just didn't know if there was something, if you guys --

MR. TRUE: I haven't changed anything. The only thing I've changed since that first presentation other than doing the other alternatives was I added the

SRV cycling failure probability. Other than that, it's the same model we presented in September.

MR. STUTZKE: Okay. So the path forward, and I guess the last bullet is what I want to focus in on before we go. But yes, we had an earlier discussion about the seismic hazards.

James is working hard on the detailed HRA. Once I get that, I can look at the nuances of the assumptions.

MR. FALLON: Marty, is there anything we can help you guys with on the HRA, working the MAAP, things like that?

MR. CHANG: The plan details, I'm not so knowledgeable.

MR. FALLON: That's fine. You just let us know what it is that will help you get a good number. That's what we can do.

MR. TRUE: And our fearless leader, we can't offer much, but should we have a segment in the next public meeting or something? You can go over the performance shaping factor inputs you'd like to get from us or something. Is there something we can do to help that?

MR. SZABO: Yes, I think that would just be, yes --

MR. TRUE: Because we've got operators here who actually do this.

MR. SZABO: I think that a follow up to our, and that was actually one of the questions I meant to ask Steve was in their letter they mentioned some of the dates for the other information.

And I think this ties in kind of to this major assumptions thing, so I almost got to know what Steve thought the scheduling would be for all of that. But I figure at the next meeting it's kind of a follow up action to that in the same nexus of that.

We can have that discussion. And we'll try and put together some clarifying information from what we sent to you to help facilitate that.

MR. FALLON: We can't ask you for miracles if we don't agree to participate and help you.

MR. STUTZKE: The last bullet, I talked before about sensitivity study, and I guess I need to do some sort of uncertainty analysis. Excuse me. It was not my intention to do a parametric uncertainty analysis.

But that's where one normally puts probability distributions around all these numbers and Monte Carlo samples. And since we can't guess the basic number, you won't believe the distribution parameters anyway.

MR. TRUE: Yes, I have come to the same conclusion.

MR. STUTZKE: It leaves me a little cold to be able to do that. The other sorts of uncertainty is modeling uncertainty. I don't think we'll do anything in that area other than to treat it maybe with sensitivity.

You asked Hossein about some of the cases, so I think I'm going to pick your list and go through it, see if that makes sort of sense. I pointed out early in my talk about the incompleteness on certainty, sorts of things that aren't quantified.

I called them unquantified benefits like that, and I don't know how to poke holes at this point. Probably Aaron will be doing certain sensitivity uncertainty analysis, chat up the benefits by someone.

MR. SZABO: I'll try and do things that help try and quantify what we did not necessarily quantify in SECY 12-0157. Generally, the idea, at least in my mind is at least a sensitivity trying to quantify more this defense and depth idea, how exactly that'll be done with still being realistic and still being determined.

But that's just a general idea. And the idea is to try to capture as much currently non-quantified data as possible. And those we can't quantify anyway, of course, I mentioned the various techniques that we're initially thinking about.

To just wrap up today, I'm just going to go through the takeaways. I'll probably go through this again tomorrow.

MR. TRUE: One last question.

MR. SZABO: Sure.

MR. TRUE: This was on Mark I. There's not, as I understand it, is not a plan to do the same thing for Mark IIs. Do you have any thoughts? You're not looking at me, Marty.

I guess I'm looking at Aaron and Hossein. How do you marry Hossein's new Mark II results to the Mark I? Have you thought about how you're going to do that? We're doing the whole thing explicitly, so --

MR. SZABO: I think at this point we'll just, we have to take that back and just, yes.

MR. TRUE: I figured that might be the case.

MR. STUTZKE: Question, you guys haven't done any isolation --

MR. TRUE: We have not. Actually, it's not on my list. Well, it is sort of in a sense. We talked about doing plant to plant variabilities. That's one we would probably do an investigation on. I just can't do every alternative and every scenario.

If we seem to be honing in on 2A and 6A or 6B or whatever as kind of more interesting scenarios, then we might just try to run those. That's what I'm thinking. And that's a whole other map.

MR. GABER: Are they bounded by the early RCIC cases? Maybe you could convince yourself that they are.

MR. STUTZKE: I look at it two ways. It's a lot of work for me to build probabilistic models for the isolation at your plants, but they don't have a MELCOR deck for it anyway. So, what have I gained this way?

Similarly, I could build a probabilistic for a Mark II plant in a short time. I don't know much about them. It's a steep learning curve at least for me, but that may be some viable way to go about it.

MR. SZABO: We'll take that back and discuss the best way forward.

MR. TRUE: What about, and another one on MACCS. In the spent fuel pool, transfer spent fuel pools because it's been done high, medium and, higher population, medium population, lower population sites, are you envisioning that as being part of this or just going to stick to the reference plant?

MR. SZABO: We are planning to run

sensitivities in relation to MACCS, in relation to population likely, highly likely that we're going stuff with population densities potentially right now with assumed evacuation percentages just to see how sensitive some of the releases are.

Mostly, if you're talking about beyond design basis accident, I think. Unfortunately, John's not here. My understanding is it's 99.5 percent evacuation by the time we, understand we're talking about a very low probability, very large, very bad day for everyone just as a sensitivity possibly looking at smaller, less percentage.

It's an order of magnitude less but still a significant, I'm not saying, those would not be our base case. That would just be the sensitivity just to see kind of how effective some of these strategies would be.

MR. TRUE: Another question I'm struggling with, we're struggling with is when we're doing the MACCS work, we're doing different Mark II MACCS calcs than we are Mark I MACCS calcs.

MR. SZABO: So initially before when we did not really have the time to develop the MELCOR for the martin, which we ran the MELCOR for the Mark II, even the slimmed down version based on our own schedule, the idea is we weren't going to distinguish between, and within MACCS either.

We would just do sensitivities based on not, the path forward at least as of right now is to now separate them so there will be Mark I based MACCS and then a Mark II based MACCS.

MR. TRUE: We pick the ranges based on the Mark II sites and the Mark I sites?

MR. SZABO: Yes, that would be the idea. That's to my understanding right now. Unfortunately, John's not here to verify that, but I'm pretty sure.

MR. WACHOWIAK: When are you going to do that?

MR. SZABO: I believe some of the MACCS have already been run in parallel with MELCOR when they're being completed.

MR. WACHOWIAK: Mark II?

MR. SZABO: Oh, Mark II will be after we're done running MELCOR. The dents are being built. It's just the running the model itself.

MR. WACHOWIAK: So we need to get our hands on that one, too.

MR. SZABO: Well, actually, look here for a second. I'm not sure if the deck is built yet. I know it is at least being built, and the goal is to have it built by the time the Mark II is done.

MR. ESMAILI: You're talking about MACCS input?

MR. WACHOWIAK: Yes.

MR. ESMAILI: I talked to John. I don't know what state they are.

MR. WACHOWIAK: If we're going to be done in August, and we need their input and they don't have it done until September, that doesn't work.

MR. TRUE: We'll have to do something else. We can link it to the MACCS two source terms, more the site.

MR. WACHOWIAK: Yes, if they're changing the site.

MR. SZABO: I can take that back as something we will make sure that before the next public meeting, which John will present that, that we have that answer to you guys at least on the, if there's any other comments, questions, I'll go to, oh, no I'm sorry.

I'll go through takeaways. Once again, I'll probably repeat this tomorrow afternoon. The first thing is anyone who in the industry side talks to Steve tonight because I didn't get to ask him about the other dates that they said, that we proposed in the letter to them.

And you kind of responded back with if

industry feels like they can meet those dates, if not what dates they think they could meet because I believe I recall talking about there was some concern about meeting all of the dates.

MR. TRUE: All the data.

MR. SZABO: Yes, and if we can just get a plan, that's all I, a general plan.

MR. GABER: Can I ask a question that relates heavily to that since I'm on the hook for one of those three data tasks? The people that asked the questions on the Mark II, I don't know if it was you or Ed, have you, I would assume the answer's yes.

But have you looked at, we just started finding that NUREG/CR-5623 had a lot of good information in it that kind of categorizes, I mean it names all the Mark II plants. It describes they shape and have you guys reviewed that. And is it helpful to support the Mark II work?

MR. KARIPINENI: Which NUREG is this?

MR. GABER: 5623. It's 1991, Cheryl Green and company did a lot of work on kind of the preliminary background work on looking at what might happen in the Mark II.

MR. FULLER: I've taken a good look at that, and it's quite helpful in terms of looking at, they are just cartoons mind you.

But it gives you some idea of what kind of pathways might be developing in bypass scenarios as well as, I guess one possibility of bringing suppression pool water and debris together.

But there are some things that are a little bit confused here. So there might be some, if you start with those, there probably would still be some specific information that might be needed from the plant.

MR. GABER: That's my question. So if you start with that, and maybe you already did this.

MR. FULLER: I don't think they did. I don't know if anybody else saw that besides me.

MR. GABER: If you look at that, does it alter the data request, and I think it was Number 3 or whatever the question was because there were a lot of subparts to that related to the Mark II design.

I'm just curious because if there something in there that answers some of those questions, please tell me before I go off and gather then data.

MR. SZABO: I'll take that back and get back to you on that.

MR. GABER: Thanks,

MR. SZABO: The other takeaway first is Steve's is how we get to the end game. I think now at the level that we are, in our working group we've also, we've started bringing back up the performance goals and everything as I said.

I think we all kind of realized we need to run the data and see kind of where things were going before we can have a general idea of what general performance goals and criteria really make sense.

And as we've seen, we've actually come up, the industry's presented even new performance goals or ideas for them at least right now. The second thing I have, we mentioned this before, is the decon costs and the O&M costs that industry is going to work on.

The next thing I had was the criteria. This was the HRE question about the criteria for the decision to deploy and the time to deploy. I believe that's FLEX, some of the FLEX stuff.

We are also, for industry, the fraction of hydrogen based on location. We have the, I just ask that you guy let me know if the WinMACCS thing is not coming in. I did not realize there was the delay. I just haven't been in the loop.

MR. GABER: First things first, I mean John did an awesome job with the input data, but we don't have a code to run that data.

MR. SZABO: Okay.

MR. GABER: That was the problem.

MR. SZABO: Can we help, or is that you guys?

MR. GABER: I think you've done enough.

MR. SZABO: Okay.

MR. GABER: If there's anything you can do to follow up, I guess, but we thought that all the paperwork was done. And it was just a matter of you sending the code to us or giving us access to the code.

MR. SZABO: Okay. And I'll touch back with my people to see if there's, make sure there's, and maybe tomorrow you guys will have it.

MR. AMWAY: Just going back to the costs of data that we presented --

MR. SZABO: Yes.

MR. AMWAY: -- understand the O&M and decommissioning pieces but with what we provided so far that satisfies the rest of the information requests related to cost estimates.

MR. SZABO: Yes. In my opinion, at least, it does. When we end up doing this I don't see any other concerns. I mean, as I said, as we go deeper into it, we might have additional questions.

But at least in relation to the information request, I think that was sufficient. I don't see any major requests coming off the top of my head. As I said, the only thing, I didn't say this before, but we have different guidance on how we have to do costs and so forth.

So there's no guarantee that we're just going to use your guy's number, of course. But our number will clearly be informed by what you provided us.

I have, okay back to the takeaways. I have specific information on the Mark II on I Pass. No idea where that was.

MR. GABER: That's not my new, did you look at the NUREG question?

MR. SZABO: No.

MR. GABER: It's different.

MR. SZABO: That was, at the time I wrote study Mark II on bypass. I'll go back and figure that out by tomorrow.

MR. GABER: We asked Hossein, I remember asking you how you were going to handle that.

MR. ESMAILI: We are looking at, we have one input deck.

MR. GABER: One plant.

MR. ESMAILI: Yes, we have one plant, and depending on what we learn from there because as you said, there are differences between how the pedestal is, how far, how deep it goes. We cannot run.

Maybe we can run some sensitivity by just lowering the pedestal floor, but at this point, we are just focusing on one plant and trying to have some insights as to what happens.

I think, I don't know what, have you done any MAAP calculations for the Mark II? Are the release characteristics going to be that different from the Mark I?

MR. GABER: If you bypass the suppression pool in the early stages with the --

(Simultaneous speaking.)

MR. ESMAILI: In the early stages, yes, but do you bypass in the early stages? What happens?

MR. GABER: At vessel breach we do. Unless it's a plant that doesn't have that, which there is one of the Mark II's that doesn't have a drain, or if they, like Doug showed, if we analyze that they protect the penetration, then obviously that does a bypass.

But for the others, we would, at vessel breach, we would create some sized hole between the drywell and wetwell air space based on just the drain line failure.

MR. SZABO: So, our takeaway was to go back and check to see what we're going to do on that --

MR. GABER: Okay.

MR. SZABO: -- on that issue. I'm going to send an email list with what the final versions of the alternatives are. I hope we don't get anymore.

MR. GABER: I hope so, too.

MR. SZABO: Marty's going to check the breakdown by the core debris location for the 2A and those various. We're going to offline, we're going to discuss the SRV cycling number.

At the next meeting, we're going to have a discussion that provides clarification on the information necessary for HRA in the realm of the, our second question on the major assumptions.

We are going to get back to you guys about how we're mapping the Mark II as well as, and then the next month we're going to have a presentation on MACCS at least in general.

And I will give you guys an answer, hopefully before then, on what we're doing for the Mark II and when we'll finish that deck if it's not already. As I said, I'm not sure.

The other thing to note is after Friday I will out for three weeks, so Fred Schofer is going to be my backup. That's F-R-E-D dot S-C-H-O-F-E-R at NRC.gov. If you send me an email, you will also get this information about that.

And I will be out of the country without electronics, so there's really no way to reach me. But thank you very much everyone.

MR. FULLER: Before you end, there's one other Mark II aspect that wasn't explicitly discussed, and that is for those cases where you get a lot of core debris on the diaphragm floor.

What does that do to your water management strategies, if anything, relative to if you have the case, configuration that we are now having to do with the pedestal below the vessel and no way to get the debris to the diaphragm floor? I don't know if there are any surprises, but it's something to at least be looked at.

MR. SZABO: We'll take that back.

MR. FULLER: That is very important, by the way, because most of them are that way and not the way we're looking at it.

MR. SZABO: Yes.

MR. GABER: We have more to talk about on the Mark II?

MR. SZABO: Yes.

MR. GABER: Let's just leave it at that.

MR. SZABO: Thank you for everyone, for those of you who are going to be here tomorrow morning, I look forward to seeing you.

Tomorrow's there's going to be a presentation by, I believe Maria Korsnick on the deliverables, content deliverables and milestones for the Phase II part of EA-13-109.

That's only a half day. That is not in the same building as this meeting. It's in Three White Flint. The bridge line is going to remain the same.

And as people have pointed out, the bridge line that was on the webinar was incorrect. However, the bridge line that's on the meeting notice as well as in the slides is correct.

It's 888-807-8339. And the pass code is 86834, and for those people on the webinar it is a different address. So make sure you're registering for the right one.

MR. FULLER: Can you get that room number?

MR. SZABO: And the room number is 9A28 in Three White Flint, but for the visitors you have to wait for us.

MR. FULLER: Ninth floor?

MR. SZABO: Yes, nine. I mean there's a, follow your escort, but 9 o'clock to 12:00.

(Whereupon, the meeting in the above-entitled matter was concluded at 4:34 p.m.)