Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Filtering Strategies Rulemaking

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Thursday, December 12, 2013

Work Order No.: NRC-456 Pages 1-

NEAL R. GROSS AND CO., INC.
Court Reporters and Transcribers
1323 Rhode Island Avenue, N.W.
Washington, D.C. 20005
(202) 234-4433

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

\+ + + + +

FILTERING STRATEGIES RULEMAKING

\+ + + + +

PUBLIC MEETING

\+ + + + +

THURSDAY

DECEMBER 12, 2013

\+ + + + +

The Meeting convened at the Nuclear Regulatory Commission, Room 08A28, 11601 Lansdown Street, Rockville, Maryland, at 1:00 p.m., Fred Schofer presiding.

PRESENT

FRED SCHOFER, NRC

SHANA HELTON, NRC

MARTY STUTZKE, NRC

SUDHAMAY BASU, NRC

JEFFREY GABOR, ERIN

PHIL AMWAY, CENG

JEROME BETTLE, NRC

RANDY BUNDT, SNC

YUNG HSIEN (JAMES) CHANG, NRC

HOSSEIN ESMAILI, NRC

PATRICK K. FALLON, DTE

CARMEN FRANKLIN, NRC

NAGESWARA (RAO) KARIPINENI, NRC

KAMISHAN MARTIN, NRC

BILL RECKLEY, NRC

STEWART SCHNEIDER, NRC

TOM STEVENS, NEI

KARL STURZEBECHER, NRC

JENNY TOBIN, NRC

RICK WACHOWIAK, EPRI

WEIDONG WANG, NRC

TABLE OF CONTENTS

ITEM PAGE

Welcome, introductions and logistics..4

Presentation on core damage event tree, containment event tree, and

MELCOR analysis....................................6
NRC Presentation...................................15
Break
Presentation on core damage event
tree, containment event tree, and
MAAP analysis......................................75
Industry Presentation
Closing Remarks...................................130
Adjourn

P-R-O-C-E-E-D-I-N-G-S

1:06 p.m.

MS. HELTON: I'll just briefly open the meeting and then I'll turn it over to Fred Schofer who will walk us through some housekeeping items and building security and all of that. So my name is Shana Helton and chief of the branch of the Office of Nuclear Regulatory Regulation and I'm very happy to see so many people. I'm sorry for those who are participating by phone but our Webinar is not up and running. We will continue to try to troubleshoot that and see if we can get it up and running later on in the meeting.

Today we are here to talk about the filtering strategies rulemaking. It's one of the series of ongoing public meetings that we've been having to develop our technical and regulatory bases which we will be sending to the commission probably around February of 2014. So we're hoping that -- I'm sorry. I misspoke. We are resuming more public meetings to continue these dialogues probably in about February of 2014. Our regulatory basis is due later next year. So thank you to everybody whose here to join in. We do have a fairly structured agenda. We will have time for a break around 3:00 p.m. I will turn it over to Fred Schofer. I know everybody is used to seeing Aaron Szabo but he was not able to be here today. So Fred is standing in for him.

MR. SCHOFER: Thank you. Hello everyone. My name is Fred Schofer and I'm a senior cost analyst with the NRC and the Office of Nuclear Regulation. Thank you for taking the time to attend today's meeting to discuss topics related to preparing the filtered strategies rulemaking regulatory basis. In addition I want to thank the members of the public who are in attendance and who have called in to today's meeting. For those hoping to be on the Webinar, unfortunately we are having technical difficulties. We'll try to get that up and running as soon possible but for the time being it will have to be teleconference. For those in the room I hope you picked our public meeting feedback form.. You can fill this out here today and give it to any NRC staff member or drop it in the mail some time in the future. Your opinions are important to help us improve upon future meetings. So, take the time hopefully and provide your feedback. If you prefer you can also e-mail Aaron Szabo directly and he can take your comments. In the unlikely event of a fire alarm, in which we would need to evacuate the

floor, please proceed directly to the stairwells and follow your NRC escort east of Marinelli Road to the evacuation routing point located on Citadel Drive. Public restrooms are accessed by passing through the elevator lobby and turning right or left. It looks like the men to the right. To the facilities, if you are a visitor, you'll need an escort to accompany you to and from the facility.

With that, I'll go to slide two which is the purpose slide. Today's purpose is to provide the best current understanding of the filtering strategies including our bases and assumptions prior to the staff's undertaking of MELCOR analysis. Our plan is to resume public meetings after substantial completion of these analyses. Of course if we undercover anything unexpected results we may have a public meeting prior to the February time frame. Although there may be differences in opinions on assumptions between the NRC and the industry for the runs, today's meeting is to ensure that we agree on what the core damage sequences are and an opportunity for stakeholders to provide comments.

Regarding slide 3, is the agenda. Shana already briefly described that today. Once we get through the introductions on logistics the plan is to have Mary provide the NRC presentation and then have a general discussion and then a break. And then following the break, we'll have the industry presentation, general discussion and then closing remarks.

Are there any other agenda items, anyone was anticipating?

MR. BASU: So, Fred probably not explicitly stated here, make sure we all understand -- let's see. Is this one working?

MR. SCHOFER: Yes.

MR. BASU: Can you hear me now?

MR. SCHOFER: I can now, yes.

MR. BASU: Okay. I was saying that it's not explicitly stated but I think we all understand that the purpose of the meeting is also for the staff to be informed by the industry with regard to the assumptions of the industry will be making and I glanced through the industry slides already and I see the elements of DSO, recognizing that.

MS. HELTON: I'll use this little break as we are troubleshooting the Webinar to remind everybody that when they are speaking for the benefit of those on the phone and also for the transcriber to please state your name. Please remember to do that. For those on the phone in case you are wondering the pause, we're troubleshooting the Webinar right now. So hopefully with our technical support we can get the Webinar up and running in just a few moments here. I think Fred

might have already covered that but please for those in the room, please make sure you get your name on the sign-in sheet so that we can capture you are here in our meeting summary and for those who are participating through the Webinar or by phone, if you could please e-mail Aaron Szabo your name for the summary meeting as well.

MR. SCHOFER: All right. Slide 4. This is category three meeting and although comments can be presented throughout the meeting, would like to have it grouped. During the presentation itself, we would like technical discussions based upon the presentation and any general discussion following the presentation. This meeting is being transcribed and the slides for the meeting will be made publically available along with the meeting summary and the transcript of the meeting.

Slide 5. A couple of announcements. Because it is being transcribed, please make sure to say your name before you make a statement for the transcriber. I currently have an attendance sheet which I request everyone to sign, for those in the room. In addition, I will ask each person in the room to introduce themselves and the organization that they represent. And then upon completing introductions within the conference room, I will then ask those who have called into the meeting to identify themselves and the organization that they represent.

I am Fred Schofer, NRR.

MS. HELTON: Shana Helton, NRR.

MR. STUTZKE: Marty Stutzke, Office of Research, Division of Risk Analysis.

MR. CHANG: Jim Chang, Office of Research.

MR. BASU: Sud Basu, Office of Research, NRC.

MR. BETTLE: Jay Bettle, NRR.

MR. KARIPINENI: Rao Karipineni, NRR.

MR. WACHOWIAK: Rich Wachowiak from EPRI.

MR. GABOR: Jeff Gabor with ERIN.

MR. AMWAY: Phil Amway, Constellation Energy Nuclear Group.

MR. HENNEKE: Dennis Henneke, GE Hitachi.

MR. STEVENS: Tom Stevens, Nuclear Energy Institute.

MR. BUNDT: Randy Bundt, Southern Nuclear.

MR. FALLON: Pat Fallon, DTE Energy.

MR. LANE: John Lane, NRC Office of Research.

MR. STURZEBECHER: Karl Sturzebecher, NRR.

MR. SCHOFER: Please speak up.

MS. FRANKLIN: Carmen Franklin, Office of Research.

MR. ESMAILI: Hossein Esmaili, Research.

MR. RECKLEY: Bill Reckley, NRR

MR. SCHNEIDER: Stewart Schneider, NRR.

MR. WANG: Weidong Wang, ACRS.

MS. TOBIN: Jenny Tobin, NRR.

MR. SCHOFER: And for those on the phone?

MR. COWEN: Bob Cowen, GE Hitachi.

MR. BEEMAN: Glenn Beeman, GE Hitachi.

MR. WILSON: Frank Wilson, TVA.

MR. MUDWIDDY: Dan Mudwiddy from Tell Energy.

MR. VAN HALTER: Ryan Van Halter, Westinghouse.

MR. McINTYRE: John McIntyre, Duke Energy Brunswick.

MS. GERTZ: Amy Gertz, NRC Office of Research.

MR. SCHOFER: For those who are participating by teleconference, if you could please e-mail aaronszabo@nrc.gov to let them know of your attendance I would appreciate that. And we also have one more person join us.

MS. OLMSTEAD: Joan Olmstead, NRC OGC.

MR. SCHOFER: Okay. As stated in the last public meeting, there is a list of all public meeting summaries. We included that as slide 6 as well as some other noteworthy documents. Specifically one of those documents, Aaron Szabo presented at a recent NEI workshop on November 12 and presented information that had previously been discussed at the various public meetings. No new information was provided in that meeting although the meeting summary is included in the listing.

There is also a clarifying conference call between research and EPRi about some of the information provided during the November 6 public meeting. That phone log for the meeting is currently being developed and should be available in ADAMS later this month.

Slide 7. As discussed in the last public meeting, some of the completion days have been revised and I thought it would be worth repeating. The schedule for completing the regulatory bases and the proposed has been extended nine months as shown on the slide. We do not believe that this scheduled extension will affect the final rule date. The new dates for the regulatory basis is December 19, 2014. The changes are due to the amount of information as being accumulated for this rulemaking and to provide a sufficient time for having the ongoing discussions and information sharing that part is occurring during these public meetings.

Slide 8. This slide identifies information the NRC has already requested or that the staff needs for the development of the regulatory bases. The NRC formally requested the Rev 3 of the BWR Owners Group emergency procedures,

guidelines and severe accident guidance by January 2, 2014. This information is needed for both the rulemaking and for recommendation 8 rulemaking. And the letter also requested the PWR Owners Group provide the similar guidelines for the use for the recommendation 8 rulemaking. The second item resulted from a previous public meeting where industry provides preliminary high level cost information. During that meeting they stated they would providing more detail cost information by the end of the year. We are wondering if you are still on track to meet that due date and if you know the level of detail that are planning on providing as well as whether a formal request is needed.

MR. BUNDT: We're still making progress on that. I doubt the January 7 date is going to be met. Randy Bunt, Southern Nuclear. We have not formally requested that.

MR. SCHOFER: And do you expect that you will request that or no?

MR. BUNDT: We don't believe that we will need it inviting. We did ask that it be suggested at the steer committee so that the management knew of the request. But we don't think we need it in writing.

MR. SCHOFER: Okay. Thank you.

MS. HELTON: If I could just say one thing on that. This is Shana Helton again. So you know we do the best that we can in accessing the cost. I know that with this particular rulemaking activity the commission has a keen interest in understanding the cost and benefits of any proposed regulatory action. That's one of the reasons why our regulatory basis is going to the commission next year. Usually the regulatory basis document doesn't get that much visibility with our commission. It's more of a lower level document and they get into the proposed rule. So with that said, you know, I do think the NRC is going to do our best to develop the costs and benefits associated with this regulatory action but any input that we get outside of the agency is going to really help and I know its going to be of great interest to commissioners as well. So if it would help for us to write some sort of official letter requesting the information, please let us know that and we can do that.

MR. BUNDT: Well right now we don't believe that's going to be -- I don't believe that's going to be necessary but I will talk with our leadership and make sure.

MR. SCHOFER: Okay. It is important feedback for us. Thank you.

MR. SCHOFER: The last item on the slide is something that has been discussed before and that is how the emergency procedure guide lines and

guidelines would change based on filters. Current have been using the referee version which did not have any assumptions without changes to operator actions if filters were installed. For us to properly evaluate the case we are interested in industry's input with regard to what operator actions may change based on having filters and would this change the order or expecting timing of any actions identified in these procedures to properly analyze the filter options understanding how operator actions may change is key. So, keep that in mind. I'm not sure if anyone has any response to that at this time.

MR. BUNDT: We thought we would have a separate meeting to talk specifically about that on how filters would be, when we get further along with what is going to be considered.

MS. HELTON: Thank you.

MR. SCHOFER: Okay, finally the last slide is contact information, provide Aaron Szabo's contact information. He is the primary contact for the, the primary NRC contact for the project and can be contacted using the information provided. Before we get into the NRC technical presentations, are there any questions? Hearing none, Marty, would you like to begin

MR. STUTZKE: Hi. I'm Marty Stutzke, again from the Office of Research. I've been cast to developing the level one and level two PRA logic structures, the event tree logistic structures as part of a risk analysis as well as assembling and generating final risk estimates.

On slide 10, I've listed some topics, listed some topics for discussion today. What I've called inside litigation strategies. That's to convince you guys I've actually been doing my homework. I have in fact read all of the for the SBO mitigation strategy. The next thing I would like to discuss is ELAP frequencies, exactly the best mission of what an ELAP is and how its frequency should be calculated in contributors like this. I will then show you the latest event tree which has been revised somewhat based on the discussions in November. The results of that generated plant image state frequencies and what I see are the next steps in completing the analysis.

Okay. So on slide 11 the SBO mitigation strategies, when I came away from the last meeting, I realized I needed a better understanding of the implementation of FLEX at plant level in order to develop adequate models of this. So I did take on the effort to read all of the submittals to the SBO order. It is order EA-12-049 if I got the number right. Including all the timelines like that, it's a lot of information. I will emphasize my purpose

in reading these is not to perform the regulatory review. So I didn't generate a big list of REIs and send them up to NRR to dispose of them.

MR. STEVENS: Others did.

MR. STUTZKE: I could have easily done that having worked in NRR for a number of years but I controlled myself. So I did look at the 11 BWRs that have frequency systems like that. That was the focus on that. And I guess my insight is flex is flexible. I'm reminded, I pulled this off the internet, this is the old Indian folktale about the blind man feeling the elephant and trying to describe what it is. One says it's a spirit because he feels its tusk and another one feels its tail and says "no it's a rope." And to some extent I think I feel that way about FLEX because truly the implementation details vary from site to site. Logistics virtue you know from the perspective of reducing risks and things like that. But it is a challenge for someone like me because I can't do a site specific risk assessment for all of the sites. That would be cost prohibitive I think for us. But bearing that in mind then I assembled a little table here to summarize what I found on this. On Slide 12 the kinds of, referring back to the timelines that are in the submittals. The times of start of RPV cool down and depressurization likely vary from the submittals somewhere between ten minutes and six hours. It is all over the map. That's kind of important with respect to the programs like this. With respect to RCIC pump room cooling, the five plants stated clearly that no cooling is required. Four plants said well they would open the doors and/or provide some portable cooling. I have an IOU from a plant that said we are going to do the analysis and another plant is not even mentioned in the analysis at all in the submittal. Even more interesting is the wide variation and the battery lifetimes ranging from a low end of two hours assuming there is not road shutting all the way up to a whopping 13 hours. With respect to the containment heat removal, plants indicated containment venting was the way to do this. Other plans have this, however I never encountered before, they called it torus feed-and-bleed. But the idea here is to pump cold water into and dry up the hot water and remove the heat that way.

Finally and I guess most importantly is how plants are using the FLEX pump. Everybody has a FLEX pump that pumps. It is portable, in generally a diesel driven sorts of things like this. One plant intends to use it strictly to provide RHR heat exchanger cooling so its like a backup to service water. Most of the plants, seven plans say well the purpose of the flex pump, the pool makeup, so we are

going to feed into the condensate storage tank and/or the torus as we need to, to make up for evaporative losses when we have containment. And that is available as a backup for tort cooling by lining up directly for RPV injection. So, what's interesting is of the seven plants, there is no planned transition to FLEX. But in the other three plans, they say oh no we plan to make a transition to FLEX as part of our strategy.

So, based on this type of information I've made assumptions in the event tree structure accordingly. And I guess the primary one is that the event tree structure now says FLEX is used to provide suppression full makeup and its backup purpose is RPV injection. So in other words, FLEX would be operated as long as it could be operated.

MR. BUNDT: Another clarification point here is, this is Randy Bundt, FLEX is actually RCIC, the FLEX pumps and offsite resources because FLEX has three phases. When you say FLEX here you are talking about the portable pumps?

MR. STUTZKE: That's correct.

MR. BUNDT: Just from a clarity standpoint.

MR. STUTZKE: Yes.

MR. GABOR: This is Jeff Gabor. A lot of the comment I guess I had Marty on the top on the first one, is the start of our PB cool down and I think we know from past discussions why that it is important. But that doesn't mean the time that the operator takes manual control of the pressure. That's a little different. I think this from what I understand, this is an actual 80F or 50F per hour kind of cool down of the primary system. But doesn't represent the fact that at some point and perhaps even earlier than this time, would be earlier, the operator would take manual control to prevent the site on the SRVs.

MR. STUTZKE: Yes, I agree. Okay, good. So moving along. The definition of elapse is something that I guess is necessary to understand clearly in order to develop the event tree structures like this. I have been proceeding them and it was nothing more than a long session block out and how long that actually is. As a reference I've gone back to the regulatory basis document issued in April of this year for the rulemaking on the SPO mitigation strategies. I understand this is not the formal approved definition but it's a good working definition to get us going. And as I talk about, it's a complete loss of AC power to the essential and non-essential. That's in my PRA logic model. The loss of electric power system concurrent with turbine trip. I have extended that to include diesel fails to run prior mechanisms as well as

failure upon demand. I will show you how I did that in a slide or two. What distinguishes I guess ELAP from station blackout is that the duration of the blackout is longer than the coping time specifics in the SPO rule. So that's either four or eight hours depending on what the coping time of the power plant. I tried to incorporate that in there. On availability and potential non-recoverability of offsite power sources. To date, we have been talking as if ELAP was created by seismic events and only seismic events and there was never any chance that it would be recovered. I have also included various weather related ELAPs as well. So high winds. I think of tornadoes, hurricanes like this, snow storms, like the monster one we had. Things like that and in fact I did include non-recovery probability in those calculations and I'll show you in a little bit about how to do that. Credit for power being supplied by the safety related batteries, assumed available as I treated it probable and that means specifically including both random failures and batteries as appropriate and the seismic failure of batteries as appropriate. Supplemental AC power sources, that's been credited into the PRA model and credit for other portable equipment and that's been included into the PRA model as well. So I think what I've done is reasonably in alignment with this definition of ELAP.

MR. STEVENS: Tom Stevens. Is your credit for the portable equipment that's only the onsite portable or also the offsite?

MR. STUTZKE: That's only the onsite. We will get into it a little bit further. What I've tried to model is phase one and phase two of FLEX.

MR. STEVENS: Okay.

MR. STUTZKE: And then once the calvary arrives in the original support center, the model stops. The argument is at that time it is so difficult to identify boundary and a nickel condition's draw logic structure. I have no recourse for that.

MR. STEVENS: Flexibility really comes into play at that point.

MR. STUTZKE: Exactly.

MR. STEVENS: There's no preset schedule for delivery of any specific piece of equipment until the plant decides this is what I want.

MR. STUTZKE: Understand.

MR. WACHOWIAK: This is Rick Wachowiak. Did you identify that there are any sequences of interest that fall into the phase three category?

MR. STUTZKE: No I just --

MR. WACHOWIAK: We wouldn't really have much to analyze in that area. So, it's not really significant?

MR. STUTZKE: I don't think its significant with respect to filtration strategies.

MR. WACHOWIAK: Right.

MR. STUTZKE: One of the things that I have to bear in mind and I encourage all of us to, the only reason why were into this for definitions of ELAP is because that seems to be the likely scenario when you want to vent containment. And therefore when filtration strategies are involved, its not my intent to do an analysis of elapse of SPO. I'm doing it on the side because I have to do it in order to get it. Believe me if I could avoid by possibly, you know -- I would get out of that.

MR. GABOR: We've got paper copies. We're good.

MR. STUTZKE: So moving on to slide 14. Moving on to slide 14. These are the categories of ELAPs that were identified as an NEI 12-06. The types of external hazards. And basically that analysis came up with five categories. Seismic events, external floods, extreme cold, snow and ice sorts of things, high winds, tornadoes and hurricanes and high temperatures. And I thumbed through all the submittals trying to understand, I made a little table, to understand which plants, which one of these hazards were applicable to them. And some of the results were a little surprising to me. But I won't go into that now. With respect to the modeling treatment and what I've done, seismic is there for all of them.

MR. AMWAY: A comment I have on the modeling treatment -- oh excuse me. Phil Amway, Constellation Energy. A comment I have on the modeling treatment for the seismic source characterizations. The GI-199 has been rolled into seismic 2.1 for the seismic re-evaluation and we are using the 2012 central eastern U.S. seismic source characterizations as input to that re-evaluation, which is a later version than 2008 USGS. So I recommend using the same seismic source characterization model that we are using to resolve seismic 2.1.

MR. STUTZKE: When will that information be available?

MR. AMWAY: It is available now. We have been using to develop our seismic hazards.

MR. STUTZKE: Has it been submitted?

MR. STEVENS: I think it submitted in March.

MR. AMWAY: Submitted in March 2014.

MR. BUNDT: The hazard information has been submitted. The GMRS values are submitted in

March. The hazard were submitted in September. The model was submitted already also.

MR. AMWAY: Right. Both of those have been endorsed by the NRC staff for performing seismic hazard re-evaluations.

MR. BUNDT: Right.

MR. STUTZKE: But it's not, the models are not available until March?

MR. BUNDT: They are already available. The response spectrum is not available until March.

MR. STUTZKE: With respect to external floods. Back in January of this year, the NRC held a workshop including Corp of Engineers, Department of Interior, USGS, etc. and published a flood hazard assessment. Basically we don't have progress of flood hazard assessments for any of the sites. So the only way to treat it reasonably is some sort of qualitative consideration. It won't be numerically included into the risk assessment. As far as the remaining three categories, the extreme cold, the high winds and the high temperatures, what I've done is to go back to the weather related LOOP frequencies and outside power recovery that were developed in NUREG/CR-6890. That was a couple of years ago. They actually include historical data from high winds and I think there was one snow incident in there. So that would seem to be a reasonable way to estimate ELAP frequencies from that. Right now the logic model only treats these types of things as initiating events. In another words, there's nothing in the model that says they had a high wind event and they created an ELAP and it also blew over this thing or destroyed something. But that sort of additional damage to point systems and structures, I can't incorporate into the model.

MR. BUNDT: Marty, this is Randy Bunt again. On your flooding one, are you using any other drive versus the wet site classifications that came out of any I12-06 and 049 FLEX order?

MR. STUTZKE: I'm aware of them and that's what I was referring to earlier.

MR. BUNDT: Qualitative?

MR. STUTZKE: Yes it will be qualitative.

MR. BUNDT: Okay.

MR. STUTZKE: So yes what I had in mind obviously there are some sites that are not portable by virtue of their location and the other sites that are. The ones that are, they are a challenge.

MR. BUNDT: Yes, I assume that's what you meant but I just wanted clarification.

MR. STUTZKE: Okay. Slide 6. I had a professor in college that said every good presentation needs to have an equation in it. Here's my equation. Not to intimidate you, but here's, to give you the idea of what's going on. We

consider a loss of outside of power event occurring at plant zero here. And let's assume that the diesels originally start so we have power available. But some time later than the diesels randomly fail. And that is the beginning of the station blackout. Then if that blackout continues for some time period which is greater than the prepping time, we are actually in an ELAP. Okay. Somewhere between four to eight hours. So, in order to get a handle on this, on this technique called probabilistic convolution that's looking at treating all of these quantities as random variables and computing probability distribution functions. That's the purpose of the equation down here. What I was trying to do or was concerned about is when you put in a diesel fails to run event into a PRA model. So say it meets the time. 24 hours is typically what we use in PRA or could be somewhat higher of something like that. When you get down the road timewise, you run the diesel let's say for 24 hours and then the blackout occurs. The initial boundary conditions of that logic structure have to change because you have it vague. Plants are different. Operator actions are different. And since my model assumes we are starting out at full power when the trip occurs. It's not appropriate to integrate this thing over the full time period. So that's the notion to try to put a time on when the ELAP could actually occur. I should also point out that there is conservatism both on what I've done with the weather related ELAP frequencies because they consider things like snow and ice as well as high winds and stuff. Normally for high wind events, some types of subject like hurricanes and the plant shut down an event prior to that And again that's not the logic structure that we have. So, it is conservative to say you know the plant is running at full power and a category 5 hurricane rolls over the top of it, something like that. That being said, I have no idea what the amount of conservatism would be over the required reactor have a shut down type of model.

Okay, so on the next, slide 16, this is the weather related loop recovery curve that comes out of CR-6890. This is actually a log normal curve. It's been filtered to historical data. This is done by our contractors at Idaho National Laboratory a number of years ago like this. What you are seeing here is the probability that offsite power is not recovered. So, for example, if I pick eight hours. It says the probability that it's not recovered within eight hours is about .3, .28, something like that. Even when I get out to 24 hours, there's about a ten percent chance that offsite power is not effective. So that's the curve

that goes into the integral and other to determine these weather related ELAP frequencies like that. As you can imagine the integral is a little bit tough to solve. I've solved it numerically and then I spent my snow day Tuesday solving at Monte Carlo. So I'm reasonably confident. Now as far as the power system models. One way to do it would be to actually go to an entire fault tree model electric power system to quantify it. Because every plant has different characteristics. I didn't do that. Rather I turned to an update NUREG/CR-5500 which actually does this work for us. It's based out of our SPAR models, standardized plant analysis of risk models of STP and other regulatory purposes. What they do is to calculate EPS reliability for three classes of systems, classes two, three and four. But roughly refer to the number of onsite power sources. So an EPS class two source. And so therefore the SPAR models include all the random and common cross failures and its not just the diesels. It is the fuel systems, all the support systems for the models. To them I added in for the seismic evaluation, the seismic failure of the diesels and the switch gear in a very crude way, assuming that they are 100 percent. So when one diesel fails, the assumption is they are going to fail. So, putting that in there and turning the crank generates the list of frequencies you see on slide number 9, excuse me 18. I'm reading off my old copy before they got merged in there. So slide number 18 and I'll emphasize the word graph because these are as yet unreviewed, unapproved sorts of numbers. I'm pretty confident they are right, having spent most of the weekend checking and fixing errors. But these are the values you come up with. I think the message out of all of this is the weather related ELA frequency is up the same magnitude as the seismic ELAP frequency. At some places it is notably higher. But as a general rule you see equal contributions, roughly equal contributions.

Okay, so with that in mind. You can move on to slide 19 and I have to get a drink eventually. Which is the revision to the core event tree that was shown in the public meeting back in November. That is, this event tree right now is only treating the BWR Mark I plants with RCIC systems. So the plants with isolation condensers. I haven't touched yet nor have I done anything yet with the BWR Mark IIs like that. You know that goes hand in hand, given that I were to develop the logic structure, I put a burden on the city because they become hydraulic for those sorts of plants. So we are focusing now on the Mark I with RCIC systems. The assumption is the external initiated with the plant operating power. The event tree itself, as we

talked a little while ago, handles the first two phases of the SPO mitigating strategies. The phase one is the phase where you are relying on the installed plant systems like this. Phase two is relying on site portable equipment like this. There is another assumption embedded in here and that is the duration of phase one is four hours. That is roughly an average of battery lifetime plus an educated guess to the minimum time necessary to rig out the portable pump for FLEX. That's consistent with what we've done back in November like that. So, during that phase the assumption is the core cooling provided by RCIC as I said with the portable pump that's not yet been aligned. Our operators are in the process of doing this like this and venting is not required, might be done, but its not required. In contrast in phase two similarly core cooling provided by RCIC, special makeup supplied by the portable pump. If RCIC should fail for any reason , the portable pump can also be used to provide reactor compression injections. And it keeps being removed out containment, either through the dry well. So the total emission time is since looking up to 72 hours. So, the failure modes which I've considered which are the event tree headers considered in the phase one logic structure are, there are three of them. One with the loss of DC power, failure of the RCIC pumps are the second one. And RPV depressurization is the third one. The loss of DC power considers random failure, battery fails on demand, it's reasonable low probability pump but it also includes seismic failures. And I did that for the following reason. Basically when you look at the seismic fragility of something like switched gears and emergency diesel generators. They have a minimum seismic capacity of a little over 3Gs. Batteries on the other hand have somewhat higher capacities at about 3.8Gs. The RCIC pump is on the order of 2-1/2Gs meeting capacity. So when you think about it, if I have a seismically induced ELAP, there's a good chance I've also seismically failed the RCIC pump and damaged that. They all seem to be roughly equal. That's a simplistic view of it in a PRA model that has actually done of a true seismic PRA on all of these things. But that's the concern. So as far as the RCIC pump goes, I've modeled --

MR. BUNDT: Are you factoring in anything related to the actual experience to the Fukushima plants where RCIC worked and the batteries worked even though it exceeded into a seismic event there?

MR. STUTZKE: No.

MR. BUNDT: Okay.

MR. STUTZKE: As far as the RCIC pumps goes, we have the random failure modes, start

failure to run as well as the seismic failures put in there in addition. As far as the RPV depressurization, the assumption in the model is if the systems depressurize these are through a stuck-open relief valve. The failure of the valve itself like this or if the operator is perhaps a little over zealous and he pressurizes too small the assumption is that the pump turns off, not come back on again.

MR. GABOR: Marty, this is Jeff Gabor again. On the RPV, I was thinking while you were talking I think. You said that if the operator failed to, I guess, terminate the depressurization then that would result in failure of RCIC. Is that right?

MR. STUTZKE: That's the assumption.

MR. GABOR: If they follow EPG/SAG Rev 3, then take control as we discussed in one of our previous meetings then that would not result in failure of RCIC?

MR. STUTZKE: The way the model works is if they have taken control and so they are in the cool down stage like this. There are demands on the SRVs because cycling up, I think we have been using 200 psi. So they will still cycle and therefore still have some possibility of opening but not nearly as much as if they just chatted away. The model tries to account for both.

MR. FALLON: Marty, Pat Fallon from DT Energy. Just a question for you. Did you set a key value of pressure at which all this occurs because the SRVs basically will automatically close when they get to a certain pressure and usually runs between 60 and 100 pounds. And the SREs close it between 25 and 50. So your pressure margin is like where you can actually have not able to operate and the SRVs able to operate.

MR. GABOR: It's either, this is Jeff Gabor. It's even, I think even more physical than that. Because in fact I think some of the MAAP work that we've done and that Dr. Fuller has done would say that for a single stuck-open relief valve which is a generation of steam. The pressure doesn't get down. So is your model going to acknowledge that?

MR. STUTZKE: I got --

MR. FALLON: I had one other point and this probably related to one of the focus unit plants. HIPC is a backup for RCIC. It's that way in tech specs. You are not allowed to have both of them out to operate. Are you flowing HIPC away also in the model? MR. STUTZKE: That's not incorporated no.

MR. FALLON: Okay.

MR. BUNDT: And your failure to restart is just a installation of something. Correct?

MR. STUTZKE: Yes.

MR. AMWAY: This is Phil Amway. This is going back to the seismic question but the numbers that you offered for fragility, for batteries and diesels, did they, even if we stayed with a 2008 USGS data, is it showing demands that high for the BWRs we looked at?

MR. STUTZKE: Yes, because by meeting capacity remember it would access that the ground is at that value, say 3Gs. There's a 50 percent chance. So, what that implies is that the ground is less than 3Gs, there's still some probability it's just a percent. You need to involve it across the entire seismic curve.

MR. BUNDT: The industry is working on evaluation at a higher seismic standard based on more modern information for the phase one equipment which would contain RCIC equipment and has to be done by the middle to the end of next year. Would any of that be beneficial to factor in to any of this work?

MR. STUTZKE: It's always best to use the most recent information.

MR. BUNDT: That's going to be, the evaluation of some of the phase one type equipment for plants from a seismic hazard standpoint?

MR. STUTZKE: That's not compatible with the schedule.

MR. BUNDT: I understand.

MR. AMWAY: This is Phil Amway. When would you have to have it?

MR. STUTZKE: Probably by the end of this year.

MR. BUNDT: Some plants will be complete by then.

MR. BASU: This is Sudhamay Basu. You would have to have before the end of this year, before we can start on MAAP.

MR. STUTZKE: Yes.

MR. BASU: I just want to make sure.

MR. STUTZKE: I can say all I need to do then is to take the updated seismic capacities and put them into the spreadsheet as well as the updated seismic hazard curves. It was straightforward computation now that its all set up. The fact is we can't wait.

MR. STUTZKE: And so consideration of the loss of DC in this time. The assumption is the battery is depleted and the portable generator is not yet aligned. We need to consider containment venting for the heat removal pathway, additional RCIC pump, RCIC fails to continue running for the duration of phase two like this. Another RPV depressurization affects the RCIC pump. So, the loss of suppression fuel makeup hurts the operation

to make up for the losses of containment venting. And finally RPV injection using the portable pump.

MR. RECKLEY: Going back to what was mentioned, the work that's planned to be done on this. Do you have a logic for the outcome you are trying to get? I forget what it is called.

MR. BUNDT: Yeah the expediting seismic equipment list evaluation for augmented approach that we are taking. The expectation is that plants will do whatever it takes to get their phase one equipment to be capable of the increased seismic hazards, R2 times SSE and that will be completed by 2014/2015, which will be before the rule.

MR. RECKLEY: Without knowing what the modifications are, the logic of what they are trying to do psi. Couldn't it Marty?

MR. STUTZKE: It's possible.

MR. BUNDT: And that logic is laid out in some papers and other things under recommendation 2.1, 2.3.

MR. STUTZKE: From my personal opinion, its just a matter of timing. I couldn't be wrong on this one. The actual core damage events tree as currently stands is shown on the next page. I apologize for the small font. If you read this on a daily basis, your eyes will be as bad as mine.

MR. WACHOWIAK: Marty, this is Rick Wachowiak from EPRI. Could we or could you handle the upcoming information for the next year by just doing a sensitivity sort of look and see that if the seismic contribution to your entry, it was drawn a little bit, if that would significant, if that would bring in any additional MELCOR runs that need to be done and maybe just anticipate that its going to move around a little bit before the whole thing is done but still have all the MECORs that you are going to need?

MR. STUTZKE: Yes, that's a possibility. It's hard for me to imagine that it would have a multiple run.

MR. WACHOWIAK: That's really what your constraint is my understanding.

MR. STUTZKE: Right.

MR. WACHOWIAK: Then we've opened the possibility of doing that convolution again when the data becomes available.

MR. STUTZKE: Right. I think what I'll do is I'll get a hold of Cliff Munson over at NRO and get the latest seismic info and just run with it.

MR. BUNDT: But would it be an item that would be good to put in from a sensitivity study that was a known value that could be utilized when we are looking in the future to the cases for the

plants specifics to evaluate how to address the rule?

MR. STUTZKE: Yeah.

MR. WACHOWIAK: This stuff kind of works together.

MR. STUTZKE: Right.

MR. WACHOWIAK: Your two times SSE doesn't often enough that something higher than that makes a big difference in what the outcome of this would be. We would take a new back on that.

MR. BUNDT: And for the batteries NRCIC because all your phase one type support.

MR. WACHOWIAK: And I think the way we were planning on dealing with those sorts of things was in our uncertainty sensitivity analysis. So, we weren't going to be relying so much on the availability of that data at this point.

MR. STUTZKE: Yeah I mean, you know, the two times the SSE is not likely to change the meeting capacity that much anyway. The two times SSE is the value. But yes you can see on slide 22 the second bullet it is always seismic coming out of our RASP handbook. And the last handbook is basically what we give to our senior analysts, our SRAs that are out in the various office when they do analyses for SBPs or any sort of RSP related activities. With that being said, those numbers are pretty dated because they are in fact generic. Other are coming from our SPAR models, SPAR 2010 update, the information that's been collected about BPIC that weren't actually published until early 2013. And last but not least all the HRA events and failure events have been set for 0.3.

MR. FALLON: Marty, Pat Fallon from DTM. I just want to understand a piece of this. You said the over zealous operator that depressurizes too much and takes RCIC out forever at some point in time. Is that a snapshot that is like an unrecoverable action or if RCIC stopped taking control of SRVs and let them closed and the reactor depressurize due what its going to do for literally months after the event. You would pressure him where you can run then. Is that part of the model? Is that part of this HRA?

MR. STUTZKE: That would be part of the HRA in my mind. The model was structurally, it's correct.

MR. FALLON: Right. But he could take it out of service but doesn't loop back and say that it could be brought back later based on the real plant conditions?

MR. STUTZKE: Well, it is recoverable. It is not taken away forever.

MR. FALLON: Right. So you would lose some period of time of injecting water in and you could get back later once the --

MR. STUTZKE: That's correct.

MR. FALLON: And HRA will pick that up?

MR. STUTZKE: Yes. The way it is structured right now.

MR. HENNEKE: Marty, Dennis Henneke from GE. You are sending all the HEPs to .3. So it is in there but its not really credited in your analysis?

MR. STUTZKE: It's not credited in there at this time. The human error probable is 0.3 because we are still waiting on the EPG/SAGs.

MR. HENNEKE: Oh okay.

MR. STUTZKE: So I have no technical basis to assign numbers.

MR. FALLON: The EPG/SAGs is below the rate.

MR. BUNDT: But, this is Randy Bundt. You are assuming the .3 is based on one of the EPG/SAGs that you have seen?

MR. STUTZKE: No, those are good screening HRA numbers consistent with pretty well state of the art PRA.

MR. BUNDT: So they are not based on any version of EPG/SAGs?

MR. STUTZKE: No.

MR. HENNEKE: Just a screen.

MR. STUTZKE: Just a screen. Okay. Slide 23. The point haven't changed since November. I just included it on the slide to show you the attributes. Sequence time, RPB pressure, containment vent status. I believe those are the ones you guys are still using. I added two other ones, DC power status and FLEX pump status to MAAP in the containment event tree.

MR. GABOR: Marty, Jeff Gabor. The FLEX pump status, is your model going to pick up the initiation of a FLEX pump after core damage but prior to vessel breach to an in-vessel recovery?

MR. STUTZKE: Exactly. So what I intend to do with it is, for example, it is easier to get from I guess from the bottom up and see the XX. All that means is they didn't ask the question. So I'll go ahead and consider all of the problemistic failure modes of FLEX. The H1 is where operator has not aligned it in time to prevent core damage but this additional find that he could line it up to prevent vessel breach. The back category is another pump itself has physically failed but we know this is a spare pump. Then you consider the use of a spare pump as well. Okay. Then on slides 24 and 25 are direct results. For each one of the core damage sequences in the tree, like that associated with

damage directors -- excuse me. These are asserted by damage directors as well. The first one in the plant showing the contribution from weather and seismic and some light. The results, at least in my eye, look very similar to the sorts of numbers you get from station blackout contributions, total core damage frequencies. Our current SPAR models on the average SPOs are roughly 12 percent of the total CBI. We normally get frequencies in the six numbers which was pretty much what we are seeing here.

Finally on slide 26 in order to get the information we needed for the MELCOR, this is a rollout by the director and then sorted by the average frequency and that is the average of the fleet. When you actually look at the results, you see the same sequences kind of dominant although the absolutely frequencies change the percent contributions to include image. So I tried to give you an indication what sequence it comes from out of the event tree itself. The phase is whether its in phase one or phase two FLEX and then a short description of what's going on here. So what this is saying is the number one sequence is early failure because of this depressurization either stuck-open valve or the operator. Like this and its roughly 40 percent of the total.

MR. GABOR: Is your HEP driving that do you think?

MR. HENNEKE: It's .3, isn't it?

MR. STUTZKE: Yes, it probably is.

MR. GABOR: So just thinking ahead. We had, unfortunately you weren't here but we did have a public meeting where we walked through the EOPs, at Peach Bottom and I think it was, part of walking through that was to demonstrate the actions the operators would take to control pressure. So we're not, these numbers don't really reflect that public meeting or the information that was relayed during that.

MR. STUTZKE: No, right now they are just screening numbers.

MR. HENNEKE: Marty Dennis. What's driving the DC fails in phase two?

MR. STUTZKE: It's an operator alert. Try to get the portable generators up and running.

MR. GABOR: But wouldn't that have RCIC operate for the four-hour battery time?

MR. STUTZKE: Yes. You made it in four hours.

MR. GABOR: Got you.

MR. STUTZKE: It just says eventually you run out of DC power.

MR. BUNDT: So you are saying that it is less than one in ten at FLEX?

MR. STUTZKE: Say it again please.

MR. BUNDT: You are saying that an ELAP occurred. Am I missing the point here that this is implying that the likelihood that FLEX is going to be successful is less than one in ten?

MR. STUTZKE: You looking at the conditional per damage frequencies?

MR. BUNDT: I'm looking at the difference between the ELAP frequencies and then the failure mode RPB but you are not improving.

MR. HENNEKE: Less than a factor of two.

MR. BUNDT: So it's less than a 50 percent chance that its going to work.

MR. WACHOWIAK: Randy, you can't tell that from this because of the screen. The best you can get is .3 if everything else worked right.

MR. HENNEKE: Well we have .6. We have two event tree sequence, each at .3. I'm sorry. The depressurization failure and then the DC power failure, one after the other. Sequence 46 and 47 each one with .3 screening, so .6.

MR. WACHOWIAK: But I wouldn't put any validity on the actual numbers at this point since there is no real HRA that's being done here. And we know that the ELAP response requires human actions. There's nothing that's automatic. So it's going to be driven by the HRA. That portion, my understanding is, hasn't been done yet. Screen value is put in there. My question though is have you looked at this and it should be fairly easy for you to do and go back in and say okay what if the, what if I screened it .1 or something else to see if any of these other cases that the real reason you are doing this at this point right now is to identify which PDSs need to be looked at and so if you kind of look at, if you think it's being driven by that HEP screening value yo monkey around with that you see are any of these other ones going to bump into your 95 percent so that when we do finally get a real, or more real near HEP value stuck in that we haven't forgotten something.

MR. STUTZKE: I can do the sensitivities pretty easily.

MR. WACHOWIAK: But yeah, but I wouldn't look at these CCDPs at this point and say that they have any meaning. They just seem out of wack because what the industry is trying to do with FLEX is getting better than a 25 percent chance of success.

MR. BUNDT: And see its troubling to have a formal document issued that shows that its than 25 percent success path or an activity that we're spending multi millions of dollars and lots of resources on and deferring other activities for.

MR. WACHOWIAK: So my follow up question to that is then before you publish your final report

that has the numbers, the screening values will likely have been resolved?

MR. STUTZKE: Yes.

MR. WACHOWIAK: So the report shouldn't contain those numbers?

MR. FALLON: Pat Fallon from DC Energy. One more time. The loss of DC Power by operator actions results in a loss of RCIC, correct? Is there no credit given for RCIC black operations? That RCIC could run without DC power and we took credit for it and 50.54(hh)(2)?

MR. STUTZKE: The concern on the loss of DC power is loss of instrumentation. Loss of indication of frank conditions.

MR. FALLON: 50.54(hh)(2) also covers for that. There is no DC power in that, one of the initial conditions.

MR. BUNDT: And 049 also has the provisions of how to take instrument readings without DC power available. It is a requirement being added.

MR. CHANG: This is Jim Chang. You mentioned about the 25 percent improvement? Is there any analysis to account for that number?

MR. WACHOWIAK: That's part of the issues. That part has not yet been done.

MR. GABOR: The industry did provide in a public meeting some HRA evaluations. We provided in the August 14 meeting I thought. They were a whole series of PES and I don't remember exactly but there were, there was a sample of some of the HEP analysis using SPAR that we performed that we provided to you on the 14th, I believe.

MR. BASU: Sudhamay Basu, Office of Research. Is it fair to say that would be kind of what we are talking about here is really not going to change the broad picture significantly because you have two core event tree conditions. When I look at the earlier versus intermediate versus failure. It is still coming out at 40 40 20 roughly.

MR. GABOR: That will dramatically change I think. I mean just looking at this list for example. If we do, if you do the HRA evaluation. I suspect something like the sequence 48. RCIC fails to operate because that's hardware will go up. The others will come down. So if you cut off above that, you might miss once the HRA is updated, you might miss more dominant scenarios. That's what we are trying to work through here is that you don't, that doesn't happen.

MR. BASU: It's failure, because you couldn't align those. It failed. That was it. That was 40 percent contribution to the OR.

MR. FALLON: That was the, that was too low in pressure. That is not failure.

MR. STUTZKE: Not really.

MR. BASU: 39 percent.

MR. STUTZKE: No, that's the stuck-open relief valve, the depressurization. The early RCIC failure was sequence 48. So their concern was when you back off and you lower the human error probabilities, the upper sequence is followed at the bottom of the list, the EPRI sequence.

MR. WACHOWIAK: Well they will shift around a little bit. I wouldn't necessarily expect them to go all the way to the bottom of the list. But there's a chance that you may pick up 11, 12, 13 as something that's of interest that you'll need to look at. But in my mind, where all the actual numbers follow in is when you end up doing a cost benefit analysis at the back end. Then you need to get good numbers for these. But for right now we just have to, all we have to do is make sure that this line isn't taking something out of your analysis that you are going to need later.

MR. GABOR: That's a good point.

MR. WACHOWIAK: At this point we just need to focus, I think you just need to make your line a little fuzzier by doing some.

MR. GABOR: And honestly when we put up our top 95 percent core damage we can MAAP them to these. I think they all MAAP above your lines. So I'm not sure that we're completely out of sync here. The numbers might be different but the contributor will likely going to be similar.

MR. BUNDT: Particularly under the top ten. They just may not be in the same order.

MR. GABOR: Yes.

MR. WACHOWIAK: As long as you have a note there. What we are doing now I think looking like you are on the right track. MR. FALLON: If you are looking at the wrong ones to look at your cost benefit, you may be wasting a lot of effort.

MR. WACHOWIAK: That's what I mean. Those have to be, before we get to the cost benefit, before we get to the cost benefit part.

MR. FALLON: Absolutely.

MR. STUTZKE: Okay. So 26 out of the significant ones. So you just draw the line at 95 percent or one percent, pick them up like that. You are right. There's not a sharp. You have some, .9 percent and stuff. So maybe we ought to pick those as well. So, next steps. Obviously complete to HRA. When we get the available information we need to do so. I'm working on the containment of entry now. Back on the drive down here from Church Street I told Sud, I'd have it done by the end of the year. The MACCS2 population like this, the risk was and

the focus was not on absolute risk but it's the delta risk. Remembering we have to go back and pick up the qualitative insights for things like external floods or conservatism in the model or something adjusted. And the last but not least our reviews, that's something that we could discuss perhaps a little bit. We will certainly review in-house, like John Lane, to check. Those numbers get typed in computers wrong and things like that. Or, logic structures on picture isn't what you actually saw, bugs like that. But I don't know to the other extent what we would use that we could or should do on this thing before it gets issued. I don't know whether it would go to ACRS, for example.

MR. BASU: It would.

MR. STUTZKE: Yes at some point and the question sooner than later, that sort of thing. That's it.

MR. LANE: A question about the HRA. This is John Lane. Are we sure we are going to get that much more?

MR. GABOR: Better than .3?

MR. LANE: Well the SPAR H isn't really a based assessment. I don't know.

MR. FALLON: A lot of these are inducers. The high temperature.

MR. GABOR: In the last public meetings we went through the EOP portion very cleanly and yes, I guess what we are all reacting to is the dominant sequence is one that is clearly called out by the override at EPG/REG3 to not depressurize to the point.

MR. WACHOWIAK: It's a component to that one but that includes your SRV failure.

MR. GABOR: Well and the SRV failure has to also acknowledge that a stuck-open valve may not result in loss if RCIC per the analysis that we've done.

MR. FALLON: And there's one similar piece in here that you don't take the vessel down too fast in temperature to break it. That's very conscious in operator training that you are not going to exceed that 100 degree per hour cool down rate. So that's a fundamental everybody is training. Don't break the vessel.

MR. GABOR: If you, Marty said he looked at the overall integrated plans. The overall integrated plans are also very clear as to what controls will be in place to the neutral pressure to maintain receipt long term which is what the strategy involves. Two pieces primarily with vetting and the pressure control are very important to the integrated plan strategies.

MR. WACHOWIAK: This is Rick Wachowiak. EPRI has started, and I will emphasize started a

project to look at the HRA and I guess I can go back to the group that's working on that particular project and see if there's anything that can be brought from that to this project on the time line that we knew. I would suggest that there's nothing, they are not going to be falling off a wall to influence which of the sequences that will have to be done as I said before on the sensitivity analysis. But if we can find some time in the, maybe in the second quarter next year, we may have some beginnings of something that we can get going with this. But once again, it is not my project. I know others that are working on it but like I said, they just started to figure out what they are going to do. So I would have to try to see if there's anything that can be brought forward in that. But it sounds like it would be helpful.

MR. GABOR: Yeah. I know we just gave a sample but we did provide on August 14 a FLEX following early successor, so there was some SPAR-H worksheets completed and provided to you.

MR. LANE: So when you look at the ELAP and then you look at the core damage basically its about 70 to 80 percent of ELAPs to core damage. That's what we are reacting to you.

MR. WACHOWIAK: Yeah, Rick the screening values.

MR. LANE: Have you made a, FLEX was developed in the first place. Is there preliminary assessment as to what the number is this time?

MR. WACHOWIAK: What were the objections of some was not working.

MR. BUNDT: And part of it because you had so many things before you even got to that point. You have that bound and then your fitting multiple ways to do it and multiple connection points. So you are double dipping both in possibility and diversification, even though you are adding factors to it. You are adding frames to offset them.

MR. WACHOWIAK: So I'll see what kind of time line I can get from that project to see if there's something we may be able to use before we are done.

MR. REED: This is Tim Reed, from NRC. I have a question about that. This comes out and I'm always trying to figure out what would be human liability under circumstances. I don't even know where you start.

MR. WACHOWIAK: It could be anywhere from zero to 100 percent.

MR. REED: It could be just beyond where it is a piece of cake. And it's going to be a function of the severity. The sequence is in the front end of it somehow. More severe, you can more changes to

or otherwise affected psychologically. Then trying to understand what happens to all the equipment and whether somebody can accomplish the action. I don't know where you start. I'm glad you are giving it a shot but then it comes up and I don't even know where you would start that.

MR. WACHOWIAK: With the HRA document, it ended up coming up with five different methodologies to do that. They are not always consistent with each other and it's hard. But it doesn't mean there's not insight. We also don't have to know if its .1 or .11.

MR. REED: And the value that comes out of that, it helps us.

MR. WACHOWIAK: So we are trying to get our HRA experts together to try to look into this problem and see what we can come up with. I'm certainly not a HRA expert.

MR. BUNDT: I know their phone numbers.

MR. REED: I know through the actions that were done and how they more of a flood time component capability of it and then also looking at the emergency response action and major disasters when things aren't connected with personnel.

MR. BUNDT: I think they are all going to factor into that which is a little bit different than what we have typically done for our industry.

MR. REED: I think you could significantly better answers.

MR. HENNEKE: Dennis Henneke here. I guess there was a question these are actions we have now and for the most part it is core damage kind of venting. So, and I'm looking at for example depressurization. I mean I'm looking at our event trees here and the vent trees for typical events and its not even showing up. It's not a credible failure. It is a screen .3. It's not in our existing PRA results at this point and now we have an event tree.

MR. FALLON: It would be a good problem to have, to depressurize. I would really be happy with that.

MR. HENNEKE: The DC power we are showing in the ten months in the .3 range. So, these pre HEPs are stuff we've been doing for 30 years. We don't need EPGs and SAMGs to do that.

MR. AMWAY: This is Phil Amway. We are both in operational experience. I'm not a HPR but when it comes to the core pressure ready vent, the top four priorities and any operator learns is you deal with power level pressure and containment. In this event power wasn't an issue. You are already shut down. So you are down to level pressure and containment and your priorities and your actions are focused on at least maintaining those parameters.

That's independent of this. That's where, globally for any type of event, the success probability for being able to control pressure within, something we do training on every fifth week, not necessarily for the ELAP condition but other similar conditions, including SBO. That's all, highly confident that the operator can get within a pressure pan and be able to maintain it.

MR. CHANG: This is to control the pressurize -- psi to 400. Will continue to depressurize.

MR. FALLON: At least in my experience we generally don't go below 600 pounds because we're pretty, well no, our big driver is to not exceed in an hour that 100 degree cool down rate because you really don't know what the vessel is going to do. So you basically take it slow. You don't rapidly depressurize any time that you have a choice.

MR. CHANG: Right. So that's probably extended to the one and half hour, two hours. That is 400 because the last time meeting mentioned 400. That was two hours. That person stayed there for two hours.

MR. GABOR: I really would tell you to go back, it wasn't the 14th. What was the meeting where we had Jay Liner and Jan Felice here. July?

MR. FALLON: Early November.

MR. GABOR: Right. There was a lot of information presented at that meeting. They had the ELPs up. They walked through it. They time lined it. That was the intent of that meeting was to have some reality to these estimates. I'm not sure we had a lot of comments, a lot of criticism or comments during that meeting.

MR. FALLON: That was when we started asking for the actual documents themselves. We were kind of flying by the seat of our pants.

MR. GABOR: Again, that material has been presented multiple times. We had a EPG/SAG Reg 3 a couple of training meetings where the actual override language was provided to you. So its not like your completely blind.

MR. BUNDT: And also as Dennis mentioned, several, most of these actions are things that have been in place for years, control pressure, control temperature, the different activities. So, like you say you don't have a 3, you do have other revisions, do you have other ones that are out there. They have been at the agency for a while.

MR. AMWAY: That's been a standard ever since I originally got SRO certification in 1991. Those four parameters have been unchanged the entire time.

MR. FALLON: And coupled with that, we are always trained, as our agent for control,

control of the plant, control of those parameters, not just recognize them but control them and keep them in their bans and don't do anything in a hurry. Doing things in a hurry generally gets you in trouble.

MR. SCHOFER: This is Fred Schofer. I believe these are important points that you are trying to bring forth so we have record of it. It maybe worthwhile providing a letter to us summarizing these so that we can incorporate it appropriately through our analysis.

MR. BUNDT: We'll take that action to NEI to get some information on it.

MR. SCHOFER: Thank you.

MR. LANE: This is John Lane. It's possible that we may have not done it, we haven't done an HRA on these prior versions at all.

MR. WACHOWIAK: So I have a question for Marty on one of his slides. It's the slide you said was unnumbered but's actually 21. Sequence 47, I think that your event?

MR. STUTZKE: Sequence 47.

MR. WACHOWIAK: It's 47. So this is kind of the one we've been talking about.

MR. STUTZKE: SORV.

MR. WACHOWIAK: I want to understand what's on your tree here. The heading you have is P1, RPD pressure for short term RCIC.

MR. STUTZKE: Right.

MR. WACHOWIAK: But then down on the wedge you have SORV and phase one. It's that just, that the dominant failure or the dominant cuff settings?

MR. STUTZKE: It's a bad label. This is a mix-up. The valve actually sticks open for the operator.

MR. WACHOWIAK: Okay. So in your P1 fault tree you have more than just SORV?

MR. STUTZKE: Yes.

MR. WACHOWIAK: Okay. So when looking at this, I should ignore the labels on the branches.

MR. STUTZKE: Take them with a grain of sale.

MR. WACHOWIAK: Okay.

MR. SCHOFER: Before we go forward, I want to give those on the phone, if they have any questions or comments? Hearing none, we will proceed.

MR. BASU: Okay. I'm Sudhamay Basu from the Office of Research. The purpose of my presentation over the next few slides, I wanted to remind ourselves of the progression of the activities that staff conducted over the past six months. And the other purpose is to provide a segway at the end of my presentation to industry

presentation so that we can be better informed on the industry. So if you go back to June we actually had a presentation where the staff considered a number of analysis options. This is nothing new. We looked at the operation, RFX failure, intermediate failure, HRP depressurization. At the time we also discussed the drywell. We did not cover the vessel injection and venting versus recycling position venting. And more recently during the course of our interaction the concept of early preventing option came about. So in the same meeting, December 29, the same meeting we presented preliminary MELCOR calculation matrix and what I'm showing here on this slide is just a slice of a number of calculation option that we presented in that meeting. This one only contains five cases. I don't intend to go through these because we have actually discussed it at length in previous meetings. This was in July, we came back with their option. Again options where they present five cases and that one had no core injection or drywell. They are dry injection. I said no core injection. I'm not sure this one whether you meant FLEX injection or core injection there. You can correct me. Then there was the external RPV water injection point. That was case two with two options there. Option one, the first set of option is option one, the base case of water injection. We had the pressure vessel. And the option 2A with event cycling. Case three the drywell water injection and again there were three options. And then you also consider an option of small filter, not necessarily based on the DF value. At that time was to be defined. It was a large filter. In the others we mapped our cases and advised, at least I'm looking at, I'm on slide 35, we mapped the MELCOR cases, the device to industry alternative from the previous slide. We also mapped then to the SRM requirements. So it was at this point that we, the staff basically two pieces of information. One is the identification of sequences with regard to the PRF sector. And the other piece of information is initial conditions for the analysis, whether to MAAP analysis or analysis. And by initial condition I am referring to litigation features alternatives, some specifics. And I'll be touching on those shortly. Moving on to slide 42 this is core damage event, formulation presented back in September I believe. I think that date is correct. And the first twelve that actually covers about 97 percent of the total core damage frequency. They are not on this slide. There are two, but the only failure dominance and also the other thing to note here, the total core damage frequency is 2E minus 5. Marty has since presented his new event tree. I picked up the first eleven sequences from

there, again covering about 70 percent cumulative damage. And I was commenting earlier, we do the two, in the interim, we do the two broad base and I don't see maybe that was difference, demonstrates early, intermediate and late. It is coming out 40 40 20 and I understand that maybe when HRS considered that as way to have some impact on it. Cumulative value frequency we find, from Marty, the project, 2 minus 6? So what does all this mean? It really to me means that the MELCOR analysis MAAP presented with some minor revision kind of stays the same perhaps to consider the other failure, consider the failure and rate failure and other things we have to consider. I take a very quick glance at the industry presentation and I see that you also had some of these included. So that kind of brings me to the slide 34 and 35. What do we need from the industry at this point? I already said that there are two things we are looking at. One is the sequences that Marty is working on at our side. They are working on and some point we will see more final presentation of that. In the two slides, 34 and 35, we are looking for staff on some of the specifics. I listed the specifics for the event tree, pressure for example, early criteria that you are going to use in the analysis so we need to know that. MR. WACHOWIAK: I have a question for you on that. What's your definition of participatory venting. We've brought in this issue on our own side that's two different groups of people talking about venting and they are called the same thing, early venting. Now we sorted that out amongst ourselves how to use the anticipatory venting and then in the severe accident case, the early venting. Now you have mixed them together here. What do you thinking about?

MR. BASU: So my concept early venting?

MR. WACHOWIAK: Prior to?

MR. BASU: Prior.

MR. WACHOWIAK: That's what we call anticipatory venting.

MR. BASU: And then a low containment pressure. You guys talked about pressure 20 psi to perhaps 50 psi. What we are thinking about and subject to 15 psi.

MR. WACHOWIAK: 15?

MR. GABOR: 15 which is what we put on our slide.

MR. BASU: Yeah I see that. I hope to get answers from you in your presentation.

MR. BUNDT: There is maybe strategies directorate or resolution anticipatory venting which talks about the pressure range that will vented out, how it will be utilized. It will be a reference that you have for your information.

MR. BASU: Yeah, I think I know what you are referring to and that's kind of, anticipatory venting in a fairly quieter manner. I'm not sure I saw a specific numbers or anything but maybe there is.

MR. BUNDT: There is a version of it submitted in late October/early November I believe that has more information. I'm saying there is more than what's presented on our slides. There is some other information available. If you need something more, let us know.

MR. BASU: Some specific risk operation. I think at times we are the greatest suction would be from suppression pool because we don't know if will survive or not.

MR. BUNDT: Depends on the time frame.

MR. BASU: But we don't have any sort of, I guess, the final decision from the agency side whether you are going to follow that practice from suction from suppression pool and not CST. So, because that changes. That changes the analysis option that we would use as well.

MR. BUNDT: In their application for the industry is if the CST is available, the CST is a primary source of water and there are a handful or 20 to 30 in the plant with a CST assigned if they robust, therefore is credited in the analyst to go to CST in the suppression pool views once you get to the limits.

MR. BASU: The CST is a valid and will be to from CST when the other questions come up will they have CST refill and at what point are you going to position from CST to suppression pool? Is that information out there?

MR. BUNDT: That's typically in the individual plants OIPs where because it is strictly dependent on the CST volume levels at that point. It is also in the roadmap document or the NEDC that was submitted for the BWR typical plants where there were three or four different representation plants that were going through the FLEX process.

MR. BASU: How can I MAAP with large number cases specially, it's either going to be suction from CST to suppression pool or CST all true from the beginning from the suppression pool. But have you come to some decision for that affect? I'm looking at the analysis.

MR. WACHOWIAK: We don't have that explanation in our presentation today.

MR. BASU: Okay.

MR. WACHOWIAK: However the way that I thought we were going to handle that was that we would take one of our representative ones and see if doing CST or a suppression pool case weighed, if that slot made any significant difference in the

sensitivity and then carry forward based on the answer that we would get form that. When we were looking at the cases to establish the study state condition with RCIC being operated in this mode. There really wasn't a whole lot of difference in the containment conditions that we were calculating for that short period when we were looking when restudy state. So I'm expecting that there's not going to be much difference in that. But it was only looking at a short time. So once we achieve study states and what are the containment conditions, there wasn't a whole lot of difference. So I'm thinking its not going to be whole lot different.

MR. BASU: A steady -- what is the duration?

MR. WACHOWIAK: 12 hours is probably the longest case, I think, we ran with that. So I understand its based on the short term but it was also essentially a steady state. We were seeing what the changes were.

MR. BASU: Okay.

MR. BUNDT: In the document that gives five different cases for FLEX applicability, I think it is 37711. It actually did some comparisons on either feeding from a CST or feeding suppression pool. It showed there was no long-term at the vent, work, there was no long-term really significant difference between two water sources from a maximum temperature standpoint and within the first few hours that wasn't a significant difference in the temperature rise. It was just the angle of rise over the first few hours was the biggest difference. But that is the curve that is in that report that NRC has.

MR. WACHOWIAK: That's the same within a few hours.

MR. BASU: If you follow the --

MR. GABOR: Well what's interesting is in order to address the rulemaking objective, we have to submit core damage. So, in those scenarios our strategies all involve obviously external water source. That's going to be a lot more, its going to have a lot more impact on results than what happens prior to core damage in the time period when we are using RCIC. So, I'm not sure its going to be a really major impact. I think we can do a sensitivity and kind of rule out any major impact on it.

MR. BASU: Okay. We will probably also do something along the same lines.

MR. WACHOWIAK: But that was, I thought addressing that was doing the sensitivity based on short-term results, like you said.

MR. GABOR: I think one of those things where you can't be sure exactly which way influence

the final answer because obviously suction early, suction off the CST or suction off the CST adds inventory to the torus potentially, but it also suppresses, has potentially suppress some of the steam generation. So it could actually delay pressurization. Taking suction from suppression pool obviously doesn't add inventory. You would think in that early period of time could result in some that higher pool, faster pool heat up rates. So a lot of competing factors there. Again, how that all will translate into the overall decontamination factor that we are trying to calculate. I think it is going to find it is second order in importance. But we've got to do that. We've got to do the sensitivity to rule out.

MR. BASU: Exactly. So when we do that we will find out if it is.

MR. WACHOWIAK: We could some of that time maybe. Part of me thinks in some cases there are going to be the ones where something in that process failed.

MR. SUDRAN: Four hours of RCIC, 16 hours of RCIC. You know you are going to start with the CST. I think that's what you said.

MR. GABOR: I'm not sure. That's what I've been doing. I have actually credited the CST and then transferred over to the pool based on the high pool, low CST levels. I'm not sure I'm going to do that. I think what we probably, what I'm thinking, we haven't resolved this. But what I would think about doing is follow the OIPs, the integrated plans, which from the ones that don't have a seismic qualified CST are forced to use the pool. Again in my, I tend to think that results in a faster heat up of the pool. And in a way that, maybe I could translate that to be conservative.

MR. SUDRAN: What I think is happening is that you have four hours of RCIC you don't have enough CST. But if you have 16 hours, at some point you are going to have to. And from what we have seen before, right, there is one from CST to suppression pool. So it's a question of CST refilling, whether its four hours or 16 hours.

MR. WACHOWIAK: But we have to remember that when we are modeling thing its easy to make assumptions that we know what's coming up in the future when we are trying to MOPP the model ELEP. But in the real plant they don't determine that it's an ELAP for the first hour or so.

MR. BASU: So I kind of realize that using your time and in fact this two pages, something that you --

MR. WACHOWIAK: I think so.

MR. BASU: I'm going to stop here and then as you go through your presentation.

MR. GABOR: Make sure it is covered.

MR. BASU: Yes, exactly.

MR. SCHOFER: Okay. Are there questions/comments on the phone line? All right. Hearing none, we are about ten minutes behind time. How about we rejoin at twenty after? That's ten minutes. Okay. We will be on break until 3:20.

(Whereupon the foregoing matter went off the record at 3:09 p.m. and went back on the record at 3:19 p.m.)

MR. SCHOFER: All right. This is the NRC conference room. The meeting is going live again. And I'm going to turn it over to Jeff Gabor to present the industry presentation.

MR. GABOR: Okay. So this is a continuation of work. The EFRI project, Rick Wachowiak is the manager. The project manager for EFRI, Doug True, are being investigative. We are the investigators, principal investigators. Next slide please.

A couple of things just as background. The information we are providing today is meant to support the regulatory basis for rulemaking on filtering strategies. That's our, I think Marty had a very similar statement in one of his slides. We're expanding our information provided in past public meetings with the intent of focusing, I think we are all in agreement here that we're focusing on identifying the dominant contributors to core damage and that's something that's discussed in the SRM. We're going to talk about, we use different words. These words are all very specific to our analysis we are doing for rulemaking. For example, where base case pops up in a couple of our slides, obviously that's not meant to represent the most likely scenario we would expect to see in a nuclear plant. It is relative to rulemaking. It represents a case without any mitigation strategies. Release mitigation strategies and again it's a case that as by the SRM must go to core damages.

Next slide. So some of our general assumptions are already pointed out. I missed one. This is, again this was a slide we presented earlier. I did modify it a little bit with some more details. So, as we said and already laid out, the cases are ELAP type scenarios that we are analyzing. We are assuming that EA-13-109 capability which is the hardened vent, the actual capable vent, is in place. As needed, we'll assume a wetwell vent of 16 inch a drywell vent of 12 inch. The actual size of those is probably not going got have a huge impact on the overall decontamination factors we calculate. And its really dictated to a large extent by the integrated plans in response to 12-049. Because as Marty has already sene, reading

through all the integrated plans, the goal there is to extend the use of RCIC by anticipatory venting. Obviously the size of that vent must be adequate to achieve the goals which in most of the OIPs are somewhere around 200 maximum cool temperature 230 to 240 degrees Fahrenheit. So that really dictates the size. 16 inches is typically larger than what you need. But this is what we'll assume. We are going to assume, we talked about this I think at the last meeting as well. We're going to put a K factor on that release pad, it's a K factor 10 which the discharge probation is K. You get about a discharge multiplier or discharge co-efficient of .3. So you are reducing your effective area, flow area of that 16 inch vent by 2.3 times. We are assuming EPG/SAG Rev 3 is in place. And for the analysis that we're doing, that really boils down two key critical elements. I shouldn't use the word critical. Two key elements, I have to watch my language here. But the two actions that are important to this analysis are as we've been laboring with Marty about the depressurization. It's the override that's in Rev 3 that will tell the operator very clearly in order to maintain RCIC long-term, do not let the pressure drop below a point in which that RCIC turbine would be challenged. We've picked 200 pounds as we discussed in our past public meetings. I'll give a little more detail on that later. Oh and the second element. That was only one. The second part of Rev 3 that's important to us is the anticipatory venting. It, again, it probably has more impact on being able to credit RCIC for an extended period of time. Whether or not its going to have a huge impact on the overall decontamination once we do get a core damage event, I'm not so sure that's going to have a profound impact on that. But it does affect the probablistic analysis on when does RCIC fail and its important because it, again, its one of those two elements that helps the operator extend the use of RCIC. That's all part of the 049 responses. So FLEX is assumed to be in place for both pre-core and post core damage. So much like the analysis that Marty is doing. We look at the availability of the FLEX pump. And if it is available post core damage it won't be considered as part of one of our filtering strategy alternatives. If that strategy involved adding water to the reactor or adding water to containment, assuming that pump was available, we will take credit. And then some other things in our strategies we'll talk about later, that have to happen in order to be able to utilize that FLEX pump. RCIC, the same assumption you are making. We are assuming that when RCIC is running we do have DC power so we do have the ability to control level.

We've been discussing that. So that's our base assumption. Yes?

MR. SUDRAN: So going back to Marty's, DC power is always available?

MR. GABOR: No. I put the copies of our event, our core damage trees in here. They are hard to read just like Marty's. Abut you will need Marty's glasses to see them. But they do play out the cases where DC power is available.

MR. SUDRAN: And this anticipatory venting, it open to EPG/SAG.

MR. GABOR: Yes.

MR. SUDRAN: Do you isolate?

MR. GABOR: We do and I think Marty has got a similar event in his tree where that's all pre core damage. And we have an action and a decision point that says does the operator isolate that prior to or at post core damage, because it could affect the decontamination.

MR. SUDRAN: What is core damage? How do you define core damage?

MR. GABOR: We typically define it as 1,800 peak core temperatures.

MR. AMWAY: This is Phil Amway. From an operational perspective when we get to the point where the RCIC strategy has failed, we are going to lose vessel level. When we get down to the middle of the water level, we would transition from the EOPs to the SAMGs and that's our, that would be our transition point to say we no longer meet the override condition for having the vent valve open. We have to call this. And then your vent would then be controlled by the SAMGs procedures.

MR. GABOR: And Phil's right and then as I think consistent with Marty we've got some HEP in there that would say there is some likelihood that didn't happen and will AOIs be affected. We're going to use MAAP. Your going to use calculate the timing a vessel breach. I don't think that's a profound statement. The last bullet on there is important we think. We've talked in past meetings about how the containment might respond to core damage events. We presented, I think in past meetings some temperature response in the upper parts of the drywell. Even if we have core on the floor and we're putting water on the core on the floor, there's a potential that the elevated temperatures inside the reactor vessel could be radiating convecting into that upper part of the drywell and start to challenge either the head seal or penetrations. So, we've just assumed based on a lot of information on seal leakage and such that if we start seeing temperatures greater than 700 Fahrenheit in the upper drywell, we're going to assume a .1 square foot leakage. What does that

mean to us? It means to us that well our strategies have to, our strategies we believe need to address that potential for elevated temperatures in the drywell. I'm not sure we are going to see them in all of our scenarios and all of our strategies, but we are going to be conscious of it. If we get there, the significance of this too and we discussed this is looking at a scenario, one of our, I think its four and five of our alternatives where we have an external engineered filter vent path. That engineered filter will be less effective if we allow our temperatures to exceed that point. So we wanted a way to capture that additional leakage. The other point, the sub bullet there is important to us as well. And that if you are analyzing the case as we will where you are looking at the benefits and the response with external filter on the vent path. You also have to consider that if you create this leak path, you have to know how to close those vents. Because a typical filter vent is going to have a DP across it. And you need to acknowledge that DP relative to a different DP that's created by this leakage that's coming through the drywell. So we don't have all the details of that worked out yet. But I wanted to put it on this slide so you know that we are going to be looking at that pretty closely.

MR. SUDRAN: Regarding NUREG-1150, some high temperature right?

MR. GABOR: Yeah it's consistent with information going again back to support the individual plant examinations by Chicago Bridge and Iron where they analyzed the Mark 1 containment. They started to see leakage at these types of temperatures. In some of the leak tests, you could potentially depending on the configuration of the test, they might have seen leakages as low as 500 degrees. And then by the time you get to 900 degrees, again per the CB&I report, the leakage gets quite large. So we pick 700. We're not trying to say this is a best estimate. It's kind of a surrogate but we want to make sure we don't miss out in our strategies because our strategies obviously are not only to reduce the releases but by creating this leak path we're not going to be able to reduce the releases. So it works against us in our filtering strategies if we allow the temperatures to get there or if we see the temperatures. Okay, next slide.

MR. BASU: Before you go to the next slide. What's a release calculated with timing, correct?

MR. GABOR: It's calculated, yes.

MR. BASU: Now I suspect some of your mitigation strategies are tied to vessel bridge. And as you know MAAP core timing of vessel bridge is

different from the MAAP time of vessel bridge. That's had an impact on mitigation.

MR. GABOR: Well yes and other factors. I mean for example, the extent of core damage can affect that. Because as we seen in some of the MELCOR calculations, the peripheral bundles in the core could stay behind for an extended period of time. That's a heat source that now can be adding to the heat of the upper drywell.

MR. BASU: So I want to say even if we started out with conditions, at that point they are going to deviate.

MR. GABOR: We could, we could deviate. We could. We felt it was important enough because like I said its important because it can kind of bypass the value or the effectiveness of some of our other strategies like an external filter if this occurs. Much like we talked about and we've seen in all of our results, that if we don't cool the core debris on the floor of the drywell and we get liner melt-through, the benefit of an external filter is dramatically reduced.

MR. BASU: Right.

MR. GABOR: So it kind of fits into that category.

MR. BASU: It does. And we are saying the same thing perhaps that you may come to conclude that filter is not affected in a particular scenario, it is not affected based on the vessel bridge timing and what's coming out. We may come to a different conclusion.

MR. GABOR: You might. I guess the reason for putting the boat up there is we don't want you guys and obviously we don't want to ignore that potential leak path.

MR. BASU: Oh leak path, that's fine.

MR. GABOR: That's all. And how that impacts the overall leak contamination, you are right. It might be different between the two.

MR. BASU: Okay.

MR. KARIPINENI: The drywell leakage is solely based on temperature and no pressure?

MR. GABOR: Yeah, yeah. It is based on both. Obviously its based on both. At this point, if you look at the curves and the fact that one of those plots is in the 1302 guidance. It, to some extent it reflects this number. As was pointed about before at 700 if you go to that block diagram we provided in 1302. There is it would appear that you would need some over pressure at 700 to cause a leak. We're going to say for simplifying this analysis that you don't. That once that temperature is achieved, there is some amount of leakage. .1 is not a lot of leakage, .1 square feet. It would be considered a small leak not a catastrophic rupture.

Again, its just kind of a surrogate to make sure we don't miss a potential leak path that could reduce the effectiveness of any filtering strategy.

MR. KARIPINENI: These cases are run with the drywell working at that time?

MR. GABOR: Yes. You right Rao because I think if we didn't open the vent we would have other problems, over pressure challenges and containment. So you are right. This would be for cases where we were successfully venting. But let's say for example we were controlling the pressure, not at zero but at some elevated pressure. Then now you do have a pressure temperature component that could result in some amount of leakage at 700. I think we are going to talk about this more as we start seeing results from our analysis. If we calculate temperatures below 500, its not an issue. If we calculate temperatures at 650, 700, 750, we are probably going to want to investigate it a little bit further.

MR. SUDRAN: I think its hard to imagine we are going to get to 700, right?

MR. GABOR: Okay, we'll find out. We just don't want it going --

MR. WACHOWIAK: One other thing before we move off this slide. You were talking about adding a DP for the filter. The current thinking though is if we do an anticipatory venting, the anticipatory venting would bypass the filter and so during that portion of the calculation before the prior core damage, the additional DP would not be included.

MR. BASU: Say that again. I didn't understand.

MR. WACHOWIAK: High temperatures.

MR. BASU: So you have a filter.

MR. WACHOWIAK: So if we have a filter and you will see in one of our later slides what the capacities of the filters are based on. If the plant is running prior core damage and venting to keep RCIC in operation. It's not likely that they are going to be passing all that to K factor through their filter because the filter would eventually be spent by the time it might need to be used. So my understanding is that anticipatory venting would bypass the filter and you would have to reclose that to engage the filter. So there's two different, essentially in modern space, it's two different vent paths. One with a filter and one without.

MR. BASU: That's your point of view, you thinking.

MR. AMWAY: Another aspect of that too with just a DP as a filter itself was about 7 psi. So to meet the anticipatory venting and trying to keep that containment pressure down around 15 pounds, the only way you can do that with the vent

sizes we are looking at here is to bypass that pressure drop.

MR. GABOR: The significance is in a couple of slides down. It will define what a small large filter capacity is. I think that's what Rick is getting to. Is we're only going to kind of start the clock on that capacity once we're venting afer core damage. We're not going to penalize ourselves for and as Phil said, we're going to assume that the anticipatory venting bypasses.

MR. WACHOWIAK: Right. But the other implementation to that is when you do the alternative case event tree the ramifications of not reclosing the vent are significant because its going to bypass the filter.

MR. BASU: So let me ask you, maybe it's a dumb question. Anticipatory venting, you have a filter, right?

MR. WACHOWIAK: Yes.

MR. BASU: You react to the, you will not utilize that. You will actually open the drywell vent. Is that correct?

MR. WACHOWIAK: No.

MR. AMWAY: The large filter will tie in downstream where they would join up again. So you are going to have a wetwell vent path, drywell vent path that's going to come into a combined header. That combined header is where the filter will be.

MR. BASU: Okay.

MR. SUDRAN: We're concerned it doesn't make any difference because you are not explicitly.

MR. GABOR: The only, you are right. We are planning to do the same thing. But we wanted to make sure that's why we put this on this last bullet, is that we're, we consider the fact that as Phil points out. There is a DP across the filter and perhaps a much less DP across some sort of a leakage path. And that may change the effectiveness of the filter. That was the reason for putting it here. That's all.

MR. KARIPINENI: But from an operational viewpoint what does this say? There is not even a benefit of having the filter. You don't have the reactor into the filter too many times.

MR. GABOR: Okay. Next slide. We talked about this quite a bit. We had our EOP folks from Peach Bottom come out and walk through this. Based on the information provided, based on the existing EOPs and looking at, we have three EPG/SAG Rev 3. Again specific to the action, the override that tells the operator to terminate the depressurization or control pressure in a ban that continues to provide adequate to the RCIC turbine. This is what comes of that. Also I think its consistent and Marty would know if you look at the

integrated plans for the 12-049, I don't think its inconsistent with any of the information I found in there. We did at five minute, at ten minutes we are going to assume that the operator takes control of pressure and controls between 800 to 1000 range.

MR. SUDRAN: It's like the old psi.

MR. GABOR: The dead bans that we are using prior to ten minutes I think are around 50 pounds.

MR. SUDRAN: 50 pounds?

MR. GABOR: Which I think a three percent kind of variation. The information just so I say this. The information that Jan Felice provided to us in the public meeting would, one would conclude that the operators would take manual control much earlier than ten minutes. So we're being conservative by riding it out ten minutes. And then one hour would begin a control depressurization. Again this is very consistent with all the information you can read in the 049 integrated plans. And again consistent with EPG Rev 3 EPG/SAG Rev 3 keep the pressure in the 200 to 400 range. We talked about that before to keep RCIC going. Those are our base assumptions. If we need to do sensitivities on those, if we think its critical. We can do that. Because this is going to be our base assumptions going in. Next slide please.

This is an old slide that you saw before, much like the information that came out of analysis and I believe probably going to be fairly consistent with assumptions made in your analysis. There will be a failure probability if we are high pressure that the main steam line could rupture as a result of core damage and over heating of the upper head and the nozzle, the steam line nozzle. MAAP currently for reasons that some of you know, doesn't calculate, doesn't see those high temperatures. It has a lot to do with the details of core modeling. We're not going to argue about that here. We're going to look to the MELCOR analysis, come up with approximation for when the main steam line would fail. It occurs prior to typically in the MELCOR analysis, it occurs at the time or near the time of core relocation in the lower head. So we'll likely make a similar assumption in that branch of our APEB or CET. We will represent a main steam line rupture into the upper part of the drywell. We assume that you'll just use your normal calculation in MELCOR.

MR. SUDRAN: You're not looking at the exact timing. It is just core making --

MR. GABOR: Right. And I think – we are just trying to demonstrate that LOCA, that induced LOCA prior to vessel breach and the impact it has on our filtering strategy.

MR. WACHOWIAK: In a relocation, the temperatures are pretty high. You get that surge of pressure at that time.

MR. GABOR: And the same thing applies to the second bullet, the SRV seizing open as again in the MELCOR analysis, in the SORC analysis, SRV seizer was almost a given. That once the temperatures in the upper head exceeded an elevated temperature threshold the SRV was seize in an open position. That's actually an interesting failure because it creates a pathway for radionuclides now to be deposited in the suppression pool unlike the main steam line rupture which results in bypass of the pool and radionuclides directly in.

MR. SUDRAN: Is this happening or is high temperature?

MR. GABOR: The high temperature. Yes, the high temperature. They will look at the sensitivity of potentially a partially open SRV. I put that bullet here but it really impacts Marty's discussion on the stochastic failure of an SRV and whether or not that's a complete or partial failure. Because a partial failure may keep the pressure in the RPV elevated high enough that RCIC failure doesn't occur. Which in your preliminary draft results was your top 40 percent of your core damage was coming from something like an event like that.

MR. BUNDT: And Jeff we know in a lot of the plants, RRAs right now, many plants require more than one SRV to stick to get the pressure low enough that it would fail RCIC. So it isn't a SRV failure in most plant PRAs today.

MR. GABOR: Yes. No that's a good point. I know that Dr. Fuller has been doing some preliminary MAAP analysis. We've been doing our own with, as I said earlier, with a single stuck open valve, we don't get there. We don't get low enough to lose RCIC. We don't get below 60 pounds.

MR. SUDRAN: Do you just need one SRV?

MR. GABOR: Yes.

MR. AMWAY: Yeah you would need one SRV. And the way we would do that in actuality is we would step down our pressure bans. So 200 pounds is pretty much the standard especially for the higher pressure rate. So we would step that down from 800 to 1,000 and then we would go 700 to 900, 600 to 800 and we would just walk that down. So we got low on pressure and of course the change in temperature for PSI is a lot different at a 1,000 pounds than it is down at 200 pounds. So you would have to modify that once you got to 400 pounds. That's how you would do it. And one SRV through the whole range would be sufficient to do that.

MR. GABOR: The debris cooling, so now we are in to our filtering strategy alternatives.

When we have a case where we are providing water to the RPV, the failed vessel or to the drywell, we are going to assume 500 model, 500 GPM. We probably much like we did in the original EPRI investigation on filtering strategies for the MARK 1 and 2. We did some sensitivity on the flow rate. Obviously you are going to see one of our strategies is going to involve water management and obviously in that case we are going to be reducing the flow below 500. We'll talk about that in a minute.

The last bullet again if we don't vent obviously that's not a strategy that's going to result in a high decontamination factor. So, but just for completeness and perhaps as part of our base case analysis. If we don't vent and the pressure gets high enough, we are going to use the similar SOARCA methodology where I think its 80 psi. There's a pressure versus area leakage rate. We will use the exact same thing. Again, I didn't really need to put this up here. That's not a strategy. That's not a filtering strategy. That's more of a base case failure mode.

MR. BASU: You've got -- injection timing.

MR. GABOR: I didn't. That's a good point. I don't know that we completely resolved that. I mean in our past analysis we've assumed the injection was available at the time of vessel breach. It could be delayed slightly. What we are trying to do, obviously we're trying to prevent the earlier containment failure modes, which for a Mark 1 could be a liner meltdown. So we want to have water available in a timely manner to prevent that.

MR. BASU: Or even a drywall injection.

MR. GABOR: Or into a failed RPV after vessel.

MR. BASU: What about cooling injection. What's the timing for cooling injection?

MR. GABOR: Again, the SRM requires that we look at core damage events. So any mitigating strategy has to occur allowing core damage to occur. We have, that's why I brought up the vessel retention issue earlier. There is a possibility where we go through the containment event tree that the FLEX pump was not available in time to prevent core damage or peak core temp of 1,800 let's say, but was available later in time prior to vessel breach. Now in some of the analysis I think I've seen for MELCOR if the injection was available prior to core slump it had a high likelihood of presenting vessel breach.

MR. BASU: Okay.

MR. GABOR: I actually think you could probably extend it even further than that. So we're going to analyze those cases but they won't result in vessel breach. As we saw in the EPRI study that

fact alone provided much larger decontamination factors in containment by avoiding the phenomenon that occurs once the core comes out on the floor. So, for the other scenarios we're probably going to initiate either injection to the PRV or directly to containment at the time of vessel breach.

MR. BASU: And that timing something that you are?

MR. GABOR: Calculated with the code.

MR. BASU: But in reality how do you know? Even in the core, I can see drywell injection timing based on core calculative vessel breach.

MR. GABOR: Yes.

MR. BASU: But cooling injection, the vessel injection time, is that based on some level in the vessel?

MR. GABOR: You are right. Start with the first one. You are right that EPG/SAGs do guide the operators to get water on the drywell floor prior to vessel breach.

MR. BASU: Yes.

MR. WACHOWIAK: So that's pretty clear in the SAG that's an action that I think in some of the cases that we looked at before we started drywell injection if we were going to use drywell injection. We started it when the water level got below the minimum steam cooling water level. I think that is what was consistent with the SAMGs. But we did sensitivities to take all the way out to just after vessel breach and show that it didn't make a real lot of difference.

MR. AMWAY: The way the SAMGs are written if you get in that situation where you can't get injection into the RPV. So you go transition your SAMGs because your water level is below the steam core water level. If I make an assumption here because it asks you questions all across the top of the SAMGs to figure out what path you are in. But if I don't have any injection to the vessel, my next strategy is to put water on the drywell floor. So whether I know there's a breach or not, the procedure is directing me to get water on the drywell floor in preparation for breach of the vessel.

MR. BASU: If you cannot inject into the vessel?

MR. AMWAY: Correct. It might be, you know, a stuck valve or something. I have a pump that can deliver water but if I can't get it into the RPV and recover water level then my other option is to get it on the drywell floor.

MR. BASU: Okay. So if you can inject into the vessel, when would you inject it?

MR. AMWAY: As soon as I got a pump line out?

MR. BASU: Nothing to do with the water in the vessel?

MR. AMWAY: No.

MR. BASU: Okay.

MR. AMWAY: But the water level has already told me I need water there as soon as I can get it.

MR. SUDRAN: So here our interest is not injecting in the RPV with the RPV intact at 500 GPM, right? And what I heard is that you are going to inject into the drywell before. I think you made an assumption some time ago that there was no injection. If I don't inject into the vessel, so I have enough time to build up the water level. So is that what you are thinking about right now?

MR. GABOR: Yeah, I mean I think you are right. I mean that the strategy would and again this is an alternative filtering strategy we are looking at. But the strategy would be to get the water, follow the SAGs, get the water on the floor prior to vessel breach and then the decision would be made after vessel breach where the water could go. It could go in the RPV and there are some advantages to doing that. If there is peripheral bundles left behind, you know there could be an advantage to putting the water in the vessel and having it go out where the debris went. That's why, that's how we have the difference between three and, two and three in our strategies is to look at is there a preference to at some point switching it back to the RPV.

MR. BASU: So are you going to then have to fixed pump line out?

MR. GABOR: We could do both with the same pump. And if its going through our charge.

MR. AMWAY: Yeah we can direct it either way. If it was going through our charge, you can certainly redirect it to where you needed it.

MR. BASU: Without much –

MR. GABOR: We can pile the valves and of course we have a pump and we have a connection that we satisfy the, any challenges from hazardous environment condition, yes.

MR. KARIPINENI: So the same pump can both the injection to vessel and to the drywell. Why wouldn't you inject into the vessel?

MR. GABOR: You would. And you would prevent more damage.

MR. KARIPINENI: And you prevent core damage.

MR. GABOR: One scenario, for example, let's say it's a hot pressure. I think Marty had right now pressure melt. That would be one where you weren't successful in preventing core damage.

But the moment that the vessel fails and depressurized, then your injection becomes viable.

MR. AMWAY: Right. And that's what, I don't just get in a lane and stay in that lane once I've made that decision. All along the time that I'm venting the event, I have to reassess where I can get water. And as soon as I can get water in the pressure vessel, that's what I will be doing, just realign it.

MR. CHANG: The condition from the EOP to SEMG probably two foot. They take control. At that time condition to SEMG so because its not I assume no need to inject into RMP but at that time you have?

MR. GABOR: Yes. And that follows the guidance in the SAMGs.

MR. AMWAY: And just to be clear because we've talked about this at public meetings before. Once I make that transition from the EOPs to the SAMGs, I stay in the SAMGs. I can't go back up and re-enter DOPs again. That's where I'm at. The SAMGs will cover the case where okay maybe after the failure, I'm able to recover active fuel. I still use the same pumps, the same basic strategies but I'm still in the SAMGs.

MR. SUDRAN: Any recirculation on the pump?

MR. GABOR: A good point. I didn't say that. Yes, we are assuming pump seal leakage of 38 GPM.

MR. SUDRAN: 18?

MR. GABOR: It's 12 per pump plus.

MR. SUDRAN: 18.

MR. GABOR: 18 per pump, yes.

MR. WACHOWIAK: But what is done its calculated at that normal pressure calculating the open area as the pressure changes. It will adjust itself.

MR. SUDRAN: So now at some point you are going to go solid and you are going to have to private.

MR. GABOR: You're right.

MR. WACHOWIAK: Yes. Case 2C and 3C cover.

MR. GABOR: So let me go on. I think this helps to address some of your questions Sudran on containment venting. What we are going to assume is -

MS. HELTON: Jeff?

MR. GABOR: Yes.

MS. HELTON: Sorry. Before you go on. Since it was such a healthy discussion in the conference room, I think it would be good to check in and see if there's anybody on the phone line. So does anybody on the phone have any questions or

comments before we go on? Remember to hit mute so we can hear you. All right.

MR. GABOR: Okay.

MS. HELTON: Thanks.

MR. GABOR: On containment venting again, this is an older slide that we presented before. I don't think its been changed too much. Prior to core damage we discussed that we will on the appropriate branch in the core damage tree, we will credit anticipatory venting to maintain the low pressurable temperature for RCIC. That's a simple open event and leave it open. And as Su pointed out, we are picking 15 psig. You see kind of a spread in that pressure in the integrated plans. I still think some of that is still under development in response to the 12-049. There's no cycling involved. You just open up. What you are trying to do is to prevent the pool from increasing above a threshold. And that's the purpose of that. And I didn't put it out on here but its in our containment event tree, there is as we've talked about recently, there is a type of event that looks at the failure of the operator, to isolate that. As Phil said, transitioning into the SAMGs no longer required this. The vent would be isolated. But there is a potential HEP calculated for failure to do that. Entering the SAG now and that's around the minimum steam cooling. The vent would be closed unless its required to be open to maintain pressure suppression function. The PSP, which is the 30 PSIG. And then after vessel breach the venting pressure requirement is based on PCPL and that's 60 pounds. Four of those strategies where we assume vent cycling which I think is 2B and 3B, we're going to pick a psi delta control band. Closure of the wetwell vent in our demonstration cases is going to be based on a pool level of 21 feet. It's representative of one plant out there. We found in our tabletop if you go look at the tabletop report. You will find that the plant that was analyzed had a much higher shutoff with a torus. But this 21 feet is consistent with at least one plant specific procedures. And then we'll look at sensitivity cases to investigate depressurization prior to isolating the wetwell vent. So at this 21 feet in the torus, the operators are told to secure, isolate the wetwell vent path. The next time you go back to our original effort report then the next time we hit the PCPL we would then be vetting through the drywell. One of the strategies we found in that EPRI report that was very effective, effective in terms of increasing the DF was when they know and we appreciate this. This isn't currently in the procedure. But what we found out is when the operators know that they are reaching that limit on

being able to utilize the wetwell vent. If they depressurize completely with the wetwell vent, it buys them a lot of, it creates a lot of margin for future. And it had a fairly significant impact on our overall DF. So we are going to be looking at that, not as a, probably as a separate strategy but as a sensitivity for consideration.

MR. SUDRAN: How do you tell MAAP to go ahead and close the vent? What exactly do you --

MR. GABOR: I base it on that minimum steam cooling level. So when the cool level drops the collapse level on the downcomer drops below two-thirds. I close it but I also have to run a case why I failed to close it because I have to be able to MAAP the first time.

MR. SUDRAN: Isolation is based on closing?

MR. GABOR: Yes. Next slide. So here are the alternatives. Again I've modified this very slightly. Our base case, in fact this is the same slide that Sud put up earlier. I did add a new case 2 Charlie. It's identical to 3 Charlie except that maintaining injection point is to the RPV. But they both address the same thing and that is by moving into a water management strategy, I can actually prevent the need for drywell venting later. I can either delay it dramatically or I can prevent it altogether. And just to give you an idea, we haven't worked out all the details on it. Other than we're going to try to achieve the goal that's stated here and that's the prevent the need for drywell venting. One of the ways that we can do that is we could initially start our flooding process with a high rate of flow, maybe its 500 gpm. Once we get the torus level starting to increase, we know that we put sufficient water in to provide debris cooling and remove sensible heat from debris. We can then back that flow off by simply watching the torus water level. The torus level starts increasing too rapidly. We can reduce the flow. The goal here would be to get ourselves into a situation where we are basically putting in the same amount of water that's steaming out through our vent path, our wetwell vent path. And if we can get into that mode, providing cooling to the debris, keeping the temperatures under control, we can sit there, wetwell venting for an indefinite period of time. That will be our objective for 2C and 3C. And then the only other thing I did is based on our September 19 public meeting, I specified what we're going to consider a small filter and a large filter to be. And we'll actually total up after the vent is opened, not as we talked earlier. Not factoring in the anticipatory venting period, but the actual, you know, venting per the SAMGs. We are actually going

to total up to keep track of the aerosol loading on the filter. And when the aerosol loading exceeds those thresholds are DF for the filter will go from whatever the design value of 1,000 or whatever it is, down to one. We will reduce it to one.

MR. BASU: So that's a number you will be calculating?

MR. GABOR: We'll just calculate the aerosol flow through the pipe.

MR. BASU: Okay. So you have actually rechartered before?

MR. GABOR: I did. I did. And the reason we did that is as we've, since we've talked last we spent some time looking at local temperatures in the drywell. And we actually think that there may be advantages as we were just talking to perhaps transitioning at some point into putting the water in the RPV because it will have a stronger impact on suppressing the high temperatures inside the RPV which can affect the upper drywell temperatures. So we see that as an option and we think coupling that with the water management might be a good strategy and could actually produce the largest overall decontamination factors.

MR. SUDRAN: No why is management, you are not just going through with dumping fire prevention and what is the criteria?

MR. GABOR: Like I said, our objective there is going to be to not drive ourselves to the point where we have to isolate the wetwell vent. We want to keep on the wetwell vent. So that's going to be our objective.

MR. SUDRAN: And you have the water levels?

MR. GABOR: Yes.

MR. SUDRAN: To make sure its below the 21 feet?

MR. GABOR: Yes.

MR. BASU: and you will find, I'm not saying that's going to happen, you are going to find you are defeating the other purpose which is to control the upper drywell temperature, right?

MR. GABOR: Correct. Correct. No you are right. It is possible, yes.

MR. BASU: Okay.

MR. WACHOWIAK: Which is why we handed 2 Charlie because we think we might have a better shot at it that way because that does both.

MR. GABOR: And if the vessel is breached, that water in the RVP will make its way to the debris.

MR. LANE: Jess.

MR. GABOR: Yes.

MR. LANE: A question remind me again. What's the external injection point?

MR. GABOR: The reason, the significance of that is we're saying that we have a FLEX system that's implemented per 12-049. The guidance for that or the motivation for that is to permit core damage. We believe that an external connection prevents the need to put an operator inside a reactor building. And by doing that it makes it more reliable to use during a severe accident.

MR. LANE: So this is a vessel connection that's existing already that we are going to re-use?

MR. GABOR: That's extended out to the out of bounds.

MR. AMWAY: Right, the reactor building walls hook up outside the reactor.

MR. GABOR: The idea with this and this is based on a lot of preliminary analysis that various people have done. Is that once you get into core damage, the local radiation dose that's inside the reactor building start to get large. And by making and we have the, we have the FLEX pump. But if we have to go in the reactor building to hook it up during the core damage event, it may reduce its reliability. So we're going to and I think we had some in our previous presentation. We had some cost estimates for how to develop that modification and what it would cost. It was in the, I think, one million or two million dollar cost estimate range.

MR. AMWAY: For plants that have RE charts that are simple right because you can tie into the piping system and its positioning valves to get it to the RPV or to the containment. We have to have a separate connection point for the containment injection versus the RPV injection. Either way, the concept is the same.

MR. SUDRAN: In terms of what is going to happen first, is that before you get the vessel breach, you want to put water into the drywell to make sure you have some water there.

MR. GABOR: Yes.

MR. SUDRAN: And then after that, then we make a decision.

MR. GABOR: Yes.

MR. SUDRAN: And the point that we would want to do can change?

MR. GABOR: I think it can. If it turns out, let's just say. Let's say that we are seeing some elevated drywell temperatures. Obviously the point which I would and if by putting water in the RPV turns those temperatures around, then I want to achieve that before I started to challenge the drywell. So there is probably a pretty big window there where I could make the change to switch over to the RPV. And we'll be looking at that.

MR. SUDRAN: And the same calculations you've done before previously? That is when you

would have an injection. So any time between the 16 hours and 35 hours we could start injecting into the vessel?

MR. BASU: I think. I don't remember that was that 16 and 36.

MR. SUDRAN: So about 24 hours.

MR. GABOR: Well the, putting water in the drywell is pretty clearly spelled out in the SAG, in the SAMG. And upon entering, I mean literally once you are in the SAG and the SAMG you are told to get water on the floor. You are not flooding containment yet. You are not bringing the level up high but you are getting water on the floor. I mean, if you go to the SAG it's called out in the steps.

MR. BASU: That would mean some kind of that will achieve that right?

MR. GABOR: Yes.

MR. BASU: Have you all settled on that?

MR. GABOR: I think –

MR. SUDRAN: And the control?

MR. WACHOWIAK: More or less.

MR. GABOR: More or less, yes. You just turn it on, start to see the level come up and stop. Because at that point you know you've got it up to the spillover in the drywell so now you've accomplished the goal of the SAG, of the SAMG, of having water there prior to vessel breach.

MR. WACHOWIAK: The plant that I use to work at, the way their technical support aides for the engineers to look at that, with the SAGs, it told how much water it needed to have to get up to the spillover and it said, however many gallons it was, this many gallons. You are suppose to calculate what your rate is and tell the operators, okay you need to flood for 20 minutes or something like that. So that type of information is typically known.

MR. KARIPINENI: It would depend on the concentration.

MR. WACHOWIAK: That's why they don't just say bring in at this rate or for this much time because you have to make an estimate of what your rate is. Because you know everything is degraded. So it has to be done during that time frame. But its not a real long time. I think we are seeing, what, in the case we got, a half an hour. So it is sufficient at the 500 gpm.

MR. KARIPINENI: 21 level.

MR. WACHOWIAK: To get to the spillover was. When you start.

MR. KARIPINENI: To get to the 21?

MR. WACHOWIAK: No.

MR. SCHOFER: We need to a time check. It is 4:15.

MR. GABOR: I'm almost done.

MR. SCHOFER: Okay.

MR. GABOR: The event trees, I wasn't going to go through those. They are the same ones that we had before. Slightly simplified version of what Marty put out but we actually believe it covers a lot, pretty much covers the same territory, asks the same major questions, addresses the same major issues. Marty's got a little more detail.

MR. HENNEKE: Dennis Henneke here. Jeff I have a question. The depressurization of 5 there. How does that compare with Marty's depressurization? It looks like it is asking a different question. I just want to confirm that.

MR. GABOR: Well you go to the next slide actually.

MR. WACHOWIAK: It's the same brand. Sufficient for RCIC. RCIC lost our low pressure.

MR. STUTZKE: A sum of probability.

MR. HENNEKE: Except if you are look at the event tree it's on the bottom RCIC is not available.

MR. GABOR: It's not, it was just asking, if RCIC was not available. Good question. If RCIC is not available we go ahead and ask the question on emergency depressurization based on the steam cool. And the only, the reason we do that? Is it splits between a high pressure core mount and a low pressure mount. That's the only reason. So you're right. RCIC fails. We do ask about RPV. That's why we put a different, some different language on the tree and just said, it's either high pressure or its depressurized. And that's only to split a high pressure core mount from a low pressure core mount.

MR. STUTZKE: You use two events.

MR. GABOR: Right. We use one event but it means something different depending on where you are at. Okay? And then the next slide again it's the same thing we had before. It just describes all the top events. Unless anybody's got a question. We went through this before. I think its pretty self explanatory. Next slide.

MR. BASU: A quick question. MCCI.

MR. GABOR: You're ahead. He is two more ahead.

MR. BASU: Oh okay. I'm sorry.

MR. GABOR: Thank you. That's good. Now we move to our containment event tree and go to the next slide to answer Sud's question. When we initially put this on here, what we were trying to capture is we believe that there may be differences in how we're logging poor concrete attack and how effective debris cooling is. So this would be with debris cooling. What we've seen in some of the, say pool analysis, that even with water up to the debris, there was a considerable amount of concrete attack.

MR. BASU: Yes.

MR. GABOR: In some of the earlier MAAP there was less concrete attack but now with MAAP 501 we are actually seeing numbers not, I guess, dramatically different from MELCOR.

MR. WACHOWIAK: 502's out.

MR. GABOR: 502 is out. Rick can shed some light on this. We're not sure if degree of concrete attack whether it's a flip or three feet is really going to matter all that much. We're not going to necessarily change our strategy. It's not something we can control because we are putting water over the debris, which is what we can control and we are trying to cool the debris. So, we were just trying to see, we just put that in there to see if the debris of concrete erosion would impact the effectiveness of our strategy.

MR. BASU: Yeah that's right. And again looking at in this case I presume axial revolutions rather than lateral going into –

MR. GABOR: We calculate both just like you do.

MR. BASU: You will. What we saw in some of our calculations with the water. You can actually start lineup failure. So I was wondering if that would be better for your –

MR. GABOR: Not really. It's the degree, its probably more driven by the aerosols being released as a result of NCCI because that equates to pressurization and fission product release. So we were looking at it more from how it influenced our overall DF.

MR. BASU: Yes, okay.

MR. GABOR: For the end of our study we'll be looking qualitatively at some of the stuff at Argon and Oakridge doing this area right now just to make sure that what we have

is in a reasonable range. We're not going to try and explicitly model what they are doing right now in this particular study. This is outside of our time frame. Okay?

Next slide is really one of our more important slides. It finally kind of links up with Marty's top ten list. We did a very similar calculation with the qualification and core damage event tree and that was the one we presented the details on August 14. So here are our top five and our qualification results in approximately 95 percent of the total CDF. And these core damage event states, you can go back to our event tree and you can see where they match up. But again keep in mind that we have to, we're talking about getting the core damage and how do we get to core damage? Well what you see in the first and third case is what obviously to get to core damage is to have RCIC fail early. And if that occurs, we don't have time at the time to get FLEX started up to prevent core damage. We might have it in time to prevent vessel breach but not prevent core damage. And the only difference between the first one and the third one is what Dennis pointed out earlier and that in CD-19 the operator does follow, even though they don't have RCIC early, they follow the EOPs that require at minimum steam cooling, two-thirds, we were talking approximately, they would depressurize the RPV. So that makes, that turns this event into a low pressure versus the CD-20 case where they failed to do that.

MR. SUDRAN: The CD-017?

MR. GABOR: Right so CD-17 is a case where RCIC is available but we don't have DC power or FLEX DC power. FLEX requires us to station batteries with some source of backup power, invertors, charges, you know, whatever we have. In that CD-17 FLEX is not available. So RCIC will run. We are assuming its running to the point where you deplete your station batteries for a time area.

MR. SUDRAN: Four hour hours on the station batteries?

MR. GABOR: Right. So that's why I tried to say in the 17, DC charging early. So just deplete the batteries, assume that RCIC fails.

MR. BUNDT: But Jeff a lot of plants have not only the FLEX DC power they also have

other means for depressurizing without their installed DC power because that's already requirements. But if multiple actions and multiple ways to depressurize independent have just been installed.

MR. GABOR: Yeah we have to talk to what Doug actually, in some Doug has factored some of those success passes.

MR. BUNDT: To respond back to answer if we lose normal power and we don't have FLEX DC power we still have ways that all plants to be able to depressurize. So there is already multiple ways independent of flex.

MR. WACHOWIAK: Or station baggage.

MR. BUNDT: Or station baggage, right. So we have that capability for other scenarios.

MR. GABOR: So those are the first three. The last two CD-002 is at the top of the tree, the success path. And this is kind of of the FLEX success path. This probably matches up with the overall integrated plans where RCIC succeeds early. We are successfully transitioning to FLEX early which means we have DC power. We take control of our DP pressure. We drop it eventually. We get it down to the 200 to 400 range. And we are just sitting there and we have anticipatory venting. So we are keeping our pool temperature under control. We're keeping it in the 230 range. And literally as demonstrated in the integrated plans for 12-049, we can operate this way forever. Again, there is some likelihood that we would lose at some point RCIC would fail. And if FLEX was not available late and we put 16 hours for the reasons that we talked about before as kind of a representative time period. Because anything beyond 16 the containment is in the same condition prior. So we pick 16 and we just assume that at 16 hours RCIC fails for some reason and then we will go to core recovery and core damage and eventually vessel breach if its not recovered. Again, what's key here is if FLEX fails late. So that's the added failure probability that takes this to core damage.

And then the last one is similar to that. RCIC works. FLEX is available to keep DC power. We can depressurize. But in this case the operator fails the anticipatory vending step. And if that happens, temperature in the pool just continues t o go up. Without venting

it continues to go up and will just assume that 230 Fahrenheit RCIC is unavailable. So those scenarios lead us to core damage and represent 95 percent. This is with the HEP type numbers that we shared with you guys previously. We didn't share all of them but some samples of it.

MR. HENNEKE: So we here it CD-017 is similar to Marty's number two sequence. What we don't see here is Marty's number one sequence which is over-depressurization. The event tree is a little different in that the over-depressurization also has a FLEX.

MR. GABOR: And I think those instincts, they are on the list. I mean we've got the complete list. But the RCIC fail early cases are a higher likelihood.

MR. HENNEKE: But again, your event tree essentially has FLEX on your, failed on depressurization that your FLEX coming in over depressurizing.

MR. GABOR: You could. You could.

MR. HENNEKE: That's not on Marty's.

MR. GABOR: Yes. Sorry. I didn't pick up on that. So Marty will you be able to represent that if it takes long enough to depressurize and lose RCIC as a result of the SORV, would you also check on whether FLEX was operating to be able to?

MR. STUTZKE: I'm going to have that back.

MR. GABOR: Okay. I guess I missed that piece. Any other questions on the top five that we've got? And again I think they do, as Dennis pointed out, they do line up pretty well with the one exception that we don't have that top event number one that you have. We have it, it's just below the 95.

MR. BASU: It's not.

MR. KARIPINENI: You don't have any preliminary data?

MR. GABOR: Of course we don't. We don't. Well he had enough to create the list but not in a form that we are ready to distribute yet.

MR. WACHOWIAK: And for our analysis it's a little less to have those percentages at this point because our plan is not to try to limit it to five or ten cases. We are going to do this as well as we could.

MR. SUDRAN: Do you have any MAAP cases?

MR. WACHOWIAK: Well our ambition right now is to run them all. We'll see how that goes.

MR. BUNDT: And just to go back to our point before that one that on top followed here is because again as mentioned before in most of our existing PRA studies we have type of failure there but its such a low frequency because of the operator training, because of all other options there we showed a very low probability that existing PRA studies. Therefore we don't arbitrarily put it at a human factor 5.3.

MR. WACHOWIAK: But when we do that we have to check to be sure and I think Doug already has the beginnings of this model in there. If its an issue of a seismic event, there's a different performance factor that goes in. If it is a high wind event, there could be some differences that are in there. I think he's got them captured. But its not exactly the same one that is in yours.

MR. HENNEKE: Well initially I counted the HEP differences but when I saw the event tree structure actually crediting I guess it was the assumption that it takes so long to get there. But by the time they would do that and then of course you have over cooled and so you have time to recover and you could get FLEX in by the time the core event occurs. I think its more of an event tree structure. So I think Doug assumed the .1 HEP failure versus .3. So it wouldn't be that big of a difference

MEMBER HANSON: He used SPAR-H to calculate.

MR. GABOR: It's closer to .1 than .3. And then the last slide. I'm on my last slide. The last slide is we've actually also qualified the containment event tree as well. And again, what we did here as Rick pointed out. We intend to run as many of the instates from the CET as possible, if not all of them. But what we tried to do here more focused on the MELCOR analysis is to identify the dominant contributors to offsite release. And what we find, I don't think there is any real secret here, any surprises here. Maybe one. But what we find in our base case so that would be cases without water addition after vessel breach after core damage. They are all dry cases. In our analysis and our tree the dominant path

would be for dry cases would go to I don't know. That's how the variation on those cases are described by that first, the first comment there. We have cases there. We have SRV seizure like SOARCA. We have cases where we have main steam failure, also like SOARCA and primarily from the SOARCA analysis. And if neither of those occur, you could be left with a high pressure melt case. So, those are the kind of versions, the flavors of cases that lead to containment breach, liner melt that have the highest likelihood of a release. Like I say, you can look at our containment event tree. There are all kinds of other ones that we could get into. We mostly likely will quantify but these are clearly our qualification, the highest likelihood. When we look at our alternatives it really implies we haven't quantified all of our alternatives yet. But what we are going to, what we are pretty sure we've done some of them. We're going to end up with these being the dominant instates for those. But remember. All of our alternatives involve getting water to the debris. So we are doing that to prevent high temperature failures. We are doing it to prevent liner melt through. So we will have successful wetwell events. It clearly is the dominant path. As we pointed out in our tree, there are cases where the wetwell event fails and we were forced to use the drywell event. I also didn't put on here. We talked about this before but anywhere that we say wetwell venting. We mean wetwell venting followed by drywell venting if the water level increases. It's a given. Now the only case where that might change is going to be in the water management strategy. Because in those cases, wetwell venting probably will just mean only wetwell venting. But in all the other strategies where we are not controlling water. Per the SAMGs, we will transition to a drywell vent at some point. We have to.

MR. SUDRAN: When you use wetwell venting?

MR. GABOR: If a component failure, valve failure. So they are unlikely but they are in our tree. They are not dominant. So the dominant cases are the wetwell venting cases. The one case that we are also seeing as a dominant instinct would be the one that I

brought up with Marty and that is a case where FLEX is available. The pump has not failed. You are depressurized, able to depressurize. You just can't do it in time to prevent core damage. Let's say core damage happens in one hour. Vessel breach might happen in or core slump relocation may happen in five hours. So you've got four hour time window that you could potentially recover that FLEX pump or be able to inject and have it hooked up to prevent vessel breach. So those would be the in-vessel retention cases. And then there is a component where obviously where the ex-vessel strategy isn't reliable enough and doesn't work such that we do get liner melt through. We don't get the water in containment. Obviously that's on our tree as well. And those actually are, when we look at the dominate contributors to release. Those show up on the list. Now that case is actually not unique to these alternatives. It's represented as you saw in our base case. Anything that had a lighter melt through, we think is going to have a pretty similar fission product release, at least characteristic. It's already covered in the base case.

MR. BASU: So this is the case where you have injected but not enough to prevent liner melt through?

MR. GABOR: Or we didn't have, we didn't. Our strategy says we're going to turn on external water.

MR. BASU: Yes.

MR. GABOR: But there's a probability.

MR. BASU: This area.

MR. GABOR: Yes.

MR. BASU: Sure. But then that's actually liner melt, same as the base.

MR. GABOR: Same as the base. So I don't really have to run another MAAP around there to represent that?

MR. BASU: Yes.

MR. GABOR: I already did it. So you know, we had five dominant, just for I guess for MELCOR point of view, or maybe if we get tired of running MAAP, we had five core damage states times I think it was eight alternatives times I would say three, I guess four CETs. A lot of MELCOR runs.

MR. BASU: Yes.

MR. GABOR: That's kind of what we were looking at. And that's why we try to identify at least in our first cut what the dominant CET instates is.

MR. SUDRAN: You have some representative, I mean that's what you have to do eventually.

MR. GABOR: I think so. The reason why we identify these is because we think they are unique from a source term perspective. We think that in vessel retention obviously has a unique source term release. And we think the difference between an SRV failure and a main steam line failure, has an impact on the source term. That's why those appear. That's why those three appear there because we believe they are unique from a filtering strategy effectiveness perspective.

MR. BASU: You've got a study from scratch and running five times, eight times, maybe four or five, 200 right?

MR. GABOR: Yes.

MR. BASU: But we have a number of runs already done albeit maybe with slightly different values etc. So we know some of them anyway. I'm not sure –

MR. GABOR: No I think you are right. I think you can use those results to help focus the field that you have to look at. The only thing I caution you. You brought this up I think in one of your, had it on one of your slides is just make sure because your early runs did not represent the EPG/SAG REV 3 actions. The two key actions of pressure control. So you should just make sure that when you do use an existing case, that those actions wouldn't affect those results.

MR. BASU: Yes.

MR. SUDRAN: We are going to repeat some of these calculations.

MR. BASU: We have to work around anticipatory venting and then compare with those and make some adjustment as to what difference does it make.

MR. GABOR: I agree. I agree. That's all I have.

MR. SCHOFER: All right. Let's give those on the phone line a chance to provide comments. Hearing no comments, let me just make a few closing remarks. First I want to thank everyone for participating in this meeting. I do want to verify with both industry and staff that we met our purpose, that we have a sufficient understanding of each other's dominant core damage sequences including the bases and assumptions to begin the analysis.

MR. WACHOWIAK: Agreed.

MR. SCHOFER: Agreed. Such that we can plan on performing those analyses and having our next meeting probably in the February time frame, after some results have been calculated?

MR. BASU: Okay. That is the anticipated date. We should and see how things develop between now and then on both sides.

MR. SCHOFER: And you guys agree as well?

MR. GABOR: Yes.

MR. SCHOFER: Okay. Hearing that and hearing no more discussion, that brings us to the conclusion of today's meeting. I do want to remind everyone that this meeting was transcribed. Slides of the meeting as well as the meeting summary and the transcript will be provided within a month. Okay. That's it. Thank you.

(Whereupon the above-entitled meeting was concluded at 4:39 p.m.)