UNITED STATES
NUCLEAR REGULATORY COMMISSION ADVISORY
COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

July 30, 2013

MEMORANDUM TO: ACRS Members

FROM: John Lai, Senior Staff Engineer /RA/
Technical Support Branch
Advisory Committee on Reactor Safeguards

SUBJECT: CERTIFIED MINUTES OF THE ACRS RELIABILITY AND PRA SUBCOMMITTEE MEETING ON LEVEL 3 PRA ON DECEMBER 4, 2012

The minutes of the subject meeting were certified on July 22, 2013, as the official record of the proceedings of that meeting. Copies of the certification letter and minutes are attached.

Attachments: As stated

cc C. Santos
E. Hackett

UNITED STATES
NUCLEAR REGULATORY COMMISSION ADVISORY
COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

MEMORANDUM TO: John Lai, Senior Staff Engineer
Technical Support Branch
Advisory Committee on Reactor Safeguards

FROM: John W. Stetkar, Chairman /RA/
Reliability and PRA Subcommittee

SUBJECT: CERTIFICATION OF THE MINUTES OF THE ACRS RELIABILITY AND PRA SUBCOMMITTEE MEETING ON LEVEL 3 PRA ON DECEMBER 4, 2012

I hereby certify, to the best of my knowledge and belief, that the minutes of the subject meeting are an accurate record of the proceedings for that meeting.

/RA/ Date 7/22/2013
John W. Stetkar, Chairman
Reliability and PRA Subcommittee

Certified By: John W. Stetkar
Certified on July 22, 2013

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
MINUTES OF THE ACRS RELIABILITY AND PRA SUBCOMMITTEE MEETING
December 4, 2012

The ACRS Reliability and PRA Subcommittee held a meeting on December 4, 2012 in Room T-2B1, 11545 Rockville Pike, Rockville, Maryland. The meeting convened at 1:00pm and adjourned at 6:49pm. The entire meeting was open to the public. No written comments or requests for time to make oral statements were received from members of the public related to this meeting.

ATTENDEES

ACRS Members

John Stetkar, Subcommittee Chairman
Dennis Bley, Member
Harold Ray, Member
Joy Rempe, Member
William Shack, Member
Michael Ryan, Member
Steve Schultz, Member

Mario Bonaca, Consultant

ACRS Staff
John Lai, Designated Federal Official

NRC Staff
Alan Kuritzky, RES/DRA
Martin Stutzke, RES/DRA
Don Helton, RES/DRA
Keith Compton, RES/DRA
Susan Cooper, RES/DRA
Anders Gilbertson, RES/DRA
Michelle Gonzalez, RES/DRA
Mary Drouin, RES/DRA
Kevin Coyne, RES/DRA

Other Attendees
Jana Bergma, Scientech
Ali Azarm, IESS
Mike Macfarlane, Southern Nuclear
Joe Junes, Sandia (SNL)

See Attachment 1 for the complete attendant List

SUMMARY

The purpose of the meeting is to hear staff's level 3 PRA Technical Analysis Approach Plan (TAAP) in response to the Commission's Staff Requirements Memorandum (SRM) on SECY 11-0089. The meeting transcripts are attached and contain an accurate description of each matter discussed during the meeting. The presentation slides and handouts used during the meeting are attached to these transcripts.

Major Issues discussed during the meeting are described in the following Table.

Table 1. Major Issues Discussed During the Meeting

Major Issues Discussed	
Issue	Reference Pages in Transcript
Alan Kuritzky of RES stated that the meeting today will focus on the "reactor" aspects, spent fuel pool and dry casks will be the subjects for a subsequent meeting.	8
Chairman Stetkar stated if the team can discuss how all the pieces of analysis stitch together for an integrated level 3 PRA quantification, the members will appreciate it. He also mentioned that he did not get the sense that all the interfaces (For example, interface between level 1 and level 2) are discussed in the plan.	13-14
Alan stated that the staff relied on the Licensee's PRA model heavily. They will sort through the model to see if any changes need to be made for the interface.	15-16
Alan discussed the objectives of Level 3 PRA are to reflect the current advances since the publication of NUREG-1150 (1990's); to extract new insights for decision making; to enhance staff's PRA capability; and to obtain insight of technical feasibility and cost of developing Level 3 PRA.	18-19
Alan discussed the project timeline and plan for the level 3 PRA development.	19-22
Chairman Stetkar, Member Schultz and the staff discussed staff's assignments on the organization chart. The discussion focused primarily on the role of the principal technical advisor and that person's responsibilities for active technical guidance for the entire integrated Level 3 PRA project.	23-29
Member Rempe and the staff discussed the interactions between the licensee (model owner) and the staff.	29-31

Chairman Stetkar and the staff discussed the process of building level 3 PRA models. Chairman Stetkar asked how the decisions are made to limit some details of the analysis in one area while another area may receive more attention. The staff replied that there are iteration processes among the principals and project leads.	31-42
Chairman Stetkar stated that some scenarios have little effects on CDF but may have big impacts on level 2 and 3 analyses. He asked whether the staff investigates these scenarios. Staff responded that they will look into these when they review the PRA model.	44-47
Chairman Stetkar stated that if the current PRA standard does not cover the development of scenarios that involve consequential failures, it does not mean that the PRA level 3 model should not pay any attention to these consequential scenarios.	47-51
The staff described the work plan of level 1 PRA work for the reactor at power condition.	53-56
Chairman Stetkar and the staff discussed the current status of the SPAR model for Vogtle. The Vogtle SPAR model includes only the level 1 internal events model at full power. The staff is in the process of converting the licensee's models into SPAR models.	56-62
The staff discussed using MELCOR to confirm some of the success criteria for the internal events of the Vogtle SPAR model.	62-64
Chairman Stetkar pointed out that the existing internal flooding scenarios are developed only for one unit and consider only core damage. One would not know how floods affect the whole model until the integrated level 1, 2, and 3 PRA models are built.	65-67
Chairman Stetkar stated that one needs to understand all the fire scenarios and the contributions of these scenarios to the level 2 releases before the scenarios can be grouped together to reduce the number of fire scenarios.	73-75
Member Bley asked if there are any configuration controls on the SAPHIRE code. The staff replied that the code is well controlled by the established QA program.	80-82
The staff described how the linkage between level 1 and level 2 for an actual SPAR model was tested in SAPHIRE 8. Member Bley and the staff discussed the treatment of high conditional probabilities in SAPHIRE.	82-86
Chairman Stetkar and the staff discussed the licensee's seismic model.	87-91
Chairman Stetkar stated that one needs to examine the consistency of the seismic model applied to all areas such as spent fuel and dry storage cask.	92-96
The staff discussed the approach for high winds and external floods analyses. The approach is similar to that of the seismic analysis. Other external events could use the screening approach as described in the ASME/ANS PRA standard.	99-100

Chairman Stekar stated that the external flooding approach described in the plan (development of flooding fragilities) may not be the practical approach used by the practitioners.	101-102
Chairman Stetkar stated that it is important to carefully consider the operating states in the low power and shutdown (LPSD) analysis because the operating states having the higher source of risk are not intuitive.	107-108
Chairman Stetkar stated that the data and correlation of maintenance unavailability among systems and specific plant operating states during an outage are totally different from those at power. The staff stated that they are working with the licensee to organize the collection of these data.	109-113
Chairman Stetkar and staff discussed how to determine the initiating event frequency at the LPSD condition.	114-116
Chairman Stekar stated that it is more efficient to have one walk down which would cover all the requirements for the “spatial interaction” tasks.	117-119
Chairman Stetkar and the staff discussed the interface modeling between level 1 and level 2 PRA.	124-131
Chairman Stetkar, Member Bley, and the staff discussed how to use MELCOR results to build/verify the containment event trees.	131-135
Chairman Stekar and the staff discussed the “consequential” steam generator tube rupture scenarios and how the level 1 and 2 interface is modeled.	138-141
Chairman Stetkar, Member Rempe, and staff discussed the plan for the uncertainty analysis work for level 2 PRA.	142-145
Member Bley asked how the integration of level 2 to level 3 works for the site study, specifically, the timing information. The staff replied that it will be treated in the integrated site risk analysis.	146-148
Chairman Stetkar, Member Bley, and the staff discussed the approach to do the “Offsite Consequence Analysis”, especially with respect to external events and meteorological conditions that have correlated effects on the Level 1 and Level 2 event sequences and the Level 3 consequence analyses.	154-158
Chairman Stetkar, Members Bley, Schultz, and the staff discussed the timeline of the project.	160-167
Chairman Stetkar asked if the staff has considered how external hazards will affect infrastructure and evacuation time estimates if not already considered by the Vogtle emergency plan. The staff responded that they have thought about this, but it is not in the TAAP.	168-172

The staff stated that they have not decided what specific consequence metrics, uncertainties, and sensitivity results will be reported for the level 3 PRA.	176-179
Chairman Stetkar, Members Bley, Rempe, and the staff discussed if any parts of the existing HRA methods need to be modified for events other than internal events such as the LPSD, seismic, flooding, etc. In principle, the same qualitative approach should apply to all events. For other applications in level 2 PRA and Spent Fuel Pool PRA, will the existing HRA methods have limited use? The staff clarified that the conditions having limited coverage by existing methods are scenarios that include the SAMGs and decisions by offsite personnel.	183-193
Chairman Stetkar and the staff discussed the plan to investigate the existing Vogtle level 1 HRA and modify it to form the basis for the level 3 PRA project.	194-202
Susan Cooper of RES discussed the plan of using the existing methods for group 1 analysis and finding out what the requirements are for group 2 and group 3 analyses.	203-213
Marty Stutzke of RES discussed the approach of performing integrated site risk. He showed major modeling issues in performing the analysis of integrated site risk.	215-221
Chairman Stetkar asked if the results are very different when comparing the Licensee's PRA model to the SPAR model. Marty stated that the results are reasonably consistent. But he noted that the risk profiles from the licensee's current version of the PRA are notably different from those reported in the license renewal SAMA analyses, and the staff does not yet understand why.	223-224
Marty discussed the site information that the staff is looking at. Marty discussed the ideas of looking into different combinations of events affecting the multi-unit site.	225-233
Marty discussed the multi-unit sequence types for model consideration. He gave examples of events that have a direct consequential impact on both units. He also noted that some events may require manual shutdown of the unaffected unit, as described in the Emergency Management Guidelines.	233-238
Marty described the multi-unit accident sequence development. In practice, the sequences cannot be formed by a process of "Anding" two single-unit sequences. The staff plans to use some type of screening approach to determine which scenarios must be quantified for the multi-unit risk.	239-241
Marty discussed the potential integrated risk metrics including those presented in NUREG-1150 and some new ones such as the individual early injury risk, cancer incidence risk and land contamination.	241-243
Members and Marty discussed what risk metrics can be used for level 3 PRA project, for example, what is the appropriate risk metric for spent fuel pool accident?	244-248

Chairman Stetkar and the staff discussed how different basic event names used in level 1 and level 2 models can be linked to the same parameter for the uncertainty analyses.	253-255
Chairman Stetkar and the staff discussed how the mean value of a parameter is treated in the analysis. The mean value will be generated using a distribution and derived from there.	255-256
Chairman Stetkar and the staff discussed how the model uncertainties are treated. It is not determined how it will be treated for the project at this time.	256-260
Members and the staff discussed how the PRA model will be structured for this project (e.g., discrete models for different classes of initiators, one large model with conditional house events, etc.). The staff stated that they have not decided on the structure. Chairman Stetkar cautioned that it is a very important issue for configuration control and consistency among the various initiator-specific models.	263-268
Member Bley suggested having a person with “senior reactor operator” experience in the Technical Advisory Group and Independent Peer Review Group.	270-271
Members and the staff discussed the project plan.	276-285
Member Schultz stated that it is important to keep the documents in good order because they will be referenced not only at the present project but also referenced in the future.	289-290
Member Bley stated that the schedule seems ambitious and there are many people(more than usual) involved in the project. He thinks that coordinating that large team will be a challenge for the project.	293-294
Chairman Stekar stated that some of tasks can start early and that can help identify the links needed in the project.	294-296

Table 2. Action Items

ACTION ITEMS	
Action Item	Reference Pages in Transcript
None	

Documents provided to the Subcommittee

1. Technical Analysis Approach Plan for Level 3 PRA Project, Rev.0 – Working Draft and Attachment 1(Integrated Site Risk Viewgraphs), November 2012 (ML12312A448)

Attachment 1 List of Attendants

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETINGS ON RELIABILITY AND

PROBABILISTIC RISK ASSESSMENT

December 4, 2012 (1-5 PM)
Date

NRC STAFF SIGN IN FOR ACRS MEETING

PLEASE PRINT

	NAME	NRC ORGANIZATION
1	Donald Helton	RES/DRA/PRAB
2	RICHARD LEE	RES/DSA/DSEB
3	NATHAN SIU	RES/DRA
4	Jeffery Wood	RES/DRA/PRAB
5	ANDERS GILDERTSON	RES/DRA/DRB
6	michell GM	NMSS
7	~~M. ALI AZARM~~	~~NRR~~
8	Alan Kuritzky	RES/DRA/PRAB
9	Pete Appignani	RES/DRA/PRAB
10	Susan E. Cooper	RES/DRA/HFRB
11	Lauren (Killian) Ning	RES/DRA/PRB
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14	Chris Hunter	RES/DRA/PRB
15	Michelle Gonzalez	RES/DRA/PRAB
16	MARGARET TOBIN	RES/DRA/PRAB
17	Jose Pires	RES/DE/SGSEB
18	Mark Fuhrmann	RES/DRA/ETB
19	Selim Sancaktar	RES/DRA/PRAB
20	JOHN JOLICOEUR	OCM/AMM
21	Tina Ghosh	RES/DSA/AAB
22	RL Sullivan	NSIR
23	Michael Scott	RES/DSA
24	Charles Ade	NRO/DSRA
25	KEVIN Coyne	RES/DRA
26	Suzanne Schroer	NRO/DSRA
27		
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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETING ON SUBCOMMITTEE MEETING ON RELIABILITY AND PRA

December 4, 2012 (1-5 PM)
Date

PLEASE PRINT

	NAME	AFFILIATION
1	Gana Bergman	scientech
2	MALI AZARM	IESS/LLC
3	Mike Macfarlane	Southern Nuclear (SNC)
4	JOE JONES	SANDIA LABS
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Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards Reliability and PRA Subcommittee

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Tuesday, December 4, 2012

Work Order No.: NRC-2064 Pages 1-296

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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

RELIABILITY AND PRA SUBCOMMITTEE

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TUESDAY

DECEMBER 4, 2012

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 1:00 p.m., JOHN W. STETKAR, Chairman, presiding.

COMMITTEE MEMBERS:

JOHN W. STETKAR, Chairman

DENNIS C. BLEY, Member

HAROLD B. RAY, Member

JOY REMPE, Member

MICHAEL T. RYAN, Member

STEPHEN P. SCHULTZ, Member

WILLIAM J. SHACK, Member

ACRS CONSULTANT:

MARIO BONACA

DESIGNATED FEDERAL OFFICIAL:

JOHN LAI

TABLE OF CONTENTS

P R O C E E D I N G S

1:03 p.m.

CHAIRMAN STETKAR: Okay. The meeting will now come to order. This is a meeting of the Reliability and PRA Subcommittee. I'm John Stetkar, Chairman of the Subcommittee meeting.

ACRS members in attendance will be Dennis Bley, Steve Schultz, Bill Shack and Joy Rempe. Our consultant, Mario Bonaca, is also in attendance. John Lai of the ACRS staff is the Designated Federal Official for this meeting.

The Subcommittee will hear the staff's discussion of the Level 3 PRA Technical Analysis Approach Plan.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's meeting. And it's my understanding that we do not have anyone on the bridge line.

The entire meeting will be open to public attendance. The Subcommittee will gather information, analyze relevant issues and facts and formulate proposed positions and actions as appropriate for deliberation by the full committee.

The rules for participation in today's

meeting have been announced as part of the notice of this meeting previously published in the Federal Register.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register Notice.

Therefore, we request that participants in this meeting use the microphones located throughout the meeting room when addressing the Subcommittee.

The participants should first identify themselves and speak with sufficient clarity and volume so that they may be readily heard.

We will now proceed with the meeting and I'll ask Rich Correia - Rich is not there - Kevin Coyne of the NRC staff for some opening remarks.

MR. COYNE: Thank you very much for the opportunity to brief the Committee today on the Level 3 PRA project.

I have to extend regrets for both Doug Coe and Rich Correia. They did want to be here, but they had an unavoidable conflict that kept them away. So, I apologize for that, but we'll do our best to carry on.

CHAIRMAN STETKAR: They're having root canals without anesthesia or something more

pleasurable, right?

(Laughter.)

MR. COYNE: Again, thank you for your flexibility in scheduling the meeting. It was a bit of a conundrum for us on how to get the amount of information we had to relate to you through in this meeting.

And I know going on to 7:00 p.m. isn't ideal for anyone, but I appreciate the flexibility in supporting that and we'll try to keep the presentation moving as well as we can.

I do want to highlight, and Alan is going to talk to this as he gets into his presentation, there was a substantial amount of infrastructure development that went into this project.

This is a very complex, large project with a lot of pieces that have to come together. So, we spent a significant amount of time trying to get the infrastructure pulled together in a coherent fashion so that we'd be well-positioned to do the project.

So, we have commenced the technical portion of the work, but I want to just give you that heads up that as you see as we go through the presentation, it will seem like we haven't started too much yet and we haven't started too much of the

technical aspects, but there's been a tremendous amount of infrastructure development work that's been done for the project to put us on a good path forward.

So, with that, thank you again, and I'll turn it over to Alan.

MEMBER REMPE: Before we do that, Mr. Chairman, I have to acknowledge and publicly announce that because of organizational conflict of interest concerns I have to refrain from participating in certain topics that might be discussed today, okay?

CHAIRMAN STETKAR: Thank you.

MR. COYNE: Okay?

CHAIRMAN STETKAR: Yes.

MR. KURITZKY: Hello. I'm Alan Kuritzky from Office of Research, Division of Risk Analysis, here to talk today about the full scope Site Level 3 PRA project.

I welcome the opportunity to talk to the Subcommittee. It's been quite a while since we talked about this project, I think, back in the February time frame.

As Kevin has mentioned, we've been doing a lot of work on the infrastructure for the project. We are moving forward now in some of the technical aspects as well and hope to talk to you and get your

feedback on what we've worked on so far.

As everyone is aware, this is going to be a long meeting. We're going to go fairly well into the late afternoon/early evening and there's a lot of material to cover.

We originally wanted to talk about all the aspects, all the technical elements of the project today.

We realized that would not be practical. So, we're going to only focus on the reactor aspects today, and the spent fuel both in pools and dry casks will be the subject of a subsequent meeting.

But even on the reactor side, there's a lot of material. So, as Kevin mentioned, we'll try and move through it as quickly as possible. But by all means, you know, we want to entertain full discussions on any topics that the Subcommittee is interested in.

Okay. I'll be talking about the Level 1, generally about the Technical Analysis Approach Plan, as well as the Level 1 aspects of the reactor portion of the study.

With me up here today are Don Helton who will talk about the Level 2 aspects, and Keith Compton who will talk about the Level 3 aspects.

Mary Drouin right here is one of my principal technical advisors for the project, as well as she's going to be the person talking about the Uncertainty Analysis and quality assurance aspects of the project.

Later on, Susan Cooper will come up to talk about the HRA aspects, and Marty Stutzke will talk about the integrated site risk aspects of the program.

CHAIRMAN STETKAR: Alan, before we start, the plan is a pretty massive effort, 299 pages, if I recall. And some of it hasn't been fleshed out yet.

The plan as it's presented to me, anyway, has some dangers in it. And if you recall some of our comments about the organization of the Level 3 PRA, I like to think of things of taking a horizontal slice through the PRA.

In other words, going, you said, Level 1, 2 and 3 for reactor at-power, get those models built, get them quantified. And then extend those models to look at other operating modes, other hazards, you know, and add in spent fuel pool and dry cask storage multi-unit effects.

The plan is very much organized at least as I read it, in vertical slices. It talks about

we're going to do all of these things for the Level 1 at-power internal events stuff. And we're going to do all of these things over here for the Level 2 at-power internal events stuff. We're going to do all of these things for Level 3.

And, if you can, if the team here can give us some idea about how those pieces will be stitched together horizontally, because, quite honestly, in the plan, I'm not sure how you get across some of those gaps.

So, if you - all of you as you're presenting sort of the technical elements if you can try to address that issue, how do we get from where we are today to a fully-integrated Level 3 quantification of risk metrics for Level 3 for at-power at least internal events and how that's supported, that's something that I'd appreciate.

And I was trying to thumb through - I haven't quite seen it in the handout materials, and that's why I -

MS. DROUIN: I have a question here, because I want to make sure I understood your concern. Because the way the plan is laid out, and I was a main architect of the plan, is to do a Level 1, 2, 3 PRA for internal events and then build upon it.

CHAIRMAN STETKAR: Okay.

MS. DROUIN: So, it's not designed to do all the Level 1, you know, considering all your challenges.

CHAIRMAN STETKAR: Let me give -

MS. DROUIN: And it makes me nervous that that hasn't come across.

CHAIRMAN STETKAR: Well, let me give you a couple of specific examples. And I don't want to take up too much time, because we do have a lot of material to go through, but a couple of specific examples.

A lot of the external hazards, seismic, are described in the context of here is how they would be integrated with a Level 1 PRA.

By implication, there's very little discussion of them in Level 2. And yet, external hazards can substantially affect Level 2.

In fact, external hazards might have some implications about how you binned particular plant damage states, for example. There isn't any of that notion.

It isn't build a complete horizontal model and then integrate external hazards into that whole thing.

MS. DROUIN: I understand.

MR. KURITZKY: So, let me - a couple of things. We're going to get into some of this as I do this presentation. Both in this initial presentation I'll touch on it to some extent, the exact approach you just mentioned, and then I think Chapter 3, or Two or Three, I've tried to describe in simple words how we're going to do the horizontal linking.

Doesn't go into details of how the linking should be done, but that we're going to take that approach as opposed to -

CHAIRMAN STETKAR: That does at a high level.

MR. KURITZKY: Right, at high level.

CHAIRMAN STETKAR: You're right.

MR. KURITZKY: Now, and I guess to some extent hopefully during the presentations, you'll get a little better feel for how the pieces will stitch together, but I do want to answer that is our intention to go through and pull it together in that horizontal fashion. And as Mary mentioned, the table of contents really is laid out in that regard, also.

And as I'll mention in a few minutes when I talk about the TAAP in more detail, we haven't given it a - no one has read it cover to cover and tried to -

(Laughter.)

MR. KURITZKY: And so, there's naturally going to be inconsistencies and there's things that have to be cleaned up.

So, any comments you have in that regard are welcome right now, because we know we have to go back and clean some of that up. And that gives us, you know, things that we can focus on when we go to -

CHAIRMAN STETKAR: Some of the concerns, and this may - the other one that I wanted to mention, one was the external events and the context in which they are presented. That may not be as important.

Something that is in my mind a bit more important is that, for example, the Level 2 analyses are kind of characterized as something that is strung onto the end of the Level 1 models.

In my experience doing these studies, plant damage state definitions and decisions about binning those plant damage states very often, in fact, almost always, require fundamental changes to the logic structure of the Level 1 models. There's no sense of doing that.

In other words, knowing, for example, whether or not water was injected in particular scenarios when that question was never asked, because

you went to core damage because of no secondary heat removal. So, the questions were never asked in the branching logic in a Level 1 model.

To sort out important conditions in the plan to answer questions in the Level 2 model, would then require information about on those scenarios, was water injected? Is the pressure in the primary system, is it actively depressurized prior to core damage, you know? That question may never be asked, because it's not relevant to simply a pass/fail, core damage/no core damage.

That's not something that's simply strung onto the end of the Level 1 models looking at containment isolation or fan coolers or sprays, you know, or all of those traditional solely Level 2 system sort of focuses.

I didn't get a lot of that sense, and that's part of this whole integration process. And that's, actually, that's a lot bigger concern than the way external hazards are treated.

So, let's get into it. But, again, I'd appreciate it if you've thought about any of that stitching together in detail, if you could kind of emphasize it as you go through each of the individual tasks, I certainly appreciate that.

MR. KURITZKY: Okay. So, let me just up front I'll mention I don't think we're going to hear a lot about that in today's presentation. We haven't done a lot of thinking about that.

Our kind of going-in assumptions are that, yes, the Level 2 can drive some logic decisions in your Level 1 event tree structure, et cetera. However, typically there's only a few things that might be important.

I mean, most of what you would need in the Level 2, your Level 1 generally will get it for you. There's only a few things that you might have to be - you'd have to do something differently than you normally would, say, if you're just doing a Level 1 study.

A lot of those things you can account for in the plant damage state or early in your containment event trees to get that information if it's not directly available from the Level 1.

There may be some cases where it's more efficient to make a change to a Level 1 event tree structure than try and do some post-cuts, manipulation, et cetera, to account for it in the Level 2. So, I definitely welcome that feedback.

We haven't thought it through that far,

but we will take a look at with the Level 2 to make sure that if there's anything that they feel the Level 1 structure is not going to get for them and want to reconsider it up front before we get too far along, we can.

I will, as I will discuss shortly, we're basing our Level 1 model very heavily on what the licensee has done.

So, it's not like we're starting event trees from scratch such that we would be in a position to change things readily if we wanted to do it a little differently to make it easier for Level 2.

The licensee also will do a Level 2 model. So, presumably their Level 1 model hopefully is done in a way that supports their Level 2.

As we get a chance to look into their models more carefully, we'll be able to make a better judgment on that and decide if there's any changes we need to make in the Level 1 that we feel would make things better for our Level 2 modeling.

CHAIRMAN STETKAR: Alan, have they done a full Level 2, or they only done out to something that they can dump into large early release -

MR. KURITZKY: Well, Don is the one that's gone through it, but I think they've done it for

internal -

MR. HELTON: I'll cover that.

CHAIRMAN STETKAR: Okay.

MR. HELTON: I'll cover that. And I'll also cover the point about the Level 1/Level 2 interface.

CHAIRMAN STETKAR: Okay, good. Let's get started then.

MR. KURITZKY: Okay.

CHAIRMAN STETKAR: I just kind of wanted to raise the sensitivity.

MR. KURITZKY: Good. Appreciate it.

Okay. So, the outline for this presentation today, we want to give you some quick background information on the project objective schedule and organization.

The main focus of the meeting will be on the Technical Analysis Approach Plan, the approach that we're proposing to do, the Level 3 PRA study.

I will - we will go into some of the details about the plan itself and let you see how we're thinking to do things. And at the end, I'll give you a quick summary of our project status and our future steps.

Just to quickly go over the objectives of

the project, we discussed this, I think, in other forums previously, but there's several objectives to this study.

One of the main objectives is the fact that it's been over 20 years since NUREG-1150 studies were completed. And those were the last Level 3 PRA studies sponsored by the NRC.

In that time frame, there's been a lot of advances in PRA technology, as well as improvements in plant safety and operational performance.

And so, we want to be able to reflect those in a modern-day, state of practice PRA to see what impact that would have on the risk profile of commercial nuclear power plants.

Also, we would like to take the advantage of the new study to expand the scope out beyond what was looked at in NUREG-1150 specific in areas like multi-unit risk and spent fuel.

Another objective of this study is to extract new insights to help support regulatory decision-making. Also, to help us make better cost-effective decisions for the limited agency resources.

We want to also enhance our PRA staff capability. We have a lot of senior PRA analysts in the Agency. Some who have retired or moved on

recently. More could be going out the door at any minute. You never know.

So, we want to groom that new crop of PRA analysts so that they can pick up the mantle and move forward with risk-informed activities in the Agency.

So, we're going to try and bring as many of those people in the junior and mid-career level into this project to enhance their experiences with performing PRA.

Also, we want to improve documentation practices to make PRAs more transparent and more readily useable.

And we also would like to get at least some insight into the cost and practicality of doing Level 3 PRA studies.

Okay. Here is what we currently envision being our project schedule. And as you can see from this chart, we have broken down - on the left-hand column we've broken it down by the initiator group and plant operating state, and we have the milestones to various levels of the PRA. This kind of goes to the horizontal look that you were mentioning before, Mr. Stetkar.

The first thing we'll be doing is looking at reactor at-power for internal hazards. We hope to

have the Level 1, the preliminary Level 1 results done in around April of 2013.

Several months later we'll complete the Level 2. And by early 2014 we'll have the initial Level 3 results for at-power internal hazards.

CHAIRMAN STETKAR: I hate to do this to you, but if I were looking at, say, about April 2013 for Level 1 reactor at-power internal hazards, I would pretty much have all of my event trees, I would have all of my fault trees, I would have all of my data.

We're quarter past December already of 2012. Where are you in terms of the model development for that?

MR. KURITZKY: You don't believe in miracles?

CHAIRMAN STETKAR: I've been a consultant too long and I promised miracles to several clients and they convinced me I wasn't a miracle worker. I wound up working for free a lot.

Where are you?

MR. KURITZKY: Well, I'll get to that. Actually, I have a thing at the end of the presentation.

CHAIRMAN STETKAR: Okay. Let's cover that then.

MR. KURITZKY: Okay, all right.

CHAIRMAN STETKAR: I only wanted to ask, because you brought it up.

MR. KURITZKY: It is ambitious, but it's not out of the question.

So, in any case, so we'll do the internal hazards -

CHAIRMAN STETKAR: So, you say I got a chance. There's an old movie from -

MR. KURITZKY: Right.

CHAIRMAN STETKAR: Dumb and Dumber.

MR. KURITZKY: Okay. I don't want that to be the motto for this project.

Okay. So, external hazards will follow along a few months behind internal hazards for both Level 1, Level 2 and Level 3. And then we'll do the low-power/shutdown will also be tagged along behind that.

In each of those cases, we'll be starting work in those areas - we already are starting work in those areas, but the actual deliverables will trail the items above it.

And then spent fuel pool and dry casks will be coming later in 2014. And the final deliverable will be based on the - look at the

integrated site risk, multi-unit risk issues, uncertainty analysis, and that will be completed in middle of 2015.

I just want to show this for a few seconds just to kind of give you the idea that there's a lot of what I would call administrative functions required for this project.

As Kevin mentioned earlier, this is a very complex and broad project. There's a lot of pieces to it. And correspondingly, there's a lot of overhead-type activities that have to occur for this project.

And so, you can see from the upper two-thirds of this diagram there's a lot of administrative functions that have to be accomplished.

And if you go down near the bottom you'll see the long, horizontal row of all the principal, technical elements for the study.

And given the fact that we have so many technical elements and the fact that we want to try and include as many staff as possible in the project, we end up having a very large team of people to work on the project.

And they're all pretty much part-time workers, which leads to some management logistical challenges. But that's just the nature of what we're

trying to accomplish.

And we are fortunate that we have a lot of really capable NRC PRA people assigned to this project. However, they also have their time split between many other high-priority projects, many other commission-directed activities like the Near Term Task Force activities and the Risk Management Task Force.

So, one of the challenges for us will be trying to maintain keeping that team together, keeping the focus of the capable people that we have here in the Agency on this project.

MEMBER SCHULTZ: Do you have a different name in each of the boxes, or are they all -

MR. KURITZKY: We have a different name - we have a different name for many of the boxes. Some people's names will show up in multiple boxes. They're not full-time positions, for the most part.

MEMBER SCHULTZ: Are all the boxes identified with at least one individual?

MR. KURITZKY: Yes, with one question mark on one. That advance documentation is the one we still haven't really nailed that one down.

MEMBER SCHULTZ: That's fine. Thank you.

CHAIRMAN STETKAR: Alan, I think I asked you this the last time we got together and I don't

want to hazard a guess in the construct of this organization chart.

So, in my experience when we used to run large PRA projects, we always had a person who was called the principal investigator.

And that person, I'd characterize that person as the conductor of the orchestra. I see on the bottom there is the orchestra.

We always had a program manager, that person - budget, schedules, resources, all that kind of stuff, but the principal investigator was the puppet master.

That person basically understood all of the elements of the PRA and made technical decisions in terms of technical questions and resource allocations. No, we're not going to do the world's best MELCOR model on this interesting project, little side concern, because it's much better to, for example, quantify seismic events to make the miracle happen.

Which of those boxes here - and that's a full-time job. It's not a part-time job. It's not a review and oversight job. It's someone who basically lives, breathes and eats this thing 24 hours a day.

MR. KURITZKY: Right. Okay.

CHAIRMAN STETKAR: Which of these boxes provides that role, and who is that person?

MR. KURITZKY: Okay. So, here's the ideal situation. I'll be in that program manager block, okay? And as much as I would like to be involved in those technical decisions, I'm going to be so swamped with that project program management that I'm not going to -

CHAIRMAN STETKAR: And that's the answer you gave us back whenever in March.

MR. KURITZKY: Right. So, then we have about a team of half a dozen very experienced PRA experts that will be doing this project, but that's not what's going to happen here.

We have that block that says "Principal Technical Advisor."

CHAIRMAN STETKAR: Okay.

MR. KURITZKY: Okay. That's the person that you're talking about.

CHAIRMAN STETKAR: Yes.

MR. KURITZKY: And that role is being served by two people right now in our project. Mary is serving as a principal technical advisor, and Marty Stutzke is serving as a principal technical advisor.

And the reason we have two people is

because as you just mentioned, you want one person full-time living and breathing it. Well, we haven't got that.

We have two people who have multiple projects that they have to deal with and we're trying to make this a primary focus for them, but we only have a certain amount of control over that.

So, what we where ideally we'd have exactly what you mentioned, we don't have that. So, we're going to have two part-time people to fill that role.

Mary actually doing more of it right now. Marty was very heavily involved in other activities early on.

I'm hoping Mary isn't going to be pulled in too many directions at once, but she has - I see a lot of competition for her time. And so, we've got to make the best of what we have.

We don't have a single 24/7 person to stick in that box. We can want one, but we're not going to get one.

MS. DROUIN: But what you don't see are the subsequent figures to this figure. And what I mean by that is that if you go down there and you see the row of boxes, reactor at-power internal hazards, reactor

at-power external hazards, there's a person to that, but this chart actually folds up into a higher level where there is one person who is responsible for the reactor Level 1, Level 2, Level 3 PRA.

MR. KURITZKY: Right. That's a good point.

In fact, if you look at the very lowest level of boxes, that's in fact why we show it a little bit separately there, because we have one person who is in charge of Level 1 PRA, one in charge of Level 2, one in charge of Level 3.

And then there are people at the levels for the different hazards or -

CHAIRMAN STETKAR: Hang on a second, because I'm hearing - I'm probably not understanding the words correctly.

I heard Mary say there is one person responsible for the reactor Level 1, 2, 3. And I'll say that altogether, because that's important.

MS. DROUIN: Yes, we have a flow chart that shows that.

CHAIRMAN STETKAR: You're saying that there are three separate people.

MS. DROUIN: Yes.

MR. KURITZKY: But, Mr. Chair, I thought you were saying that there's one person in charge of

all Level 1, 2 and 3 together.

MS. DROUIN: They all report up to - yes.

CHAIRMAN STETKAR: Alan.

MS. DROUIN: No, there's a person in between Alan and this.

MR. KURITZKY: But for Level 1 -

CHAIRMAN STETKAR: What I'm trying to get to is PRA is not done by committee and it's not a democracy.

MS. DROUIN: That's right.

CHAIRMAN STETKAR: Otherwise, we'll never finish.

MS. DROUIN: That's right.

CHAIRMAN STETKAR: Because each one of those tasks in those boxes -

MS. DROUIN: You have to have somebody steering the ship.

CHAIRMAN STETKAR: - knows inherently that they are the most important task in the world.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: And each of the supporting tasks under each of those boxes knows that they're the most important task in the world. And somebody needs to guide that process from a technical perspective -

MR. KURITZKY: Right.

CHAIRMAN STETKAR: - and say, no, indeed everybody is not equally important. Everybody is equally unimportant.

MR. KURITZKY: Right. That's the principal technical advisor. That's the role of the principal technical advisor -

CHAIRMAN STETKAR: That role needs to have continuity.

MR. KURITZKY: It doesn't.

CHAIRMAN STETKAR: Okay. It's a real - the project can be done that way, but you've added one more impediment to the miracle happening.

MR. KURITZKY: Yes. And believe me, I'm aware of that.

MEMBER REMPE: So, before you leave that slide, when I was reading your almost 300-page review plan, the question that kept coming up in my mind was how much interaction is there with the staff from Vogtle.

When results are obtained in various tasks, is it going to be reviewed by anyone from the plant staff?

Is there a member from the plant staff on the Technical Advisory Group Committee or the peer

review?

Is there, I mean, sometimes when you get these results, does it need to have a sanity check with the -

MR. KURITZKY: Right.

MEMBER REMPE: - people from the staff? Then I can see that -

MR. KURITZKY: And I can go into a little bit more of that later, but we have a communication protocol to establish with the licensee and - both to guide the information that we need to get from them in order to do the study, as well as to provide our information that we've developed -

MEMBER REMPE: Back to them all the time regularly.

MR. KURITZKY: - back to them for both factual checks, as well as, you know, for company confidential proprietary information, we have to check for that also.

And so, we'll have a lot of that interaction. Plus, we'll be going on - we'll have a lot of interactive meetings at the staff level with the licensees who are doing the various -

MEMBER REMPE: So, maybe I missed it -

MR. KURITZKY: - pieces of work.

MEMBER REMPE: - in the 300 pages, but I didn't see it in there.

MR. KURITZKY: Yeah, I'm not sure how much of that is described in this plan itself, because that's more project level, not at the individual technical element level.

MEMBER REMPE: Okay.

MR. KURITZKY: Okay. So, moving on to the plan itself, the objectives of the plan are to ensure that the project is done consistent with current best practices, and also to enhance the consistency between different technical analysts on the project.

Also, it's going to provide a traceable record of the work we've done specifically for this model, how we put this model together. And also provides a basis for our self-assessment, the work that we do.

The scope for the model, I think we've discussed this previously, but it is to cover all the major radiological sources on the site, both reactor cores, spent fuel pool and also dry cask storage.

There is not currently dry cask storage at Vogtle, but it is going to begin next year. They already have a cask design picked out and plans for doing their initial offloads.

So, we'll use that information, as well as information from, I think, another plant from the same licensee that already has dry cask storage in operation.

And we might have to initially base our procedures from that plant, and then maybe modify later on depending on what new information we get for Vogtle that's Vogtle-specific.

We're also going to be looking at all operating states as we discussed, full-power operation, low-power and shutdown.

We'll be looking at all internal and external hazards. Everything is on the table except for deliberate sabotage. And we'll be looking at all three PRA levels, 1, 2 and 3.

This slide titled "TAAP Limitations," are really not limitations of the report or the plan itself. It's limitations of the study.

There are - our intention is to be as realistic and complete as possible in doing this study. However, we have to recognize there are practical limitations due to budget and resource constraints - or, excuse me, schedule constraints.

And, therefore, we will use risk information to help us focus our emphasis on those

areas that are most risk significant.

So, while everything will get a look initially, more resources will be applied to those areas that are more risk significant.

CHAIRMAN STETKAR: Alan, and this might - tell me to just be quiet, because we have limited time.

One of the things that I'd like to explore is under that first sub-bullet it says, not all aspects of the study receive the same level of effort.

There's a lot of discussion about development and exercising of MELCOR models. Not much of that discussion is characterized with the caveat that you have in the plan that, gee, we might have to limit the scope of this because we don't have enough time or people.

That tells me that somebody made the decision that this is a MELCOR model and not a risk assessment.

So, I'd like to understand - there's discussions of, gee, we have to build detailed finite element analysis models of the containment and the spent fuel pool.

And yet, perhaps we might do an abbreviated analysis of some other issues like

definitions of plant damage states or definitions of source terms or release categories, because those do have the caveats that say, gee, we aren't - we might not have enough resources to do this.

So, I'm wondering who has made the decision already, because some parts of the plan do have those caveats explicitly listed, and others don't.

Who has already made the decision about which elements of this whole PRA will receive more attention and more resources, MELCOR finite element analysis, versus less, which is some of the - my concerns about integrating the whole PRA, development of detailed plant damage states and binning those things.

MR. KURITZKY: Okay. So, what we have so far is the task leaders for each of the major elements have proposed -

CHAIRMAN STETKAR: All of whom know that their little area of expertise is the only important thing in the world.

MR. KURITZKY: Exactly.

CHAIRMAN STETKAR: Okay.

MR. KURITZKY: So, adhering - sticking straight to that precept, they each came in with their

estimates and what it would take to do their parts of the project.

And Mary and I summed them all up and we saw that they were of course way more than what the budget would allow.

So, Mary and I went through the numbers and we cut them back into what we felt was more appropriate for the different elements of the study as the first cut.

We went back to the technical leaders and said, now, this is what you actually have to work with, you know. Explain why you think you need more and what can you get done for this amount.

And the next version was people coming back, the technical leaders coming back and saying, okay, this is what we can do for that amount.

In some cases, you'll see like in the Level 2, they identify very clearly what stuff will not get done because of the resource constraints.

That decision as to what should be done and should not get done under that specific tech element was made by the technical leader for that task.

Now, that's not to say that's the final word in what's going to get done in the project.

We're just moving forward with the actual work, and the project leadership, the principal technical advisor, the leadership you talked about has to go through there and say, okay, well, I see what you're saying. I don't agree that that's -

CHAIRMAN STETKAR: Okay.

MR. KURITZKY: - what should be cut. This should be cut instead. Or maybe we can get you - if that's go to be cut, maybe we can get a little more money for that and cut something somewhere else.

Those type of integrated decisions like these you mentioned that someone has to, you know, who is looking at the whole project has to make - and that second level has not been done yet.

CHAIRMAN STETKAR: Hasn't been done, okay.

MR. KURITZKY: But that's what the next stage will be.

CHAIRMAN STETKAR: Okay, thanks.

Don, did you want -

MR. HELTON: I think it's fair at this point to oversimplify it to say that the answer to your question with the specific examples you were raising, is me.

So, I'm the one that at this point has to convince you that that's the right balance.

CHAIRMAN STETKAR: From my experience, it's not, but I'm willing to be convinced otherwise.

MR. KURITZKY: Okay. All right. So, given that, we do have the limited resources. So, we do have to make those kind of decisions.

And what you brought up was an example of something a priori that has to decide where we're going to focus -

CHAIRMAN STETKAR: That's right, because some tasks - some tasks are serial, some tasks are parallel. And some people, you know, it's now getting closer to quarter past December. A lot of things need to get started very soon.

And if certain task leaders believe that they are going to construct a certain level of model or perform a certain level of analysis, they're going to structure their starting work with that presumption.

You can't stop them in midstream and say, well, I'm sorry, you know, we re-decided things. The 25 percent of your budget you've spent already is gone and you need to finish everything in the remaining three percent, because we only allocated 28 percent now.

So, those decisions are difficult

decisions -

MR. KURITZKY: Yes.

CHAIRMAN STETKAR: - but you need - somebody needs to stand back from the whole project and say, here is what needs to be done to put all of this together and everything else is subsidiary.

MR. KURITZKY: Right. And unfortunately because of, as I said before, competing demands on people's time, we haven't had a chance to get as far along those lines as we needed.

Before, we could always say, well, we're not doing the work yet. We still have time. Now, as you have brought up, we're already going there and some things we still have time, because they haven't made a commitment yet on a certain thing. Other things we already are starting to walk out the door in certain directions.

And if we have to change those directions, there's going to be lost, you know, inefficiencies there.

And unfortunately that's a reality. We are trying to address that situation to minimize that type of inefficiency. I don't know whether we'll be a hundred percent successful, but, believe me, we are very conscious of those concerns. That is something

we have, you know, we are focused on and we're just trying to do the best we can with the portion of the situation that we're operating under.

MS. DROUIN: And I will have to say from a personal perspective, I don't see a whole lot of changes from our first go-around because we have a set budget, you know, we know that the budget can change within a certain percent.

But when your budget can only change within, say, ten percent and you're over your budget by 500 percent, you know, you need to step back and make some drastic changes.

CHAIRMAN STETKAR: The only thing that I've seen wrong -

MS. DROUIN: And those, you know, are what they're going to be. I mean, you know, we can't be negotiating that.

CHAIRMAN STETKAR: The only thing that I've seen - and this again is from my experience, and I know we're talking about generalities, but in some cases generalities are more important than some of the technical details.

There are some tasks in a PRA that tend to be very resource-intensive when you talk to the people who do that type of work. One is thermal-hydraulic

analysis, MELCOR model development. That's one.

Another is structural analysis. Either the support containment failures from internal phenomenology, or structural analysis to support a seismic evaluation, for example.

Those people will come back and tell you, my God, to develop the kind of model that I need to answer your questions, it's going to take $6 billion and last 15 years. Those are very resource-intensive.

If you took those estimates and just cut back everybody by a factor of 50, 5-0, uniformly to get from 500 percent to, you know, ten percent or something like that, you still have that disparity.

I mean, you know, you cut back some poor systems analyst who now has to spend 15 minutes to develop a fault tree for, you know, a system that has not been modeled yet versus cutting back $6 billion in whatever I said, 20 years down to, you know, $200 million in five years.

In many cases, you need to wholesale, cut out that task and say, no, you know, you give me - if it's a best estimate back-of-the-envelope calculation for a buck 98, that's what we'll have to settle with. You guys, you know, you folks go be creative to do this.

Or we'll do a detailed analysis of two or three things, and we'll do a simplified analysis of everything else and see how the results come out.

MR. KURITZKY: Okay. So, that's exactly -

CHAIRMAN STETKAR: And if you've done that, fine.

MR. KURITZKY: Right, and that's exactly what we've had to do.

MS. DROUIN: Yes.

MR. KURITZKY: Because, first of all, Mary "the hatchet" Drouin went to that initial budget and she - before, it was you and I working together. Now, it's -

(Laughter.)

MR. KURITZKY: So, anyway, Mary has a lot of experience with large PRA projects, and a good understanding of how much relative effort is needed for the various parts of the project - went and made, you know, informed judgments as to what the budget should be for the different pieces.

So, it wasn't like a straight across-the-board, like, sequestration or something. It was actually there was thought went into what things would be cut.

And some of the task leaders were okay

with it, some didn't like it, but that was the reality.

But to be fair, all of our task leaders recognized there are budget limitations, and they recognized they're not going to go through it and do the gold standard.

Our structural analysis people, our Level 2 people, they're all aware of limitations. And so, they are making their best guess.

We may not agree with every choice they make, but they're making their best guess as to what they think given the limited budget, where they should apply those funds or those resources.

So, we're aware of that and we're making those educated - hopefully educated choices and decisions.

CHAIRMAN STETKAR: Okay.

MR. KURITZKY: Okay. So, just to wrap up that first bullet, as you mentioned, the idea of things a priori deciding what you're going to focus on and making sure you don't go overboard in some specific area that isn't as critical to the overall PRA.

This is also getting at the aspect of after you go ahead and start to do some of the work,

you'll find out that certain things are not as risk significant when you do like a first cut.

And so, then you can apply more resources and effort to those that are more important and you can lighten up on those things that just aren't as important. So, that's where you use the risk-informed approach.

We'll also have identified certain things that are very important aspects for a full-scope PRA. There are things that we would love to include within the scope of our project, but we just simply can't because of physical constraints.

And, therefore, we can identify them as good candidates for other research. Some, in fact, as I list here some examples, are the subject of other research.

Aqueous transport and dispersion of radioactive materials, this is something very big given the Fukushima event, but something we simply are not going to address in our study, but the Agency as a whole is looking into it.

The same with the seismic-induced fires and floods. That's something that, again, comes out of Fukushima, obviously very relevant to Fukushima in the seismic-induced tsunami, but it's something that

we can't address in our study, but there already is another research project looking into that specific issue.

So, again, we'll identify certain things that we feel are important and we'll identify them for candidates for future research, but they're just not going to be within the scope of this study so we can get done.

CHAIRMAN STETKAR: Alan, one thing I did want to ask, and I'm glad you highlighted these things, that third sub-bullet, consequential linked multiple initiating events, I understand seismically-induced fires and floods. You've mentioned those.

In my experience, a lot of people who look only at core damage don't look at consequential effects of event scenario progression within a model.

For example, transient-induced LOCAs, stuck open pressurize relief valve, a lot of people look at that because it might affect Level 1, some people don't.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: More important things are, for example, transient-induced overcooling scenarios that can affect certain plant damage states.

The effects of pressure, the high, dry and

low conditions that might affect the consequential steam generator tube rupture conditional probability doesn't have any affect whatsoever on core damage frequency for all practical purposes, could have a substantial affect on Level 2 or Level 3.

Those are sort of - they're not multiple initiating events, but they are consequential events that could change the structure success criteria, however you want to call it, of the event models that affect this integration of the Level 1, 2 and 3 PRA.

Now, I understand seismically-induced fires and floods. I was curious whether part of this scope limitation will also restrict you to only the types of scenarios that were specifically examined in the existing Level 1, plus whatever they did, PRA for Vogtle. Because it's very, very likely that they didn't look at those kind of things, in my experience.

Now, maybe they did.

MR. KURITZKY: I can't tell you whether they did or didn't right now, but we would - those are the types of things that we would like to look at and we will try and identify. And to the extent that we can account for them, we will.

One thing I thought you were going to go with this, is, you know, consequential linked multiple

initiating events is much broader than seismic-induced fires and floods, obviously.

It's the seismic-induced fires and floods is the reason this bullet is on here. I think the wording is probably a little too general that we wrote off, because as part of the integrated risk aspect, the multi-unit risk, we're going to be looking at certain consequential events that one unit impacts what can happen in a second unit.

Even, like you said, in a Level 2 -

CHAIRMAN STETKAR: I was presuming you did that, but there isn't a lot in the plan for that. So, I couldn't really -

MR. KURITZKY: Right, right, right. I guess on this slide, I don't even know how much - either the appendix or the slides, I don't remember how much that goes into it. But when Marty presents that stuff, you can ask him more about it.

But things like a hydrogen explosion in an aux building, in a common aux building as the Level 1 - it's a Unit 1 severe accident progressing and that can now cause a problem that could start an event in Unit 2.

That kind of stuff we do want to take a look at and see, you know, how we can address it.

CHAIRMAN STETKAR: I was looking more in the context of just putting my blinders on even on a single unit --

MR. KURITZKY: Single unit.

CHAIRMAN STETKAR: - extending from what I'd call a traditional Level 1 internal events pass/fail, core damage/no core damage out into the kinds of questions that could be important for Level 2/3 considerations.

MR. KURITZKY: Right. And I can't speak for the technical team leads who are going to be doing those parts of the study, but certainly that's the stuff we were -

MS. DROUIN: I think that's going to come down to how well that stuff is captured in the standards. And if the standards have captured it, then it certainly would be within the scope of our analysis. But it's too early to -

CHAIRMAN STETKAR: Well, given the fact, you know, I'm not a standards kind of person and I recognize that you're trying to make this thing consistent with the standards, but my goal is to understand risk.

And if the standards are deficient, somebody goes and changes the standard.

MS. DROUIN: Absolutely.

CHAIRMAN STETKAR: And right now the Level 2 standards are still in draft form. And the Level 3 standards are in preliminary something or other less than that.

So, just because somebody hasn't thought of something in a standard because they've never really done a full scope PRA themselves -

MS. DROUIN: So, I'm just saying that hopefully it's captured in the standard, you know.

CHAIRMAN STETKAR: I think the standard does address consequential failures, but I'm not sure, again, because the standards are written through these vertical slices also.

MS. DROUIN: Right.

MR. KURITZKY: But I do - I want to make one thing - I need to make one thing clear is that I go back - I didn't overly stress it, but back to the objective where I talk about the fact we're doing a state of practice PRA.

So, there are going to be things that are good ideas and things that might have a very significant impact on risk. But if they're not state of practice, this project is not going to be able to handle that.

CHAIRMAN STETKAR: It depends on what you call state of the - I'm not saying anything in this meeting. I will not say anything in this meeting that I have not personally done in my life once or twice.

MR. KURITZKY: So, state of practice -

CHAIRMAN STETKAR: So, it depends on what you define as state of the practice.

MR. KURITZKY: Okay. So, let me give you some clarification there. Maybe a distinction between what we consider state of practice versus state of the art.

In my mind, state of the art means someone has done it somewhere. It's been done. That's state of the art. Now, that's the new state of the art, because it's been done.

State of practice as we define it, are methods, tools and data that are routinely used by the NRC or licensees, or have acceptance in the technical - the broader PRA technical community.

So, the first part means that it's going to have to be something that's routinely used. So, just because someone did it somewhere and was successful at it, doesn't mean it's now state of practice. It means it's state of the art, but it doesn't mean it's state of practice.

If it's gotten acceptance such that even if a lot of people haven't used it yet because it's new, but it's already been said, okay, well, this is the way we should do it from now on, then that might qualify as state of practice.

CHAIRMAN STETKAR: The only reason I bring this up, you know, in principle, and you mentioned it already, there could be things that might be important that you don't look at because of this state of the practice process.

I think you need to be very careful, because you are going to go through a number of reviews. And if there are critical reviewers who say, gee, why didn't you do this now fairly well down the path, you need to have a very, very good basis for answering that question.

Not just answering questions about is what you did technically correct, but why didn't you look at this whole class of scenarios that would lead to these potential consequences, for example.

MR. KURITZKY: Right. And assuming that we identify them and that we believe they're state of practice, we will look at them. And if we don't, that will -

CHAIRMAN STETKAR: And a little bit of that

goes to what Mary was saying about -

MR. KURITZKY: Right.

CHAIRMAN STETKAR: - is it in the standards.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: The standards do indeed to a great or lesser extent, define the state of the practice.

But in areas where the standards are still evolving, that state of the practice is a little bit more driven by what people have really done.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: Okay.

MR. KURITZKY: Okay. So, the last bullet on this slide I just want to mention that we plan to use the currently available PRA standards. As Mary was just mentioning, we're going to try and do this to the standards.

We have the ASME/ANS PRA standard. We have the Level 1 LERF PRA standard. There are also draft standards for Level 2 and Level 3, and a low-power/shutdown draft standard that hopefully will be out for trial use sometime in the future.

So, even though we can't formally refer to those standards because they're not official, but we

will use their information in them to help guide us in doing those aspects of the study.

Okay. As far as the plan itself, it is not intended to be a step-by-step procedures guide. It is a higher - obviously, you've read it - a much higher level than that.

It is intended to give general guidance and a record of how we perform this specific study to give it, you know, a traceable record of how we've done this study.

It does focus on the different type of elements and how they interface with each other. It provides a high-level description of some of the key information of each technical element, you know, the key assumptions and limitations, what type of information is needed for the analysis, what are the key steps, what are the outputs, and also some of the task interfaces are identified in each of the sections.

The last thing I want to mention about the TAAP document itself before we go into the actual technical work, there are essentially for a project of this great scope, you know, this expansive scope, there are two principle ways we can go about doing the study.

And this is a topic that we already we actually discussed previously and I don't really have to delve into it, but you can do the - what Mr. Stetkar introduced as the vertical slice, or the horizontal slice.

You can either go into all your Level 1 results first for everything, for all your different initiators and for all different operating states.

And then once you have your complete set of plant damage states, then you move on and do your Level 2.

Once you have your complete set of release categories or source term bins, you go on and do your Level 3.

That minimizes how many gyrations you have to do at the Level 2 and Level 3 phase. However, the alternative approach would be to go ahead and take an initiator category and track state like internal events at-power, do the Level 1, go ahead and do the Level 2 with that, go ahead and do the Level 3 with that.

After you complete the Level 1, or actually kind of in parallel and slightly staggered delayed offset, you start doing the external hazards, you start doing the low-power/shutdown.

The advantage of doing it in that kind of staggered parallel fashion like that is that you get Level 3 results much sooner.

So, you know, if for any reason the project should be excessively delayed, something should happen and budgets get redirected, we at least have a much higher chance of getting some new Level 3 results out of the study.

Also allows us more time to try and come up with solutions for technical issues into the less mature areas like in the spent fuel area, because that gets pushed back a little bit further.

So, it is that latter approach where we would try and maximize or, say, minimize a time until we get to Level 3 results that we're going to pursue.

Okay. Moving on to at-power, the reactor at-power Level 1 internal hazards. Level 1 modeling for internal events, internal floods is very well established here in the U.S. Every nuclear, commercial nuclear power plant in the country has a Level 1 internal events, internal floods PRA that's been peer reviewed to the standard.

This is fairly routine. It should be straightforward to go ahead and perform these aspects of a Level 3 PRA study.

It should take minimal, you know, not very many resources. And as such, we're not going to discuss it too much in the presentation today.

I do want to point out I think we've talked a little bit about it, but that the licensee, Southern Nuclear, for Vogtle has performed a Level 1 and Level 2 PRA for internal events. And they have performed a Level 1 and LERF PRA for internal floods and internal fires. All of those have been peer reviewed. They've had, you know, external independent initial peer reviews.

They also are in the process right now of performing a seismic PRA. And we'll be using those PRAs and peer review reports to help facilitate the development of those aspects of the Level 3 PRA project.

Being able to leverage that work is going to greatly enhance our ability to meet our project, you know, our schedule and our budget limitations by using the work that the licensee has done already.

And that's one of the reasons why when you talk about that April 2013 date, I'm not as nervous about it. I'm not going to sit there and say, oh, yeah, I would give you my right arm if we don't make it, but I think we have a fighting chance to make

that.

(Laughter.)

CHAIRMAN STETKAR: In any case, what's the current status of the SPAR models for Vogtle?

MR. KURITZKY: Okay. Vogtle - a SPAR model, we only have internal events at-power model for Vogtle. So, we don't have -

CHAIRMAN STETKAR: Level 1.

MR. KURITZKY: Level 1. We don't have any all-hazards model or shutdown model.

CHAIRMAN STETKAR: Substantial changes will be needed to bring those models to even a consistent scope with the Vogtle model.

MR. KURITZKY: Right, and I'll get to that at the very end of the presentation.

CHAIRMAN STETKAR: Okay, okay.

MR. KURITZKY: But we are right in the process of doing that right now.

Okay. So, the starting point -

CHAIRMAN STETKAR: Sorry. You started to do that already?

MR. KURITZKY: Yeah, we already - we're converting over the licensee model into a SAPHIRE framework. We're building out the SPAR model.

I'll tell you right now -

CHAIRMAN STETKAR: Okay.

MR. KURITZKY: - the starting point for this study is going to be - is the Vogtle - existing Vogtle SPAR model. And we are using the licensee's PRA information to build out that SPAR model into the other areas that aren't covered in the current SPAR model.

I do want to point out that those will be two separate models. The existing SPAR model will continue to be used for all licensing or risk-informed activities. This separate Level 3 PRA project model would just be a copy of that and then built out reflecting what we've learned from licensee's PRA and peer review reports, as well as additional - I'm just looking at their PRA. There's other things that we have to do in building out that model for internal hazards also, but that's the main starting point.

And the fact that the licensee laws have been peer reviewed is important that - to enhance confidence in the results both for our use in leveraging that information in our study, as well as to help us focus our auditing and review of the use for the licensee.

CHAIRMAN STETKAR: Have their Level 2 peer models been peer reviewed, or only the Level 1?

MR. KURITZKY: No, because -

CHAIRMAN STETKAR: There's nothing to review.

MR. KURITZKY: Yeah, there's no Level 2.

CHAIRMAN STETKAR: Okay.

MR. KURITZKY: So, you know, the Level 1 and LERF is what has been peer reviewed.

We also will be performing a self-assessment on the work that we do for the internal hazards, Level 1 internal hazards.

And naturally as a result of that, there will be some things that will end up having to be changed and modified.

So, the question that remains is to whether or not we want to do a separate independent peer review of that portion of our study.

We're going to do independent peer reviews of many portions of this study at different times. Mary will talk to you about that later.

But this one because so much of it will be coming from or based on an already peer reviewed PRA, we have to decide is it worthwhile to redo that peer review.

And what we - we're kind of thinking is depending on how much things we have to change from

what we get from the licensee's model, the peer reviewed model, will kind of guide us. And what we decide to do about that is probably going to be some kind of - I'm guessing at this point, but some kind of focused, narrow peer review just focused on certain aspects.

It wouldn't be a broad, like, from scratch peer review of the whole internal events or internal hazards models, but it would be focused on areas that we felt were deserving of a second look.

CHAIRMAN STETKAR: Yeah, I don't know how many initiating events -

MR. KURITZKY: How many internal initiators?

CHAIRMAN STETKAR: Yeah.

MR. KURITZKY: I don't know. I haven't looked at the PRA model, honestly.

MS. DROUIN: Also, it gets into perceptions, you know. An independent peer review was done of the licensee's model. This is now the NRC model.

So, do we need to be able to say or do we need to say we had an independent peer review of the NRC model? And, you know, what kind of perception that carries.

CHAIRMAN STETKAR: I have a dollar. Am I going to spend a dollar doing a review, or am I going to spend a dollar developing some more plant damage states?

That's part of the -

MR. HELTON: Level 1 money to Level 2. I've got it on the record.

(Laughter.)

CHAIRMAN STETKAR: But not MELCOR analysis. Real Level 2 PRA.

MR. KURITZKY: But the answer is not that straightforward though. The answer is not that straightforward.

CHAIRMAN STETKAR: No, it's not. But, I mean, that's got to be part of the whole project integration -

MS. DROUIN: Yes.

CHAIRMAN STETKAR: - that there are not - in the same way that there are many things that you'd really like to do technically to satisfy purely technical desires, there are also many things that you'd really like to do in terms of review, oversight, openness and transparency, the need, you know, that reinforce public confidence in the process and all that. You still have that dollar.

MR. KURITZKY: Right. But, you know, it goes to --

MS. DROUIN: Except the independent peer review. We're hoping to get industry to do it and we don't pay for it. So, sorry. No dollars there, Alan.

(Laughter.)

MR. KURITZKY: We'll pay some. We'll pay some anyway.

But the point, you've underscored one of the things that we've obviously come to realize is a very important fact especially when doing the budget, is that doing a project as a government agency, is a lot different than doing it out in the, you know, the private sector. There's a lot more baggage we bring along with us. So, it's not quite as streamlined.

Okay. So, moving on there's for the internal events part of the PRA, we don't expect there to be very many challenges. It's pretty wrote and should be fairly straightforward.

There are a few things that we will be modifying from the licensee's model that we might do differently than they do. For instance, our treatment of - well, our intention is to use the SPAR modeling conventions that we now use for our SPAR models, to use those in the global Level 3 PRA model, which may

be different than what the licensee has done in their PRA.

For instance, the treatment of loss of offsite power and station blackout might be different in our models versus theirs. Common-cause failure modeling will be possibly different in ours than theirs.

I don't know exactly how they've treated all the support system initiating events, but we have a certain approach that we've worked on with EPRI that we use in the SPAR models and we will want to have that same -

CHAIRMAN STETKAR: What is that approach? I'm not familiar with it.

MR. KURITZKY: The approach is primarily - my understanding is where everybody goes and includes support system initiating events in their model. And what typically oftentimes for those that are system oriented where you do a fault tree, you know, we'll do a separate fault tree on the side where instead of having failure probabilities on demand, et cetera, we would have, you know, more like a running type thing, failures to run. So, you come up with a yearly frequency for that failure, that system.

And then we take that number, a

distribution point, and we stick it in as the initiating event frequency in an event tree where that's the initiator.

But what this is doing now is actually in the PRA model itself having the fault tree structure for that, you know, having a fault tree for the, let's say, service model system as a consequential event, and also the initiating event. And they're using the same event names where possible, but changing the date, et cetera.

And it's all integrated and linked as opposed to being manually done on the side and plugged back in.

So, there will be some things like that that we might have to end up doing additional. And so, I don't call them particularly challenges, but it's obviously different than just copying directly over what the licensee has done.

Now, one other thing, and getting to the point you were making before, Mr. Stetkar, about the relative schedules and getting ahead of ourselves, one of the problems is we want to be able to do thermal-hydraulic calculations to try and confirm certain success criteria even for the Level 1 internal events.

But, unfortunately, we will not have our

MELCOR model completed until probably the earliest version will be in January.

And so, you know, we may be kind of beyond that phase a little bit. And if we should do some confirmatory calculations and decide that something needed to change in terms of success criteria, we'd have to obviously go back and rework something.

I'm not ideal, but at this point we don't feel that's a major issue. We don't expect there to be major changes in success criteria, but it's just one thing that we're keeping our eyes on as we do the internal events part of the study.

Internal flood, a few other items, a few challenges here. One thing we wanted to make sure is that the approach and data used for the internal flood initiating event frequency is up to date.

Whatever approach the licensee used several years back, to make sure that reflects current data, current approaches.

Also, the peer review for the - the licensee's peer review, independent peer review for their PRA identified an issue with the flood screening analysis. And so, that's obviously going to be a focal point for us, too, to see exactly what was the issue there and making sure that we account for it

properly in our study.

Also, in the licensee's model, they identified several internal flood standards that affected, you know, shared errors between the units. They weren't very important to the licensee, because they weren't very risk significant. And so for a single unit, it was no big deal what's in the noise.

But, again, for us because we're looking at multi-unit risk, we'll have to give those a second look to make sure that they don't have a bigger impact in terms of multi-unit.

CHAIRMAN STETKAR: I'm glad I heard that. And also, because everything I read was focused on internal flood Level 1 at-power.

What about internal flooding scenarios that affect -

MR. KURITZKY: Shutdown?

CHAIRMAN STETKAR: Shutdown.

MR. KURITZKY: Oh, yeah.

CHAIRMAN STETKAR: SSCs. Not just equipment, but perhaps the flooding scenarios are fundamentally different because barriers are open during shutdown.

MR. KURITZKY: Right, yeah. We're going to talk about that.

CHAIRMAN STETKAR: So, you know, you just can't take the -

MR. KURITZKY: Right.

CHAIRMAN STETKAR: - existing flooding scenarios and copy them over.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: Spent fuel pool cooling systems even on a unit-by-unit basis.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: So, this is another area - I keep saying - I know they've done an internal flood, and people think of internal flood for Level 1 at-power.

To me, it's much better to get an integrated Level 1, 2, 3 model built and then hit that model with internal floods.

It's a subsidiary task. It's later. It isn't something you do Step 1 in the process. It's done like Step 87 after that whole model is built.

MR. KURITZKY: Right. Well, we wouldn't make it completely --

CHAIRMAN STETKAR: Well, only because until you get the whole model built, you aren't necessarily sure how the existing flooding scenarios that they've defined affect that whole model.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: You know how they affect the Level 1 scope you've looked at, but you don't know how they affect Level 2, equipment that's necessary for Level 2.

MR. KURITZKY: Right. And that's true in any type of - because you can't wait until everything - the bow was tied on one thing and then start the second thing. Otherwise, your schedule is going to run out, you know, way beyond whatever you were planning for.

So, there's going to be certain work you have to start doing. Use judgment to say, I think I can safely start this part of that work now. And there are going to be some decision points and I hope I'm going to have the information from this other step before I get to that point, you know, and then move forward from there, but it's a balance. It's a balance.

We have a few years to get this study done now. We've used up one. We've got roughly two-and-a-half years before we have to have the whole thing done. And there's a big scope -

CHAIRMAN STETKAR: I'd say you've used up about 30 percent of your budget time, anyway, planning

to get started.

MR. KURITZKY: Right, right. So, we can't string things out too far out into the future.

CHAIRMAN STETKAR: Well, but again my whole point is if you don't get to a Level 3 PRA model that at least quantifies internal events at-power in some reasonable schedule, meeting some reasonable schedule, it's not going to be a good day.

MR. KURITZKY: And that's exactly my -

CHAIRMAN STETKAR: And in that sense, internal fires although it's got that word "internal," and internal floods although it's got that word "internal," are simply a different type of hazard.

They're not external hazards. They're other hazards. They're not internal events in my -

MR. KURITZKY: Understand.

CHAIRMAN STETKAR: Just this artificial way that people -

MR. KURITZKY: Right.

CHAIRMAN STETKAR: - puts them together.

MR. KURITZKY: For us old-school PRA people.

CHAIRMAN STETKAR: Yeah.

MR. KURITZKY: But in any case, but I thought we tried to stress that early on that that's

the way we have structured the project is to get that internal events all the way through Level 3 done as fast as possible.

CHAIRMAN STETKAR: And in some of the discussions about, gee, we're looking at internal flooding scenarios and we need to make decisions about how they screen those, you might need to make different decisions once you get the whole model built.

MR. KURITZKY: Right. Well, those decisions aren't necessarily -

CHAIRMAN STETKAR: And you don't want to make those decisions twice.

MR. KURITZKY: Right. Well, they're not necessarily -

CHAIRMAN STETKAR: That's the whole point.

MR. KURITZKY: - made up front.

CHAIRMAN STETKAR: Huh?

MR. KURITZKY: Those decisions aren't necessarily getting made up front. I mean, that's when we go into internal floods model.

Working on the internal floods is not going to detract from getting the internal events stuff done as fast as possible in Level 3.

That's why it's kind of like a staggered

thing and the staggered stages go for it as availability of people come to do that work without detracting from getting the level above it done as fast as possible.

CHAIRMAN STETKAR: Okay.

MR. KURITZKY: Okay. So, in fire we have a few more challenges. One of the things we need to do is focus on minimizing the number of scenarios that we have to model in the PRA.

There can be a tremendous number of fire PRA scenarios. And I think the licensee's model has a quite expansive list.

What we try to do is combine similar scenarios to reduce the total number. In doing so, it makes it more manageable, of course. But in doing so, we have to be weary of two things.

One is that we're complete, that there's nothing important that we leave out when we make this reduced number of scenarios. And the second thing is also we have to be careful not to be overly conservative, too.

And when you combine things together, you're going to do that in a conservative manner and you want to make sure that you don't do it such that you have unrealistically conservative results when you

do the combining. So, that's one challenge that we'll be facing.

Another thing is that because, again, well, we have limited - we have limited both expertise in certain fire PRA areas, as well as availability of people and resources.

So, we are, again, going to leverage as much as possible what was done in the licensee's fire PRA particularly in areas like cable tracing, spurious actuation modeling. These are things - fire initiation, fire spread. These are areas where we can rely heavily on what was done by the licensee.

We're not going to have the resources and expertise to go and do those from scratch. But given that we're going to take that from the licensee, it's incumbent on us to make sure we do a good, credible review of that information so that we're not just copying over the licensee's work and now we're saying this is now the NRC study.

So, we do need to have sufficient expertise on our side available to do a credible review of the work that we're going to leverage from the licensee's fire PRA.

CHAIRMAN STETKAR: A couple questions.

The need to or the desire to limit the

number of fire scenarios compared to what Vogtle has already defined, is that a software limitation? Is it a, I mean, why?

If they've defined them already and you feel comfortable with them, why should I care whether I have six or 600?

MR. KURITZKY: It's partially a - I can't say for a fact it's a software limitation. I know that we are working through some issues with the software right now in terms of the size model it can handle. We were only in the internal events and -

MEMBER BLEY: We're talking SAPHIRE.

MR. KURITZKY: SAPHIRE, right.

So, we're already working those issues right now. So, I can't say that ultimately it would be able to handle every single scenario we want it to, but we don't actually need to push the limit just to find out whether it works or doesn't.

But I think just from a practical managing the issue and how much work and resources involved if we can simplify it by combining like scenarios without impacting the ultimate risk profile, it's worthwhile.

See, if you're doing a study from scratch, you don't know ahead of time what you're facing. You've got to look at them all, but we have an

advantage.

Someone's gone and done all the work for us. And if they can show us that 80 percent of the scenarios contribute less than one-tenth of one percent, we don't need to do detailed look at those - that 80 percent of the scenarios.

So, we, you know, we want to take advantage of the information that we have available to us.

CHAIRMAN STETKAR: Good lead-in.

Has their fire analysis - you said they have a Level 2 PRA model, which, to me, means they have - which means they have defined release categories.

If that's the case, does their internal fire model cover Level 1 and Level 2?

MR. KURITZKY: The internal fire model only goes through LERF.

CHAIRMAN STETKAR: Okay. So, you're going to have to do fire analysis in this study if you're going to do a Level 2 PRA.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: So, you're going to have to understand all of those, let's call it, 600 scenarios, because some of them might not be

important.

They might be one-tenth of one percent to, oh, core damage frequency. They might be 90 percent of some particular plant damage state or some release category.

MR. KURITZKY: Yeah, and that's a good point. I don't know exactly -

CHAIRMAN STETKAR: Even though the frequency is very small, it could be a very large -

MR. KURITZKY: Right. That's right.

CHAIRMAN STETKAR: So, you're going to have to look at all of those anyway.

MR. KURITZKY: Yeah.

CHAIRMAN STETKAR: To some greater or lesser extent.

MR. KURITZKY: Again -

CHAIRMAN STETKAR: You can't just bin them by core damage.

MR. KURITZKY: No, but you can bin them by effect. In other words, there may be a large chunk of them that even though there's different aspects of where the fire started, how it progressed, the impact on the things that would affect Level 2 or Level 3 are the same.

CHAIRMAN STETKAR: You need to know what

1 those effects are, though, first.

2 MR. KURITZKY: Right.

3 CHAIRMAN STETKAR: You need to know what

4 boxes you need to throw them into.

5 MR. KURITZKY: That's right. So, you can't

6 just all of a sudden say I'm going to take all these

7 low standards and I'm just going to call them one name

8 and stick them under that.

9 I mean, you do have to look at those

10 standards before you - you have to look at them. In

11 order to bin them, you have to be able to, you know,

12 or combine them to bins you have to be able to see

13 what they're talking about.

14 So, it just means that one of the things

15 that we have to consider when we do that binning is

16 not just their frequency in terms of core damage

17 frequency, but the impact on anything that could

18 matter for Level 2 or Level 3 PRAs.

19 So, yeah, I mean, that's a good point and

20 that's something that we'd have to do as part of that

21 binning process.

22 And that means that we might end up with

23 more bins than we'd like to have, but we still think

24 we could come up - we'd have a lot less than we have.

25 CHAIRMAN STETKAR: It's just - it's again

this resource allocation.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: You don't want to start that decision process until you understand the parameters or the metrics that you need to take into consideration when you start thinking about those scenarios. Either the existing scenarios, or the extension of the fire impacts.

If you don't have that, having people sit down and look at, you know, 600 internal fire scenarios and say, gee, we can get this down to 12 --

MR. KURITZKY: Right.

CHAIRMAN STETKAR: - from the perspective of core damage, by definition it means you're going to iterate. Which means time, which means resources, which means - and once you need to iterate, there's going to be a lot of incentive for real people doing real work to say, ah, we'll just get by with this or next time when we understand how to do it, we'll do it differently.

MR. KURITZKY: Yeah, the point is well valid, but I would say that I would imagine that you wouldn't be able to get from 600 to 12 -

(Discussion off the record.)

MR. KURITZKY: We're not going to go from

600 to 12 and then also find out things that we didn't consider. I mean, I would say that you probably can go from 600 to 300 knowing that there's nothing that's really different between them and you can easily do it.

But, yes, the final level of cuts will - and binning we'll obviously have to take into consideration as other factors.

CHAIRMAN STETKAR: Okay.

MR. KURITZKY: Okay. So, some other things that we do need to - well, one primary - another challenge that may come into play, just something that I've become more aware of recently, was that there's still apparently some disagreements between the NRC and industry on how to treat certain aspects of fire PRA.

CHAIRMAN STETKAR: Some?

MR. KURITZKY: Some. Well, at least some that are fairly critical.

And so, depending on how that plays out and what the licensee here has done in their fire PRA, that might make it more challenging for us to take advantage of their work.

CHAIRMAN STETKAR: On the other hand, and here's a case where I will bring you back, state of

the practice. Snapshot of what is done now.

MR. KURITZKY: Right. And I -

CHAIRMAN STETKAR: I mean, this is - actually, there are some areas where that's an important issue.

And if it's not resolved, you know, now or very, very soon, it's not resolved for the purpose of this PRA.

MR. KURITZKY: Right. But then, again, the issue is going to be if the licensee has done it a certain way and we don't agree with it though -

CHAIRMAN STETKAR: That's a problem. I mean, if it - if they've applied some methods that the staff has -

MR. KURITZKY: Right. That's the one that I'm worried about.

CHAIRMAN STETKAR: Okay.

MR. KURITZKY: But we'll see.

CHAIRMAN STETKAR: I thought you were addressing it in a more, you know, holistic generic sense.

MR. KURITZKY: No, no, no.

CHAIRMAN STETKAR: But there's a -

MR. KURITZKY: There's some very specific things that -

MEMBER SCHULTZ: But you might get away with - not "get away." The wrong term. You might benefit from finishing that sentence. We disagree with what the licensee has done, because.

MR. KURITZKY: Right.

MEMBER SCHULTZ: If that's documented, you're most likely going to be documenting opportunities for improvement. And if you can't get to it, that's okay as long as you document why you disagree, what the disagreement is about and that you're going to move on.

MR. KURITZKY: Yes. That's kind of like a last card to play. Certainly one we wouldn't want to play too often.

MEMBER SCHULTZ: Exactly.

MR. KURITZKY: Thank you.

MEMBER BLEY: Can I just ask you --

MR. KURITZKY: Yes.

MEMBER BLEY: - a couple questions about SAPHIRE?

MR. KURITZKY: I'm going to have to call someone else up, but go ahead. I've never used the code myself.

MEMBER BLEY: Has it been used to do a Level 2 PRA at all? Have we worked this linking

process between Level 1 and -

MR. KURITZKY: Well, I don't know much about SAPHIRE, but the guy who knows about using SAPHIRE for Level 2 is sitting at the table right here.

MEMBER BLEY: Well, that's good, but before -

MR. KURITZKY: Take it away, Keith.

MEMBER BLEY: Before you answer that one -

MR. KURITZKY: Yes.

MEMBER BLEY: - have you got some kind of management plan for how you handle configuration control on SAPHIRE if going through this process you're needing to have changes made to the code?

I know of at least one project in the past with the predecessor of the current SAPHIRE where by the time they were finished, there had been many modifications to handle the details that were needed in that work.

And at the end, they couldn't replicate the calculations that were in the report for the earliest parts of the model.

I mean, it really did lose configuration control on the model.

MR. KURITZKY: Right, and I think that's a

good point. I mean, whatever we do to SAPHIRE, and we already are making substantial changes to SAPHIRE to bring in the licensee's model, will have to be frozen as a - and we'll have to identify that as a specific version of SAPHIRE for this model.

Kevin -

MEMBER BLEY: Well, yeah, but then it changes again. I mean, that's the -

MR. COYNE: Yeah, we have a software QA program in place for the SAPHIRE code. It meets NUREG/BR-0167.

We're actually going to audit the QA program next week out at Idaho National Lab. So, we do have a process already in place. It's well established for maintaining configuration control over the code.

For this particular project, that QA program will be in place so that we don't run into that kind of situation where we've made changes to the code and have lost track of the version.

So, we have pretty careful control over version control and things like that. Kevin Coyne, by the way.

MEMBER BLEY: But will you have different parts of the model that have been run with different

versions of the code, or will you bring everything up to current as you go along?

MR. COYNE: The goal here is to have an integrated model that runs within, you know, a single version of SAPHIRE.

MEMBER BLEY: So, it will always be rerunning the whole -

MR. COYNE: And that's one of the reasons we're using the SAPHIRE code is, you know, we can control the code, we can make changes to the code to facilitate the project.

MEMBER BLEY: That's great being able to make the changes.

MR. COYNE: Right, right.

MEMBER BLEY: I'm glad to hear that, but, boy, watch that one closely or you'll be unhappy.

MR. COYNE: Right.

CHAIRMAN STETKAR: I'm more interested to hear from Keith.

MEMBER BLEY: Yeah, me too.

CHAIRMAN STETKAR: Or Don or -

(Speaking over each other.)

MR. HELTON: Okay. The SAPHIRE - well, first of all just for those who don't know, the current version of SAPHIRE, the current macro version

of SAPHIRE is SAPHIRE 8.

There were Level 2 models constructed in - actually in - and then ported over to SAPHIRE 7. That was done a couple years ago. That pointed to some modeling issues with the way that you might want to do this in SAPHIRE 7 at the time.

And part of the upgrade to SAPHIRE 8 included bringing some of those functionalities into the code. And I'll get more into that in a minute.

Separate from that or related to that about a year ago when it was clear this project was going to move forward, we went ahead and started doing some work with sort of the integrated capabilities aspects of SAPHIRE 8.

And so, we've had a project over the last year that's taken a SPAR model that had internal events Level 1, that had external hazards and all other hazards model. We built in the SPAR state of practice shutdown modeling into that and the model also had a feasibility Level 2 model.

And so, we tried to bring those things together in a single SPAR model, a single instance of SAPHIRE 8.

We're wrapping up that work now. Most of the work is done. And in terms of SAPHIRE's ability

to handle the event tree modeling in Level 2 space, the transfers, the linkages between PDS and containment of entries and release category of entries, that is all working.

The one issue that we're working with right now is to be able to do things a little more effectively from a modeler standpoint in terms of using phasing to basically be able to solve parts of the model at a time if you're only interested in solving a Level 1 part at a particular time or you've pre-solved the Level 1 part and you only want to solve the Level 2 part right now, trying to get all of that to work the way that we want to.

So, we've made a lot of progress in that area. It gives us a fair amount of confidence that we're going to be able to do this.

With that being said, just the quantification issue, the computational burden of quantifying, you know, a model that's going to get larger and larger, it is a concern.

MEMBER BLEY: And you're going to have some so-called incoherent logic that has to go - that sort of thing when you start going into release categories and high probabilities of - I won't call it failure - branching probabilities that are pretty high into

those release categories.

Has that been exercised?

MR. HELTON: To some extent. The large failure probability issue, I'll throw that term on it even if you used more eloquent words, the large failure probability issue is a concern in Level 2 space, but it's also a concern in seismic space for large seismic events.

MEMBER BLEY: Yes.

MR. HELTON: So, we have quantified models that have that. SAPHIRE does have the capability to do direct what I'll call explicit quantification of particular parts of the model.

Again, I guess the way I'd characterize it is it has been exercised, but it's certainly not, you know, a capability that we routinely use.

So, it's something that we do have to continue to pay attention to, be a little skeptical of and move forward on that basis.

MEMBER BLEY: Okay.

MR. KURITZKY: So, work is being done on that. Whether it's going to work for our model, it will be a little more challenging, but we are optimistic.

MEMBER BLEY: That's all right. You only

have two or three months to -

(Discussion off the record.)

CHAIRMAN STETKAR: There's how many hours between now and April?

MR. KURITZKY: Okay. So, moving on to external hazards, I'm behind schedule. I'll try and move forward.

The external hazards work - Level 1 PRA external hazards work we're looking at seismic events, external floods, high winds and other events.

And moving to seismic events, obviously as I mentioned before, it's a big part of PRA. There's obviously a lot of focus now with the post-Fukushima thing.

And the licensee, as I mentioned, is doing a seismic PRA right now. Last I heard, I think they were trying to get that completed at the end of 2014. That's obviously not a time frame that allows us to wait and use their, you know, leverage their whole PRA, but there is work that they're doing already for that seismic PRA which we do hope to leverage.

The idea of being - we want to maximize - we're coordinating with the licensee to maximize what we can leverage from their work and, therefore, minimize revisional work that we have to do on our

end.

One of the things, for instance, fragility calculations. They already have done some fragility calculations and we'll want to take advantage of them, review them and take advantage of them.

We may have an opportunity to help or to have input as to what they might do next. And so, it will be done in a time frame that would support us. And so, we're looking into those opportunities.

The seismic PRA itself addressed in the PRA standard, there's three basic areas. The probabilistic seismic hazard analysis, the component fragilities or the structure system and component fragilities, and plant response.

So, it's the basic elements of the seismic PRA and we'll plan to do this work with a mixture of in-house staff and commercial and lab contractors.

Okay. The general approach for doing the seismic PRA, it's the typical for - there's nothing hew here. I mean, we use the same seismic PRA approach that's been used in the past.

You come up with the seismic hazard bins. You come up with impact on the SSCs. Come up with fragilities and you plug it into your seismic PRA.

And I guess this is what I would call the

true engineering part of the seismic PRA. The next slide will go into more of the PRA modeling side of it.

But particularly in this part of the seismic PRA we're looking at the more engineering aspects. We're looking to do this in a two-phased approach.

The first phase just takes whatever we have available in terms of the seismic hazard information and whatever fragility calculations have already been done either by the licensee or that we may have done in-house.

And they get plugged into the PRA model. We run through the seismic PRA coming up with core damage frequency under our Phase 1. And then we go on to Phase 2.

The Phase 1 results can be passed on for the Level 2 people. But then at the same time we'll go to Phase 2 which says, okay, now, any new information we have on the seismic hazard information, any new fragilities that either we or the licensee have since been able to complete, will now be folded into Phase 2.

And in addition, we can use the risk results from Phase 1 to point us to something that -

in the areas that we didn't have fragilities, plant-specific fragilities for it in Phase 1, we're going to use surrogate fragilities for.

Now, when we get to Phase 2, we can say do any of those surrogate fragilities come up to be important? So, let's focus on those. Maybe we can do some plant-specific calculations for those, either us or the licensee, to then incorporate that into Phase 2.

So, we'll have the Phase 1 results to give us some risk insights and to move forward with the Level 2 work. At the same time, we'll then be able to upgrade it with new information on both seismic hazards and fragility information.

In terms of the PRA aspects of the seismic PRA, that's going to be, again, just typical type of thing.

We're going to have, I guess, typically, you know, we'll make use of the event trees and fault trees that were done for the internal events. Probably the loss of offsite power, station blackout event trees tend to be the ones that get used most often.

But we use whatever is already existing from internal events. We'll make modifications as

necessary to customize it for the actual - for seismic events.

We'll plug in the various values for the initiating event frequencies and the seismic failure probabilities, HRA, HEPs, et cetera, and then crunch out the numbers.

And, again, as Mr. Stetkar mentioned before, a lot of these things impact Level 2 and 3 also. This slide only goes and talks about the core damage frequency, but there will also be corresponding changes that will have to be customization. So, it will have to be done on Level 2 and Level 3 to account for the fact that seismic events have a different impact on some of these other, you know, accident sequence progression aspects.

So, that's the basic approach for the seismic PRA. One of the assumptions going in there is of course that the licensee is doing this PRA. We're going to be able to leverage information from them. That's what makes it more manageable for us.

CHAIRMAN STETKAR: Does their seismic PRA extend all the way out through their Level 2 model?

MR. KURITZKY: I believe it's probably only going to go through LERF, but I don't know that for a fact. But I have a feeling it's going to go through

LERF.

The only thing that went out to Level 2 was internal events. They never even quantified it at that stage either. They just did the modeling structure.

CHAIRMAN STETKAR: So, they actually never -

MR. KURITZKY: I don't think they ever used the actual Level -

CHAIRMAN STETKAR: They don't have a Level 2 PRA.

MR. KURITZKY: Well, they have the logic structure, I think.

CHAIRMAN STETKAR: Well, until you've actually developed the model and quantified it and looked at the end-states and said they're okay, you don't have a PRA.

MR. KURITZKY: Right. They don't have a - right. They don't have a complete Level 2.

CHAIRMAN STETKAR: Okay.

MR. HELTON: Well, they have used the Level 2 PRA for - they did use it for their license renewal application. So, for SAMA.

CHAIRMAN STETKAR: Okay, okay.

MR. HELTON: So, it's a different arena

that it's been used in, but -

CHAIRMAN STETKAR: But they've actually exercised the model.

MR. HELTON: That's my understanding.

CHAIRMAN STETKAR: That's good.

MR. KURITZKY: So, now on Level 2 questions I'm not going to respond. I'm just going to let Don talk to you. I'll give you wrong information.

CHAIRMAN STETKAR: Well, he's the MELCOR guy, right?

MR. HELTON: Who said I was giving them the right information?

MR. KURITZKY: He was happy with it.

CHAIRMAN STETKAR: Sounded like a good story.

MR. KURITZKY: Okay. So, again, it's critical that we be able to leverage information from them from their seismic PRA. Trying to do a seismic PRA from scratch could also be a game buster.

CHAIRMAN STETKAR: One of the things, though, Alan, you know, I did read through this whole thing. I've got pages and pages of stuff, which obviously we don't have time to discuss.

But some of the things when I was reading through the spent fuel pool part of the plan, the

spent fuel pool part of the plan addresses seismic events.

It says, well, you know, we're going to go through a binning process, all of this stuff you've just talked about. For example, we're going to have four seismic bins.

No, you're going to have the same number of seismic bins that you use in all of the rest of the models, because eventually you're going to have an integrated site-wide seismic analysis.

So, I have a seismic bin X that covers a frequency range from A to B. That bin applies to everything on the site. Dry casks that are sitting out on a pad, spent fuel pools at each unit, Level 1 in, you know, things, and that's the type of - now, granted I know you haven't stepped back from this and looked at all of these little bits and pieces, but you need to start thinking about that.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: There isn't a different binning.

MR. KURITZKY: Right. I wasn't aware of that, but that -

CHAIRMAN STETKAR: Just because somebody did a spent fuel pool scoping study and conveniently

did four bins, you know, for the purpose of that study.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: That's irrelevant.

MR. KURITZKY: It will be made consistent. It will be made consistent.

MS. DROUIN: Our next step in this plan, you know, is that we've had each of the different technical leads write their part. That's as far as we've gotten.

Now, we know how to get all the technical leads together -

CHAIRMAN STETKAR: You and Marty.

MS. DROUIN: - to start talking to each other.

CHAIRMAN STETKAR: No, not the technical leads. You and Marty. It's not a democracy. You and Marty need to sit down in a room and say this is the way we're going to do it.

MS. DROUIN: Right, but with the technical leads, is all I'm saying. We need to bring them together and they need to understand that it's not a democracy.

CHAIRMAN STETKAR: That's right.

MR. HELTON: But if I may to your point,

the demarcation points between your seismic bins need to be consistent.

And ideally, and I would expect this is the way that it's going to play out that the reactor versus the spent fuel pool are going to have the same three bins or the same four bins.

However, if there is something important fragility-wise that happens at the midpoint of one of those bins that's - for the spent fuel pool, that's irrelevant for the reactor. Then going off and having four bins for the reactor -

CHAIRMAN STETKAR: You know, that's why you ought to have all of your seismic fragilities for everything so you can step back and look at how those fragility curves are changing as a function of the seismic hazard across the whole plant.

Stuff that's important for Level 1, stuff that's important for Level 2, stuff that's important for low-power and shutdown, stuff that's important for spent fuel pool, you know, so you can make those kinds of decisions about where indeed it makes the most sense to subdivide the hazard bins, if you will.

MR. HELTON: Yeah, there's no doubt that that's the best way to do it in the ideal. And then that ideal gets put into the confines of - or gets put

into the constraints of the project and worked out as close to that as practical.

The spent fuel pool does intentionally trail either - or is in synch with or trails the reactor portions for this reason. So that if a decision is made to do something different for the spent fuel pool, it's delivered and it's done with an approach for how it can be reconciled from a site risk perspective.

CHAIRMAN STETKAR: Except for the fact that there might be some tasks that are really more efficient to do up front.

For example, if you're going to be doing fragility analyses for things that haven't been already addressed in the existing PRA, fragility analyses for structures, perhaps, or even equipment, that it would affect Level 2 at-power, or that would affect shutdown or any of the other tasks in this, it's more efficient to do all of that at once.

You know you're going to need some sort of fragilities eventually for the fuel pool study. They might be simple fragilities. They might be a HCLPF capacity and a beta C, but you're going to need something.

You ought to make some decisions about

that, because that will help to inform your seismic binning for the whole study. Follow me?

MR. HELTON: I agree with you and I think we're trying to do that as much as we can. So, for instance, we're already working on the finite element for the containment even though it's primarily a Level 2 issue.

But by the same token, I don't want to overcommit, because there are going to be practical constraints.

This is in some respects, at odds with our earlier discussion of getting through the internal events Level 1 through 3 as quickly as possible so that you've got a product there. And then, you know, we have to reconcile those things that are partially at odds with each other.

MR. KURITZKY: Right. That's exactly right. And so, we've taken information, the feedback, and certainly it's something we're going to consider and we'll work with it within the constraints that we have.

Okay. So, moving on to - well, and the last assumption was just the fact that before we could actually start doing the seismic scenarios, of course we have to have a relatively stable internal events

model to work with.

Going on to some of the challenges with the seismic events, most of the challenges kind of come into two categories. They're pretty much issues associated with revised ground motion at the Vogtle site, and also the fact that Vogtle is a very deep soil site.

So, with the revised ground motion we have to, you know, worry about the impact on the in-structure spectral acceleration demands. And also with the deep soil site, that brings into play certain things like local site amplification effects and potential for soil liquefaction. Those are things we have to be conscious of.

CHAIRMAN STETKAR: But in principle, they've already addressed those concerns in their study.

MR. KURITZKY: The seismic PRA is the one that they're not going to have completed by the time we're done.

CHAIRMAN STETKAR: Oh.

MR. KURITZKY: I don't know what they've done at this point. That's one of the things we're going to - one of the things we're going to do very soon is meet with them to go over exactly where they

are in their seismic PRA, what they've done.

And if there are things that would really help us out if they were going to do it, but aren't going to do it right then, maybe we can adjust their schedule a little bit to be, you know, more advantageous for us. So, we're going to hold those meetings and find out.

Okay. Moving on to the high winds, external floods and other events. Those of you who were around for the IPEEE days, HFOs, you may catch me using that abbreviation as I do this discussion, obviously an area where there's not a lot of, you know, there's not a lot of quantitative PRA modeling for many of these events. And, in fact, and Vogtle does not have a PRA for any of these types of events.

The standard does cover them. That will become our guiding force for doing this part of the study. Again, it will be a mix of in-house staff and both lab and commercial contractors.

The general approach for the high winds and external floods, very similar. Analogous to seismic, your hazards analysis, your fragility analysis, your plant response.

For the other events, it's more of a screening, at least it starts off as a screening

thing. You look at the various - the plant-specific hazard data, the licensing bases, and then you go through a qualitative and quantitative screening approach.

And then those things that survive both of the screenings then would be subject to more detailed analysis.

CHAIRMAN STETKAR: Looked at that. Couple of questions.

You ever do an aircraft crash analysis? Military commercial aircraft crashes?

MR. KURITZKY: We are going to. They're on the list to be looked at.

CHAIRMAN STETKAR: On the list, okay. Good. I didn't see them listed.

MR. KURITZKY: Well, we don't, but you'll see -

CHAIRMAN STETKAR: They're part of "other" then.

MR. KURITZKY: Yes. If you go down to the last bullet, the Appendix 6-A, I assume without having checked, I'm assuming that they are covered under that appendix.

CHAIRMAN STETKAR: It's obvious that some people who put the plan together were under some time

pressure to get the plan together.

The external flooding analysis guidance is basically a cut and paste from the winds, which is a cut and paste from the seismic.

It talks about a median flooding capacity with a beta R and a beta U to develop flooding fragility curves.

I'm pretty much not aware that people do external flooding analyses like that. It might be okay for flood loading on structures in terms of failure of a structure due to some static or dynamic load, but usually develop a frequency of exceeding a certain level, water level depth with uncertainty about that.

And since water depth tends to be - I hate the term "cliff edge," but once it spills over the surface, it sort of fills up everything below that level.

That's not a median capacity with a beta R and a beta U. It's a much different way to do things. And yet, the external flooding analysis is sort of cast in that different framework.

MR. KURITZKY: Yeah, unfortunately I can't - I don't know whether that may be something like you said, it may be copied over that wasn't changed or

whatever, so - or - I can say that as far as flooding, and I think we'll get to it -

CHAIRMAN STETKAR: Only because flooding is pretty interesting. And the last I checked -

MR. KURITZKY: Right.

CHAIRMAN STETKAR: - this site is on a river.

MR. KURITZKY: Right, but the situation here is as I was going to mention shortly, the high wind analysis, we do expect to do a quantitative analysis. The floods we do not, because -

CHAIRMAN STETKAR: Yeah, I notice you've got about a 50-foot --

(Speaking over each other.)

CHAIRMAN STETKAR: So, you're probably okay.

MEMBER SHACK: The high wind should seem to have a fair amount of margin and -

MR. KURITZKY: Yeah, I don't know - unfortunately, I don't know -

CHAIRMAN STETKAR: The only problem is they got a fair amount of margin for safety-related buildings. But if I wipe out off-site power and tear down the turbine building and rip up some piping, I suspect they might not have looked at that.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: And in a risk assessment, you would, because you get independent failures of everything else that's left standing.

And, you know, they do have remnants of hurricanes that go through that area and tornadoes hit that part of Georgia.

MR. KURITZKY: Right. And another thing, for instance, the other event section is the fact that it's so close to Savannah River, too. I don't know whether there's going to be some industrial-type or whatever events. That might be an issue for Vogtle, too, because of their proximity to Savannah River.

CHAIRMAN STETKAR: One of the reasons I asked about the aircraft crashes, you're not all that far away from Augusta Airport.

MR. KURITZKY: Augusta Airport, right.

So, that takes care of the at-power. Very quickly since we're behind schedule, I just want to go through the low-power/shutdown Level 1 PRA. We only have a few slides on it.

The state of practice for low-power/shutdown PRA obviously not nearly as advanced as for at-power.

U.S. industry experience is very limited

here. There's a little more work being done on this overseas. Some of the countries overseas have done low-power/shutdown PRAs, but we don't have too many -

CHAIRMAN STETKAR: Most of the countries overseas have done low-power/shutdown.

MR. KURITZKY: In this country, very few of them have them in this country. The utilities do qualitative risk assessments a lot for supporting outage management using software like ORAM, but not actual quantitative risk analyses.

And Vogtle itself has not done a low-power/shutdown PRA. So, we'll be doing that one from scratch.

We will try and closely follow the low-power/shutdown standard. Like I said, it's not out yet. It's a draft, but we will still make use of it. We can't formally reference it, but we'll use it as probably a guiding document.

And we do have, actually have staff, NRC staff have some experience with doing some of the limited scope shutdown models with some of the SPAR models. So, we have some experience there.

The general approach for doing a low-power/shutdown, one of the big items kind of analogous - well, not similar to with the fire, but the idea is

trying to get your hands around the scope.

The shear number of potential plant operating states and plant configurations can make the problem get very big very fast.

So, we'll be really focusing on trying to manage the size, you know, the extent of what gets modeled.

The actual technical elements - and when we do the low-power/shutdown PRA, we're going to do it for the internal events first and we'll see how that works. And then we'll expand it out to the other internal hazards, the other external hazards.

Because, again, that's going to - could potentially explode in terms of scope once we try to build that out. So, we'll try and get a good handle on internal events, and then move on to the other hazards.

The technical elements in the analysis are very similar to what's in at-power. The only different one being that first element, that operating state analysis. That's unique to the low-power/shutdown study.

And then it also includes outage schedule assessment, you know, what activities, what equipment is out of service, but then the rest of the analysis

follows pretty much the same elements.

But, again, because we have, and I tink maybe it's on this slide, because we have so many potential, you know, plant operating states and configurations, we have to, you know, very much, you know, manage that.

And even those that we analyze will not generally be to the same level of detail in terms of scope and level detail that you would have for the at-power just because of, you know, time and resource constraints.

So, we will try and focus on identifying the key plant configurations and outage and operating states that we need to look at in detail.

CHAIRMAN STETKAR: A couple of things, Alan, comments, because I read this with some interest.

You need to be very, very careful, because this study will be presented as the definitive Level 3 PRA performed by the NRC.

And, therefore, the notion of completeness is something that the whole team needs to be very sensitive to.

There are statements in there saying, well, just parroting back what you just said about,

well, the necessity, we're going to need to look at only a few plant operating states. We won't be able to do a complete detailed plant operating state analysis, because it's resource intensive.

If you do that, suppose in a larger study I were to find - pick a number - 15 to 20 plant operating states and develop models for each of those plant operating states and you decide, well, we're only going to do three, those three had better cover the entire - characterize an entire outage.

Because otherwise if you just cherry pick among three of those 15 to 20 and say, I'm going to model this one and this one and this one because I know a priori that they're most important to risk, you'll probably be wrong and you're certainly not going to be complete.

But people look at that and say, well, the definitive Level 3 PRA said we only need to look at these particular snapshots.

The only reason I bring that up is experience from really doing low-power and shutdown PRAs overseas is that occasionally you're surprised.

There are plant-specific design features and plant-specific outage management practices that may have already addressed important sources of risk

in those two or three things that you would otherwise cherry pick.

And the real sources of risk may be in plant operating states that you haven't even thought about very carefully.

So, unless you're careful about saying you've somehow characterized the entire outage progression in your Two or Three, which is really difficult to do.

MR. KURITZKY: Right. That's good feedback.

CHAIRMAN STETKAR: That's something really important to be aware of.

MR. KURITZKY: Right. And I didn't mean - maybe I was overly simplified when I -

CHAIRMAN STETKAR: You're not going to have 200. I understand.

MR. KURITZKY: Right, right. I mean, the point was that we're going to just pick a few just to -

CHAIRMAN STETKAR: One other thing, and we are getting short on time, but something that I really noticed is - go back to the preceding slide, 28. And go - data analysis.

There are many, many statements in that

section of the low-power and shutdown that says, well, basically we're going to take the data from the Level 1 full-power models, because, you know, it's directly applicable.

That's true for equipment failure rates. It's absolutely invalid for maintenance on availabilities.

MR. KURITZKY: We're aware of that.

CHAIRMAN STETKAR: And it's a huge task.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: Not just compiling the data, but compiling the correlations among systems. This is - you talk about, you know, large numbers like 1.0, 0.8 that something is out of service in a particular plant operating state and it's correlated.

Because the way people manage the outage is they may take a whole chuck of the plant out and they're not random independent maintenance variables. It's a completely correlated set of conditions.

It's a huge effort and there's -

MR. KURITZKY: Right. I understand.

CHAIRMAN STETKAR: - very - there's no discussion of that in this current plan.

MR. KURITZKY: And that's also one of the feedback we got from our technical advisory board.

When we briefed them, we got the same comment back. So, that's something obviously that has to be reworked.

I mean, reworking the words in the TAAP is the easy part. Accomplishing the work is the hard part.

CHAIRMAN STETKAR: Yeah, but it's -

MR. KURITZKY: You know, there's ideal and there's going to be what we're going to be able to do. And we're going to have to -

CHAIRMAN STETKAR: Well, but, I mean, the two important things, everything else that I read through there I kind of understood. But characterizing the outage, having a reasonable characterization of the outage at plant operating states and mapping the equipment unavailability within whatever number of plant operating states that you have, at least in my experience is their key. If you don't do that reasonably, you really haven't done a low-power/shutdown study.

And of course the other part is defining the initiating events.

MEMBER BLEY: To some extent it's a little easier now than it was 15 years ago because of the - maybe 20 years ago. I forget.

CHAIRMAN STETKAR: `83.

MEMBER BLEY: Because of what -

CHAIRMAN STETKAR: It's 30, Dennis.

MEMBER BLEY: If you have the utility's cooperation because of the way the plant outage is, I mean, it's much more organized and planned out now.

So, instead of rummaging through reams of old notes, you can find it in the plan pretty well.

MR. KURITZKY: Right. And that's actually one thing that the TAAP doesn't really get into, but our low-power/shutdown lead was going to talk about.

He wants to go down and find out what exactly they have, because really what steps we take is going to be strongly influenced by what information he can get from the licensee.

Here he is right now.

MR. WOOD: Jeff Wood, Office of Research, and I'm working on the low-power/shutdown portion of this study.

Yeah, I'll just elaborate a little bit further on the approach. I don't know if all the details are captured in the TAAP, but the idea is to really do a detailed characterization of an outage with a good number of POSs defined in detail.

And based on that, then we'll have to make

some decisions about how to group them and how we group them for initiating event analysis and so on and so forth.

But we do want a detailed characterization of the outage POSs, including the unavailabilities.

CHAIRMAN STETKAR: Okay.

MR. WOOD: We're going to have to rely on Vogtle for that information. To this point, we haven't received detailed information. They have sent us some procedures.

We're working on setting up meetings and the plan is to hopefully have some good coordination with the plant staff to provide us those details.

CHAIRMAN STETKAR: This is one area where to have any kind of credible study, you really do need that because you just can't do it generically.

MR. WOOD: Yes.

CHAIRMAN STETKAR: The way they run their outages determines their risk. And so, if you can't get that good cooperation, it's going to be a real challenge.

MR. WOOD: Yeah, I think we were fortunate to have some recent experience with our SPAR models. We had a team who has gone out and discussed with some of the licensees there, we have discussed their outage

manage strategies. And we had operations people and PRA staff discuss their approaches.

So, we do have some experience here with that and we were hoping to have a good relationship with Vogtle and have that level of information.

CHAIRMAN STETKAR: Okay.

MR. WOOD: Thanks for the feedback.

CHAIRMAN STETKAR: Yeah, thanks.

MR. KURITZKY: Okay. So, I guess we were on this slide from before. So, the only other thing I want to mention here as far as the initiating event frequencies, one of the things we have to do is come up with updated initiating event frequencies.

There is an EPRI report on loss of decay heat removal events at shutdown - you're shaking your head. You don't like that report, huh?

CHAIRMAN STETKAR: Just don't use it. This is - low-power and shutdown is not a generic event. I mean, you know, their loss of decay heat removal depends on their alignment of their systems at a certain time. It's more like a support systems initiating event frequency, you know.

If you come out with a frequency of 10 to the minus seven per year and the experience shows that you lose decay heat removal, you know, 10 to the minus

two per year, you might really go take a hard look at your models.

But the relevance of generic compilations of losses of decay heat removal or any, you know, LOCAs, for example, during shutdown conditions, it's nice information to read, but we've kind of struggled with this 30 years - 29 years ago. And you really have to look at what's done in each of, you know, how many trains of equipment are running?

It's more like the support system analyses in terms of, like, loss of decay heat removal.

MR. KURITZKY: But in terms of actual operational experience, where do you get your data from?

You want to do a plant-specific analysis and outage-specific analysis. Where is your data coming?

CHAIRMAN STETKAR: Data for what?

MR. KURITZKY: The frequencies of these initiating events.

CHAIRMAN STETKAR: You have to create them.

MEMBER BLEY: Or these days use the outage plan for the upcoming outage.

CHAIRMAN STETKAR: No, no, no, no. I'm talking about, you know, loss of decay - what is the

frequency in this plant operating state that you would lose decay heat removal?

You have a system model for the decay heat removal system the same way as you have a model for the component cooling water system that you quantify the frequency of loss of component cooling water for your Level 1 internal events at-power PRA.

You know the configuration. You know the equipment that's operating. You know the likelihood that perhaps redundant equipment in the same system is out of service for maintenance based on their maintenance plan, on their outage plan.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: What you don't know necessarily - and you have information about the types of activities that are performed, human types of activity, testing and maintenance so you can take a stab at human cost initiating events. Inadvertent drain downs, for example.

MR. KURITZKY: Okay. So, it's using equipment unavailabilities and human error calculations into a system analysis.

CHAIRMAN STETKAR: In my experience, that's much more effective than looking at generic industry summaries. Because typically what you find out in

many cases other than drain down past mid-loop operation, there's a lot of data have been compiled on that, but they've been compiled over a long time and people have learned.

That's a case where plant-specific design features if they have an automatic level alarm that screams so loud that you can't stand it, the likelihood that they'll drain down and lose suction for the RHR pumps is pretty low compared to, you know, old days where they had a guy sitting on stairs staring at a piece of Tygon hose that had a loop seal in it and you didn't know that the level didn't change.

So, you need to be a bit careful. Generic data isn't all that useful. That's not good news for you, because it means more work.

MR. KURITZKY: Right. And, again, but it's good insight and so we'll try to account for it as best we can.

Okay. So, I'll just mention the last bullet here. So, we do it for the internal events first. When we get to the other internal hazards, external hazards, obviously it gets complicated, because it gets complicated just as some of the things you mentioned earlier in the meeting.

It's not just a question of so many more states and configurations, but then you have maintenance-induced fires, maintenance-induced floods. You have barriers and doors that were normally closed, are now open. There's all kinds of hot work and other things going on in the plant.

So, it's definitely more challenging when we move into those other -

CHAIRMAN STETKAR: By the way, you know, we're behind schedule, but one thing that struck me, has Vogtle done something that we used to call a spatial interactions analysis?

I don't know what you want to call it. It's a map to show where in the plant pieces of equipment, cables, et cetera, SSCs are located.

Do they have that comprehensive set of information? Because you need that for - you need that for internal fires, you need it for internal floods, you need it for seismic events and perhaps other hazards that you might run into. Aircraft crashes, if you can't screen them out. High winds, if you can't screen them out.

Right now in the context of as I read this plan, it says, well, we're going to go do walk-downs for seismic, we're going to go do walk-downs for fire,

we're going to do fire at-power, we're going to do fire at shutdown.

There's no mention of developing a comprehensive database that can be used among several of these tasks and I don't know whether Vogtle has that or not.

MR. KURITZKY: You know, I don't know what's actually in there in the PRA documentation or whether it's something they have and they didn't supply it, but they have a cable tracing database that they use for the fire PRA. So, you have a similar thing at least for the cables.

Whether that extends out to all the other types of equipment and physical locations, I don't know that. But, obviously, that would be something very valuable if they had it.

MS. DROUIN: I do believe that that is a requirement in the standard. I'm visualizing the words -

CHAIRMAN STETKAR: I think the standard does say something -

MS. DROUIN: - and I do think that they -

CHAIRMAN STETKAR: - about that notion.

MS. DROUIN: - have to do the spatial interaction.

CHAIRMAN STETKAR: The only reason that last bullet brought to mind and I wanted to bring it up, because in the plan right now the compilation of information and confirmation of locations for all of these hazards analyses whether it's fires or floods or seismic, were all sort of individually addressed within each of those tasks where indeed you might be able to pull a lot of that effort out into, you know, a single task.

MR. KURITZKY: Right.

MS. DROUIN: And that's how, you know, in my mind when we start going through and now reading the TAAP and looking at it, I mean, personally that's where I would have brought in an insight saying, whoa, you know, there should be this spatial interaction document, you know, and that should be used to guide and we just aren't going to go off and post-scale do all these walk-downs unnecessarily, you know, because, you know, we need to learn what we can.

CHAIRMAN STETKAR: You'll be bumping into yourself.

MS. DROUIN: That's right.

CHAIRMAN STETKAR: Because you'd be doing the walk-down for one task while you're coming out and doing -

MS. DROUIN: Exactly.

MR. KURITZKY: And we only had to start doing that external to the TAAP, because we had to - there are a simple thing as our travel plans for, you know, the Agency has to do their travel plans every year, right?

So, we had to go through and come up with all the trips we want to take, domestic trips this year. And so, we were trying to figure out what trips and which ones we can combine together.

The plan, like we said already, it's individual, separate contributions from different authors right now. There's -

CHAIRMAN STETKAR: Yeah, got it.

MR. KURITZKY: So, everything is repeated. But in reality, it will be combined as --

CHAIRMAN STETKAR: Good.

MR. KURITZKY: That's a good insight.

Okay. That wraps up the Level 1 PRA aspects.

CHAIRMAN STETKAR: And we're going to take a break.

MR. KURITZKY: Good timing.

CHAIRMAN STETKAR: Excellent timing. So, take a break. 15 minutes. 3:15.

(Whereupon, the proceedings went off the record at 3:02 p.m. for a brief recess and went back on the record at 3:18 p.m.)

CHAIRMAN STETKAR: Let's reconvene. Let's hear about Level 2.

MR. HELTON: All right.

CHAIRMAN STETKAR: Heard about the easy stuff, right?

MR. HELTON: Let's talk about the greatness that is Level 2 PRA.

(Laughter.)

MR. HELTON: All right. The first slide is just intended to provide some basic background. The tool set that we use here at NRC does rely heavily on a simplified LERF approach.

The distinctions between the types of assumptions you would make in a LERF approach versus a full Level 2 approach have already come out in some of the discussion earlier.

We've also talked already, so I won't dwell on it, about the second bullet, which is this integrated capabilities project.

Similar to other aspects or other parts of the project we are going to be using a mix of in-house staff, as well as contracted effort.

Just to go ahead and define the scope a little further with the fourth bullet there, we do think that dynamic Level 2 PRA has its place. It has a lot of advantages in the right setting, but it is beyond the state of practice as we've defined it here. And we don't plan on pursuing it as part of this project.

Finally, with respect to the licensee's Level 2 PRA model, Alan already described that the internal events and the major internal floods feed into a full Level 2 model. Internal fires feeds into a LERF model.

The full Level 2 model is based on a 2005 WOG simplified Level 2 modeling guidelines document. The Level 2 model was updated for use in the license renewal of SAMA.

And finally we, you know, as with other parts of the licensee model, we'll be reviewing it and adopting portions of it that we agree with and expanding upon it in areas where we think it needs expanding.

The next slide simply talks about the different technical elements of the Level 2 PRA. And this is how the TAAP is also structured.

The first is the Level 1/Level 2 PRA

interface. And this is the part I wanted to mention given Mr. Stetkar's earlier questions. There at this point, is a step that describes the iteration on the Level 1 modeling and talks about the fact that you at times will want to change the Level 1 model versus accommodating sins that you've inherited from the Level 1 model in your plant damage state versus accommodating them in the Level 2 containment of entry.

Nonetheless, Mr. Stetkar also accurately identified that that's one of the things that we've - or one of the areas where we've identified that if push comes to shove, that we may need to focus less on that area. So, appreciate the feedback about the relative balance between that effort versus other things such as the use of deterministic tools.

CHAIRMAN STETKAR: Don, in general, each of the tasks in the plan were laid out with a number of subtasks.

Is it correct to interpret that the intent is that those subtasks would be performed sequentially? In other words, in particular you mentioned Level 1. I'm searching through the document and I'm not finding it. So, you may have to refresh my memory.

If I remember right under Level 2, the first subtask was basically appending things to the end of the Level 1 model to account for containment systems and functions that had not been modeled for the Level 1 PRA.

I'm thinking, you know, fan cooler sprays -

MR. HELTON: Containment damage to -

CHAIRMAN STETKAR: Containment isolation, that sort of stuff.

Then there was a bunch of MELCOR modeling. And then in Task Number - I think it was Four or Five is where this discussion of, gee, maybe we might have to iterate back to the Level 1 models. And that's where you just mentioned that we might have to disregard that.

MR. HELTON: So, you asked two questions there. The first is, is the TAAP laid out sequentially? The answer is, yes and no.

In general, the flow of it and the flow of these seven steps is intended to be somewhat, you know, at a broad level or at a high level, the sequence of events.

But, for instance, if you go look at the Gantt chart I have as to when individual subtasks are

getting performed, it doesn't look like a diagonal there --

CHAIRMAN STETKAR: Yeah, okay.

MR. HELTON: - going down. There are some things that are getting done earlier, and there's some, you know, it's not strictly a progression through the tasks.

Your second question about the iteration of Level 1/2 model, on the Level 1 model, you know, I'll have to verify this, but it's my recollection that that's covered under the Level 1/2 PRA interface.

I thought it was Step 4 of the Level 1/2 PRA interface and that's something that -

CHAIRMAN STETKAR: It might be. And I can't find it real quickly here anyway. So, I mean, we can just go on.

MR. HELTON: I mean, that's something we can verify offline. But the intent is that that's something that you're going to want to be doing fairly, you know, up front.

I can only be creating an entire model structure and then at the end saying, I think I'm going to go back and tinker with what's coming into that model structure.

CHAIRMAN STETKAR: There's been a lot of

experience, you know. I remember doing several studies where tube rupture, for example, showed up as an important contributor to risk. Big surprise. Wow.

And the Level 2 people came back and said, well, gee, it makes a big deal about whether we're releasing through the condenser and if the condenser has water in it compared to whether releasing through the atmosphere, you know.

Can you tell us where the water is going? The answer is no. Gee, I wish you had asked that question, you know, six months ago and I could have put a branch in there and I could have told you.

So, it's that type of decision process that we're discussing before.

MR. HELTON: Yes.

MS. DROUIN: And in the TAAP under each technical element, we do have one heading that's called "Interfaces." And right now it's at a high level, but it's meant to get down to the detail, you know, to take care of, you know, this iterative nature of when one element is speaking to another and what needs to be done when, because when they feed back and forth in all of that.

So, that is meant to capture these kinds of issues.

CHAIRMAN STETKAR: Okay.

MR. HELTON: The final or the remaining technical elements are the containment capacity analysis, the severe accident progression analysis which is a primarily deterministic set of tasks, the probabilistic treatment of event progression which is a primarily probabilistic set of subtasks, the source term analysis, presentation of results and the Level 2/3 PRA interface. And this structure does closely follow the draft Level 2 PRA standard.

The next slide just tries to orient us one level down in terms of what we're thinking. We are planning on building something that I would couch as a traditional and contemporary model structure. That being the Level 1 end-states feeding into the containment system extension that we were just talking about, feeding into plant damage states, an accident progression event tree which I'm using here synonymously with the containment event tree, feeding into release categories into level 3.

As we talked about earlier today, the intent is to try to build an integrated SAPHIRE 8 Level 1/Level 2 model.

There still will be a pseudo-pinch point at the plant damage state, but the intent is to allow

the Level 2 to be able to refer back to failure probabilities and other things from the Level 1 when needed.

Again, quantification and just computational constraints are a concern here that we'll have to continue to be cognizant of.

CHAIRMAN STETKAR: The SAPHIRE doesn't have the capability of basically hanging a progression event tree on the end of every sequence from the Level 1 event trees; is that -

MR. HELTON: It does have that capability, a containment event tree and effect is just another event tree.

CHAIRMAN STETKAR: Yes.

MR. HELTON: And so, from the SAPHIRE perspective it doesn't really care whether it's a, quote/unquote, Level 2 event tree or, quote/unquote, Level 1 event tree. The more practical issue is what it's always been, which is the need to take the wealth of information coming out of the Level 1 and shrink it down into something that's more manageable not being at the plant damage state.

CHAIRMAN STETKAR: Well, but if that's the - let me pursue that a little bit. The only information that you have at the end of Level 1 is the

frequency of each end point from each Level 1 event tree, right? You don't have any more information than that.

I mean, you have cut-sets. But in principle, each cut-set has the same characteristic. It might be a pump fail to start versus a pump fail to run. It might be, you know, something else, but each of those cut-sets led to that particular event scenario.

And that event scenario characterizes a certain configuration at the plant, right?

MR. HELTON: Uh-huh.

CHAIRMAN STETKAR: So, why can't you just tack the containment event tree to that scenario and let it continue?

MR. HELTON: Well, even at a - if we're going for a minute, the difference between the cut-set level and the sequence level, and there are important different distinctions there even just between, say, failure to run versus failure to start, but, I mean, even at the sequence level you're talking about hundreds of end-states coming out of a typical PRA Level 1.

And so, at some point you've got to condense that, because in your Level 2, in your

containment event tree, you're going to make decisions about what are you going to evaluate, what you're not going to evaluate, what split fractions are you going to use, and what's the basis of those split fractions going to be?

And some of those tie back to the details of exactly what sequence it is you're trying to capture.

MR. KURITZKY: I mean, it would just be a -

MR. HELTON: You're basically talking about, if I understand you correctly, basically talking about a situation where you go from the 10 to 20 plant damage states you might typically have to a situation where every sequence coming out of the Level 1 is its own damage state, which now you've got - it's the equivalent of having hundreds of plant damage states.

CHAIRMAN STETKAR: Well, but it - that might be overcharacterizing it, but you can look at those sequences and say, well, I'm going to treat Sequences 3, 5, 17, 137 and 156. And I'm going to use this containment event tree for those - whatever I said - half a dozen sequences.

It's the same type of thought process, but you don't go through this intermediate type of

translation matrix, which I've never really seen anybody do correctly.

MS. DROUIN: There have been a few cases where people have built their event tree from the initiating event all the way up through the release so that interface of that Level 1/Level 2 doesn't exist.

Okay. But if you do it that way, there's a lot of up front thinking that has to occur at the beginning of the Level 1 that hasn't occurred here. So, you're forced to do this Level 1/Level 2 interface.

CHAIRMAN STETKAR: Okay.

MR. HELTON: Finally, the issue of deterministic tools came up earlier. Certainly acknowledge Mr. Stetkar's concern about the balance of deterministic modeling versus probabilistic modeling.

The one thing I'll say at this point is, is that we are trying to strike a balance between, you know, on one end of the spectrum you've got a probabilistic model that has a very weak deterministic underpinning. And, therefore, has a lot of uncertainty in the fidelity. And on the other end of the spectrum you have, you know, a case where you've a priori said, well, I'm only interested - I believe these are the three important sequences and I'm going

to, you know, study the heck out of these particular sequences.

We're trying to strike a balance because, you know, complete fidelity and complete completeness are not going to be achieved. And, you know, we will take the advice under consideration and we expect this to be going - to sort of be an ongoing point of interest not only from the ACRS, but from the TAG and others and this part of the peer review as well.

CHAIRMAN STETKAR: A little bit of the concern I had, quite honestly, Don, is that as I read through it and perhaps I'm overly sensitive, is it sounded like you were going to do MELCOR analyses of selected sequences to develop the logic structure of the Level 2 event model.

Perhaps I'm mischaracterizing that. And that sort of says, well, we're going to do deterministic analyses of some set of sequences that we think are important. And we'll use - because it said, well, for example, if we come to cases where an operator action might be important, we'll run two MELCOR models.

And that's sort of building the PRA model as the output from deterministic analyses, where in normal cases we build the PRA model to kind of

comprehensively ask questions about functions, operator actions, dependencies. And then use the computational tools to answer the questions that come out of the PRA model.

MEMBER BLEY: Well, the truth is you build that structure a lot based on your knowledge of how the plant responds.

CHAIRMAN STETKAR: That's right.

MEMBER BLEY: Which is tied to what you know from computational models that were done if not for the particular project, for earlier cases.

So, you're doing essentially the same thing, I think.

CHAIRMAN STETKAR: That's true.

MEMBER BLEY: Only they're pinning it down here or -

CHAIRMAN STETKAR: Well, in terms of - but it comes back to resources and schedule in the sense that if the plan is to run for this particular project a number of MELCOR runs first, then build the tree that asks the questions, and then run some more MELCOR runs to specifically answer those questions, it's not clear why you need to do that up front analysis. Because as Dennis said, there is a compilation of knowledge.

I mean, the industry, the people who do this know the basic parameters given the type of plant, what types of parameters are you interested in; pressure temperature, water level, you know, those types of - containment - size of containment isolation, filtering if you have filters, that sort of stuff, so you can characterize that - you can develop that what we used to call plant damage state matrix. You need that knowledge, but you don't need necessarily the results of half a dozen focused MELCOR runs for specific sequences to do that.

MR. HELTON: I guess for the purposes of today you're not far off - for better or worse, you're not far off from where I want us to be.

CHAIRMAN STETKAR: Okay.

MR. HELTON: But I do draw a distinction between the containment event tree, the accident progression event trees will be built in what I would call a MELCOR-informed as opposed to a MELCOR-based fashion.

CHAIRMAN STETKAR: Okay.

MR. HELTON: So, we all recognize the deterministic and probabilistic parts of the Level 2 are iterative to some extent. And some people have a predisposition to come into that from the

probabilistic side, others from the deterministic side.

Again, we're going to try to shoot down the middle --

CHAIRMAN STETKAR: Okay.

MR. HELTON: - and try to make that as iterative as possible, because we do have a Level 2 model, the licensee's Level 2 model that's one of our starting points.

We do have the deterministic experience from the MELCOR analysis as another starting point, and those have to merge somewhere.

CHAIRMAN STETKAR: Okay, that helps. That makes me feel less concerned.

MEMBER REMPE: Don, in the report several times it just doesn't mention what version of MELCOR you're using except for Table 1237 and it says MELCOR 2.x.

Are you using MELCOR 2.1? Is the model going to be for the current version?

MR. HELTON: Yes, the model is being - the intent is to use MELCOR 2.1.

MEMBER REMPE: Okay.

MR. HELTON: The only exception to that at this point would be that if we do earlier as mentioned

for the Level 1 internal hazard success criteria, the Vogtle model may not be ready, we may do some sensitivity analyses using another model that we have for a high-head four-loop Westinghouse plant.

And if we do, we have both versions, both 186 and 2.1 versions of that model. So, it would just be a practical decision as to which one we use.

MEMBER REMPE: Okay. And that's the plant from which - it mentions it in the report what plant you're basing this new model on and that's the plant you're talking about?

MR. HELTON: It is, and it's Byron.

MEMBER REMPE: Okay, yeah.

MR. HELTON: I wasn't trying to be coy.

MEMBER REMPE: It's in the document. I didn't -

MR. HELTON: Yeah, sorry. I wasn't trying to be coy. It's Byron Unit 1.

CHAIRMAN STETKAR: Okay. Number 3 says, assumes the units are identical.

Are they?

MR. KURITZKY: Fairly close.

CHAIRMAN STETKAR: Identical means identical.

MR. KURITZKY: Not identical, no.

CHAIRMAN STETKAR: They're not.

MR. HELTON: The only - and we'll learn more as we go forward. The only thing I've happened to come across so far is different condensate storage tank capacities and condensate storage tank lineup, if you will.

I believe one of the units may have two condensate storage tanks, and the other one has one larger one. But so far the stuff that I have seen suggests that the units are very similar.

CHAIRMAN STETKAR: How about cable routing?

MR. KURITZKY: Well, that's interesting because for the internal events and internal floods they did a single model, because they figured the two units were very similar. So, they did - they were similar.

But the internal fire because they weren't sure about cable running, they actually did a Unit 1 - a fire PRA for Unit 1 and one for Unit 2.

CHAIRMAN STETKAR: Oh, okay. Good. So, that information is available.

MR. KURITZKY: The fire PRA we haven't gotten yet. That's hopefully in the mail, but that's my understanding.

MR. HELTON: All right. So, obviously the

Level 1 has to get done. The notion here is, is that a single Level 2 structure will be able to support the internal - different internal hazards, the commonality between the two units that was just discussed.

And finally at this point, there's not an intent to handle inadvertent criticality during reflood, but we would plan on highlighting any specific instances where that's a more likely event than it would normally be. So, i.e., those situations where reflood happens soon after core damage.

CHAIRMAN STETKAR: Are you going to model-induce consequential, whatever you want to call it, tube rupture scenarios? That's not necessarily Level 2 phenomenological. But since those things are sort of dumped into Level 2 usually, it's just a general question.

MR. HELTON: Do I interpret the question is consequential steam generator tube rupture, the high/dry/low, is that part of the scope?

CHAIRMAN STETKAR: Right.

MR. HELTON: Yes.

CHAIRMAN STETKAR: It is?

MR. HELTON: Yes.

CHAIRMAN STETKAR: It's certainly an area where I would bet my - I'll bet my left arm rather

than my right arm that they haven't necessarily structured their Level 1 models to ask those questions. And you probably won't have the information even in the cut-sets if you looked at cut-set by cut-set, because the question just hasn't been asked.

MR. HELTON: We will see.

CHAIRMAN STETKAR: You might know that it's dry, because it went to core damage because it's dry, but you might not have any information - and usually that's high pressure in the primary system, but there could be a reasonable fraction of those things that are low. Because in the real world, the operators will try to depressurize it to get low pressure, you know, feedwater condensate or something in there.

MR. HELTON: I guess my perception going in is going to be that regardless of how rigorously it was considered as part of the licensee's Level 1, I would expect that your cut-sets are going to have the necessary information to tease that out in terms of, like you said, a high/dry/low.

If you're on a high pressure recirc and you're in a transient without any induced LOCA, you know, that you can tease out whether your primary system pressure is high at the time of core damage,

low on the secondary side if, as you said, one of your cut-set actions, operator actions is to depressurize to allow for condensate feed to the steam generators, okay, you know that. Dry if you are in a - if a cut-set that has loss of all feedwater -

CHAIRMAN STETKAR: You might, you actually might know that if that level of fidelity is in the models, but my whole point is you really need to look at those.

As soon as you say, yes, we're going to look at it, you need to look at those Level 1 models to make sure that when you do examine the cut-sets, you do have that information.

MR. LOHR: Is this on?

CHAIRMAN STETKAR: Yes, it is.

MR. LOHR: Another aspect of this -

CHAIRMAN STETKAR: Ed, we all know you, but the record doesn't.

MR. LOHR: Oh, Ed Lohr from the Office of Research. I'm senior advisor for severe accidents.

One of the other aspects in addition to whether or not the operator is opening or closing secondary side valves is whether or not they fail for some reason in a consequential tube rupture analysis.

And a third aspect is it's not just

looking at temperature-induced tube ruptures, but also pressure-induced tube ruptures before you get to the point of having high temperatures in the steam generators.

MR. HELTON: Thanks. And I cheated and used Ed's comments as a time to confirm that it is Step 4 in the Level 1/2 PRA interface where it's talked about iteration on the -

CHAIRMAN STETKAR: I knew it was four of something. I couldn't remember what -

MR. HELTON: Yeah.

CHAIRMAN STETKAR: It's Step 4 of the -

MR. HELTON: We've created enough levels in the hierarchy to make it self-concealing.

CHAIRMAN STETKAR: Thanks.

MR. HELTON: Okay. So, yeah, we're on the next slide now. Just some challenges. Some of these have already come up and some of them will come up later, but, you know, the consensus standard is still in flux, the characterization of SSCs for beyond-design-basis external hazards, HRA which Susan will talk about later, mechanistic modeling for particular energetic and low-probability phenomena.

Equipment survivability determination, here I just wanted to allude back to the earlier

discussion about spatial interactions and the fact that that's something that's going to creep up throughout the project. This is, you know, equipment survivability is another area where spatial interactions is going to show up.

Treatment of uncertainty in the Level 2. And then the other thing I wanted to add from our earlier discussion is just the use of SAPHIRE and the quantification challenges that will come into play as the model gets bigger and bigger.

MEMBER REMPE: Don, before you jump to the next slide on equipment survivability, I guess I just wanted to note that I was pleased to see that you're going to be looking at instrumentation failure and considering that in the analyses and that you're leveraging some of the ongoing work of the Near Term Task Force.

But I'd like you to explain a little bit more what you plan to do with uncertainties in the MELCOR - I saw some discussion in the TAAP about sensitivity studies. I know that the SOARCA folks have been doing some sensitivity - or uncertainty analyses, and what is your plans on treating uncertainty with the MELCOR analyses?

MR. HELTON: Okay. Right now - and we're

still trying to reconcile some of this across the project. And Mary will talk about sort of the broader picture of uncertainty. Right now an approach would be the propagation of parameter uncertainties through the probabilistic model and treating the different modeling uncertainties by a sensitivity analyses.

So, that's sort of the direction we're headed, but the details haven't been worked out.

CHAIRMAN STETKAR: That's a little different. I had highlighted a statement, and let me quote this, in Subtask 1-2.4, Step 7, uncertainty characterization - this is under Level 2, 12.2.4.2. With the above in mind, there is no plan to formally propagate uncertainty through the Level 2 analysis.

MR. HELTON: Right. And that's an example of where this is evolving on - the TAAP is a work in progress version working with the work in progress from four weeks ago. There's ongoing discussion about that.

CHAIRMAN STETKAR: Okay. Because, you know, the paragraph goes on for some length.

MR. HELTON: Yes.

CHAIRMAN STETKAR: And it basically says we're not going to do it, because it's really difficult to do and it's really complicated and

there's correlations and, oh, my God, it's a lot of work.

MR. HELTON: Yes.

MS. DROUIN: No, there will be uncertainty treatment with Level 2.

CHAIRMAN STETKAR: How you treat modeling uncertainty, you know, MELCOR versus MAP versus my model versus your model is an issue.

MR. HELTON: And the issue here even in the TAAP even in that version it doesn't say we're not going to address uncertainty. It talks about - it makes a distinction between the propagation of uncertainty through the model versus the treatment of uncertainty.

CHAIRMAN STETKAR: Well, it says, this approach - yeah, the last sentence in that paragraph in fairness to you says, this approach, paren, identification and characterization, but not propagation, is consistent with capability Category 2 of the current draft of the ANS Level 2 PRA standard.

I would certainly hope the people who are on the ANS Level 2 PRA Standard Committee emphasize the fact that propagation of uncertainty through Level 2 models is really important.

Because once I get out to looking at

health effects on the public, I would really like to understand all the sources of uncertainty about that.

MR. HELTON: Right.

CHAIRMAN STETKAR: I don't want that gap.

MR. HELTON: Right. And this gets to the end-state - you mentioned earlier the end-states at the Level 1 are core damage frequency. So, you have a distribution on that core damage frequency.

CHAIRMAN STETKAR: Well, their plant damage state frequencies, because you better have a distribution about the frequency of each of your plant damage states.

MR. KURITZKY: That's the reason -

MS. DROUIN: But then the standard tells you, you know, on the how to do, it refers you back to 1855. And 1855 is not written for a Level 1.

CHAIRMAN STETKAR: That's right.

MS. DROUIN: It's written for a full PRA. And so, you know, uncertainties will be propagated. Exactly what that means and what you propagate and how you propagate is to be decided.

MEMBER BLEY: Since you brought this up and since there's no Section 17 or whatever on integrated analysis for the whole site, have you thought about what you need to do in your Level 2 such that the

overall Level 3 analysis will have reasonable inputs with respect to timing of releases reaching the Level 3 model?

Because once you add that second reactor, the Level 3 effects are really a lot dependant on the timing, especially with the difference between latent effects and early effect, threshold effects.

MR. HELTON: Is the question in terms of the -

MEMBER BLEY: Not really dumping a double source term at the same time such that it all propagates together.

CHAIRMAN STETKAR: Most likely they're not going to do that.

MEMBER BLEY: Which makes a big difference in - it doesn't make a big difference anywhere else, but it makes a big difference in the consequences.

MR. KURITZKY: I think Keith is going to address that, aren't you, in your -

MR. COMPTON: Yes, I'll be discussing that.

MEMBER BLEY: Yeah, but he needs input or will he take an account of that. That's why I'm asking Don, unless you're going to talk about that later.

MR. COMPTON: Not in great detail. I have

identified that as a challenge. That's one of the things that I have identified that, no, we have not worked out all the details yet, but that is a key part of understanding how our teams work together and why we need to get in early and not just what are your source terms, thank you very much, and then, and only then, start thinking about how you -

MR. KURITZKY: But correct me if I'm wrong, Don, your outfit is going to have timing. It's source, characterization and timing, right?

MR. HELTON: But I think you're focused on the interactions between the competing events. And you're right to bring it up in -

MEMBER BLEY: If your timing is identical in the two units, you get one answer. If it's offset by a bit, you get a very different answer especially with respect to early effects.

MR. HELTON: Yeah, and you're right to bring that up in the context of the integrated site risk, because that's one of the things that's going to drive how that gets modeled and how it gets treated. And so, that's what we're continuing to try to work on between the Level 2, the Level 3, and the integrated site risk is exactly how we're going to do the bookkeeping and the accounting for all of those

interactions.

MEMBER BLEY: It may not be real easy to deal with it. And it may start at the Level 1 as well, you know.

MR. HELTON: Yes.

MEMBER BLEY: The timing effects start right from the beginning. So, it's something that's going to go across your whole analysis when you get to the very end and start pasting the pieces together.

MR. HELTON: Yeah, I share the fear that it will not be easy.

MEMBER REMPE: I have one more question, too. On Page 162 there's a quote that says, in addition, post-calculation adjustment of source terms may be necessary in cases where MELCOR yields inconsistent results, e.g. lower releases from a calculation with MCCI versus an otherwise identical calculation without MCCI.

Was that just a sentence put in there to see if ACRS is really reading the document, or what do you mean by that?

MR. HELTON: I'm trying to imagine now, remember back the context that it's in. In all probability, it was put in with the intent that we're not going to blindly use results that the code gives

us and march forward without scrutinizing them and making sure that they make sense.

MEMBER REMPE: It might be good to revise that sentence somehow or other.

MR. HELTON: Okay. So, just some additional challenges specific to the other roads, other hazards.

For external hazards, already mentioned the fragilities for SSCs not covered by the Level 1 PRA.

For low-power/shutdown modeling conditions with the head-off, open containment and flooded refueling cavity configurations, one point I wanted to make here is one earlier reviewer had read this to mean that we were not going to be looking at low-power/shutdown configurations with the head-on and the containment closed. And want to make sure it's clear that that's not the case. We will be looking at those as well. This slide is just trying to point out that those situations were more easily treated by the deterministic models than the situations that have gotten further removed from at-power operation.

Modeling of connections to the spent fuel pool and the interplays therein, and then source term effects in air oxidation environments, and as well as

situations where the containment is going to behave significantly different, again, than the at-power analogy that we're more familiar with.

And if there are no questions, we'll move on to the Level 3.

MR. KURITZKY: Okay. Thank you, Don.

Keith.

MR. COMPTON: Okay. I'm Keith Compton. I'll introduce myself. I just took over as the technical team lead for the Offsite Consequence Analysis Team a few months ago. We've got a number of people working on this, including some folks from Research, on the consequence modeling dispersion, and folks from our other offices on the emergency response.

And one thing I'll clarify, I'm going to be referring to this part of the project as the offsite consequence analysis. There's the smaller Level 3, and then there's the bigger.

So, just to be clear to not have confusion, I'm going to be talking about the Offsite Consequence Analysis Team. So, if you see Level 3 in the sense of offsite consequence analysis, that's what it means.

Background, okay. Background is

consistent with some of the presentations you've seen before.

A key issue, and this goes to the question of resources and schedule and practical concerns as has been raised and is one of my main concerns.

The basic approach to that is that we had to apply a lot of the approaches that were developed in previous studies of offsite consequences of severe accidents to the study.

And the two key that I'm looking at would be what we've done in the SOARCA analyses, and then as well the - any SAMA analyses that were done for plant Vogtle.

So, we do have a basis. We're not starting from scratch. We do have some things that we can essentially take as a starting point, and then adapt as necessary, review, and start developing a technical basis for. And that's basically the strategy.

Obviously, though, that's not - you can't just take those two things, stitch them together and claim that you're done.

We'd have to start adapting these to account for the wider scope of what's being done in the broader Level 3 PRA project.

Again, and this has also come up, this plan is preliminary. This is - we anticipate that we need to adjust or refine assumptions.

So, again, this is giving a snapshot of our thinking, and actually our thinking of, say, a month ago, but we're continuing to look at where we may need to refine things.

Technical elements of the plan, the - I think it's clear you all read the technical approach plan in great detail.

I'd point out that the technical elements correspond to the major components of the offsite consequence analysis.

You have the atmospheric transport, dispersion modeling, the modeling of emergency response and the long-term protective actions, then the modeling of radiological impacts, doses, health effects, and the modeling of non-radiological impacts, economic and land use-type impacts.

And this has - it has been brought up. I planned to speak to it and I'll just emphasize it is that one of the keys to our success would be the interfaces.

And as just came up, there's two key interfaces for us. There's the interface with the

Level 2. Obviously, we need the information on the source term, the magnitude, the characteristics and the timing of releases.

We also need - it goes deeper than that. We need information on the timing of plant states that affects - that are an input into modeling the emergency response decisions.

So, again, we can't just kind of wait until the end and take an input. We'll need to be following - and it goes to the issue of kind of understanding the bins, understanding the actual source terms we get, making sure that they're defined in a way that are going to be useful to us in doing the offsite consequence analyses and the impact measures that we get.

But then likewise kind of on the front end or on the other end is modeling with the Risk Integration Team.

And I think the key interface there, and this has been brought up and I'll have it again on a slide, is the issue of multi-source and integrating multiple events, the idea that you may have releases from two different units or even two different sources, and how do you properly composite those.

And I'll talk a little bit about that, but

that's something that we'll be working very closely and hopefully getting lots of outstanding guidance from Marty as to exactly how to do that.

CHAIRMAN STETKAR: Before you leave this, and you mentioned interfaces, and Mary mentioned it before, one thing that I did notice, there was a fairly long discussion, meteorological data and the sources meteorological data and so forth.

And I believe there's a - under the interfaces in that section it says, well, there's no interface for the meteorological data in any other task in the PRA.

Suppose, let's just say, that I have a scenario that's initiated by, oh, let's say, a really severe storm. Might be winds. Might be really heavy rains.

It seems like the meteorological data that directly support that event are correlated to the meteorological data that are used in the consequence analyses.

You can't just randomly sample from, you know, 8760 hourly records over a year so that part of this interface that we've been talking about needs to be sensitive to those types of things. That's one area where I noticed.

Obviously, it talks about, you know, effects of seismic events on emergency response infrastructure and all that kind of stuff, but there are some other subtle interfaces that -

MR. COMPTON: I was thinking about that, actually, as I was sitting here.

CHAIRMAN STETKAR: I've actually seen people sample and say, well, gee, you know, 98 percent of the time it's dry and it's never raining, you know.

MEMBER BLEY: Before you answer, I'd like to push it even a little further. The storms that may initiate such things, aren't the storms that happen over a 20-year period. These are 10 to the minus three, 10 to the minus four per year storms well outside of the range for which you've got sample data.

And add that into John's question and tell us what you guys are going to do.

(Laughter.)

MEMBER BLEY: Oh, and throw in the word "uncertainty," if you don't mind, because I didn't see it up here.

MR. COMPTON: Okay. Fair enough. Your point is well taken. And, in fact, I probably should read through this again and take any absolute statement out of it about never or not or such, but

here would be our approach to dealing with that.

Your point is - and it goes back to this idea. Our first step just in getting the project done is, as has been said, get one good, solid, complete Level 1, Level 2, Level 3 PRA for internal events.

Then as we go on to the other scenarios, particularly the external events, you would look at everything and see is there anything in this that needs to change?

Now, my suspicion is that most likely you probably would not have a lot where you would change meteorology, where you would change, say, dosimetry, but I'm not going to make an absolute statement right now that there will never be one.

But that would be the approach is that you develop one solid internal events, and then you go through and very - once you have that base to work from, you can start very judiciously saying, this is why it's the same, this is why, you know, it's the same because it hasn't changed. It might be we've decided to do this even though we recognize that there are some uncertainties that we can't really capture, or we changed it because we have a technical basis for changing it and coming up with something better.

But that, all I can give you is an

approach. I can't tell you exactly how, you know, what the answer to that approach will be.

CHAIRMAN STETKAR: Okay. It's just that I think some of the things we're saying is that you need to be constant - you're doing an integrated site-wide Level 3 PRA. And every task in the entire project from Day 1, needs to keep that focus, you know.

MR. COMPTON: Right.

CHAIRMAN STETKAR: Any decision that you make, any guidance for some analyst sitting in some lab out in wherever the heck they sit, needs to keep that in focus.

MR. COMPTON: And my concern on that would be the - and I'm certainly quite sensitive of that. And I think most of the people on our team are sensitive of that that where that could really come into a problem is that if you did a path dependence, you started developing something, and then suddenly three-quarters of the way to the end you realize you set up something that you can't easily change.

CHAIRMAN STETKAR: Yeah.

MR. COMPTON: But my biggest concern is making sure that we stay flexible so that I don't know what's going to come at me, but that I haven't locked myself down into some - inadvertently locked myself

down into, you know, a path.

But I think that hopefully the approach of doing it the way that I laid out will minimize it. I won't say it will eliminate, but that's - yes. I've been thinking about that, and many of us are.

So, tools. Approaches, we're going to be using the standard computational tools for offsite consequence analyses. The MACCS code which has a set of support, a suite of support codes. MELMACCS, SECPOP associated with it again talking to the issue of resources and such.

We're not anticipating any significant MACCS modification specifically for purposes of the Level 3 project. We may do some minor developmental work that would facilitate the multi-source issue at increasing the number of chemical groups that allows you to get a more refined source term. And we may also do some work in refining MELMACCS that would allow more easily automate the process of compiling, compositing, combining the source terms.

Obviously, that's something that, again, that's one of the topics that we'd be working with, with Don on.

I point out, though, that this is - and this kind of came up. Codes change and they evolve

over the course of the project. We know that the MACCS code is - there is work going on, on that. And the strategy for that is that we want to take advantage of any developmental, any development that we do.

For example, if we update the SECPOP code for more recent census data, we want to sequence our work so that we can take advantage of that and this one without, you know, oh, that great update came in two days after we finished our analyses.

On the other hand, we want to be very careful that we don't bring something - bring a code development activity onto critical path for a Level 3 such that some unexpected code change suddenly is taking forever to get it fixed, but you can't because you - so, we're staying aware of the fact that we're developing the code. We'll be probably very deliberate about which code version we step to in use of the Level 3.

And we'll also under the developmental work, we're a small group, so we talk to each other, we'll be looking at developmental change to make sure that it doesn't somehow inadvertently come in and throw a wrench into the works as we're doing the Level 3.

So, let's see.

MEMBER SCHULTZ: So, Keith, does that mean that you get a freeze date sometime in 2013?

MR. COMPTON: I'll say I'm thinking of that concept. I don't have a freeze date. But obviously as we go through the analyses in the course of planning the work, we probably would have to define what I think we were talking about on the way over where certainly you have to freeze - just like you have to freeze inputs, you have to freeze code versions and such. And you'd have to just say, stop, we're in a safe state so we can do something, and then not make the next jump.

Because I have done not in this framework, but I certainly have done integrated assessments, and things trickling in a little bit at a time is a good way to just never get anything finished.

And so, I'm aware of the fact that you have to proceed kind of in a discrete rather than a continuous fashion with these.

And then obviously it's iterative so that the next time you go around the cycle if you're able to bring in updates that you didn't include simply because they were past the freeze date, you can think about them, decide if you want to bring them in or

not.

A lot of it will have to do with the resources and schedule.

MEMBER SCHULTZ: Of course. Thank you.

MR. KURITZKY: And also just to point out because of the freeze date issue, that's something that we're going to face on a lot of parts of the project.

We're not actually going to have one, single freeze date for the whole project. We're likely to have freeze dates, different freeze dates for different aspects depending on when information is available.

MR. COMPTON: And a lot of that, that's again, that's part of the day-to-day nuts and bolts integration between the Level 2 and the Level 3 is making sure that when we start working on something, we make sure that we know that either it's final or it's final enough for us to work on for a particular purpose. And, you know, again, things don't kind of come in and say, oh, I made this one change.

So, all I can say right now is that we're aware of that kind of issue and that's part of the actual planning.

CHAIRMAN STETKAR: I hate to keep coming

back to schedule and plan, but it does affect technical quality eventually.

We'll get back to the plan, probably, but at the beginning we saw a plan that said by April of 2013, five months from now, we're going to have Level 1 results. And by, it looks like, August of 2013, nine months from now, we're going to have Level 2 results. And by end of January, I think, 2014, 13 months from now, we're going to have Level 3 results. It's a nice linear plan.

Does that mean the first results, or that's everything that's final?

MR. KURITZKY: No, it's definitely - in fact, that goes back to the example I gave about the two-phase seismic work.

We'll have initial seismic results done - well, for that, you'd have to look in that chart. The second row would have external hazards, but that shows - I think it's like July or something on there. And that's initial results.

And then in the time frame between that and - there's something called reactor all modes, all hazards and we tie it all together. And so in that interim, there's room for iteration for some aspects.

CHAIRMAN STETKAR: Okay. Let me try to

understand that. Let's just look at the blue line at the top, which is reactor at-power internal events all the way, Level 1, Level 2, Level 3.

The reason I bring it up is it's relevant to this notion of freeze dates for stuff. From what you were just saying with the seismic, the green line is the first set of seismic results. And I don't have the final seismic results until the end of the orange line; is that -

MR. KURITZKY: No, no. That purple line.

CHAIRMAN STETKAR: Purple line.

MR. KURITZKY: Fourth down.

CHAIRMAN STETKAR: Oh, okay. Purple line. Got it. Got it. Got it, yes.

MR. KURITZKY: Okay. So, if you look at the - whatever you want to look at, Level 1, 2 or 3, whichever one.

CHAIRMAN STETKAR: Okay.

MR. KURITZKY: You'll see that there is about four months or so in between there. Maybe more. Five months between the green line and the purple line and that's the roll-up, because that's rolling up the blue, the green and the red all together.

CHAIRMAN STETKAR: Well, what I'm talking about is experience has shown the first time you

quantify a model, you find out you made an awful lot of stupid mistakes and the results don't make any sense.

MR. KURITZKY: Okay. That's before the diamond. That type of result is before the diamond.

CHAIRMAN STETKAR: Which diamond?

MR. KURITZKY: The blue one. Or in this case, seismic, the green, Level 1. That means we're comfortable with the results at that date. It doesn't mean -

MEMBER BLEY: So, you're going to have results by around the second week of January?

MR. KURITZKY: For the Level 1? No, not that far in advance.

MEMBER BLEY: It doesn't seem like much time to clean up these.

MR. KURITZKY: That's why -

CHAIRMAN STETKAR: We used to allocate about a third of the budget for cleanup of stupid stuff.

MR. KURITZKY: You know, if I had the budget I would like and the schedule I would like, I'd have a lot of things in here that I would become more comfortable with.

But the reality is I don't - we're hopeful

that we don't have a lot of major issues on that Level 1, because we're getting information from the licensee's PRA.

We're already working with that right now. And the process of converting over the licensee's model, well, it's - but expanding the Vogtle SPAR model to account for the licensee information we're already making, you know, comparisons with what's there and shaking things out as we go along.

CHAIRMAN STETKAR: Let me - because we are going to run out of time here and I do have to end at 7:00. We're all going to be dead by then anyway.

The reason I come back to this is Don and Keith are talking about, well, changes to MELCOR, improvements to MELCOR, changes to MACCS, changes to MACCS2, whatever, to hit targets on this schedule that are nine months for quantification of Level 2 with some degree of confidence that that isn't going to change very much, you keep focusing on Level 1, because you've got that Level 1 model right there and it's, you know, an idiot can run that thing, to hit those targets, you can't be changing software much past now.

You better pretty much be able to have assurance that when you exercise those models, it's

going to work. Because you don't have time to go back and fix things up.

You don't have time to come out and say, well, we've got until the third quarter calendar year 2013 to do my MACCS refinements, because that time doesn't exist here, you know, because there's no time built in here for fixing things up.

So, that comes back to, you know, well, we don't have a single freeze date or we have to make these decisions. You need to make those decisions now.

MR. HELTON: Well, I guess the pushback I would give on that is for MELCOR, we don't envision - the quality control or the changes that are an issue for us in Level 2 space are with the actual model. The input. The code itself, we're not relying on any code changes in order to do the Level 2 PRA.

For MACCS, that's not the case because they've got a deal - we've got to have MACCS do things that it hasn't done before.

But I would argue that even in this chart, it's nine months before Keith even gets the release categories he needs to start doing work.

So, the notion that he would be doing code development in parallel with the Level 1 and Level 2

doesn't strike me as untenable in my -

CHAIRMAN STETKAR: But if you haven't tested that whole process with some real release categories to make sure that things work correctly, you don't want to be surprised in the six months that you have allocated to -

MR. COMPTON: And this goes - and this, I think, goes to my point about saying being very judicious as we start off. And that's why I don't want to give the exact MACCS version that we're going to be using.

It could, you know, once we get it running stably and we know it works, it may be that at that point that's kind of the base. And then we say, well, if we have good reason to come off of that, yeah, we'll think about it.

But if this works, we're not going to - we're not going to jump to something that may or may not work if we know we're at a path that's good enough.

And I guess that's my point on the development is that we would, you know, we'd make sure that we've got a safe place to cross before we, you know, just jump off into the stream. And that's the idea behind that development.

CHAIRMAN STETKAR: I guess we'll go back to 41.

MR. KURITZKY: Also, analogous a little bit to the HRA, too, where there are some methods that are in flux right now that are being worked on -

CHAIRMAN STETKAR: We'll talk about HRA when Susan gets up.

MR. KURITZKY: The point being that the, you know, our whole attitude for this particular project is we will take whatever the latest, the current best practice is for this model as long as it's ready to go when we need it.

So, when it's time for Keith to start making calculations with MACCS if there's a modified version that is shaken out and good to go, we'll use it. But if it isn't yet, we're using the most recent one that was already shaken out.

CHAIRMAN STETKAR: Glad to hear that.

MS. DROUIN: I mean, this is not a research project in that regard. This is not - this is like us being a licensee given a certain amount of time and resources to develop a PRA model. And we're going to use the best tools that are available to us at the time.

We're going to have to be making screening

decisions as we go along, a lot of just typically as when you build a PRA model.

MR. COMPTON: Okay, key assumptions. These are out of the TAAP. You saw these out of the TAAP. And I'll just say that they're broadly consistent with approaches that were used in previous analyses and they represent state of the practice.

We kind of talked about what state of the practice means and, you know, it focuses on the air pathway. We're using official datasets for census and economic data. We're using the plans, the official guidance at federal or state level for emergency response or long-term protective actions.

Again, I'll talk a little bit more about it, but developing approaches, though, for the multi-source assessment is probably where we would get to in what I would call an extension of state of practice.

That's probably the one area where we might be pushing the envelope of state of practice just because there's no defined state of practice.

CHAIRMAN STETKAR: One question I've had for quite a while and I read in the plan, it says, well, in terms of evacuation time estimates, you're going to use the ETEs from the Vogtle emergency plan.

My experience has been that those

emergency plans, and Vogtle might be different, the ETEs that are available are usually based on a pretty small number of stylized scenarios that usually don't consider challenging external hazards.

Have you thought much about what you're going to do in that area for things like earthquakes, perhaps floods, if floods are important, storms, anything that could affect the regional infrastructure in a coordinated manner with what's going on at the plant?

Because very likely their ETEs unless they're different from most sites, don't cover those types of scenarios.

MR. COMPTON: I guess what I would say is I will say in all honesty, I have not thought deeply about it.

I feel fairly confident that members of our team have thought about it. And I believe that that was something that was - I believe that that was addressed in SOARCA that it was considered.

MR. HELTON: Well, I can speak to it a little bit. There is thinking going into that. I've gotten a couple of calls just over the last couple of weeks from NSER, from the AP folks saying, all right, we're scoping out exactly what we're going to need to

do in terms of developing alternate ETEs, alternate evacuation situations. Could you tell me whether the Level 2 is going to have a release category that looks like this or looks like that or is this seismic then going to get screened out?

And of course the answer to a lot of those questions right now is we simply don't know, but that thinking of, you know, what alternate EP modeling are we going to need to consider is going on.

MR. COMPTON: And EP is actually, again, in our kind of more detailed plan, there are certain things that I have a suspicion that we won't need to kind of keep going back to over and over again as we do different scenarios. I suspect again meteorology is one that just a quick check, make sure it's valid and go.

EP and release are the two things that is just you really have to just kind of, you know, do those, again, not start from scratch, but you really have to put a lot of effort in.

And that's our kind of resource planning and such, kind of focuses a lot of the effort into that kind of thinking, because that is likely what's going to change from scenario to scenario.

Other things may not change. So, we're -

yes, we've thought about it. I don't have an answer.

CHAIRMAN STETKAR: I didn't read it in - I didn't read and I'm glad to hear that, because I didn't read it.

MR. COMPTON: Right. Well, again -

CHAIRMAN STETKAR: Okay.

MR. COMPTON: - it's the - the snapshot of it again is we continue to think about what it's going to take to practically do this on a day-to-day basis, start thinking about the new - the things you wish you had said.

Okay. Continuing on, again, the modeling of radiological and non-radiological impacts would also represent state of practice.

It would rely on current guidance for issues like dose response modeling, dosimetry, health effects modeling.

In this area, the main - I'll call it a challenge. It's - the uncertainty is - the issue, one of the things I wanted to give some thought to is modeling the dose response modeling, what kind of dose response modeling that we do.

CHAIRMAN STETKAR: If you, you know, the first bullet there says, other dose response models will be considered if time and resources permit.

Well, I can pretty much guarantee you that time and resources won't permit that. So, let's pretty much assume that it won't.

Will you at least quantify in the Level 3 model, the uncertainties that might result from the uses of those other models?

It might be a fairly crude quantification of uncertainty, but we kind of know what those models might resolve.

MR. COMPTON: Right. That is the approach. This goes back to it's kind of an issue of model uncertainty.

CHAIRMAN STETKAR: Yes, exactly.

MR. COMPTON: You know, and the way that we had handled that, and this has been done before, a sensitivity analysis in the sense of try it with different, you know, different threshold levels and such like that how far - and so, that is the plan.

How far in that, how many alternatives you can consider, that, I don't know, because that's the time and the resources.

CHAIRMAN STETKAR: But there will be no formal quantification of uncertainty. I mean, there are other ways to quantify model uncertainty.

It says, well, I have Model A and I have

Model B. And Model A gives me a result that says a hundred. And Model B gives me a result that says one.

But given all of our state of knowledge, we, as experts, assign 95 percent confidence to Model B.

MR. KURITZKY: We're not planning to do that.

MR. COMPTON: Yeah, I'm aware of that.

CHAIRMAN STETKAR: Different way of assessing model uncertainty.

MR. KURITZKY: Right. Mary will talk about uncertainty in general shortly, and that's beyond what we'll be doing.

MR. COMPTON: But, again, this is where I would put that kind of discussion -

CHAIRMAN STETKAR: So, you simply have those two sensitivity cases.

MR. COMPTON: You've got to get some sense of how it, you know, when it might change. But, yes, the plan is to try to do some quantitative, not just talk to it, but how far we can go. We'll see.

Challenges. This is - I think a lot of things have already come up. And the main thing that I'm going to focus on is that first bullet, the most significant challenges is looking at potentially

complex release source patterns that could come from different sources, could come from different times and come from different spatial locations.

And the - I don't think I have to explain it in detail, but obviously you can't just take - run all of them separately and then just add them and sum them up using super position.

In some cases, actually, you might. It depends on what you're doing, you know. The effects, I don't want to - I'm not going to say never. So - but the point is, is this is something that we have to look at. And we'd have to see what would be - again, we work with Marty's team and such. Start getting an idea of what are the combinations that would be of particular concern. And what are the, you know, that you might have to really model in detail. And what are some of the combinations that may be a more simplified approach to be used.

I don't have a lot to say about that except that, yes, we've identified it, yes, we're thinking about it, we have some ideas on it, but we know that that's one of the big problems to solve and we've identified it early.

I mentioned - the last two bullets I mentioned that these issues, you know, decontamination

levels, the health effects, the basic approach there would be to look at you just use sensitivity analysis, try different alternatives and just see how things vary.

So, I don't think those are quite as challenging in terms of planning and -

CHAIRMAN STETKAR: How do you see, and this is probably a project management question, but how do you see the results of this Level 3 PRA being presented?

I mean, I'm bothered by these sensitivity studies especially if there's wildly different evaluations from each sensitivity study without expressing any confidence in those evaluations.

I mean, will the results say, here's our best estimate of the risks from the Vogtle site based on these models and, oh, they could be a factor of a hundred different, but we're not going to tell you our confidence in that?

MR. KURITZKY: Right now we have not decided how we're going to present the results. We are looking at what type of - first of all, even what type of consequence metrics we want to report let alone what format we want to put them in, what caveats we want to put in.

I mean, we are looking towards something similar to NUREG-1150 where you have, I guess, CCDFs, you know, with the - I mean, obviously ideal, I would like to match something along those lines.

How we would - or what other possible metrics we would report and what form and whether or not we would assign certain caveats or certain levels of confidence to one sensitivity study versus another, that stuff has not been involved yet, but those are obviously important issues because the risk communication and the perception from the results that come out of the study are greatly influenced by those issues.

CHAIRMAN STETKAR: The problem with CCDFs is that in principle the CCDF shows frequency, consequences and uncertainty about those results.

And when I talk about sensitivity studies, if I don't capture the uncertainty, that modeling uncertainty in those CCDF results, we're talking about shifting those CCDF curves horizontally.

MR. KURITZKY: Yeah.

MS. DROUIN: I mean, we haven't even -

CHAIRMAN STETKAR: It could be this way, or it could be over here.

MS. DROUIN: - started that dialog. And

I can tell you going back when we had the dialog on 1150, it was months and months and months of very heavy discussion of, you know, what should be the results that are reported, how should they be reported, what they should look like.

I mean, there's just a lot that's going to go into determining, you know, what are the results that are going to be reported.

CHAIRMAN STETKAR: 13 months from now we have those results, though.

MS. DROUIN: Yes, yes.

CHAIRMAN STETKAR: 13 months from now we have those results for full-power internal events.

(Discussion off the record.)

MS. DROUIN: We're going to have to start having some of these discussions right away particularly on the uncertainty analysis.

MR. KURITZKY: Right, but a lot - actually, in 13 months we don't necessarily have all of those issues resolved. At the end of that yellow line, we have the integrated uncertainty analysis taken care of.

So, you know, there's at the end of that first line, we'll have results for the internal events - internal hazards for Level 3. And you'll see some

results in some type of display, but it isn't necessarily the final word on what's going to come out.

CHAIRMAN STETKAR: I'll have to think about that. Let's go back to Keith.

MR. COMPTON: Well, that's my last thing. The only thing I would add is that, I mean, there is some precedence, some history, something to learn from about what - in terms of doing sensitivity analyses. It's not like it's never been done.

So, that would be my only answer is that I would go back to look and see what works, what has been a pitfall and make the plan from there, but I don't want to say exactly at this point how it would be done.

So, that's all that I have for the presentation. If there are any other questions?

(No response.)

MR. KURITZKY: Okay. Right now at this particular second we have two new presenters that are going to come up; Susan Cooper and Marty Stutzke.

CHAIRMAN STETKAR: For those of you concerned about time, by my clock we're about seven minutes behind schedule.

MR. KURITZKY: Right. So, we have 23

minutes. So, thank you very much.

CHAIRMAN STETKAR: Don and Keith get gold stars. They should run the whole project.

(Laughter.)

(Discussion off the record.)

MS. COOPER: Okay, HRA. This is Susan Cooper of the Office of Research, Division of Risk Analysis.

So, first, general approach. Obviously, those of you have read the whole thing, and there are some that you have read the whole thing, obviously. There is a general approach subscribed for HRA that's supposed to apply to all of the various things that HRA's supposed to support.

And you might have noticed in the previous slides that HRA isn't always explicitly mentioned, but I have been told that I'm carrying the baton in a lot of those relays.

So, anyway, so the general process that's subscribed for the HRA has been borrowed from other existing processes.

Those of you here at the table that are familiar with the fire HRA guidelines that were published earlier this year, most of these steps are already in that process.

Because HRA is going to have to align itself to some very different hazards and different types of PRAs, I have also borrowed a couple steps from the Athena HRA analysis. Those first two that talk about identification interpretation of the HRA/PRA issue, and then some connection or understanding/recognition of the scope of the overall analysis.

And these two steps are to get the HRA aligned into the right behavioral models, the right tools and thinking about the right problems before you launch into the generic set of steps.

Next slide. So, what I generally try to do is to say, well, I'm going to have to beg, borrow and steal whatever is out there and use it as best I can to address a lot of different problems. Some of which have not been addressed in a lot of detail before.

And so, I've ginned up three different categories of sort of issues or problems that the HRA is going to have to address.

The first category being the one that's most understood and for which almost all HRA methods have been developed. And that's for the reactor at-power Level 1 PRA internal events. And now, with the

NUREG-1921 internal fires, I put that in that category.

And as Alan and others have mentioned, we expect to have or we already have the licensee's PRA, and we're expecting and hoping to use that PRA moving forward with some review modification as necessary.

The hope and expectation that for HRA, we're mostly going to be doing reviews, spot checks and limited rework. So, we will be using the methods that the licensee used to quantify, you know, do HRA quantification for those PRAs.

Moving on to the next category, Category Number 2, this category is characterized as problems for which we think, or I think, existing HRA guidance and methods can be modified or extrapolated to fit the problem because of prior work or, you know, characteristics that are similar to things that we've already - problems we've already worked out.

So examples, not an exhaustive list here. Low-power and shutdown PRA where we do have some experience. We also have quite a bit of qualitative HRA understanding in those areas.

Seismic PRA, internal flood PRA, we can also talk about external floods, anything that has a spatial effect on the plant and the site, the hope is

that the fire HRA can be extrapolated to address some of those problems.

For dry cask PRA, there has been some qualitative analysis HRA work that's been done. And of course there are some existing PRAs, EPRI has done one, that had an explicit HRA, but there is some qualitative work that published in two NUREG/CRs earlier this year that addressed some of those modes.

CHAIRMAN STETKAR: Susan, could you help me a little bit before we get to Number 3, which is a little more contentious, perhaps?

MS. COOPER: Sure.

CHAIRMAN STETKAR: When you say the letters H-R-A -

MS. COOPER: Uh-huh.

CHAIRMAN STETKAR: - you say, well, there's existing HRA guidance methods. 1921, for example, talks about a systematic process for doing qualitative analysis, scenario-based approach to finding HFEs, feasibility analysis, all of that sort of stuff. And then it says once you've defined the HFEs, you have to throw some numbers in.

When you say existing HRA guidance methods and approaches will be modified, what part of all of that needs to be modified for Number 2, for example?

MS. COOPER: I think there are different answers to that question depending on which of those things you're talking about.

Let's take seismic HRA for PRA - or HRA for seismic PRA. In that particular instance, I can see the fire HRA guidelines being modified to address some of the specific issues in a seismic event. And in particular, using some of the qualitative analysis, including the feasibility, which I think is going to be an important part going forward in many of the problems in the overall study modifying that, the criteria for that, to fit a seismic event setting.

CHAIRMAN STETKAR: I guess that's a little bit what I was curious about is why would - trying to think about 1921. I remember reading it.

Why would the basic fundamental process or criteria need modification for a seismic event or a fire event or a flooding event or a high wind event or an internal event or any of those events?

There's sort of basic principles of the way you think about evaluating human performance in a qualitative sense.

MS. COOPER: I think in general, that is the case. There may be some very specific instances in which we might need to think a little bit farther.

Some people might think this is a little bit of - but personally, for me, internal events at-power Level 1 stress, for me, I don't think is an issue.

But if we start thinking about a severe seismic event and now people are having to perform, I mean, let's just take the extreme example of Fukushima, which is maybe not totally within our envelope and certainly not the common thing, but there I can actually imagine stress being an effect.

CHAIRMAN STETKAR: I still don't understand how that affects my defining the human failure event in doing the qualitative description of the scenario and -

MS. COOPER: I agree, I agree, I agree. What I'm saying is that there would be some details, some inputs that you need to develop as part of a qualitative analysis that have not been as explicitly called out in that description that might need more attention or may even need to be brought up that weren't addressed in 1921, but I agree with you.

I think the qualitative analysis approach that's described in 1921 should be - should work for most things. And that's what I say in the technical approach that -

CHAIRMAN STETKAR: Well, the reason I ask is as this slide, it just says modifying, extending, extrapolating the existing HRA methods.

And I'm trying to understand where in the context of -

MS. COOPER: Okay. Yeah, I'm not sure if - I probably didn't, but I certainly in times past have made a distinction between a description of a qualitative analysis or a process versus the quantification tools.

With respect to the qualitative analysis or the process that I think the HRA will take, I think that's going to be largely the same.

There may be some specific issues or unique issues for different hazards that we need to address.

Certainly when we start thinking about multi-unit aspects, the issue of workload and staffing may be a different - may take on some different flavors than we would have thought of otherwise.

It's still there, but there may be some different aspects of it that we need to think about. I'm just saying. I haven't defined them yet. I'm just leaving it open saying that that's a possibility.

Now, with respect to quantification tools,

then we have - then we're talking - we really are probably talking about extensions, extrapolations or whatever.

CHAIRMAN STETKAR: That may very well be, but I wanted to try to understand -

MS. COOPER: Yes, okay.

CHAIRMAN STETKAR: - just in the broad sense of HRA methods and guidance -

MS. COOPER: I think the -

CHAIRMAN STETKAR: - where you were focusing your concerns here.

MS. COOPER: Yeah, I think the principle - well, I think as a general description, the process which includes the qualitative analysis is there. But if I wanted to say, okay, just take this, you know, out of 1921 and use it for external floods and not worry about whoever is doing it, whether they're going to cover all the issues, you know, from this day forward, I want to sort of shake that out a little bit. There might be something else that we need to think about.

MEMBER BLEY: Well, John's got you going a little bit on this one and I, at least for me, I'm not sure as you go through different methods, whether methods have all the right hooks to do things to go

method to method. But certainly context, disorienting events, things like that need special consideration in some cases.

But when I go to your Number 2 and Number 3, I get a big befuddled. I'm not sure what the line is as we go from one to the other. And I sure don't understand what's so special about spent fuel pool PRA or even Level 2 PRA.

I can see in some cases, things like seismic and some other cases there are disorienting effects that have been documented. People end up doing odd things when the world isn't the way they think it should be, but I don't get the other one.

CHAIRMAN STETKAR: That's why I stopped it. I was trying to think what the distinction was between One and Two first, because I'm with you. I don't really understand why Three is so fundamentally different.

MS. COOPER: Let's just focus on the quantification methods mostly. And there is a distinction between One and Two, because the quantification methods while they have been used, let's say, for example, low-power and shutdown, both of you have used existing methods for low-power and shutdown, and there are other things, too, but it's

not, shall we say, state of the practice, if you want to go back to an earlier discussion.

The distinction then for the third category is principally because now we're talking about people who are making decisions and sets of procedures that have not been looked at in a great deal of detail.

CHAIRMAN STETKAR: Is that different from a fire?

MEMBER REMPE: Is this a case for your discussion on 55 where you talk about different decision makers and SAMG implementation -

MS. COOPER: Yes.

MEMBER REMPE: - and the technical support -

MS. COOPER: That is true.

MEMBER REMPE: Because I was reading that and I was kind of wondering - I don't understand HRA very well, but that one, I was just puzzled how you were going to deal with it.

MS. COOPER: Let's just take the difference between, say, for example, fire and technical support center decision-making.

MEMBER BLEY: So, really Two to Three you're saying is going to the SAMG?

MS. COOPER: Let's just take that as an example to try to see if we can try to tease this out.

So, for example, those plants that are using NUREG/CR-6850 and then hopefully NUREG-1921 to perform fire PRAs and HRAs, they are doing some - having to do some demonstrations or at least some justifications or borrowing on some other justifications on demonstrating that certain actions outside the control room can actually be performed.

They're having to go through that exercise. In some cases, they're actually getting people out in the plant and doing it, or in the process of doing peer reviews. People are going out and saying, hey, I don't really believe this, let's go take a look. And they're actually seeing people getting up on ladders and trying to move valves and stuff like that.

So, the actual process of the NFPA 805 transition at least for some plants, the plants that are doing it, they're actually having to do this.

CHAIRMAN STETKAR: So, the things that they have taken credit for indeed are feasible.

MS. COOPER: That's right.

CHAIRMAN STETKAR: For example.

MS. COOPER: For the things that they want

to take credit for.

Now, in the case of staff in the technical support center exercising their SAMGs, now, I have not - we haven't had a chance - we haven't gone to the plant yet. So, we don't know exactly how this particular plant is doing, but we have some preliminary information. But that's preliminary. So, I'm not going to speak to that. But I will speak to the review I - the quick review I made of the inspection reports on the use and implementation of SAMGs.

And for the most part, there are very few plants as best I can tell, that have actually been using their SAMGs when they're doing emergency planning exercises.

And the -

CHAIRMAN STETKAR: You got that right.

MS. COOPER: - expectations with respect to training is, I think, every two years they're doing some training. And it's mostly focused on the technical people and developing strategies, not the decision-maker that's supposed to try to integrate and decide what is it that we're going to do.

So, I would argue that there's limited experience across the industry at least at this point

in time, for us to draw from to understand how people will behave in situations that we would be modeling in the PRA.

MEMBER BLEY: So, back to where we started, Three is you're really thinking about SAMGs.

MS. COOPER: I am.

MEMBER BLEY: Okay.

MS. COOPER: I am.

MEMBER BLEY: The Level 2 PRA part was supposed to be -

MS. COOPER: I recognize that there could be some -

CHAIRMAN STETKAR: I was going to say Level 2 PRA isn't SAMGs though.

MEMBER BLEY: Right.

CHAIRMAN STETKAR: If it's SAMGs, I would have -

MS. COOPER: Okay. Yeah, I mean, I recognize there could be some EOP-based actions in the Level 2, but I am thinking SAMGs at this point in time.

CHAIRMAN STETKAR: Well, typically a lot of the Level 2 models do have EOP -

MS. COOPER: I understand.

CHAIRMAN STETKAR: - ish-type actions.

MS. COOPER: Understand. Understand. But I am - the shorthand of the slides, I meant SAMGs.

MR. KURITZKY: The point is, I think, the different groups are broken down by the different major technical elements of the study, which Level 2 is one. So, that's why we used the Level 2 PRA to acknowledge it, but you're right.

It doesn't just imply, it just - so, it is a little bit confusing.

MS. COOPER: So, that's why there is a distinction. We could talk about it some more, if you'd like, but that was the -

MEMBER BLEY: I suspect when you get to your Number 3 you're going to find there's a lot more than HRA method here involved. Just who's doing what and it's a whole variety of things going on.

MS. COOPER: That's true. And although in a later slide I put multi-unit risk here under Category 3 also, in reality I'm going to be having to think about that all along everywhere I go. That's going to complicate everything.

But anyway that - it was just a way to try to organize the variety of problems that I saw HRA facing for this - supporting this overall study.

So, unless there are more questions -

MEMBER BLEY: Think people in the plant think about multi-unit risk? Will it even affect anything they're doing?

MS. COOPER: I think they'll find out when - I mean, that's going to be a key thing is that we're going to have to find out by talking with them. And we haven't started any of those - any conversations like that yet.

I mean, I think Alan is just getting to organizing our first trips for early next year.

MEMBER BLEY: You're going to get time with the operators.

MS. COOPER: That's what I've asked for.

CHAIRMAN STETKAR: Susan, one quick one now that I understand that Three really is SAMG and sort of strains things, and not Level 2.

I'm assuming - I don't know where Level 2 EOP-driven things fit into this framework.

MS. COOPER: Me neither.

CHAIRMAN STETKAR: It sounds like one and a half or something like that. If that's the case, you're saying you're going to beg, borrow and steal the HRA analyses that have been done already for the Vogtle Level 1, whatever it is, PRA, without being too critical, how are you going to integrate the Level 2-

type PRA EOP-related actions that you almost certainly will need to develop as part of this study?

Because we've heard that they may have Level 2 models, but it doesn't sound like they've actually exercised them all the way out, maybe they have, to make sure that the treatment of human performance on an end-to-end sequence basis from initiating event all the way through whenever the SAMGs come into place is done in a reasonably coherent manner.

In other words, you can't just take a snapshot of, okay, this action is operator starts the sprays manually, because there's not something to start it automatically out of the context of whatever has happened in terms of human performance up to that point.

MS. COOPER: Um, I guess the short answer is I don't know yet.

CHAIRMAN STETKAR: That's good.

MS. COOPER: It's going to be a problem because -

CHAIRMAN STETKAR: You certainly don't want to go back and -

MS. COOPER: I mean, I'd like to have as informative a qualitative analysis as possible,

because I think that's going to be the major benefit of this study. Because I don't imagine or I would - I'm not counting on HRA quantification tool development to keep up with this project schedule. I can't.

(Laughter.)

CHAIRMAN STETKAR: That's a good thing.

MS. COOPER: I mean, I'm supposed to have Level 2 results by September of next year and I don't have all the procedures yet. And I haven't been to the plant yet.

So, I'm going to have to do -

CHAIRMAN STETKAR: August of next year, not September.

MS. COOPER: All right, thank you. I just jacked up the stress level here.

CHAIRMAN STETKAR: Okay.

MS. COOPER: Yeah, I don't know yet. I don't know. That's a fair question.

CHAIRMAN STETKAR: Okay.

MS. COOPER: The likely answer is that I'm going to have to be, I mean, I'm making friends with the rest of the team and I'm going to continue to make friends with the rest of team, because we're going to have to try to figure out something that helps the end

result like this guy here, what he comes out with so far as an answer.

CHAIRMAN STETKAR: The problem is, is that given the schedule and other constraints, I don't think it's feasible for you to go back to square one and develop the qualitative information for the scenarios in the Level 1 model if it isn't there, right?

MS. COOPER: That -

CHAIRMAN STETKAR: You just don't have enough time to do that.

MS. COOPER: That's -

CHAIRMAN STETKAR: You might wind up changing the characteristics of the actions that are already evaluated in the context of that model if you were going to do that. And yet, you're faced with the problem of continuing those scenarios out through the end of the Level 2 model at least.

MS. COOPER: That's why I, you know, one of the first questions or one of the questions right now on my list is help someone please get me the big picture on what this Vogtle Level 1 at-power event tree, you know, accident sequence model means. And we've got a meeting scheduled for next week, Marty and I.

CHAIRMAN STETKAR: Okay. So, you haven't -

MS. COOPER: Because he's looking in at that level and then I'm talking with Pete Appignani. And Don is going to talk some, too. He's going to be another one of my major friends on trying to get my way through this.

CHAIRMAN STETKAR: But what I'm hearing is you haven't actually looked at any of that supporting information yet to see what is available; is that correct?

MS. COOPER: I've started to look at the HRA documentation. The questions and the concerns that you have, have certainly occurred to me, but I have other problems I need to address first.

There's some question that there may need to be some rework on some of the HRA. As I've been told or we've been told, I haven't verified yet, but they did not use, I mean, they're using the EPRI calculator. They use CBDT, but they did not use ACRO or E for any of the time-driven actions.

So, I think those are going to have to be looked at and quantified with like a timer liability correlation and see if those numbers - because that may well change the answers.

(Discussion off the record.)

MEMBER BLEY: Are any of the operators who work here at NRC, former operators, part of this team working with you? And if not, it would sure be a good idea to get one or two of them on board.

MS. COOPER: That's a good idea.

MEMBER BLEY: They're really good.

MS. COOPER: They are.

MR. KURITZKY: We also have a - it was actually on that program org chart that I flipped up in the beginning. We have some at the - who is a former operator and, in fact, was actually a startup engineer, I think, at Vogtle at one point. So, we have access to him for operations-related questions also. So, we have that resource.

CHAIRMAN STETKAR: Let Mary finish. I didn't want to - the problem is if you've ever read one of our transcripts, and you probably have, when you get three or four people speaking, they're completely incoherent.

So, Mary.

MS. DROUIN: I just think, you know, we need to remember that, you know, we're not starting with a blank piece of paper. This is a Level 1 with an HRA - at least with a Level 1 part, an HRA that's already been done and that has been peer reviewed.

So, there's going to be a lot of insights that are going to come out of this external independent peer review that will help guide Susan of how to, you know, navigate through this morass in determining, you know, what needs to be done or revised, really, you know, more revised in terms of the Level 1. And then setting it up of how it gets carried out into the Level 2 and Level 3.

CHAIRMAN STETKAR: Again, that concern is that it's August of 2013, not September. But if revisions need to be made somehow on the Level 1, that's four months away.

MS. COOPER: Well, we have the EPRI calculator. We've been promised the electronic files for their analysis. We don't have them yet, I don't think. But, you know, once I've flagged some of those events for rework, that should be quick.

The question is what other things, and that's going to be maybe something that's going to run alongside the Level 1 even past the September - or August deadline. Or maybe other people so far as their looking at transformation of the model into SAPHIRE and so forth will have some issues.

But, I mean, at least so far as my charter, I will be looking at their analysis and, you

know, just checking it. And as Mary said, certainly the peer review will help, but we do have the tools in-house to do the rework relatively quickly.

And if we have their files, it's simply a matter of exercising the calculator and using a different method. It's not like we have to reinput the information or anything like that. It should all be there.

MEMBER BLEY: And it's not just that the PRA was peer reviewed. You actually have the peer review report?

MS. DROUIN: Right.

MEMBER BLEY: That's helpful.

MS. DROUIN: And maybe that's one of the things that we should have done today that we did not do, was to give you a quick overview of the findings from the independent peer review, because that's very important and that independent peer review did not find fundamental flaws.

So, you know, we're going in with a high degree of confidence in this model that we're taking from Vogtle. So, you know, we're not going in, you know, because of this independent peer review that has given us that confidence, which, to me, is a major assumption as we move forward.

MS. COOPER: But that's not to minimize what you talked about in the sense that I will have to understand how the accident is progressing and -

MS. DROUIN: Yes.

MS. COOPER: - the operator context -

MS. DROUIN: Yes.

MS. COOPER: - in more detail than is probably quantified in their report. And that will be - that will happen as part of our interaction with the plant, is my hope and expectation.

CHAIRMAN STETKAR: We'll talk at the end of this subcommittee meeting about, you know, when we'll get together next. And I think it would be useful at that meeting for us to at least get some overview of the results of that.

Not just the results of that peer review, but by that time you'll have had more of an opportunity to find out where you might need to do some refinements either based on those results or some of the other -

MS. COOPER: Exactly.

CHAIRMAN STETKAR: - examinations you've done. I'm going to try to keep this moving a little bit.

MR. KURITZKY: Let me -

CHAIRMAN STETKAR: No, I'm going to turn you off, because Don's been standing here patiently and he probably had something to say.

MR. HELTON: But he's my boss. So, he could just cut me off, too.

Just real quickly I wanted to clarify in case it matters for this discussion, when we see Vogtle SAMGs we would expect them to closely follow the Westinghouse owners group generic SAMGs.

Which means they're going to tie transition from the EOPs to the SAMGs to coregs of thermocouple of 1200 F.

The practical effect that that's going to have is that that transition is going to line up pretty well with the transition from Level 1 to Level 2 PRA.

So, in the end, I don't expect to see many, if any, EOP actions in the Level 2.

CHAIRMAN STETKAR: Hm, okay. Good.

MR. KURITZKY: And also, I'd just like to clarify one point, because it's coming up repeatedly throughout this meeting.

The due date or the completion date for this study has been determined by the Commission. And the scope of the study has been determined by the

Commission. What we have given you in that schedule is how we feel we can accomplish the study within that schedule.

Whether or not any interim milestones in there are reasonable or attainable, is for each person to make their own decision on that, but we have attempted to do the scope that we've been required to do in the time frame that we're required to do it.

CHAIRMAN STETKAR: And I think we all understand that, but it - when all is said and done, people have to stand behind the project.

And right now, there are those milestones and certain things need to be accomplished within the constraints of those milestones, unless something changes -

MR. KURITZKY: And we understand that.

CHAIRMAN STETKAR: - to change those.

MR. KURITZKY: We understand that.

CHAIRMAN STETKAR: Okay.

MEMBER SCHULTZ: And what we're trying to do here is to optimize quality within the schedule that's been allowed.

And this is an important area and I think you've got it right, Susan, in terms of identifying these three key elements. It's important that they be

defined carefully with regard to what is the content of each. And then you are moving forward to move on Item 1, identify how that will flow into Item 2s and 3s.

That's going to be important to do in an integrated fashion so that you don't spend too much time trying to fix One, and then find out that Two and Three get left behind and so forth.

MS. COOPER: That's true, but Level 1 of course is going to be the basis for everything. It's the foundation.

So, that has to be balanced, but you're right. That's the intent.

MEMBER SCHULTZ: Think about Two and Three as you work on One.

MS. COOPER: Absolutely.

MEMBER SCHULTZ: As you say, once you meet and see what's there and who you can talk to about providing their overall expert advice, that's going to be very helpful.

MS. COOPER: I agree.

Next slide. This slide is here to mostly address the third bullet, which are some assumptions and hopes and expectations about the licensee's PRA meeting our needs. And then, you know, some

statements about expectations or assumptions that we're not going to be needing to make major modifications to the HRA. And that the original work was done correctly like identifying the key and relevant performance influencing factors and so on and so forth. And not requiring major rework for post-initiators or any for pre-initiators.

For things that lie in the Categories 2 and 3 that identified in the previous slide, I'm certainly hoping that they do have formal procedures in place for the things that I'll be looking at and that actions and control panels and so forth exist.

The exception would be the on-site dry cask storage facility, but we will be borrowing information from other plants. Otherwise, it ought to be there.

Next slide. So, I'm wrapping up discussion on the HRA just to go back to these groups, classification groups and trying to identify what I think are the resources or starting points for how we can move forward on solving the HRA problems posed by the different hazards, operating modes and so on and so forth.

For Group 1 at least for the internal events, at-power internal events PRA, I didn't bother

to even try listing everything that's out there, but it's really everything that we've done in PRA and HRA and all existing HRA guidance and quantification tools. And then of course with the fire we've got the recently published 1921.

And then for Group 2, I provide some examples. Just to be clear, this is not an exhaustive list of all the things that we have.

Certainly we do have the previously performed NRC studies on low-power and shutdown. Dennis has stepped out, but he did the HRA for the Surrey low-power and shutdown study.

And then there is qualitative work, HRA work that was also performed. And one example is - that work is documented in the NUREG/CR-6093.

For the subgroup of spatially-oriented HRA hazards, I want to especially point out that in our Technical Advisory Group meeting that discussed HRA, in the middle of November our EPRI representative on that, on the TAG, Stuart Lewis, indicated that they're working on an expansion of 1921 for seismic HRA in support of PRA. And they're actually working with Vogtle, the site that we're looking at, to pilot that work. And we have been promised a copy of that when it's ready.

I saw Mary Presley from EPRI earlier today. She's back at Church Street on a different topic and she said - she's the one doing the work. She said it should be ready for us sometime in the February time frame.

Exactly how we're - what we're going to do with it, what their plans moving forward are so far as jumping in and using it or there was some suggestion of a peer review, I'm not sure yet. But the hope and expectation is that there is something there that we can start with and, again, beg, borrow and steal.

CHAIRMAN STETKAR: Well, there again, you know, state of the practice.

MS. COOPER: It will be one of the several inputs. I mean, I'm sort of in an information collection mode. And the major challenge is to try to keep track of all of it and then to decide what to do with it.

Since I know we're a little behind time, I'm just going to jump down to the dry storage, cask storage PRA. Again, there have been some previous studies.

And then Sandia did some work for me that was published earlier this year and it's qualitative HRA identifying vulnerabilities and some actual

scenarios. It's on two newer CRS.

One of them looks at all of the different - can't remember what the phrase is for all of the different things that happened to spent fuel from the time that it comes out of the, you know, gets into the pool and gets moved around. And then the later one just looks at cask drops.

CHAIRMAN STETKAR: I was going to say I'm a bit baffled by why that's called out separately. But in the interest of time, I'll just make the statement that when I'm in an outage, I pick up fuel, I move it around, I put it in things, it moves from one place to another, I pick it up, I can drop it, I can do all the sorts of things - the same kind of things that I can do when I'm picking it up and putting it in a cask and dropping the cask.

MEMBER BLEY: But it's hotter fuel.

CHAIRMAN STETKAR: Yeah. But in terms of human performance, we're dropping things.

MS. COOPER: Well, the first one covers all of the different things that happen.

CHAIRMAN STETKAR: It's not clear to me why dry cask - human reliability for dry cask storage PRA is fundamentally different from human reliability for moving fuel around in a, you know, in a shutdown PRA.

MS. COOPER: May not be. Good question, but it's certainly different than things that we do in the control room.

CHAIRMAN STETKAR: Yes.

MS. COOPER: That's for sure.

CHAIRMAN STETKAR: That certainly is.

MS. COOPER: Certainly is very different than that.

CHAIRMAN STETKAR: But if you solve -

MS. COOPER: You may be right.

CHAIRMAN STETKAR: - the moving the fuel around during the low-power, you know, the shutdown -

MS. COOPER: I'll take that as a -

CHAIRMAN STETKAR: - it's -

MEMBER BLEY: Well, and it might be that the vulnerability analysis shows that there's very little to analyze.

CHAIRMAN STETKAR: That may very well be. That's right. That's right, but I don't - anyway, I just wanted to make that comment.

MS. COOPER: All right. Next slide. Last slide. And this is the Group 3 for Level 2 and SAMGs. And I have included the multi-unit risk.

Here, I'm going to - the net is going to be cast even broader to not just - things that have

already been done.

There have been some international studies that have done Level 2. Although, it seems like the distinction there is in some cases those are what we would call EOP actions, not necessarily SAMGs. Some cases they are maybe a little bit different.

We're certainly going to be very much relying on how this specific plant is doing. And that's going to involve any kind of information we have about what they are doing with respect to practicing and implementing their SAMGs.

And then more broadly understanding from psychological literature on decision-making. And also the IDHEAS project has looked at this and has some things - is supposed to have some things in there in one of their recent reports. And I will be looking at that also as a potential input.

But for the most part, I would say that what we're looking at here is to try to get an understanding of what can be represented as an expectation for behavior. And that's the real rub is what can we say is an expectation.

And then of course quantification is another thing entirely. We may not have enough information to build a very strong expectation. It

may be a fairly non-informative - it's like these are the choices. It's going to be one of these.

CHAIRMAN STETKAR: Well, but again, I mean, you know, this is characterized, this slide, as SAMGs and multi-unit.

MS. COOPER: Yes.

CHAIRMAN STETKAR: If I look at the schedule, the multi-unit aspect of that has some time flexibility. The SAMGs for a single unit doesn't have quite so much.

MEMBER BLEY: And this is an area you're not going to get much help from what they've already got.

CHAIRMAN STETKAR: No.

MS. COOPER: That's correct.

CHAIRMAN STETKAR: Essentially, not.

MS. COOPER: That's correct. But, I mean, I think it would be a mistake to think that I can wait until the end to think about multi-unit risk.

CHAIRMAN STETKAR: Well, no, my point -

MS. COOPER: That's the only thing I can say about that.

CHAIRMAN STETKAR: Well, that is not an option, because 13 months from now you have to have some sort of coherent treatment of these types of

things in the context of a single unit at-power Level 3 set of results.

MS. COOPER: That's true. That is what I am required to do.

CHAIRMAN STETKAR: There isn't a lot of time for fundamental research work here.

MS. COOPER: I'm not trying to do any. I'm just trying to, you know, I mean, I -

CHAIRMAN STETKAR: Or even perhaps waiting around for whatever is going on, on IDHEAS. And I know a little bit about that, but -

MS. COOPER: Whatever exists that I can pull in to try to inform my description of an expectation as to how they would behave in the SAMG implementation or multi-unit risk settings, that's what I'm going to have to use.

And then when it comes to quantification, that's an answer that I'm going to have to answer and have to come to at a later date.

CHAIRMAN STETKAR: Might be expert elicitation, you know.

MS. COOPER: It might be, or it might be, I mean, I've told Marty it may be - I think it's coming down to three different choices of things that they might do. And it may be 0.3, 0.3, 0.3, just

totally not informative. Just split it all up and that's what you got.

But at least there will be something to describe how I got to that point in time, but that might be the end point of, quote/unquote, HRA quantification.

Because success, describing success is in that sort of regime time frame. It doesn't make a lot of sense for me. It's no longer like success and failure. It's pretty much just what do they choose to do in this time frame.

Anyway, that's it for HRA, unless you have more questions or suggestions for what I should be doing.

CHAIRMAN STETKAR: Anything else?

Marty, how long -

MR. KURITZKY: Marty is going to take a little while.

CHAIRMAN STETKAR: Marty is going to take a little while. Let's take a break. Can we hold it to ten minutes, if we can?

Let's take a ten-minute break. Try to be back at 5:15-ish or so.

(Whereupon, the proceedings went off the record at 5:06 p.m. for a brief recess and went back

on the record at 5:17 p.m.)

CHAIRMAN STETKAR: Let's reconvene.

Marty.

MR. STUTZKE: Okay. I'm Marty Stutzke from the Office of Research, the task lead for the integrated site risk. I'm also one of the principal technical advisors, that little right-hand corner box you guys were talking about a couple hours ago.

I'm on the Technical Advisory Committee and I have a full-time job. So, just a little busy.

MR. KURITZKY: But this is supposed to be your part-time job.

MR. STUTZKE: Okay. So, let's - briefly we'll talk about the technical task of this project, of this task, some of the modeling issues, how we're evolving our technical approach, what we've learned from our review of site information so far, some early thinking on sequence delineation, some early thinking on what sorts of risk metrics we ought to be computing, and then a list of challenges.

So, technical task, as I said, we're evolving the technical approach. It's due in March of next year like that.

The second task called multi-unit effects is what we normally call plant familiarization.

That's just trying to understand how these plants, these two units are coupled together and things like that. Knowledge of that is influencing how we're writing the technical approach like that.

Task 3 then is build the integrated model and turn the crank. So, it's all in there. And Task 4 is the integrated uncertainty that Mary will talk about later on.

To aid me in evolving this approach, we did hire a contractor to prepare us a white paper, ERI. Good job like that.

I had deliberately refrained from telling them how I would do it, because I wanted their opinion about what they thought the issues were like this. Which was probably frustrating to ERI at times, but I can sympathize with that being on the other side of the table for many years.

So, you know, the issue of multiple concurrent accident. So, if something goes on in the reactor and it might damage another reactor and then the spent fuel gets involved, this sort of thing. Multiple hazard, seismic fire, seismic floods, these sort of things like that.

The fact that with image or radiological release in one unit will impact the others, you know,

some minimum could inhibit the operators from getting where they need to go and these sort of things.

MEMBER BLEY: On that last slide -

MR. STUTZKE: Yes.

MEMBER BLEY: - how much effort do you think you can expend, I guess, doing walk-downs and examining - looking for these kinds of problems?

I mean, this is a real search. This isn't something you can just borrow.

MR. STUTZKE: I'm relying on the kindness of friends when they go walk it down like that. Yeah, because it's - basically it's open ended, you know. The challenge here is trying to do this in a very systematic process, you know, so that I don't inadvertently screen something out that could be important.

But I don't have a lot of previous PRA experience that guides me as to where I ought to be looking for the risk, you know.

I'll tell you now every time I look at this plant for multi-unit risk and I dig into it for a couple of days, it goes away. It's not where I thought it would be.

So, I am trying to be a lot - reasonably systematic within my boundaries to make certain I

don't miss anything.

Okay. Next slide. The white paper had identified or had some PRA modeling issues. And you'll see the elements basically fall out of the standard like that with a few exceptions like this.

Then they had ranked them according to whether they thought they're within our current practice or we needed some revisions or some major revisions to it.

I added the color coding and the staff doesn't necessarily agree with this assessment. And I'll point out where it is.

This slide pretty well, as you would agree, you know, the HRA is obviously a major concern for us in the multi-unit risk aspects.

The accident sequence evaluation, the concern there is actually delineating the multi-sequence - multi-unit sequences like that and making certain you got them all like that.

Dependency analysis is looking for the cross-connects or shared systems among the units, things like that.

MEMBER BLEY: Organizational cross-connects or dependencies?

MR. STUTZKE: That's possible. It's

possible.

MR. KURITZKY: Marty, I'm sorry, let me just interrupt. I just want to point out so that it's clear to everybody that these modeling issues, this characterization of the PRA modeling issue is specifically for the multi-unit risk issue. It's not for the general -

MR. STUTZKE: It's not our view on state of the art or PRA.

CHAIRMAN STETKAR: Thank you for clarifying that.

MR. STUTZKE: It's with respect to multi-unit.

On Slide 55, you know, the list continues. Apparently, I caused a great deal of consternation by saying structural analysis was red like that. The issue there had to do with some external events, you know.

You can hypothesize in a BWR where the stack falls down and the issue is where does it land, things like that.

I don't believe there are modeling issues in structural analysis, you know. We know how to do finite element modeling and things like that.

Whether it's the application of known and

proven techniques to new situations, that's an issue there.

Same thing, analysis of severe accidents, radiological releases. Well, we know how to do Level 2 PRA. We have the tools. Things like MELCOR and like that. The applicability of them or the application of them to multi-unit risk will be a challenge like that.

Construction of Level 2 event trees is going to be quite a challenge to try to sort through that.

Same thing with consequence analysis. Keith had spoken to you before, you know. The existing MACCS2 run will handle up to 250 puffs at different points in time. So, plume segments going through there.

I understand of course they all have to come from the same location.

(Laughter.)

MR. STUTZKE: And I was taking my MACCS2 refresher training this summer. And I cornered Nate Bixler at Sandia and we looked at the site map. And he goes, ah, maybe it's good enough. So, we'll go like that.

And of course the risk quantification and

integration, you know, if HRA is red, this is probably double red, something like that.

One area we disagree on is uncertainty analysis. Yeah, we know how to do Monte Carlo parametric uncertainty analysis. That's maybe not the real issue here. So, I would put it over in the red column.

CHAIRMAN STETKAR: I was going to say it's surprising that structural analysis is in the red column and uncertainty is in the green. That's surprising.

MR. STUTZKE: You know, the paper served its purpose and it was a fresh set of eyes on this.

Okay. Next slide. As part of Task 2 we've been looking at site information. It's not just me. There's several other people.

Although, personally I've probably read the FSAR by now. I've read most of it. I've read the PRA reports. I've started in on the procedures, but I have, you know, I have kind of an eclectic taste. I'm looking at the emergency guidelines and things like that. I'm not into the nuts and bolts procedures.

CHAIRMAN STETKAR: You've read the PRA report, Marty, you said?

MR. STUTZKE: Most of it with the notable exception of the HRA.

(Laughter.)

MR. STUTZKE: Yeah, so trying to get at it. Then I had people looking at what I'll call plant information, you know, FSARs, drawings and things to try to look for issues that would impact how we did the multi-unit risk.

Then I had another person look at the SPAR model, you know, for things that we would want to change. And when you slam them together, you get a good idea.

So, you know, what we're looking for is shared systems, systems that have cross-connects between the units, some sort of common locations, you know, like the control rooms, common-cause initiating events, we'll talk about those, CCF failures that need to be expanded, anything that credits cross-connect to the other units. So, recovery actions, things like that.

CHAIRMAN STETKAR: Marty, before - nice picture, but you're the only person that I think we've quizzed that has actually claimed to have some familiarity with what is there.

So, I'm going to ask you -

MR. STUTZKE: I will try.

CHAIRMAN STETKAR: You said you looked at the PRA report and you've done some looking at the SPAR model.

MR. STUTZKE: Yeah.

CHAIRMAN STETKAR: Are the results from the Vogtle PRA and the results from the SPAR model similar, different, much different, very similar?

MR. STUTZKE: Well, I think -

CHAIRMAN STETKAR: I mean, you know, in terms of kind of -

MR. STUTZKE: I saw a comparison today. The actual, you know, knock down, drag out comparison to the SPAR model with the Version 4.1 of the PRA. I just saw the graph today. Pete Appignani showed it to me like that where they do the cut-set level review.

And it's not too far out of whack. It's reasonably -

CHAIRMAN STETKAR: Oh, okay. That's good.

MR. STUTZKE: What concerns me is that I compared the PRA results that were stated in the SAMA analysis to Version 4.1 and there are notable changes in the risk profile.

Like, station blackout went from 54 percent, that's what they said in the SAMA, to 15

percent.

MEMBER BLEY: Did the frequency change, or is it just the percentage?

MR. STUTZKE: No, the frequency changed and the percents changed.

MEMBER BLEY: Oh, okay.

CHAIRMAN STETKAR: Something else would have had to have gone up.

MR. STUTZKE: You know, so there are issues like that where things have gone down - well, LOCAs went up. Medium LOCA contribution went - and the explanation is, well, we updated our initiating event frequencies per your document, NRC, and that's the answer.

So, you know, we need to look into it to make certain we understand it. But it's a concern to me because the SAMAs were done - I think the license renewal was granted in 2008. That's not that old. It's not that long ago to see such radical shifts in the risk profile.

Little bit odd, but we'll talk about that a little bit later.

CHAIRMAN STETKAR: I mean, it doesn't sound as bad as I was guessing that would be.

MR. STUTZKE: No, it's not all that bad.

So, this is a picture of the site that I took off of Google Earth to try to give you a little orientation.

MEMBER BLEY: I'm sorry, this -

CHAIRMAN STETKAR: No, don't, Dennis.

MEMBER BLEY: Okay.

(Laughter.)

MR. STUTZKE: Okay. The site sits on the southwest banks of the Savannah River. You see that forms the triangle in the upper right corner.

That triangle is actually the edge of the Savannah River site from DOE like that. The Vogtle 1 and 2 site is the rectangle in the middle left of the picture.

Off further to the left is the construction of Units 3 and 4. You can't see it on the graph like that.

Okay. So, the switchyard at the top. I look at the site. It's like a smiley face. You see the two containments pointed out there. Those are the eyes.

The mouth is the service water cooling towers, the four dots across the bottom there. The spent fuel pool -

CHAIRMAN STETKAR: Marty, it's time to

retire.

(Laughter.)

MR. STUTZKE: I asked my eight-year-old daughter to help me explain this to you guys.

(Laughter.)

MR. STUTZKE: So, one of the features is I'm pointing out cooling towers, because there's also a massive intake structure, but it's there for makeup purposes. It's not there -

MEMBER BLEY: But it's not trivial makeup. It's a fair amount of -

MR. STUTZKE: Not necessarily a trivial amount makeup, but it also points out you don't, you know, nuclear service water is not connected in odd ways like a lot of plants.

It's not a shared system or a system and a half. It's truly two independent systems with two cooling towers per system.

Okay. Sitting off in the lower right is Plant Wilson. It's a peaker unit. It's actually a diesel combustion turbine plant that can feed one unit at a time. There's an underground wire. You can probably see the transmission corridor going up into the switchyard like that.

The technical support facility is behind

the -

CHAIRMAN STETKAR: You said one unit at a time.

MR. STUTZKE: Just one at a time, yeah.

The training facility is down the road to the lower right, so like that. Okay. Some observations.

Systems that are normally modeled in PRA; service water, electric power, AC/DC, aren't shared between the units. In fact, in a lot of cases they're not even cross-connectable like that.

As John had pointed out or had observed, Plant Wilson can only supply one unit at a time. It's key interlocked. They're serious about it.

CHAIRMAN STETKAR: Marty, when you said they're not - I'm always intrigued by statements like in most cases they're not even cross-connectable.

MR. STUTZKE: Yeah, they don't exist.

CHAIRMAN STETKAR: No, that, I understand.

MR. STUTZKE: Okay.

CHAIRMAN STETKAR: But in most cases, that then implies that there are things that are cross-connectable.

When you think of the multi-unit aspects of things, for some fraction of time one unit is shut

down, the other one is operating at-power.

MR. STUTZKE: Right.

CHAIRMAN STETKAR: Do you have any inkling of whether they cross-connect things? I'm familiar with some multi-unit sites that do indeed cross-connect, you know, they put in piping sections and things and cross-connect service water, for example, because they do -

MR. STUTZKE: I have not found any indication of that.

CHAIRMAN STETKAR: Okay.

MR. STUTZKE: No spool pieces, you know, none of that, that sort of thing.

CHAIRMAN STETKAR: That's good.

MR. STUTZKE: Up in the switchyard, you know, it's odd. The Unit 1 has a breaker and a half scheme, and the Unit 2 is a ring bus and they're driven through two auto transformers.

CHAIRMAN STETKAR: Oh.

MR. STUTZKE: That's the cross-connect. And all of the transmission lines go into the breaker and a half scheme.

So, I figure it's, yeah, if I understand that right, I figure, well, maybe they built one unit at a time and then they had to augment or expand the

switchyard.

CHAIRMAN STETKAR: Sounds like, doesn't it?

MR. STUTZKE: Yeah, it's strange.

CHAIRMAN STETKAR: Where does Plant Wilson tie in? The breaker and a half?

MR. STUTZKE: Yeah.

CHAIRMAN STETKAR: Oh.

MR. STUTZKE: It's like this is a little unusual.

Okay. There are some common locations where floods and fires could propagate, you know, through the aux building, the main control room and things like that.

We identified some candidate multi-unit initiating events, the loss of grid, the consequential LOOP, we'll talk about that, and of course the internal and external hazards; fires, floods, seismic, this sort of thing.

Trying to think about how to delineate this thing to multi-unit sequences. So, I thought I'd start out with a mission statement.

We're trying to develop and quantify accident sequences that involve combinations of radiological sources. So, we could have one or two reactors, two reactors and a spent fuel pool, a

reactor, a spent fuel pool, a dry cask, all of these permutations like that.

As I had opened up with, we need to demonstrate completeness here. It would be so tempting to cherry pick it and say, well, multi-unit station blackout, that's what you get, you guys, but I'm resisting that.

There is this - the idea that because we're doing shutdown and low-power, we have to account for all of the plant operating states.

So, the question is if you have some event in a shutdown plant, can it affect or trip the other operating unit off the line?

CHAIRMAN STETKAR: Running a crane into something in the switchyard, for example.

MR. STUTZKE: Exactly, or vice-versa. If something happens at the operating unit, will it affect the shutdown unit like that? Or if something originates in the spent fuel pool, how does it affect both reactors? So, that large number of combinations is something that I'm wrestling with here.

Cross-system dependencies, you know, shared systems, well, there doesn't seem to be that many other than the yard. We'll keep looking like that.

Obviously, we need to expand the common-cause groups sizes, but that's trivial. The big issue here is the operator actions like this.

Then of course once we construct this integrated risk model, we have to be able to solve it. It would not be - let's say I have past experiences with building logic models so large they cannot be quantified. And I'm concerned about that.

And of course, you know, the constant task leaders lament to the project manager, I need more time, I need more money, these sorts of things like that.

So, one way to delineate multi-unit sequence types - flip to the next slide, Alan. 60. And, first of all, I'm beginning to think this needs to get changed from multi-unit to multi-source. Because whenever I talk about units, everybody fixates on the reactors and they go, what about the spent fuel pool?

In fact, I'm having to invent a multi in our integrated risk vocabulary so we can even discuss the problem intelligently.

MEMBER BLEY: Your last statement stepping back for a second, but you're envisioning the actual complete models for two units and -

MR. STUTZKE: Some spent fuel stuff.

MEMBER BLEY: All being coupled together into one large -

MR. STUTZKE: All one happy SAPHIRE project.

MEMBER BLEY: Hokey smokes.

MR. STUTZKE: Think big.

MEMBER BLEY: And be able to unravel if that doesn't work, perhaps.

(Discussion off the record.)

MR. STUTZKE: Well, that's - yeah, Susan points it out. It's one thing to put it all in there, you know. And that's limited by disk size. Then, there is a quantification aspect to how fast can you solve it.

And, you know, the current model, they've imported it over. It runs pretty darn fast now like this.

MEMBER BLEY: But you're going to be coupling up with AND gates and stuff near the top that's going to blow this sucker -

MR. STUTZKE: Maybe yeah, maybe no, but quantification speed is there. The issue is then I get a cut-set that is, you know, an initiating event, maybe six human failure events and a bunch of other

stuff that I have to be able to unravel. And that could take a long time.

CHAIRMAN STETKAR: And that's got fires and floods, internal -

MR. STUTZKE: Potentially, yeah.

CHAIRMAN STETKAR: - fires and floods for both -

MR. STUTZKE: Potentially, yeah. We'll talk about it. Let me try to -

MS. COOPER: Throw in lions and tigers and bears.

MR. STUTZKE: Let me sort this out by sequence types, because this is ways of trying to demonstrate completeness. And I did learn some things here.

One is we have what I'll call common-cause initiators. That's like a big seismic event that shakes everything at one time, or river flood although the river is - the maximum flood stage of the river is 50 feet below the yard grid, something like that.

Type 2 is what I'll label as a consequential initiator. I'm looking for a direct cause and effect. One unit gets in trouble and it automatically trips the second unit. And the one that comes to mind here at Vogtle is consequential LOOP,

okay?

If there were shared support systems, service water, you know, things like this, I'd be very interested in that, but that doesn't seem to be the case.

Fires and floods that get from one unit into the other unit like that, example of these types of events.

The third type is manual shutdown. It may be decided to shut down the second unit just because the first unit is in trouble. And, yeah, I've done some work on that.

The question is, when will they decide to shut the second unit down? Would it be upon core damage in the first unit, release from the first unit?

Because as you had mentioned to Keith before, now there's a time spacing that's greatly involved, you know. You spaced out the releases, you know. We need to understand that.

So, the stuff that I've done in the last few days is I've actually looked at the Vogtle - or procedure for emergency classification determination initial action. So, this is the one that says, here are the EALs. And when you exceed this one, go do this.

And it's very interesting. It comes down into the second checklist which has a page of additional actions. And it says, when you've done all of these things before, which is notify the NRC and the Governor and these things, it says determine what should be done with the unit that's not affected by the declared emergency. Consider the effect on the emergency unit, the manpower utilization, the grid stability and other relevant factors.

Okay. So, the other piece of the puzzle - well, another piece of the puzzle is we have the emergency management guidelines of which Appendix A is the EDMGs.

Okay. And the EDMGs come into play when the normal command or control function from the control room is not available like this. And it says, if reactor shutdown is not confirmed, then trip the reactors. So, I know if I'm in EDMG space, the reactors will be tripped.

And it's not just, I mean, when you read the procedure, remember these are for non-licensed operators. It not just says, trip the reactors. It says, go to the control room and push this button that's painted, you know, red. And if that doesn't work, go down to this circuit breaker panel and open

these breakers.

MEMBER BLEY: Tell me again where this - where you find that.

MR. STUTZKE: That's in the EDMGs.

MEMBER BLEY: And they're, you said -

MR. STUTZKE: Okay. They're part of the EMGs. And the Vogtle procedure number is MMP-EP-404. So, yeah, I was kind of surprised by how detailed it got.

Now, another piece of this puzzle is what would the NRC do? And the Chairman has the authority during an emergency, to direct the reactor to be shut down like that. That's clear.

It comes from the Presidential Reorganization Plan Number 1 of 1980. And it's implemented in our Management Directive 8.2, and our Incident Response Plan NUREG-0728.

And that could in fact be delegated to another commissioner or actually to the staff. So, perhaps the EDO like that.

So, if things were going bad real fast, we could actually tell the licensee, shut the plant down if we determined. And the question is, when would we do that?

Okay. So, you want to talk about safety

culture. Now, you've enveloped not only the utility safety culture, but the NRC's as well.

MEMBER BLEY: And at least there it warns you about all the things that - reasons you might not want to shut it down.

MR. STUTZKE: Yeah, exactly.

So, another clue here is I looked up the conditional core damage probability for reactor trip that the licensee calculated. It's ten to the minus seven. It's down in the noise.

Now, I don't know whether I believe that. I mean -

CHAIRMAN STETKAR: It's a number.

MR. STUTZKE: It's a number. But, you know, you got to figure it's going to be reasonably reliable, you know. And then that's what our tech specs tell us to do.

If you're in trouble, shut the plant down because you think it's safer to undergo that transition than it is to leave it operating.

So, that's - I guess that's where I am. I guess the other thing to talk about this manual shutdown is eventually, you know, the second unit could get in tech spec trouble and be required to shut down and things like that.

Last, but not least, are so-called coincidental initiators that are unrelated, but they happen within the PRA mission time.

So, that's like, oh, we had a station blackout and a day later we had a LOCA while we were still mitigating the station blackout like that.

Actually did some calculations from the PRA assuming a 48-hour mission time in the PRA, and the contribution from coincidental initiators is around ten to the minus seven.

Now, there are a lot of them that are down in the dirt, you know, when you look at certain combinations. But when you sum them all up, you get a number that can't be ignored like this.

So, I'm going through this sort of thing to say, well, if I don't have to form an AND gate of all the sequences, maybe I only need a few, and which few should those be?

That's leading into this next slide. 61.

MEMBER BLEY: Well, just that thing you did brings up a point that we've talked about several times.

If we've really gotten improved the risk at these units to the point that the numbers are very low, what other things that we screened out long ago

do we need to consider again?

I mean, we screened out -

MR. STUTZKE: Exactly.

MEMBER BLEY: - individual piping ruptures here and there around the plant, because many other things are much more important.

MR. STUTZKE: Right.

MEMBER BLEY: And I don't even have that list anymore. I mean, that's a big list.

MR. STUTZKE: I guess two things on that is when you look at the results for the Part 52 PRAs, the plants under there, they are phenomenally low in certain areas.

MEMBER BLEY: Yes.

MR. STUTZKE: But there's reasons for that. You guys are probably more familiar with this anyway like that.

But the other thing I'd point out is that the SPAR model, the Rev 4.1 model, the SAMA model, you know, the internal event CDF wants to be between one and two times ten to the minus five per reactor year.

From Generic Issue 199, the seismic CDF wants to be about ten to the minus five per year. From their internal fire - not the PRA they're doing now, but the earlier EPRI 5, ten to the minus five.

Okay. So, they're not down - they're not crazy out of alignment. It's the risk profile that has confused me a little bit like that.

Okay. So, as far as the multi-unit sequence development goes, you know, the idea is in theory you can just end sequences together and let it rip.

That's a very, very large number of sequences. If I had a hundred interesting single-unit sequences, that's 10,000 multi-unit sequences. And I don't think I'd ever, you know, that's not going to work like that.

So, I'm looking at screening approaches. Qualitatively there are some combinations of plant operating states that may not be possible. There are some sequences that can't propagate into the other necessarily like this. I mean, physically not possible. I'm looking at quantitative screening.

So, that's how I actually got into manipulating their PRA results. For example, for the coincidental initiators I can drive at least two-thirds of them below the truncation frequency used in the single PRA.

So, we're not talking about, oh, you know, multi-unit risk is only one percent. I'm talking

about driving it below the truncation frequency. So, I'll get even more benefit if we can argue that we only need to address one percent or a 0.1 percent, something like that.

And, again, the idea here is one, big integrated logic model sucks it all in together like that and we'll see what we get.

I will probably start with the SPAR models and put together the internal events just to see if I can do it.

CHAIRMAN STETKAR: See if you can do it. That's probably a good thing to do.

MR. STUTZKE: That's kind of my between Christmas and New Year's therapy project.

(Laughter.)

MR. STUTZKE: See if I can get it to work.

MEMBER BLEY: You might need some other kind of therapy.

MR. STUTZKE: You know -

CHAIRMAN STETKAR: You're a really sick person.

MR. STUTZKE: You got to understand, I mean, in the senior level advisor position, they don't let me do a lot of real PRA work. Sometimes, you know, just sitting down with some fault trees and some

cut-sets, you know, it will be good. It will be okay.

Okay. Moving on quickly to integrated risk metrics, again, you know, the idea here when we started the whole idea of the project, I had this call-me-foolish-notion that I would just turn on everything that MACCS2 was capable of calculating and let it rip. Okay. Calculate everything.

And, you know, the problem with that is when you look at the large number of sequences and things like that, maybe that's not such a good idea like that.

At the same time, we don't want to whittle the list down so tight that it's not useful in the future, you know. Ten years from now it's like, God, why didn't Marty calculate thus and so, you know. It would have been easy.

So, that's the sort of balance I'm looking for. So, I have thrown out this strawman of risk metrics. You're welcome to throw tomatoes. Certainly other people on the team are, but there are reasons why I put these on.

The first five metrics here are reported in NUREG-1150. So, they're rather traditional like this.

The third and fourth, these individual

early fatality risks, individual latent cancer fatality risk are the quantitative health objectives like this.

We use population dose risk and economic cost risk, offsite economic cost risk in regulatory analysis, backfit analysis like that.

It's been suggested we ought to look at individual early injury risk and cancer incident risk, because it's not been done before. It would be interesting.

And last, but not least, is some measure of land contamination.

CHAIRMAN STETKAR: But, you know, in some sense, Marty, the bottom three there and even the offsite economic cost risk, I'd say economic cost risk within the context of state of the practice pushing the MACCS2 button recognizing, you know, where we are in that whole arena -

MR. STUTZKE: Exactly.

CHAIRMAN STETKAR: - is probably okay. The bottom three start to sound like pushing MACCS beyond -

MR. STUTZKE: Yeah, MACCS will actually do the land contamination.

MEMBER BLEY: Well, that's the thing I'm

wondering. People haven't used those in a long time.

MR. STUTZKE: People at the -

MEMBER BLEY: What's the state of the art of what's in there?

MR. STUTZKE: People at the NRC haven't used them.

MEMBER BLEY: Yeah.

MR. STUTZKE: But DOE uses them.

MEMBER BLEY: Oh, are they? Okay.

MR. STUTZKE: Yeah, it works.

MEMBER BLEY: Okay.

MR. STUTZKE: The issue for land contamination is, you know, what - it will do it for any radionuclide you want or even gross activity on the ground.

So, it's like, in other words, it will calculate things like the number of square kilometers that are contaminated above 15 microcuries per square meter of cesium-137.

And you go, why 15 microcuries? Why not 45? Okay. Why cesium? Why not strontium? Okay. So, we've got to reach -

MEMBER BLEY: Now, you have this big list. Instead of telling you to throw some away, I'm going to ask you another question.

MR. STUTZKE: Sure.

MEMBER BLEY: Many years ago when we first started doing these kind of calculations and I suspect the code still has to do this internally, we used to calculate dose - isodose.

Is that an output, or is that something -

MR. STUTZKE: Yeah, I've got to check on that one.

MEMBER BLEY: - that would have to get, I mean, that comes up occasionally as something pretty interesting as to see where those things lie.

MR. STUTZKE: Agree. Everybody likes to look at those things like that.

MEMBER BLEY: Yeah.

MR. STUTZKE: To be honest, I don't know whether the code will do it. I haven't seen it.

MEMBER BLEY: Some of the older codes did, but I -

MR. STUTZKE: Yeah.

MEMBER BLEY: It must be doing it internally to get the integrated effects of that.

MR. STUTZKE: Yeah.

MEMBER BLEY: But it might be a major deal to see it.

MR. STUTZKE: Then of course at the bottom

of the list, the old standby risk surrogates of CDF, large release frequency and large early release frequency, even these aren't easy to understand, you know.

What is the analogy to multi-unit core damage frequency?

MEMBER BLEY: Yeah, and this -

MR. STUTZKE: I can explain that in terms of PSAM model and the risk analysts would understand it, but I'm looking for something that communicates or -

MEMBER BLEY: LRF is the same calculation that was done in 1150. It's not what most people think of as large -

MR. STUTZKE: Exactly.

MEMBER BLEY: - release frequency and gets very confusing to explain.

MR. STUTZKE: Exactly, yeah.

MEMBER BLEY: So, I would - if that's what this is, that same thing, it's a very misleading measure and I would strike that from the -

CHAIRMAN STETKAR: See, I don't even know - this includes fuel pools. What's core damage frequency for a fuel pool -

MR. STUTZKE: I don't know.

CHAIRMAN STETKAR: - in that context?

MR. STUTZKE: Is it accident frequency, and what do you mean by accident? Because that's not necessarily release frequency.

CHAIRMAN STETKAR: It doesn't mean anything until you've combined that into a release - into a source term.

MR. STUTZKE: Exactly.

MEMBER BLEY: You don't have a Level 1 part of that.

MR. STUTZKE: And the concern is that if I could create such a method, you know, such a metric like that, then inevitably people want to compare one to the other.

MEMBER BLEY: Oh, yeah.

MR. STUTZKE: And they will misconstrue it, you know.

MEMBER BLEY: Yeah.

MR. STUTZKE: So, I tend to think focus on the top ones. At the same time, we need the measures of core damage frequency to see that we're getting reasonable results.

MEMBER BLEY: That's right.

MR. STUTZKE: You know, one of the things we could do in the future is, you know, LERF and CDF

goals are calibrated to the safety goals, you know, to minus four, minus five and we could examine that.

I'm not saying we'll do it in the project, but I want to get enough machinery in order to examine those sorts of calibrations.

MS. DROUIN: And I think this is going to be closely tied to, you know, what are the risk insights that we really want to derive from this project?

And so, therefore, what are the risk metrics? But, you know, we need to have some good dialog on what are the insights, you know, what are the uses of this analysis?

Because otherwise, you know, just to generate risk metrics and have numbers that people can just run away with can be very dangerous.

MR. STUTZKE: Yeah.

CHAIRMAN STETKAR: Well, I think, yeah, and Marty's concerns about people misconstruing at least the bottom three are really valid.

I think the top set you can probably explain what they mean, because they have some, you know, something that you can identify and trace back to how you derive them.

But the bottom three are just -

MR. STUTZKE: Yeah, I agree.

CHAIRMAN STETKAR: - in the context of this study, are a little difficult to -

MR. STUTZKE: Yeah, I have concerns.

MEMBER SCHULTZ: But it depends how they're presented, because you have core damage frequency. That shouldn't apply to spent fuel pool.

MR. STUTZKE: NO, I know.

MEMBER SCHULTZ: And likewise for the other elements. But you do have to determine how it's going to be presented if -

MR. STUTZKE: Well, you can invent something for the spent fuel pool like fuel damage frequency and say that's the frequency of which the clad, the first barrier goes, but even that is misleading.

CHAIRMAN STETKAR: Having done that and having tried to explain it to people, I wouldn't even try that.

MEMBER BLEY: And trying to actually -

MR. STUTZKE: Take that one off -

MEMBER BLEY: - make sure every scenario that goes to core damage meets that definition gets really -

CHAIRMAN STETKAR: Right. Yeah, I mean,

it's - yeah.

MR. STUTZKE: But I don't want to -

CHAIRMAN STETKAR: I think the way to present those is to draw a big black bar across the bottom of that slide.

MR. STUTZKE: Okay. So, wrapping up here, you know, this list of modeling issues tends to be the focus right now and the development of the screening technique, the delineation technique for multi-source, working on this vocabulary that I think we need to get done.

Last, but not least, is managing everybody's expectations, you know. It's a matter of every time we discuss the projects like, well, you know, they'll do that when they treat the multi-unit effects.

MEMBER BLEY: Well, I feel better although there wasn't a Section 17, seeing what you're saying. But getting in and doing the things you're doing I really like, because you may need an exit strategy that doesn't do what you plan.

And then you'll have time to do that if you do some exercises and -

MR. STUTZKE: Yeah, I'm not going to wait for these guys. I'm going to experiment with what

I've got, see if it makes any sense, you know. If I can't understand it, explain it to myself, you know, then we're in trouble. Do something else.

MR. KURITZKY: That's why the yellow bar in that schedule chart doesn't start in the middle of 2014. This is an issue that Marty has to look at from Day 1.

MEMBER SCHULTZ: And we have a diamond on that chart that is immovable.

MEMBER BLEY: I'm saving that page.

(Laughter.)

MR. KURITZKY: So, any further questions?

(No response.)

CHAIRMAN STETKAR: In terms of time management for this particular meeting, we certainly want to hear about the uncertainty analysis.

Unless there is extreme interest among the Subcommittee members, perhaps we might skip a little bit or certainly breeze through a lot of the quality assurance and self-assessment things which - I know it's a big part of your plan, but there's several slides.

MS. DROUIN: And the uncertainty analysis isn't going to take a whole lot of time either.

CHAIRMAN STETKAR: It might.

(Laughter.)

CHAIRMAN STETKAR: But I do think we want to spend a little bit of time talking to you in a little more detail about the plan and the schedule and things like - and planning future get-togethers among us.

We do need to end, you know, in an hour or so.

MR. KURITZKY: Right. And I was going to mention, Mr. Stetkar, that we do - that last slide on the whole package talks about future get-togethers. And we are planning to come back again for the other parts of the - anyway, so we can just do the QA and -

CHAIRMAN STETKAR: Yeah, I just wanted to make sure that we left enough time, you know, in the next hour to discuss those things.

MR. KURITZKY: Right. So, we can move QA to the next meeting.

MS. DROUIN: You know, I don't think the QA will take that much time.

CHAIRMAN STETKAR: Okay. Well, just -

MS. DROUIN: I can breeze through it real fast, because I just don't think that there's going to be a lot of - this is what it is.

But on the uncertainty analysis, I really

don't have a lot here in the presentation to give you, you know. I don't think I need to educate you on what is a parameter uncertainty versus the model uncertainty.

When it comes to completeness, scope is not an issue, because the scope is defined for this project and it's everything. But completeness does come into in terms of the level of detail.

And so, in terms of where we're going to be doing screening, that will get into a completeness aspect of uncertainty and will need to be factored in.

If we go to the next slide, I can just tell you across the board, you know, we're going to be doing parameter uncertainty.

There are a lot of questions that we're going to have to look into and answer that we don't have answers right now today.

Are we just going to calculate, for example, a mean value across the entire study? Do we show distributions? What would be the nature of these distributions? What parameters are we going to propagate?

I mean, I think we have very good answers for that on the Level 1 part, you know, because we're rather mature there.

But when it comes to the Level 2 and the Level 3, the dry cask, you know, what those parameters are that we're going to carry through, how we're going to do our state of knowledge correlation, all of this kind of stuff, you know, we're just right now starting to look at and we're going to have to get a handle on.

And it all comes down to, also, you know, what are the ultimate results that, you know, we want to be calculating?

And so, depending on those results, you know, where are we going to be doing some of these uncertainties?

CHAIRMAN STETKAR: Mary, in the sense I hadn't thought about this before, but Marty's model to end all models when you start thinking about that, I don't know how SAPHIRE handles the thing I hate to call state of knowledge correlation, but do you just define a parameter and link basic events to that parameter?

MR. STUTZKE: Yeah.

MS. DROUIN: Yes.

CHAIRMAN STETKAR: Okay, that's good. Because then you have a common - well, I was thinking these two different - these Unit 1 and Unit 2 models will definitely have different basic event names. But

as long as they're all linked to the same parameter, you can handle that.

MS. DROUIN: So, on a simple level, we certainly are going to be calculating at a minimum and mean value and propagating the uncertainty. But in the details of how we go about doing it and what we do it on is to be determined.

On the next only slide I have on uncertainty -

CHAIRMAN STETKAR: By the way, Mary, some of the stuff that I read - and, again, I've only been able to read the words that have been cast by all of the individuals who have written the little pieces that go to this puzzle.

In some cases, they're presented in terms of uncertainty analysis, they're presented as, well, we'll develop a mean value and then we'll assess uncertainties.

Kind of traditional we'll come up with a number, and then later we'll go backfit an uncertainty.

I'm hoping that the project is not oriented that way. That the mean value for any parameter whether it's a pump failure rate or an initiating event frequency or human error probability,

is indeed the result of an uncertainty distribution.

MS. DROUIN: Right.

CHAIRMAN STETKAR: Okay.

MS. DROUIN: Yes.

MR. KURITZKY: All data is going to be input as distributions. All basic event data whatever posts in the model, will go in as distributions.

CHAIRMAN STETKAR: Human error probabilities included.

MS. DROUIN: Yes.

MR. KURITZKY: What's that?

MS. DROUIN: Yes.

CHAIRMAN STETKAR: Human error probabilities included.

MS. DROUIN: Yes.

MR. KURITZKY: Everything should have a distribution -

MS. DROUIN: Everything would have a distribution.

CHAIRMAN STETKAR: Good. Good. Because as I said, some of the pieces sounded like the old traditional - well, it sounds like it.

MEMBER SHACK: They said that's what we were going to do.

CHAIRMAN STETKAR: Yeah, well, I was trying

to be polite.

(Laughter.)

MS. DROUIN: I'm one of those ones I have not had a chance to go back and read through what everybody has written yet.

CHAIRMAN STETKAR: I mean, that ought not to happen, you know, back to the -

MS. DROUIN: No, it will follow, you know, what we have said in 1855.

CHAIRMAN STETKAR: Well, 1855 doesn't get to that level of detail, does it?

MS. DROUIN: Yeah. In Appendix 6-A, it does.

CHAIRMAN STETKAR: Okay.

MS. DROUIN: It does.

CHAIRMAN STETKAR: Oh, 6-A. You're right.

MS. DROUIN: On the model uncertainty, you know, we're going to have to identify and characterize, you know, all the sources and perform screening analyses - sorry - perform sensitivity analyses.

Now, to what extent we carry out these sensitivity analyses, a lot of discussion is going to go in there. I mean, let's just say we start with Level 1 and we do sensitivity analysis on some of the

uncertainties in Level 1.

Do we propagate that sensitivity all the way through to Level 3 to see what impact something in Level 1 has on the overall risk? The same thing when you look at Level 2 and Level 3.

So, all of this, you know, it's, I mean, it's like a domino effect and it could become very quickly unwieldy with the amount of uncertainty analysis we would end up having to do.

So, we're going to have to be very smart in trying to figure out, you know, where we're going to be doing sensitivity analyses and how we're going to go about doing that.

CHAIRMAN STETKAR: Mary, that's one of the reasons I asked earlier that I'm sensing a very strong pushback against this notion of explicitly assigning levels of confidence to different models or different sensitivity cases, if you will.

All right. Let me accept that for the moment, but a similar type of process could be used to at least organize the types of sensitivities that you might want to propagate through in the sense that you're talking about.

If I have high confidence that my sensitivity, you know, I can run a bunch of

sensitivity cases, but they're just - they're just point numbers. They could range over a factor of 10,000 in principle.

But if I have high confidence that the variability for a particular issue is pretty small, that's probably not something that I'd be very interested in running all the way through the model.

But if I had a 50/50 - 50 percent confidence that it's one or 10,000, that might be something that I'd want to propagate through even if I only do it in that context.

MS. DROUIN: I think we're going to have to come up with some kind of scheme like that. I think all we were pushing back on is that we were not proposing to do the detailed, formal modeling uncertainty analysis that was done in 1150.

CHAIRMAN STETKAR: Well -

MS. DROUIN: I mean, that was millions and millions and millions of dollars and that took a couple of years to do.

So, you know, I think that's all we were pushing back on is that we're not proposing to do what was done in 1150.

MEMBER SHACK: Or at least you could do the sensitivity analyses to find out which models might be

worth looking at in a little harder fashion.

MS. DROUIN: Right. So, how we pick and what is the level of the sensitivity analysis, we're going to have to come up with some kind of scheme. And we have not developed that scheme yet at this point in time.

CHAIRMAN STETKAR: Do you have any sense of whether Vogtle did any of that at least within context of what they've done?

MS. DROUIN: I would be very surprised, because the standard doesn't require them to do anything like that.

CHAIRMAN STETKAR: It's worth asking.

MS. DROUIN: We will, but I would just be very surprised.

MEMBER SCHULTZ: But they still may have some views and opinions.

MS. DROUIN: Yes, they may well.

MEMBER SCHULTZ: With regard to what would influence.

MS. DROUIN: Yes. And so, we will pursue that with them, but that's all I had to say on uncertainties.

I mean, I expect we'll come back to you more when we're further along on this task. But, you

know, we at least wanted to at this point give you, you know, let you know that we've started thinking in this area.

Okay. On quality assurance, I'll just keep it to these first two slides - first couple of slices, because others are in detail that you can look into. And I think what's, you know, more interesting is just, you know, what do we mean here on the quality assurance.

And, you know, it's to ensure that, you know, we have both an acceptable technical approach. But just because you have an acceptable technical approach doesn't mean that, you know, you have a technically acceptable PRA, because you want to make sure that it was implemented in an acceptable manner.

So, we are using the current term QA, which probably isn't the best term for ensuring that at the end of the day, you know, we have high confidence in the PRA model that's been produced.

So, next slide. And the way we have done that is through the use of established methods, tools and data. Established methods that are, you know, like defined in standards that are solid industry practice that have been, you know, shown to be good.

Qualified personnel. Normally, personnel

who do the PRA usually don't have requirements on them.

We certainly haven't put requirements, but we certainly have matched up our staff experts to the different areas that they're doing.

The key on the qualified personnel comes into the independent peer reviewer. Because at that point, we are absolutely relying on their judgment, on their expertise that something that has been done is correct. So, we are writing up requirements on that.

And we're not reinventing anything here. We're going back to 1.200 into the standard that defines requirements for qualified personnel.

The next thing in quality assurance is the PRA model fidelity. You want to make sure that what we have, you know, actually represents at the end of the day the plant that's being modeled.

And this is such a huge project with so many different people involved working on, you know, the same thing. It could very easily, you know, get out of whack where you've got one person - different people working on the same thing, but not on the same thing.

So, how we ensure that fidelity is key to ensuring the technical acceptability of it.

CHAIRMAN STETKAR: Mary, before you get to the review, because I think we'll have some discussion about that, in that sense, again, from what I can read in the document, there are discussions of the Level 1 internal event model. Then, there's the discussion of the Level 1 internal flooding model, and the Level 1 internal fire model, and the Level 1 seismic model and the Level 1 other hazards models.

Are those - is the concept that they will be distinct models? In other words, I'll have a fire model and I'll have a model that's got, like, LOCAs and losses of power and all of those kind of things, and I'll have a flooding model and a seismic model, or is it a single model that has a large number of basic events and house events in it?

MR. KURITZKY: Well, not just, I mean, like a traditional PRA looks at external events. I mean, we have - you have different event trees for the different issues.

You might have 15 event trees for your internal events. And you may have 36 event trees for your fire. Nowadays could be -

CHAIRMAN STETKAR: Or you might have one event tree with a bunch of house events and basic events.

(Speaking over each other.)

MS. DROUIN: We have not made the decision whether or not at the end of the day - the only decision we've made is that we start with a Level 1 model.

Okay. Now, we are going to revise it. Now, whether we keep a Level 1 model clean and we have a second Level 1 model that we revise it to do internal floods so then we have an internal flood separate model, those decisions, you know -

CHAIRMAN STETKAR: Okay. The reason I ask -

MS. DROUIN: - we have not worked out.

CHAIRMAN STETKAR: Under this Number 3 I have seen, we probably all have seen the fact that you develop this wonderful Level 1 internal events model that everybody is really happy with it. And you turn it over to your fire people. And the fire people go and say, oh, gee, I got to change this a little bit, because the fire doesn't just kind of work this way.

And now, indeed, you don't have the same model. You have two different models such that if you ran the internal events through your fire model, you'd come up with a different set of results.

And that's why I ask this question under

the model fidelity that if it's a clone of an event tree, a precise clone that's never changed, that's one thing.

If it's two separate models, ensuring that fidelity among all of the different - all of the different hazards that you'll be -

MS. DROUIN: I mean, and the decision we're going to have to make is, is it worthwhile to create and keep separate hazard models? You know, is there a benefit to having an internal events model in and of itself? Is it a benefit to having, you know, a fire PRA model in and of itself?

That decision, you know, we haven't even thought about.

CHAIRMAN STETKAR: I'll bring it back to something that I did read. It says, gee, when we build the seismic model, we'll need to add things that aren't normally in the internal events model like seismic failures of piping and seismic failures of structures, correct, and we'll also remove stuff that isn't necessary.

And that starts to bother me, because I'm not sure how you determine what stuff isn't necessary like spurious closures of valves? I don't know. Why isn't, you know.

As soon as you start taking things out, you've now changed the scope of that model. If you ran the internal events through that model and set all the seismic failures to guaranteed success, you'd come up with different results.

So, there's that notion that you're actually developing models that are different.

MS. DROUIN: Yes.

MEMBER SCHULTZ: Well, the likelihood is that that same thing has happened in the fire model development.

CHAIRMAN STETKAR: That's - the likelihood is very high.

MEMBER SCHULTZ: So, what you described you haven't -

CHAIRMAN STETKAR: I was going to say I'd bet my right arm on that one.

MEMBER SCHULTZ: - yet determined is very important. Very important to define how it's going to be -

MS. DROUIN: Yes, it's very important. And I don't think that the standard helps in that regard.

MEMBER SCHULTZ: No.

MS. DROUIN: Because the standard really tells you that at the end of the day you're getting

rid of your Level 1 model, because you can change things in it. So, your internal events, you can change things in it, you know, like for fire.

Well, now, but what happens about internal events? And so, it really doesn't do, in my opinion, a good job on that interface of, you know, now doing an integrated -

CHAIRMAN STETKAR: That's because the standard is written through those vertical slices.

MS. DROUIN: That's right.

CHAIRMAN STETKAR: Level 1 internal, Level 1 fires -

MS. DROUIN: So, you know, we're going to have to figure that out.

MEMBER BLEY: But your point if you have the fire model or a seismic model, you can still have failures of -

CHAIRMAN STETKAR: Sure.

MEMBER BLEY: - the other things -

CHAIRMAN STETKAR: That's right.

MEMBER BLEY: - that are in your internal events model not associated with the earthquake or the fire.

CHAIRMAN STETKAR: It becomes even more difficult when you start to build Marty's to be all

end all linked whole thing, because he's going to be linking a Level 1 model with something or other, you know, among units.

See, what you were saying if you could pull it off, you would almost need in your sense, a single event tree with a lot of house events and basic events under that event tree.

MEMBER BLEY: Yeah, because I -

CHAIRMAN STETKAR: Because otherwise I don't know how to combine my Unit 1, Level 1 internal event model with my Unit 2 internal flooding model that doesn't have the same scope of equipment in it.

MEMBER BLEY: True.

MR. STUTZKE: Yeah. I mean, I could have a Unit 1 fire sequence that goes to core damage, a manual shutdown on the second unit that goes back, and I need to be able to link those.

CHAIRMAN STETKAR: So, this model fidelity could be -

MS. DROUIN: It's a key on there.

CHAIRMAN STETKAR: - a dangerous pitfall.

MS. DROUIN: And that's one of the reasons that I put it in there as its own line item, because I think it deserves it.

If we skip to Slide 72, I'll wrap this up.

MR. KURITZKY: Yeah, that's what I was going to say is do 72.

MS. DROUIN: In terms of the technical reviews, there are four technical reviews. We have the Technical Advisory Group which is led by Nathan Siu. And they will, you know, they're going to be critiquing and giving us guidance -

(Laughter.)

(Discussion off the record.)

MS. DROUIN: - as we move forward. And they're comprised of senior PRA people, but also senior people in particular area of expertise that we need.

So, it's a combination of PRA and maybe, you know, somebody who is an expert in structural analysis.

We will also be doing self-assessments. So, every technical leader will be doing a self-assessment of the work that he's done. And that's going to be done against primarily the standard, you know, as part of our own internal QA.

And that's also the first step that needs to be done as part of an independent peer review. The independent peer review asks the licensee to do a self-assessment in preparation for their independent

peer review.

MEMBER BLEY: Tell me you have an operator on the Technical Advisory Group and the independent peer review groups.

MR. KURITZKY: Independent peer review groups haven't been established yet. And we take that into advisement.

The Technical Advisory Group does not have an operator.

MEMBER BLEY: Would be if I were picking them.

MR. KURITZKY: It was primarily the senior level advisors in the different offices. To my knowledge, I don't know if we have a senior level advisor as an operator, but that doesn't mean that we can't put someone on, but that was the focal point of the Technical Advisory Group when it was established.

MEMBER BLEY: It's a different point of view.

MR. KURITZKY: Right.

MEMBER BLEY: It's really important. And the nearest - PRA is the nearest thing to operate. I mean, it's really looking at the plant the way it works in an integrated fashion. And those are folks who always think about the plant in that manner. They

see some things you don't see from the others.

MEMBER SCHULTZ: The operator's perspective is really critical. To do it all or try to do it all from the designer perspective just -

MEMBER BLEY: And you've got some people on staff who were not only operators, but very experienced trainers as well. And that's a viewpoint that's very valuable to you.

MR. KURITZKY: Okay. Thank you for that feedback.

MS. DROUIN: The independent peer review, I mean, we're hoping that industry is going to volunteer. Will hopefully volunteer. And, you know, they have been interested in doing - and the peer reviews on some of our stuff in the past -

(Speaking over each other.)

MS. DROUIN: So, we're hoping that, you know, the problem is - here is that when we get into the dry cask and the spent fuel and the integrated risk, there's no standard against which you're doing the peer review in terms of the criteria against which you're making your judgment, you know, even though that standard doesn't exist.

The standards on Level 2 and Level 3, you know, are in good enough shape, you know, that they

can be, you know, used in low-power/shutdown.

So, it's finding, you know, the expertise in what do we use as our criteria. We're going back to really strictly relying on their complete subjective judgment.

And then last we have, you know, the most important, the Advisory Committee on Reactor Safeguards that, you know, we get wonderful advice and input from.

CHAIRMAN STETKAR: And we're not going to find the factor of 12 difference in your results.

(Laughter.)

MS. DROUIN: Now, the other thing I would just add is that, you know, with the Technical Advisory Group, the self-assessment, independent peer review, we're not waiting to the end of the project to do this, you know.

There's going to be key milestones along which, you know, we will have these things occur, you know. We don't have the time to wait until the end of the project and find something while even though it might be a little thing, it still needs to be fixed and it has a huge ripple effect.

So, you know, we are going to be scheduling these throughout so we can get realtime

feedback as we move along.

MEMBER SCHULTZ: And you also have - I guess it would be called a collateral product, which is the Vogtle Level 1 PRA which has been peer reviewed.

MS. DROUIN: Yes.

MEMBER SCHULTZ: And that's gone through their process of validating it for use on their facility. And you have on the Level 1 side, you've got comparative, quality products.

MS. DROUIN: Right. And that was where we had a question mark on a slide back then, you know, whether we do this independent peer review on the model that, you know, we transfer over to SAPHIRE, et cetera, whether we do an independent peer review.

MEMBER SCHULTZ: I think that's important, but you also have this other piece -

MS. DROUIN: Yes.

MEMBER SCHULTZ: - that can help -

MS. DROUIN: Absolutely.

MEMBER SCHULTZ: - influence it, advise it.

MS. DROUIN: Okay. I will skip the rest of the slides.

(Pause in the proceedings.)

MR. KURITZKY: Okay. Thank you, Mary. All right. So, we've comped some time there. I'm just going to use a few minutes just to catch you up to where we are right now and where we're going with the project.

What have we accomplished to date? Well, of course we have picked this site. We worked with NEI and Southern Nuclear volunteered Vogtle Units 1 and 2 to be the subject for this study. Units 3 and 4 are not part of the scope.

We've also, as you've heard, established the Technical Advisory Group which includes EPRI representation, but does not as of yet include operator experience, but we can look into that.

We also have been working a lot since the SRM came out last September on the contracting strategy. We knew that we were going to need a lot of contractor support for this work, including commercial contract support.

And no matter how much Division of Contracts promises us that the process is getting streamlined, it takes a long time. Took us nine or ten months to get our first contract issued.

MEMBER SHACK: That's blazing speed.

MR. KURITZKY: I guess maybe compared to -

I don't know what's - I haven't done many commercial contracts. I don't know what it used to take.

MS. DROUIN: 18 months.

MR. KURITZKY: Anyway, so we put together the contracts and we've issued contracts, we've issued a couple commercially.

We have also issued contracts to - start issuing contracts to national labs. Idaho is obviously involved with the work building up the SAPHIRE model. We have a contract with them and will be giving other - issuing other contracts for specific items as they come - as we become aware of them as the project progresses.

We have also prepared a - or we put together the organizational structure for the project in the staffing plan, as you saw, a very simplified -

CHAIRMAN STETKAR: Yeah, let me ask - something just popped into my mind.

There were some statements somewhere, I believe it was in the Level 2 discussion, that said, you know, you're going to use contractor support or lab support or something very heavily, but there wasn't enough time or resources available to consult other expertise that might be available in other labs.

I think there was references, you know,

Idaho was going to do a lot of this stuff, but you didn't have time to consult maybe Sandia on severe accident behavior for hydrogen or something like that.

MR. KURITZKY: Don is sneaking up behind you, but that's not my understanding.

CHAIRMAN STETKAR: Okay.

MR. KURITZKY: We will be going to other labs.

CHAIRMAN STETKAR: Okay. Maybe I misinterpreted something.

MR. KURITZKY: But Don can speak more.

MR. HELTON: What you're thinking of is there is the Level 2 writeup makes reference to the fact that there is - that the expertise and particular phenomena are distributed -

CHAIRMAN STETKAR: Yes.

MR. HELTON: - amongst the labs, amongst commercial contractors.

It will be a challenge for us with the resources we have allotted, to reach out to those resources. And that's something we're acknowledging at this point. We don't have a solution for it, but we want to identify the fact that just from a practical standpoint reaching out to those resources and still staying on time, on schedule and under

budget is going to be a challenge.

CHAIRMAN STETKAR: Okay. Thanks.

MR. KURITZKY: Okay. So, you saw the structure, the upper level structure for our project organization before.

As Mary alluded to, we have many pages of structure below that of all the people involved in this project.

It took some effort. It's got a lot of people, like I said, packed together on that team. There's some very capable people. It's critical that we try and keep them focused on this project and not pulled off in too many other directions.

MEMBER BLEY: How big is your team?

MR. KURITZKY: I would say probably staff - we probably have somewhere around 30 to 40 staff on the team, plus we'll probably have a dozen or two dozen contract personnel at some point or another on it.

I think to myself and I try to - I think Susan mentioned to you or mentioned shortly a while ago about trying to set up our site visits to the - going to the Vogtle site. And I think to myself -

CHAIRMAN STETKAR: Do you have buses that were big enough?

MR. KURITZKY: You know, you think of like a crack team of top PRA command that was descending on a site and getting the job done. And I think of my team as being like a thundering herd coming in with dust being kicked up everywhere and busting through the gates.

Anyway, we're not nimble, but -

MEMBER BLEY: This includes the people you are bringing on to really learn.

MR. KURITZKY: It includes everybody, right.

MEMBER BLEY: Okay.

MR. KURITZKY: And we have more experienced people leading each of the major technical elements that you say in that row across the bottom of the chart that I showed you, but we have a lot of other people that are supporting in many ways.

So, in any case, we have a staffing plan put together, you know. We just have to hope that it kind of holds together.

We're in a government agency. Different things are going to come up. People are going to get different assignments, people could transfer or do whatever. Who knows. So, we'll - we hope to keep - mostly keep people together as long as possible.

The other thing we put together was a very high-level initial plan back in March, including a communications plan which was submitted to the Commission.

We also have been working - we've worked with Southern Nuclear to establish the communication protocol that I mentioned before to govern the exchange of information between our organizations.

And that took a little while to get together because of the concerns of protecting company confidential information.

We had been working with Southern Nuclear regularly to get information that we need for the study. Unfortunately, it has been taking a lot longer than either Southern Nuclear or we expected.

I think the two main reasons are just the shear volume of information we need, you know. It just takes a long time to get through.

And I think also the control process we had to put in place to kind of protect the information, I think, has also tended to slow things down relatively substantially.

So, like I said, Southern Nuclear is working hard with us to gather this information, but it's been a long time coming for some of the

information.

We have as we discussed just in today's meeting, we've put together a Technical Analysis Approach plan. And the QA plan that you briefly heard about is also now attached to that Technical Analysis Approach plan as Chapter 18.

And we've briefed our Technical Advisory Group last month on the technical approach and the quality assurance aspects of the plan.

CHAIRMAN STETKAR: Have you received any formal feedback from the Technical Advisory Group?

MR. KURITZKY: Unfortunately, because of the - we briefed them on two separate days because there was so much material. So, we briefed them on November 8th and November 14th.

They met on November 26th internally to discuss stuff.

CHAIRMAN STETKAR: So, it's only about a week or so.

MR. KURITZKY: Right. So, we got - we have some initial information, draft information back, but they're going to be working to get us more information.

I think they're really trying to get this stuff, I think, by mid-January is when we'll probably

get the first chunk of information back from them.

CHAIRMAN STETKAR: Mid-January being two and a half months before the Level 1 PRA.

MR. KURITZKY: I don't know what you're talking about.

(Laughter.)

MR. KURITZKY: Those diamonds must be typos.

CHAIRMAN STETKAR: Yeah, must be.

MR. KURITZKY: In any case, and there's more diamonds, okay, but these diamonds are in the past. So, I know these diamonds are correct, because these already occurred.

In any case, this is to visually show some of the work that we've had to do to set this whole project up.

We alluded to this at the beginning of the presentation that there's been a lot of infrastructure work that has gone on in Commission deliverables, putting out the contracts, all the briefings that you see.

These are just the key briefings that we have listed on here with those red diamonds. If we listed every briefing, you would be seeing nothing but diamonds on that row.

We've put together the organizational team. We worked with the licensee. We are in fairly continual contact with the licensee for many issues involving getting information and the modeling.

As I mentioned earlier, we're going to be meeting with them shortly to discuss coordination in the seismic modeling. Also to discuss more about their fire modeling also.

The QA plan, Mary talked to you about it just recently. We have the TAG charter was put together. We established the TAG. We also are working on the QA plan. And the technical analysis plan and documentation work you've also heard about.

So, where are we going from here and what are we doing? We are working as Kevin mentioned in the very beginning, we spent a lot of time putting the infrastructure together, but we are actually moving forward in the technical work right now.

And Idaho is busy converting over the - expanding out the Vogtle SPAR model to incorporate information from the licensee's PRA model.

I think the last I heard from Pete they have the internal events, internal floods and Level 2 all put into the SAPHIRE framework. Though they haven't yet, you know, run it and shaken out.

They've been working with the Level 1 internal events, but they haven't yet shaken out some of the other stuff that they put in there yet. But that's ongoing and moving forward.

Already mentioned about the internal fire and external hazards will be meeting with the licensee soon.

The MELCOR input deck, ERI has been working on that for us. They hope to have in, I think, mid-January a version or Rev 0 of the MELCOR input deck. And we'll have that to support our confirmatory calculations for system success criteria and also to provide information to accident sequence timing and severe accident progression.

They also are putting them all together with basic information we'll be able to obtain for them. There was still quite a bit of information that they would need to finalize that model.

In the meantime, they're using placeholder data and values, but we hope to get the remaining information they need hopefully in the not too distant future so they can finalize that model.

MEMBER REMPE: Can't they get a map deck?

MR. KURITZKY: We got the map deck. The map deck has provided them a good substantial amount

of information they need, but there's still quite a bit more besides that that they want for the model.

We're also moving forward - as you know, Marty is obviously very active in the report and looking at the integrated offsite risk issue.

Susan is already stressing over how she's going to model some of the HRA - or some of these atypical conditions, things that haven't been looked at extensively in the past like the SAMGs.

And we're moving forward in some of the - in virtually all of the technical areas now the technical leaders are now moving forward with the work as information availability is there.

Some people have enough information to go forward right now. Some can move only a little now as they're waiting for more information, but all the aspects of the study are starting to move forward now.

We will continue to interact with our internal and external stakeholders. As we discussed earlier, we were only able to cover the reactor portion of the study today. The spent fuel pool and dry cask we'll leave for another meeting.

We also at that time will be able to give you additional information on how things are progressing, let's say, for instance, in Marty's

integrated risk or some of the other part that's advanced since today. So, we hope to come back in the spring to the Subcommittee.

At that time, also, I think we're planning to have Southern Nuclear will come and give you a presentation on the plant and their PRA model to just give you some information on that.

Prior to coming back here in the spring, of course we'll run through our standard set of briefing the TAG and then having a public meeting, and then coming to see the Subcommittee.

And then later that same year, next year, we'll have the same type of meetings where we'll go to the TAG, the public and then come here to talk about how we've been resolving the challenges we identify today.

Also, hopefully having initial results for the reactor PRA. Because as you can clearly see from the diamonds on that chart, we will be done by then. And so, we'll be able to bring you some of those results.

That was it.

CHAIRMAN STETKAR: I think that one of the things we need to discuss and probably we can do this more efficiently offline out of the context of the

Subcommittee meeting, is we've had a couple of Subcommittee meetings, you know, and you get feedback from us as individual members of the Subcommittee.

I can't recall - John, do you remember or anybody else remember has the full committee been briefed in anybody's recent memory on this project?

(Speaking over each other.)

CHAIRMAN STETKAR: I can't remember. It strikes me that sometime probably after April when you have those results in hand, we ought to actually have a briefing of the full committee because I think there is a reasonable level of interest.

I think at this stage, probably not so much. But when you actually have something in hand and perhaps have a better appreciation of some practical issues that you're struggling with, you know, rather than conceptually struggling with a lot of things that, gee, we've identified this real problem, it would make sense to come to the full committee and get some feedback.

MR. KURITZKY: Okay. So, that would - but we will come to see you first. We will come to see you as -

CHAIRMAN STETKAR: Oh, yeah, yeah. Definitely, sure.

MR. KURITZKY: And then sometime maybe in the summer or whatever we -

CHAIRMAN STETKAR: Yeah. But I mean in terms of planning, because it does, you know, it is not fair to the full committee and probably not fair to you to wait until the end of the Level 1 internal events at-power in January, you know, a year from now, 13 months before the full committee first hears about anything substantive.

MR. KURITZKY: Okay.

MS. DROUIN: I know that we did this on the uncertainty when we met with the Subcommittee, is that afterwards we sent via John, you know, a list of what we thought were the key issues that we heard.

So, if we did something here, I mean, then you all send back comments on that.

CHAIRMAN STETKAR: That's very - I think that's very useful.

MS. DROUIN: Okay.

MEMBER BLEY: As long as you understand what you did that it's not the Committee speaking.

CHAIRMAN STETKAR: That's the danger.

MS. DROUIN: And we understand that, but it's a good thing than just reading the transcript, which sometimes, you know, doesn't get the intent

sometimes.

CHAIRMAN STETKAR: Yeah, that's very often we think we heard Ralph say this. Did Ralph really intend that?

MS. DROUIN: Yes.

CHAIRMAN STETKAR: Do you have anything more?

MR. KURITZKY: Well, we have 20 minutes. We can start doing the spent fuel pool and dry cask storage.

(Laughter.)

CHAIRMAN STETKAR: You could, but you won't. You'd hear echoes.

MR. KURITZKY: Be talking to myself, right?

No, that's all. We appreciate the opportunity to brief the Subcommittee. We heard a lot of very valuable feedback and we look forward to being able to provide you more information when we meet next time.

CHAIRMAN STETKAR: Thank you very much. I, first of all, need to do this: Are there any members of the public in the room that want to make any comments?

(No response.)

CHAIRMAN STETKAR: Okay, thank you.

Let's go around the table and see if there are any wrap-up questions or comments among the members. And I'll ask Joy first.

MEMBER REMPE: No additional comments.

CHAIRMAN STETKAR: Dr. Shack?

MEMBER SHACK: No.

CHAIRMAN STETKAR: Steve.

MEMBER SCHULTZ: I just have one, because we've seen it here and we saw in the preparation for this meeting the - and also in the organization chart Alan, the documentation that has been developed.

It's already voluminous and a lot of good information is in the documentation that is being developed, but that is going to be your most important product when all is said and done.

What you are establishing here - we are establishing here a product that will be with all of what is going to be done in terms of preparation and review, the way in which this will be done. That's what we're trying to establish.

And so, with that, the documentation that is being assembled to be used is not only the project, but the going-forward model of how the project was done, will be done, the guidance documents, the review documents. All of that is going to be extremely

important.

And so, I would strongly recommend that the documentation coordinators, I'm not sure if that is the definition of what - you've got two there. One position has not yet been filled, but whether that's the intent of what they will be doing, but all of the leads, all of the organization, you in your position, need to have that as a primary focus.

And as we have talked about it here, there are a couple of areas in the documentation that currently exists that needs some attention.

And so, if we wait until the end, it won't happen right.

MR. KURITZKY: Right.

CHAIRMAN STETKAR: So, it's very important to keep up with all of that and to be sure that that's a very important focal point of the plan.

MR. KURITZKY: Right. We appreciate that, too, but that actually is something we have been stressing in all of the meetings with all of the task leads and in our internal project meetings that documentation is key. We want to have everything documented. We want to have this be as completely documented as any study has ever been.

We want to be able to trace back all kinds

of assumptions and technical bases and decisions whether we have hyperlinks in the documents or voluminous pages, whatever, but we want to make sure that we have a very good traceable record of everything that we've done for this study.

And we also - there is stuff that we need to do as work proceeds because everybody has been involved in projects who want to go in there and do all the work, they don't want to be bothered with documentation. You make a couple of notes on a piece of paper, you know, some assumptions.

Then when the project is, you know, three days from being due, oh, we got to do the final report and everybody tries to throw a bunch of stuff in there.

And we're trying to avoid that as much as possible, because we do recognize the importance of documentation.

In fact, we already had our contractor, ERI, do another white paper for us. We had the one white paper on multi, you know, risk. They have also done white paper on documentation strategy to try to come up with different ideas of how we're going to document all the work for this study.

And being specifically to this Technical

Analysis Approach Plan I didn't get a change to mention earlier, but we recognize of course this is a compendium right now of just individual contributions from different authors. It hasn't really had a cover-to-cover look except by the Subcommittee members.

And we're going to go through it, we're going to clean it up. There is stuff that has to be added to it. There's obviously inconsistencies that need to be adjusted.

There is some sections that write things more in a generic PRA sense as opposed to how we're doing things for this study. That has to be cleaned up.

So, we're going to revise that document. And then that document will also become a key input to our final documentation for the study.

So, when we do the publicly available documentation for the study, that's going to be a major part of it.

MEMBER SCHULTZ: Thank you. The completeness is a good feature. Clarity is also -

MR. KURITZKY: Yes. Right, right.

MEMBER SCHULTZ: - primarily important.

MR. KURITZKY: It's not just a word count.

MEMBER SCHULTZ: And consistency. Clarity

and consistency so it's not a confusing guidance document in the future. Thank you.

CHAIRMAN STETKAR: Dennis.

MEMBER BLEY: Yeah, I would just like to thank everyone for their presentations. It has been a good discussion, good presentations. People have thought hard about what they need to do and I appreciate that and wish you luck.

We've talked about the schedule which seems incredibly ambitious, but also managing 40 to 50 people in a project like this is a little unusual, I think. More than you normally encounter and that's going to be tough to keep this rolling and I hope you can do it. But we look forward to seeing the next round.

One or two of you mentioned innovative documentation. Maybe the next meeting you can tell us a little bit about what you're thinking there. I'd appreciate it.

MR. KURITZKY: That's the one that we haven't really - that's why that one spot was empty.

MEMBER BLEY: I understand.

MR. KURITZKY: But now that you've given us a little push, we can -

MS. DROUIN: We were hoping you would tell

us.

(Laughter.)

MEMBER SHACK: I'd settle for just a PDF with links in it.

MR. KURITZKY: That's what I was going for. That was my idea.

CHAIRMAN STETKAR: Just create the PDF and send it to him. He'll put the -

(Laughter.)

CHAIRMAN STETKAR: And I'd like to also say I really appreciate all the effort that you've put into the plan and I think it's starting to come together.

I echo Dennis' comment about the fact that the schedule that we've seen is ambitious. I think that's a word. We'll see.

One thing that I would advocate, and in a lot of my babbling I tried to probe the team anyway to see where the sensitivities were and how much you had actually thought about this.

Is anything you can do in the team in particular in the dynamic duo who's sharing the principle investigators role, to instill this notion of you're looking forward to a goal. That goal is that Level 3 PRA and you need to make sure all the

pieces are going to come together.

Now, they're not just going to magically come together because you satisfy each of the little boxes in this plan, because you'll find that they won't.

Some of the things that Marty mentioned that he is doing is, well, gee, let me see if I can - even though I don't have the final models here, let me see if I can actually stitch them together in my vision of how it might work.

It might not work. But as much as you can do early on to do some of that, I mean, you talk about defining plant damage states and binning, you can do that, start doing that now. You don't need the whole model to do that.

You know the basic types of conditions that you need to keep track of or at least have some sense of them for that interface between level 1 and level 2.

The same thing may even be the case in terms of source term definition for linking the Level 2 and Level 3.

As much as you can do to kind of point toward those - the linkages and that eventual goal, I'd advocate that pretty strongly.

So, I'll leave that as my final comment. And, again, thank you very, very much. I appreciate - you've managed to cover a whole amount of material with 12 minutes to spare. So, congratulations.

And, Kevin, good luck -

(Laughter.)

CHAIRMAN STETKAR: - with the birth. And with that, we are adjourned.

(Whereupon at 6:49 o'clock p.m. the meeting was adjourned.)

Full-Scope Site Level 3 PRA Technical Analysis Approach Plan for Reactor PRA

Advisory Committee on Reactor Safeguards
Reliability and PRA Subcommittee

December 4, 2012

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Outline

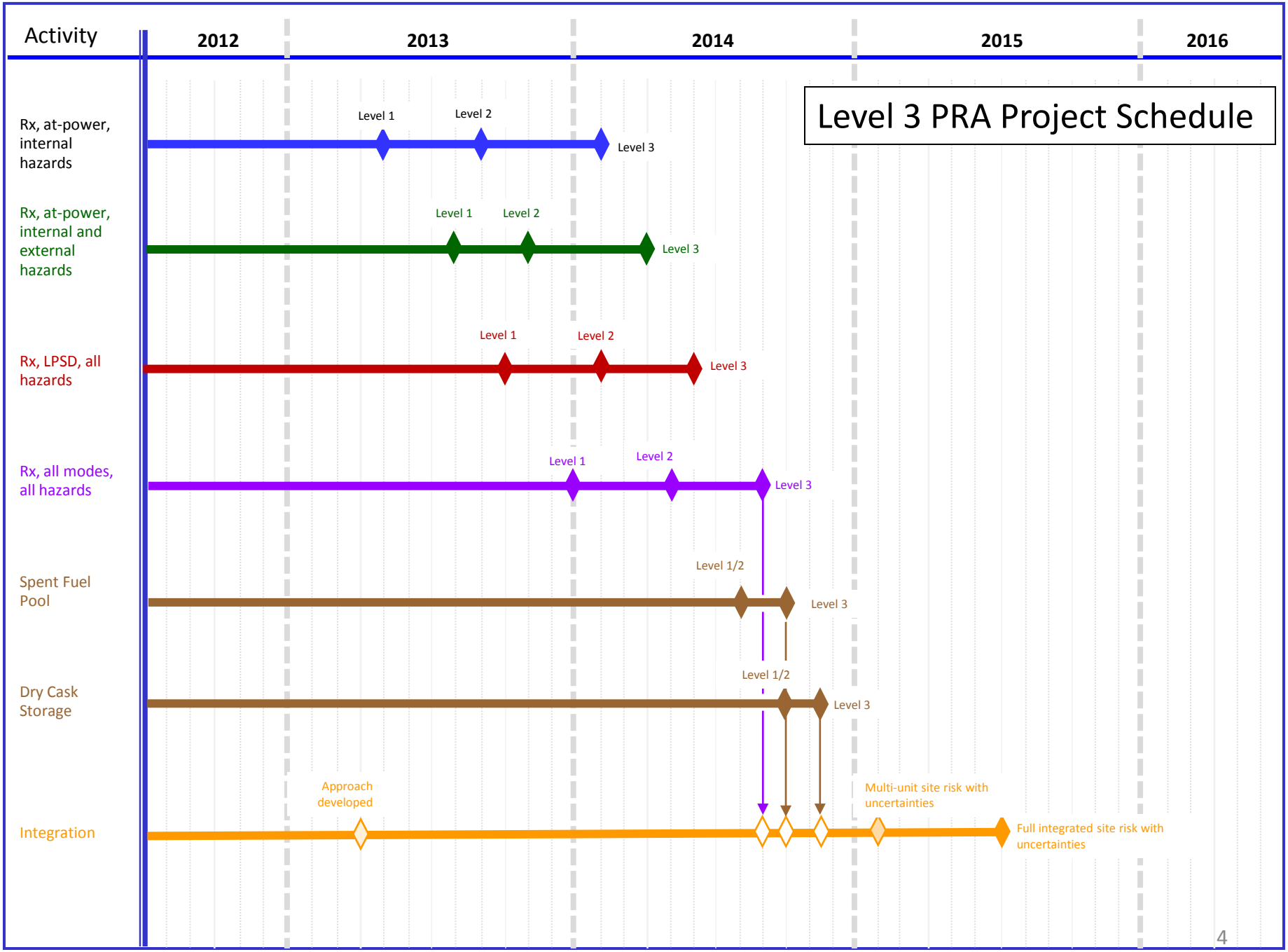
- Level 3 PRA Project
  - Objectives
  - Schedule
  - Program Organization
  - Technical Analysis Approach Plan
    - Objectives
    - Scope and limitations
    - Approach Summary
    - Reactor PRA Technical Elements
    - Quality Assurance
- Status and Path Forward

Level 3 PRA Project – Objectives

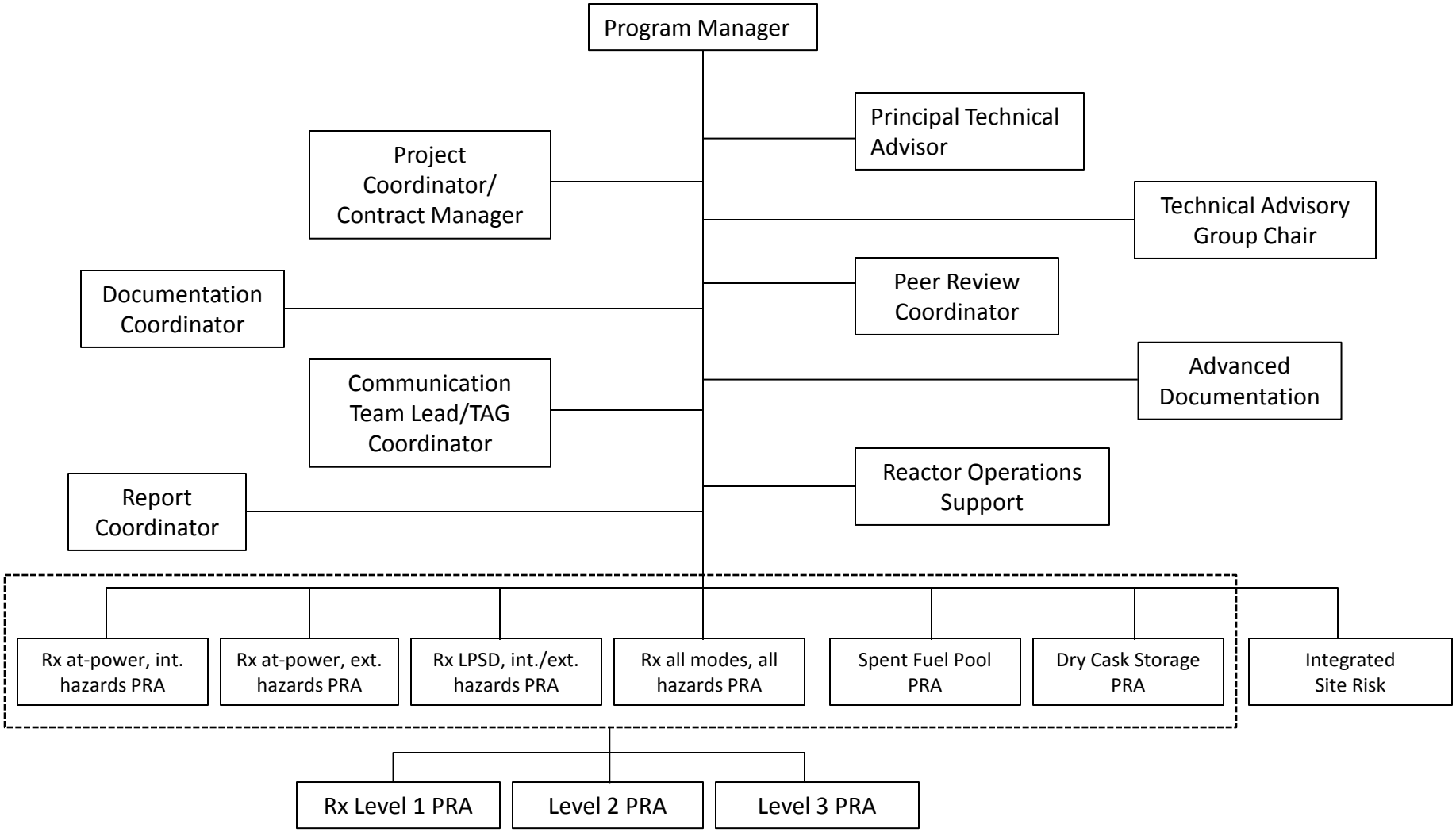
- Develop a Level 3 PRA, generally based on current state of practice methods, tools, and data,* that (1) reflects technical advances since completion of the NUREG-1150 studies, and (2) addresses scope considerations that were not previously considered (e.g., multi-unit risk)
- Extract new insights to enhance regulatory decisionmaking and to help focus limited agency resources on issues most directly related to the agency's mission to protect public health and safety
- Enhance NRC staff's PRA capability and expertise and improve documentation practices to make PRA information more accessible, retrievable, and understandable
- Obtain insight into the technical feasibility and cost of developing new Level 3 PRAs

* "State-of-practice" methods, tools, and data are those that are routinely used by the NRC and licensees or have acceptance in the PRA technical community.

Level 3 PRA Project Schedule



Level 3 PRA Project – Program Organization



Technical Analysis Approach Plan (TAAP)

- Objective: To provide the guidance to be used in developing the Level 3 PRA.
  - Consistent with current best practice as defined in both national consensus standards and other regulatory and industry guidance documents
  - Enhance consistency in the development of the PRA models by the various analysts
  - Provide traceability of how the PRA model was constructed
  - Used to support development of review criteria for assessing the technical acceptability of the PRA model
- This PRA model is comprised of the following scope:
  - Radiological sources -- reactor cores, spent fuel pool, and dry cask storage
  - Impact population -- surrounding population
  - Reactor state -- all operating states
  - Challenges -- all hazards
  - Levels of risk analyzed -- Levels 1, 2 and 3

TAAP – Limitations

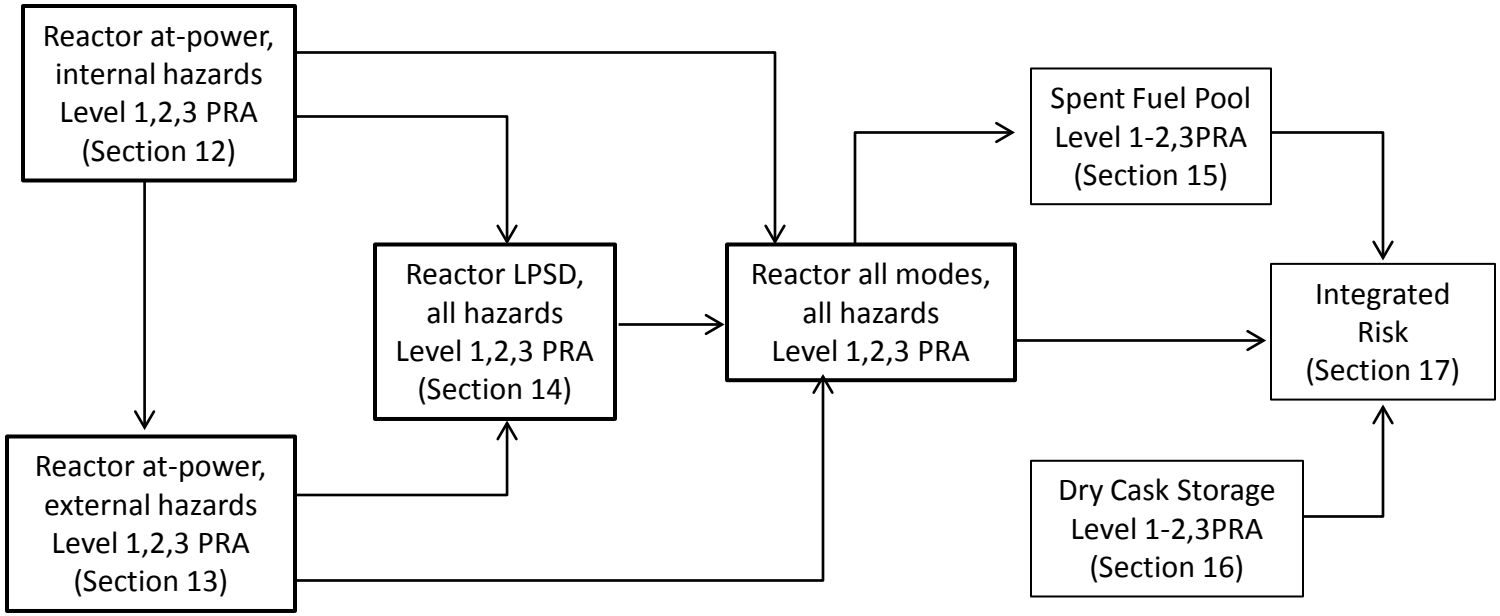
- The Level 3 PRA study is intended to be as complete and realistic as practical; however, the scope and level of realism will be balanced against resource and schedule limitations in a risk-informed manner.
  - Not all aspects of the study will necessarily receive the same level of analytical rigor, which will be a function of their relative risk significance.
- Some examples of some PRA technical elements that will not be addressed in the current study, but which are good candidates for further research to advance the state-of-the-art include:
  - aqueous transport and dispersion of radioactive materials
  - effects of aging on structure, system, and component reliability
  - consequential (linked) multiple initiating events (e.g., seismically induced fires and floods)
  - digital instrumentation and control, including software
- The staff intends to use the currently available suite of PRA standards (e.g., the ASME/ANS PRA standard) and other NRC and industry guidance documents to guide many of the technical aspects of this study.

TAAP – Approach Summary

- Not meant to duplicate existing standards or other guidance documents
- Guidance on how this specific PRA model will be constructed
- Shows how the technical elements are related and interface with each other
- For each technical element, provides a high level description of:
  - Assumptions and limitations
  - Needed inputs
  - Analytical steps
  - Documentation and products
  - Task interfaces

TAAP – Approach Summary

Selected Approach



- Produces reactor Level 3 results before completing entire site study
- Provides additional time to resolve technical issues in less mature areas

Reactor At-Power, Level 1 PRA for Internal Hazards

Overall Assumptions

- Level 1 modeling is well established, particularly for internal events and internal floods.
  - Over 75 Level 1 PRAs covering internal events and internal floods have been performed in the U.S. and have been peer reviewed to the ASME/ANS PRA standard.
- A straight-forward process will be used to develop new enhanced model for Level 3 PRA project.
- Licensee PRA and associated documentation (including peer review report) will expedite the development.

Level 1 Approach for Internal Events, Internal Floods, and Internal Fires

- Starting point is Vogtle SPAR model; use licensee PRA to enhance, as appropriate
- Use industry independent peer review of licensee PRA model to enhance confidence in licensee modeling and focus NRC staff audit
- Perform staff self-assessment
- Identify areas to be modified/revised/upgraded
- Perform independent peer review of NRC Level 1 at-power PRA model for internal hazards (?)

Some Potential Challenges

Internal Events PRA

- No significant challenges are anticipated.
- Thermal-hydraulic calculations to confirm success criteria will not be performed until after the initial internal events model is completed.

Some Potential Challenges

Internal Flood PRA

- Reevaluation of Vogtle internal flooding initiating event frequencies using up-to-date methods
- Resolution of peer review finding involving method and assumptions used for flood screening analysis
- Consideration of multi-unit internal flood scenarios
  - Vogtle flood analysis considers shared flood areas, but shared areas are not discussed in detail. No discussion of potential propagation paths or potential impacts of multi-unit floods.

Some Potential Challenges

Internal Fire PRA

- Assuring an acceptable level of completeness of internal fire scenarios to be modeled
- Performing a documented and credible review of task results that will be taken from the existing licensee fire PRA, such as:
  - Component selection and cable tracing
  - Spurious actuation modeling
  - Fire analysis
  - HRA quantification
- Handling components that are modeled in the licensee PRA but may not be present in the NRC Level 3 PRA model

Reactor At-Power, Level 1 PRA for External Hazards

Seismic Events

Background

- The licensee is in the process of performing a seismic PRA.
- The NRC's Level 3 PRA model will leverage available information and calculations from the licensee's seismic PRA.
- ASME/ANS PRA Standard Section 5-2 identifies the technical requirements for a seismic PRA at-power.
  - Probabilistic seismic hazard analysis
  - Seismic fragility evaluation
  - Seismic plant response analysis
- Mix of in-house (RES staff) and contracted effort will be used.

Seismic Events

General Approach

- Use existing site-specific seismic hazard information to define seismic bins
- Customize the seismic demands on the structures, systems, and components (SSCs) to the actual site using approximate methods and existing information (FSAR and ongoing seismic PRA study) and will update those results as more information becomes available
  - Perform sensitivity analysis to assess bounding effects of approximations
- Use available site-specific seismic fragilities to calculate basic event failure probabilities for seismic bins
  - Perform in-house fragility calculations or use surrogate fragilities, where necessary

Seismic Events

General Approach (Cont.)

- Develop event tree and fault tree models for each seismic bin
  - Use existing event tree and fault tree models from internal events PRA, wherever applicable
- Assemble new data to be put in the model (including uncertainty parameters)
  - Hazard bin frequencies, seismic failure probabilities, new or affected human error probabilities, and other data
- Incorporate scenarios into Level 3 PRA model and quantify core damage frequency

Seismic Events

Assumptions and Limitations

- Licensee will be working on a seismic PRA in the same time frame as this project. The NRC's Level 3 PRA model will leverage information and calculations from the licensee's seismic PRA, as available and appropriate.
- A stable version of the internal events model will be available before the seismic scenario modeling task starts.

Seismic Events

Challenges

- Characterization of ground motion at the site using recent probabilistic seismic hazard models
- Changes in spectral characteristics of ground motion and site conditions challenge scaling of FSAR's in-structure spectral acceleration demands on SSCs
- Soil site with local site amplification effects that affect ground motion characteristics and related seismic hazard quantification
- Consideration of soil-structure interaction effects on calculation of in-structure spectral acceleration demands on SSCs
- Consideration of potential for site-specific soil failures, e.g., soil liquefaction

High Winds, External Floods, and Other Events

Background

- The licensee has not performed a PRA for high winds, external floods, or other events.
- Collective experience with detailed PRA modeling of these events is limited.
- ASME/ANS PRA standard Sections 7.2, 8.2, and 9.2 provide the technical elements for addressing these events.
- A mix of in-house (RES staff) and contracted effort will be used.

High Winds, External Floods, and Other Events

General Approach

- The general tasks for high-winds and external flood PRA include:
  - Hazard analysis
  - Fragility analysis
  - Plant response analysis, including quantification
- The general tasks for the other events include:
  - Review of plant-specific hazard data and licensing bases
  - Screening analyses
  - Modeling of unscreened hazards

High Winds, External Floods, and Other External Events

Assumptions and Limitations

- The analysis for these events may be qualitative, quantitative, or a combination of each, as warranted by the site-specific hazard characteristics.
- The high wind analysis is expected to be quantitative, leading to scenarios to be incorporated into the PRA model.
- The external flooding analysis is not expected to require a detailed quantitative PRA model.
- The other events under consideration will consist of the hazards listed in Appendix 6-A of the ASME/ANS RA-Sa-2009 PRA standard.

Reactor Low Power and Shutdown, Level 1 PRA

Low Power and Shutdown, Level 1 PRA State of Practice

- U.S. industry experience with Low Power and Shutdown (LPSD) PRA modeling is limited.
  - Many licensees use LPSD Qualitative Risk Assessments.
- Vogtle has not performed an LPSD PRA.
- Structure will closely follow the draft ASME/ANS LPSD PRA Standard
  - Has not yet achieved consensus acceptance
  - Has not yet been endorsed by NRC
- NRC staff has experience with developing limited-scope SPAR-Shutdown models.

LPSD General Approach

- Define practical scope limitations while maintaining adequate characterization of LPSD risk
- Address each LPSD technical element for internal events
- Integrate LPSD internal events scenarios into the at-power model
- Address other hazards after experience gained with LPSD internal events and all hazards for at-power are complete
  - LPSD, internal flooding
  - LPSD, internal fires
  - LPSD, external hazards
- Address external review comments

LPSD Technical Elements

- Reactor, LPSD, internal events, Level 1
  - Plant Operating State (POS) analysis
  - Initiating event analysis
  - Accident sequence analysis
  - Success criteria
  - Systems analysis
  - Human reliability analysis
  - Data analysis
  - Quantification
  - Uncertainty analysis

LPSD Challenges

- Applying practical scope limitations to maintain a manageable model size
- Updating generic LPSD initiating event frequencies to include recent operating experience
- Reflecting plant-specific accident sequences and development of success criteria
- Other hazard analyses (internal floods, fires, and external hazards) for unique LPSD operating conditions and plant configurations

Reactor Level 2 PRA

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Background

- NRC risk tools rely on simplified LERF approach
- Some NRC feasibility modeling in recent past, including “integrated capabilities” project
- Mix of in-house (RES staff) and contracted effort
- Recent work in dynamic Level 2 PRA methods is promising, but beyond state-of-practice
- Licensee has a Level 2 PRA model:
  - Based on WOG simplified Level 2 modeling guidelines
  - Updated for license renewal SAMA, and thereafter
  - Will be leveraged, and modified as appropriate

Technical Elements

- Technical Elements:
  - Level 1/2 PRA Interface – Accident Sequence Grouping
  - Containment Capacity Analysis
  - Severe Accident Progression Analysis
  - Probabilistic Treatment of Event Progression
  - Radiological Source Term Analysis
  - Evaluation and Presentation of Results
  - Level 2/3 PRA Interface
- Structure closely follows draft ASME/ANS Level 2 PRA Standard

Model structure at-a-glance

- Traditional, contemporary model structure
- Level 1 end-states → containment systems extension → plant damage states → accident progression event tree(s) → release category binning → Level 3 PRA
- "Integrated" SAPHIRE8 Level 1 / Level 2 model
- Deterministic tools:
  - LS-DYNA (containment finite element analysis)
  - SCALE (decay heat and radionuclide inventories)
  - MELCOR (accident progression and source term)
  - specialized tools as needed

Internal Hazards Key Assumptions

- Clearly relies on substantive completion of the Level 1 PRA
- Assumes internal events, flooding and fire can be accommodated by the same basic model
- Assumes units are identical (model = Unit 1 = Unit 2)
- Omits inadvertent criticality during reflood – specific instances where this is possible will be highlighted

Some Challenges

- Consensus standard still in flux
- Characterization of SSCs for beyond-design-basis external hazards
- HRA – SAMGs and EDMGs
- Mechanistic modeling for energetic and lower-probability phenomena
- Equipment survivability determinations
- Treatment of uncertainty

Examples of Challenges Specific to External Hazards and Low-Power/Shutdown

- External hazards:
  - Fragilities for SSCs not covered by the Level 1 PRA
- Low-power/shutdown:
  - Modeling of head-off, open containment, and flooded refueling cavity configurations
  - Modeling of connection to SFP
  - Modeling of unique source term effects (air oxidation, holdup if containment is not closed)

Reactor Level 3 PRA
(Offsite Consequence Analysis)

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Background

- Will build on previous studies (e.g., SOARCA, Plant Vogtle SAMA analyses)
- Mix of in-house (RES staff) and contracted effort
- Assumptions and scope are preliminary and will be refined by project staff as necessary over the course of the analysis

Technical Elements

- Technical Elements:
  - Level 2/3 PRA Interface
  - Protective Action Parameters and Other Site Data
  - Meteorological Data
  - Atmospheric Transport and Dispersion
  - Dosimetry
  - Health Effects
  - Economic Factors
  - Quantification and Reporting
  - Risk Integration

- Structure closely follows draft ASME/ANS Level 3 PRA Standard

Tools

- WinMACCS/MACCS2: Atmospheric transport, protective actions, exposure, and health and economic impacts
- MELMACCS: Source term transfer from MELCOR to MACCS2
- SCALE: Fuel inventory analysis
- SECPOP2000: Development of demographic, land use, and economic data

Key Assumptions

- Offsite consequences will focus on atmospheric releases, which is the current state of practice for severe accidents. MACCS2's straight-line Gaussian plume segment model will be used to model atmospheric transport, dispersion, and deposition.
- Site-specific population data will be based on the available data from the latest version of SECPOP, and extrapolated forward to a target year, as appropriate.
- Emergency response and other protective actions will include evacuation, sheltering, normal and hotspot relocation, decontamination, land interdiction, and ingestion of potassium iodide (KI) pills, as appropriate.
- Dose criteria for food/land interdiction and relocation will be based on federal guidance.
- Decontamination will be modeled using land use data and land value data based on current information from the Bureau of Economic Analysis.

Key Assumptions (Cont.)

- A linear, no threshold (LNT) dose response model will be used. Other dose response models will be considered if time and resources permit.
- Dose conversion factors from the latest available Federal Guidance Report (currently FGR-13) will be used.
- The latest available risk factors will be used. Currently FGR-13 uses risk factors from BEIR V, although guidance for using risk factors from BEIR VII may become available soon.
- Economic costs will include costs for evacuation and relocation, moving expenses for displaced persons, decontamination, loss of land use of property, disposal of contaminated food grown locally, and condemned lands

Challenges

- Development of source terms for input to the offsite consequence analyses will need to consider multi-source and multi-unit considerations.
- Dose criterion for decontamination after a severe accident is uncertain as no applicable long-term land cleanup goal or level currently exists, particularly for large areas. The current state of practice is to model decontamination to the level of meeting the habitability (return) criterion applicable at the particular site. Other decontamination criteria may be considered.
- The health effect of low doses is uncertain. The current state of practice is to use a linear, no threshold (LNT) dose response model. Other dose response models may be considered.

Human Reliability Analysis

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General Approach (1)

- Human reliability analysis (HRA) is a supporting technical element for most operating modes, PRA types and hazards
- Based on existing HRA processes, HRA for this project consists of nine interrelated steps:
  - Definition and interpretation of HRA/PRA issue
  - Definition of HRA/PRA scope
  - Qualitative analysis
  - Identification and definition of human failure events (HFEs)
  - Quantification
  - Recovery analysis
  - Dependency analysis
  - Uncertainty analysis
  - Documentation

General Approach (2)

- HRA needs for the overall Level 3 PRA project can be categorized in the following groups:
  1. Applicable HRA guidance & methods exist; operator performance is understood (e.g., reactor at-power, Level 1 PRA for internal events and internal fires)
     - If licensee PRA is available, HRA effort is expected to be limited to review, “spot checks” of results, and limited or no re-work of HRA qualitative and quantitative results
  2. Existing HRA guidance and methods can be modified or extrapolated; understanding of operator performance can be developed from generic and plant-specific experience (e.g., low power and shutdown [LPSD] PRA, seismic PRA, internal flood PRA, dry cask PRA)
     - Existing HRA guidance, methods, and approaches will be modified for specific PRA application
  3. Existing HRA methods are expected to have limited or no applicability; limited experience-base for development of an understanding of operator performance (e.g., Level 2 PRA, spent fuel pool PRA)
     - Extend or extrapolate existing HRA methods to extent appropriate; develop new constructs for other cases

Key Assumptions & Limitations

- Procedures & other formal guidance that support operator actions addressed in the PRA exist & are currently being used & trained upon
- Action locations, equipment, control panels and so forth exist, are currently being used & trained upon
- Licensee's PRA(s) will form the basis for the NRC analysis, provided that it:
  - Is adequate for needs of NRC's Level 3 HRA/PRA effort with respect to scope & objectives
  - Meets the ASME/ANS PRA Standard requirements
  - Has a peer review
  - Requires no adjustment to success criteria or timing information relevant to HRA
  - Addresses key & relevant performance influencing factors
  - Has used HRA methods & approaches suitable for the application
  - Has included an HRA that was performed using HRA methods & approaches as they are intended to be used
  - Requires little or no re-work of HRA qualitative or quantitative analysis for post-initiator HFEs
  - Requires no re-work for pre-initiator HFEs

Examples of Relevant Resources (1)

- Group 1, e.g.,
  - At-power, internal events Level 1 PRA
    - Previously performed HRA/PRAs & “all” existing HRA guidance & methods
  - At-power, fire Level 1 PRA
    - EPRI/NRC-RES Fire HRA Guidelines, NUREG-1921/EPRI 1023001
- Group 2, e.g.,
  - LPSD PRA
    - Previously performed NRC LPSD PRAs, qualitative HRA work (e.g., NUREG/CR-6093)
  - For other, spatially-oriented PRA hazards (e.g., seismic PRA, internal flood PRA)
    - Any previous HRA/PRA experience coupled with expansions of NUREG-1921 (e.g., current EPRI effort to expand for seismic) & insights from relevant events
  - LPSD fire PRA
    - Extension & merging of guidance & methods for fire & LPSD HRA/PRA, separately
  - Dry Cask Storage PRA:
    - Any previous NRC or industry PRAs, coupled with recently published qualitative HRA reports (NUREG/CR-7016 & NUREG/CR-7017)

Examples of Relevant Resources (2)

- Group 3, e.g.,
  - Level 2 & multi-unit risk
    - Any previous HRA/PRA studies that address severe accident progression (including international studies)
    - Plant-specific information (e.g., SAMGs, observations of Emergency Planning drills) collected as part of this project
    - Understanding of relevant human behavior (especially decision-making) from literature
    - Insights from relevant events
    - Relevant HRA development, including underlying literature search, for “IDHEAS” (i.e., current research in response to SRM M061020)

Integrated Site Risk

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Outline

- Technical Tasks
- PRA Modeling Issues
- Site Information Review
- Multi-Unit Accident Sequence Delineation
- Integrated Risk Metrics
- Challenges

Technical Tasks

- Task 1: Technical approach
- Task 2: Multi-unit effects
- Task 3: Integrated Level 3 PRA model
- Task 4: Integrated uncertainty analysis

White Paper to Identify Issues

- Prepared by contractor
- Issues
  - Multiple concurrent accidents (reactors, spent fuel)
  - Integrated treatment of multiple hazards
  - Account for the impact of core damage or radiological releases occurring in one unit on others

PRA Modeling Issues

PRA Element and Associated Issues	Modeling Capabilities		
	Current Practice	Minor Revisions or Additions to Current Practice	Major Revisions or Additions to Current Practice
Plant Operating States	X		
Hazards and Initiating Events	X		
Accident Sequence Evaluation		X	
Success criteria	X		
Systems Analysis	X		
Data Analysis	X		
HRA			X
Dependency Analysis		X	

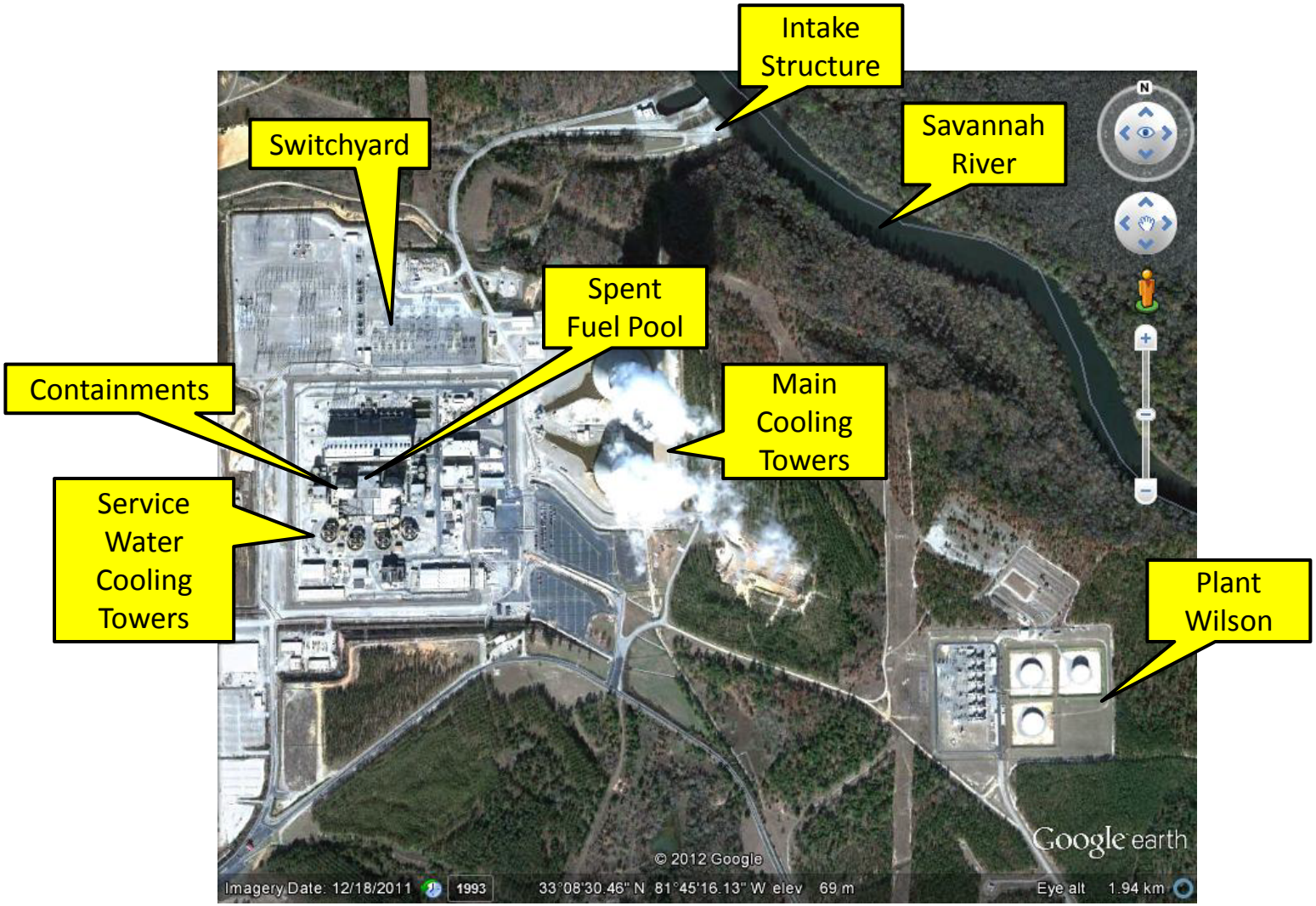
PRA Modeling Issues (Con't.)

PRA Element and Associated Issues	Modeling Capabilities		
	Current Practice	Minor Revisions or Additions to Current Practice	Major Revisions or Additions to Current Practice
Structural Analysis			X
Containment Performance Analysis	X		
Analysis of Severe Accidents and Radiological Releases		X	
Offsite Consequence Analysis		X	
Risk Quantification and Integration			X
Uncertainty Analysis	X		

Site Information Review

- What are we reviewing?
  - FSAR
  - SPAR internal events model
  - Information provided by licensee to support the project
- What are we looking for?
  - Shared systems
  - Systems that have cross-connects between the units
  - Common locations
  - Common-cause initiating events
  - Common-cause failures that need to be expanded to include both units
  - Recovery actions modeled in the PRA that credit the other unit

Site Layout


Intake Structure
Switchyard
Savannah River
Spent Fuel Pool
Containments
Main Cooling Towers
Service Water Cooling Towers
Plant Wilson
© 2012 Google
Google earth
Imagery Date: 12/18/2011
1993
33°08'30.46" N 81°45'16.13" W elev 69 m
Eye alt 1.94 km

Site Information Review Observations

- Systems that are typically included in a PRA model (electric power, service water, etc.) are not shared between units
- Plant Wilson can only supply power to one unit at a time
- Some common locations may be important for some internal hazards (floods, fires)
- Candidate multi-unit initiating events
  - Loss of grid
  - Consequential LOOP
  - Internal hazards (fires, floods)
  - External hazards (seismic, floods, high winds)

Delineation of Multi-Unit Accident Sequences

- Objective: Develop and quantify accident sequences that involve combinations of site radiological sources (reactors, SFP, dry casks)
- Challenges
  - Demonstrating completeness
  - Accounting for plant operating states (POSs)
  - Accounting for cross-unit dependencies (e.g., shared systems, CCFs, operator actions)
  - Achieving reasonable logic model solution times
  - Completing work within resource/schedule constraints

Multi-Unit Sequence Types

- Type I: common-cause initiators (CCIs)
  - Directly and simultaneously affects both units
  - Examples: seismic events, external floods, high winds
- Type II: consequential initiators
  - Second unit is automatically tripped (or required to trip) due to an evolving sequence in the first unit (i.e., a direct cause-and-effect relation exists between the two units)
  - Examples: consequential LOOPs, shared support systems, internal fires or internal floods that propagate from one unit into another
- Type III: manual shutdown
  - Operators may decide to shut down the second unit due to
    - Core-damage in the first unit
    - Release from the first unit
    - T/S requirements
    - Management decision or NRC order
- Type IV: coincidental initiators
  - Unrelated initiators that occur within a short timeframe
  - Example: SBO in one unit, followed by LOCA in the second unit

Multi-Unit Sequence Development

- In theory, multi-unit accident sequences may be formed by ANDing together two single-unit sequences
  - Brute-force approach may generate a very large number of multi-unit accident sequences
  - Qualitative screening: Some POS combinations may not be possible (e.g., simultaneous refueling in both reactors)
  - Quantitative screening: May use single-unit PRA results or auxiliary calculations to show that some theoretically possible multi-unit sequences have very low frequencies
- Need to develop an integrated logic model that includes all reactors, SFP, and dry casks
  - Adjust CCF group sizes
  - Account for shared systems and cross-connects (affects the modeling of recovery actions)
  - Account for dependent human failure events

Integrated Risk Metrics

- Identifying candidate risk metrics
  - Balance desire for completeness and usefulness against project schedule and resource constraints
- Candidate risk metrics
  - Total early fatality risk
  - Total latent cancer fatality risk
  - Individual early fatality risk (0-1 miles)
  - Individual latent cancer fatality risk (0-10 miles)
  - Population dose risk (0-50 miles)
  - Offsite economic cost risk (0-50 miles)
  - Individual early injury risk
  - Individual cancer incident risk
  - Land contamination
- Candidate risk surrogates
  - Core-damage frequency (CDF)
  - Large release frequency (LRF)
  - Large early release frequency (LERF)

Challenges

- Addressing PRA modeling issues
  - Delineation of multi-unit accident sequences
  - Human reliability analysis
  - Dependency analysis
  - Structural analysis
  - Analysis of severe accidents and radiological releases
  - Offsite consequences
  - Risk quantification and integration
  - Uncertainty analysis
- Managing expectations

Uncertainty Analysis

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Background

- Uncertainty analysis will address parameter and model uncertainty per NUREG-1855
  - Parameter uncertainty relates to the uncertainty in the computation of the input parameter values used to quantify the probabilities of the events in the PRA logic model.
  - Model uncertainty arises because different approaches may exist to represent certain aspects of plant response and there is also uncertainty with regard to a potentially significant contributor not being considered in the PRA.
- Scope completeness is not an issue, but level of detail and screening criteria are important

Approach for Addressing Parameter Uncertainty

- Enter basic event distribution information from other tasks (e.g., data analysis and HRA).
- Define epistemic (state-of-knowledge) correlation groups
- Propagate parameter uncertainty in the PRA model using a sampling process (e.g., Monte Carlo)
- To what extent parameter uncertainty is treated across the PRA and for integrated site risk is still to be determined

Approach for Addressing Model Uncertainty

- Identify and characterize sources of modeling uncertainty and related assumptions
- Perform qualitative screening of the sources of model uncertainty and related assumptions
- Perform sensitivity analyses (sensitivity test)
- To what extent model uncertainties will be addressed is still to be determined

Quality Assurance

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Background

- Quality assurance is a key factor in any analysis to ensure technical acceptability.
  - Essential to demonstrate (document) that the PRA model is technically acceptable
- Objective is to ensure that both
  - Technical approach (methods, tools, data) is acceptable
  - Implementation (actual construction of the PRA model) was performed in an acceptable manner

Quality Assurance

Four major elements to quality assurance

1. Use of established methods, tools and data
2. Qualified personnel
3. PRA model fidelity
4. Technical review of the methods, tools, data and developed models

First Three Elements

- The PRA model will be based on methods, tools and data that have been established and accepted in the risk community. Examples include
  - Consensus standards
  - Internal and external guidance documents
  - Accepted generic SSC performance data (where plant specific data is not available)
  - Validated codes
- Personnel qualification depend on whether analyst is:
  - Performers who construct the actual pieces of the PRA model and depending on their role, need to have some level of expertise (i.e., on the job training is acceptable)
  - Reviewers review and make judgments on actual aspects of the PRA mode, must have a defined level of expertise (i.e., on the job training is not acceptable)
- PRA model fidelity
  - The objective is to ensure that the various analysts are using the same data, same models, consistent assumptions, etc.
  - Both documentation and PRA model control are essential in ensuring the fidelity of the PRA model.

Fourth Element: Technical Reviews

Four different types of technical reviews planned:

1. Technical Advisory Group
2. Project Self-Assessment
3. Independent Peer Review
4. Advisory Committee on Reactor Safeguards

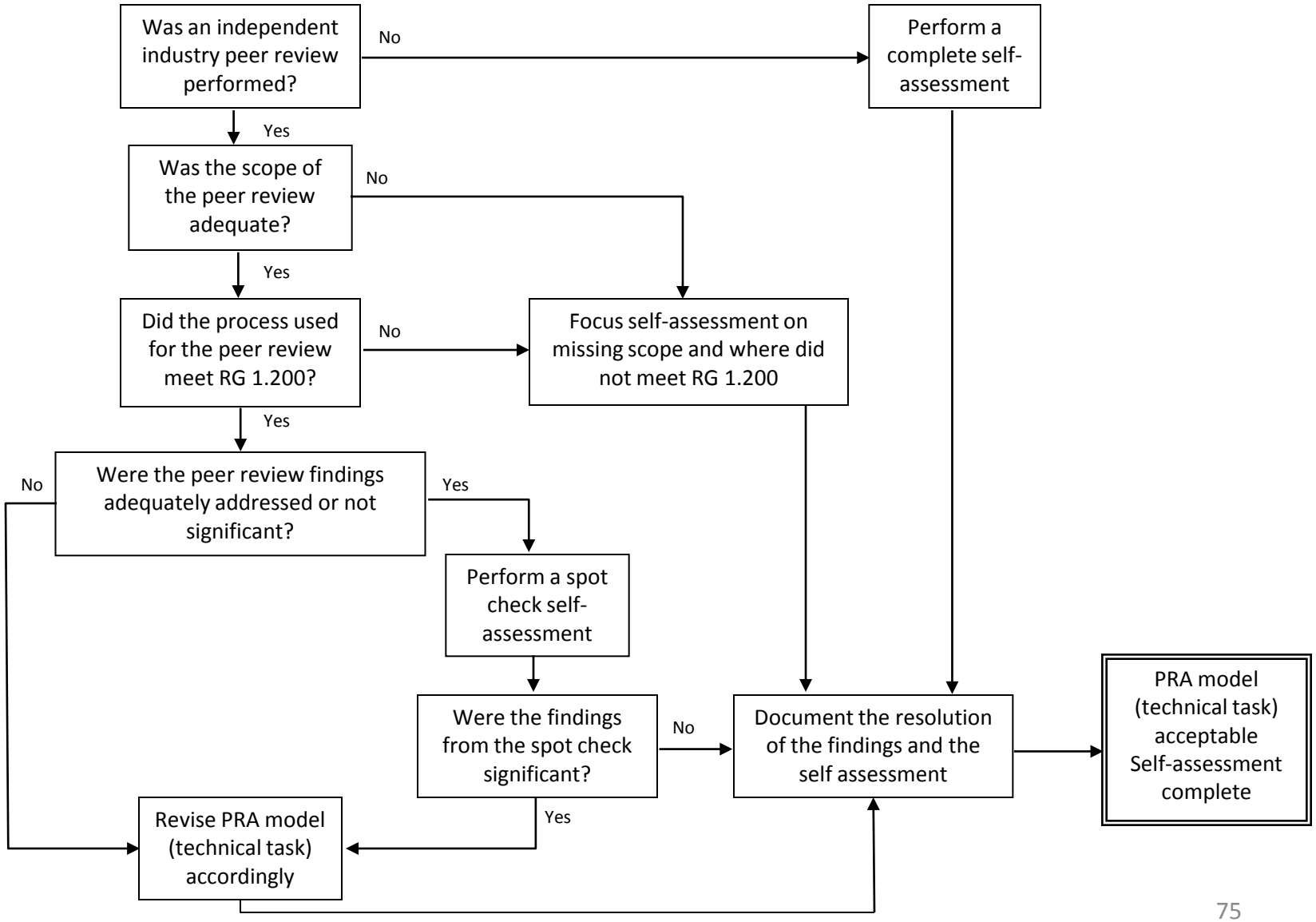
Technical Advisory Group (TAG)

- Objective of TAG:
  - Review progress in the development of the Level 3 PRA
  - Provide insights, advice and guidance on the technical bases, tools, methods and data
  - Provide insights, advice and guidance on the results of the study
- TAG members are senior level advisors in PRA and supporting technical disciplines, as well as an experienced PRA representative from EPRI
- TAG will play a key role in resolving technical or programmatic issues
- TAG will meet at key milestones as determined by the TAG chairman and the Level 3 project manager
- The TAG coordinator will be responsible for summarizing the meeting minutes (as approved by the TAG chairman)
  - The Level 3 project manager (or designee) will be responsible for identifying issues that need to be addressed in the project (based on the meeting and minutes) and how each issue was resolved

Project Self-Assessment (SA)

- Objective of Project SA:
  - To oversee the quality of the work being performed by both the staff and contractor
  - Identify any issues and allow a chance for them to be fixed in real time
- The SA is performed to determine that the PRA model is consistent with available PRA standards and other guidance, both as-endorsed by the staff
- Task leaders will initiate and perform the detailed self-assessment
  - May be multiple layers of SA because of multiple team leaders
    - Each layer involves checking the process and perhaps auditing some technical aspects
  - The purpose of SA by each team leader is to ensure the work fits into the scope of the model defined by that team leader
- SA will take advantage of previous independent peer reviews
- Each SA will be fully documented
  - The findings and observations based on the self-assessment will be documented along with how each finding and observation was resolved.
  - This document will be developed by the task leaders and the associated team leaders.

Project Self-Assessment (cont'd)



Independent Peer Review

- Objective of Independent peer review:
  - To provide an independent review of the technical acceptability of the PRA model
- Because of the scope of the Level 3 PRA project, the independent peer reviews will be performed at key milestones, as opposed to performing the peer review at the end of the project.
  - Will allow any identified issues to be fixed in real time, minimizing the extent of potential re-work
  - Will be coordinated with self-assessment
- Peer review team needs to meet the qualifications stated in both RG 1.200 and the PRA standard
  - Performed to a written process
  - Team members are independent
  - Team members together and separate have the required qualifications
- Should there be an independent peer review on that portion developed by Vogtle and previously peer reviewed?
  - Now “owned” by the staff

Advisory Committee on Reactor Safeguards

- The objective is for the ACRS to
  - Review progress in the development of the Level 3 PRA project
  - Provide insights, advice and guidance on the technical approach, methods, tools and data for the project, as well as on the project results
- The ACRS Reliability and PRA Subcommittee will be briefed approximately twice a year to obtain their feedback.

Project Status and Path Forward

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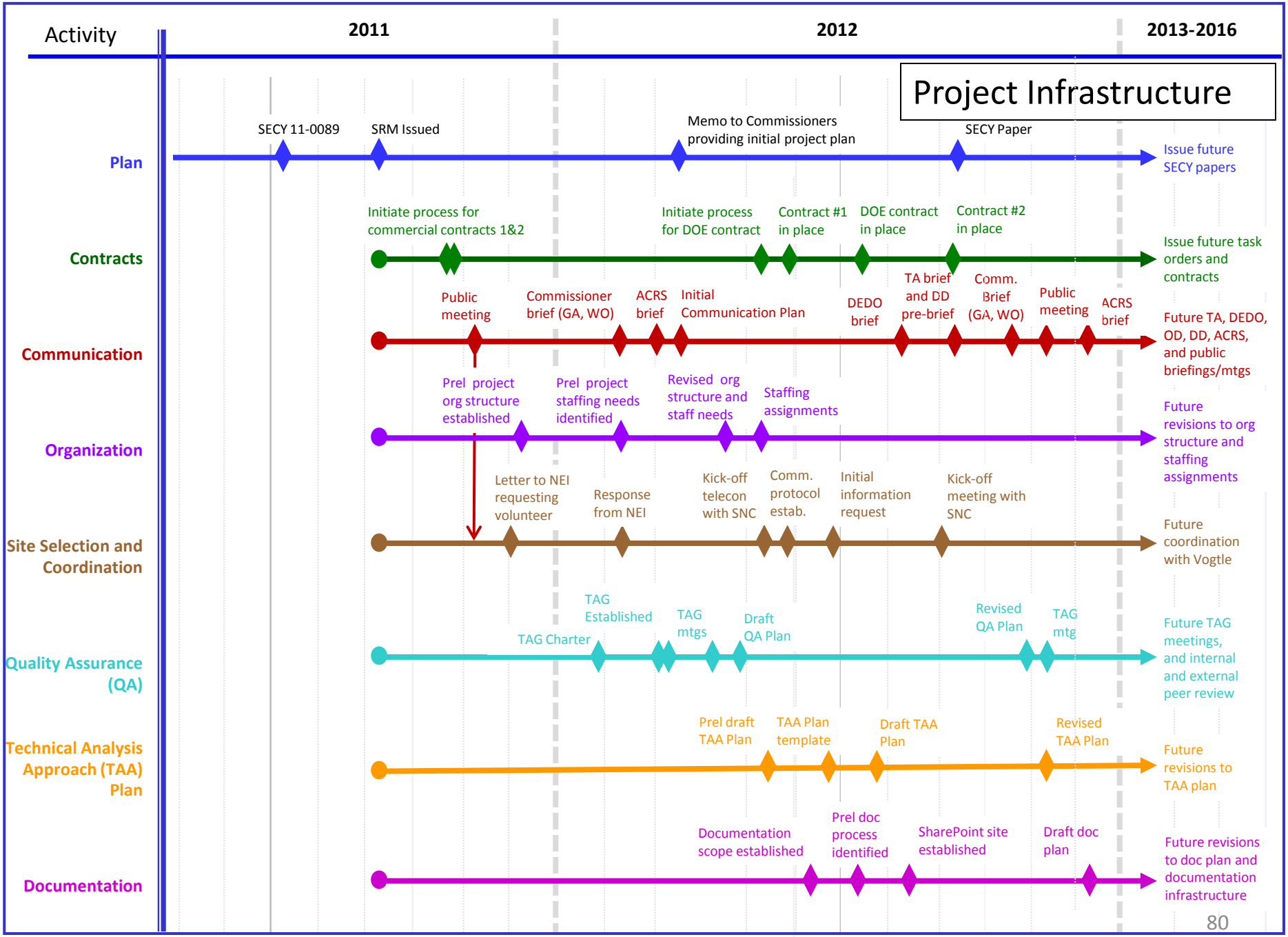
Project Accomplishments

- Selected subject site (Vogtle Units 1 and 2)
- Established Technical Advisory Group (including EPRI representation)
- Developed contracting strategy, preliminary project schedule, organizational structure, and staffing plan
- Provided initial project plan and communications plan to Commission
- Established communication protocol with Southern Nuclear Operating Company (SNC), held kick-off meeting, and working to obtain necessary plant information and coordinate interactions
- Developing technical analysis approach plan and quality assurance plan
- Briefed TAG on the above plans


Project Infrastructure
Activity
2011
2012
2013-2016
Plan
SECY 11-0089
SRM Issued
Memo to Commissioners providing initial project plan
SECY Paper
Issue future SECY papers
Contracts
Initiate process for commercial contracts 1&2
Initiate process for DOE contract
Contract #1 in place
DOE contract in place
Contract #2 in place
Issue future task orders and contracts
Communication
Public meeting
Commissioner brief (GA, WO)
ACRS brief
Initial Communication Plan
DEDO brief
TA brief and DD pre-brief
Comm. Brief (GA, WO)
Public meeting
ACRS brief
Future TA, DEDO, OD, DD, ACRS, and public briefings/mtgs
Organization
Prel project org structure established
Prel project staffing needs identified
Revised org structure and staff needs
Staffing assignments
Future revisions to org structure and staffing assignments
Site Selection and Coordination
Letter to NEI requesting volunteer
Response from NEI
Kick-off telecon with SNC
Comm. protocol estab.
Initial information request
Kick-off meeting with SNC
Future coordination with Vogtle
Quality Assurance (QA)
TAG Charter
TAG Established
TAG mtgs
Draft QA Plan
Revised QA Plan
TAG mtg
Future TAG meetings, and internal and external peer review
Technical Analysis Approach (TAA) Plan
Prel draft TAA Plan
TAA Plan template
Draft TAA Plan
Revised TAA Plan
Future revisions to TAA plan
Documentation
Documentation scope established
Prel doc process identified
SharePoint site established
Draft doc plan
Future revisions to doc plan and documentation infrastructure

Path Forward

- Continue with technical work in all areas, including:
  - Develop Reactor Level 1 PRA internal events and internal floods model in SAPHIRE
  - Meet with licensee to discuss modeling of internal fire and external hazards
  - Develop MELCOR input deck for use in analyzing system success criteria, accident sequence timing, and severe accident progression
  - Investigate methods for addressing HRA for external events, LPSD, and post-core-damage
  - Investigate methods for addressing integrated site risk
- Continue to interact with internal and external stakeholders, including:
  - Brief TAG, public, and ACRS on approach for spent fuel pool PRA and dry cask storage PRA in Spring 2013
  - Brief TAG, public, and ACRS on resolution of challenges and initial results for reactor PRA in Summer/Fall 2013

Back-Up Viewgraphs

Additional Information on IE Analysis

- Consequential and concurrent initiating events are outside the scope.
- The EPRI/NRC modeling of support systems initiating events (SSIEs) shall be used for applicable support systems.

Additional Information on Success Criteria

- Licensee success criteria and sequence timing assumptions will be scrutinized based on existing information.
  - Licensee has performed extensive MAAP4 analysis.
  - No dedicated MELCOR analysis based on schedule/ resource constraints.
  - Existing information includes past studies, MAAP4 modeling experience, and ongoing MELCOR analysis for a similar plant (Byron, Unit 1).

Additional Information on Success Criteria (Cont.)

- Vogtle, Unit 1 MELCOR 2.1 model is being developed for focused success criteria analysis for other modes/hazards (including use in Level 2 PRA).
  - Reactor coolant system, main steam system, containment, reactor protection signals, and engineered safety features.
  - TRACE 4-loop Westinghouse model also available for LBLOCA/ATWS, if necessary.

Additional Information on Internal Flooding PRA

General Approach

- The approach is consistent with the general approach used for internal events.
- The existing SPAR model does not include internal flooding.
- Review the licensee's internal flooding PRA model, model documentation, and peer review report to confirm technical adequacy of the licensee's internal flooding analysis.
  - Investigate any findings and observations from the external peer review of the licensee's model.
  - Perform a selective audit of the licensee's model and model documentation against the current ASME/ANS PRA Standard.
  - Perform a site visit to confirm aspects of the analysis. This may include plant walkdowns, interviews with plant staff, and review of drawings and P&IDs.
- Integrate the internal flooding scenarios into the internal events model.

Additional Information on Internal Flooding PRA

Assumptions and Limitations

- The licensee's internal flooding PRA has undergone peer review against the ASME PRA Standard.
- Any supplemental analysis and information gathering performed by the staff will be minimal.
- A stable version of the internal events model will be available before internal flood scenarios can be integrated.

Additional Information on Internal Fire PRA

Background

- The licensee has performed an internal fire PRA which has undergone external peer review, though the licensee has not yet received the final peer review report.
- The licensee's fire PRA will be used to identify (or define) fire scenarios for incorporation into the NRC's Level 3 PRA model.
- NUREG/CR-6850 (EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities) will be used to identify areas that may require additional analysis, if practical.
- Mix of in-house (RES staff) and contracted effort.

Additional Information on Internal Fire PRA

Assumptions and Limitations

- Licensee's fire PRA model and documentation, including external peer review report, are available.
- A stable version of the internal events model will be available before the fire scenario modeling task starts.
- Fire scenarios affecting Unit 1 will be modeled.
  - Differences with Unit 2 will be identified.
- The project will rely on analyses already performed for the following areas:
  - Cable tracing/selection for fire PRA
  - Circuit analysis for spurious actuations
  - Fire modeling.

Additional Information on LPSD PRA

Initiating Event Analysis

- In general, obtain initiating event frequencies from:
  - NUREG/CR-6928, "Industry-Average Performance for Components and Initiating Events at U.S. Commercial Nuclear Power Plants"
  - EPRI Technical Report 1003113, "An Analysis of Loss of Decay Heat Removal Trends and Initiating Event Frequencies (1989-2000)"
- Review more recent LPSD operating experience to determine if updated frequencies are needed