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

January 29, 2014

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 PROJECT PLAN ON MAY 22, 2013, IN ROCKVILLE, MARYLAND

The minutes of the subject meeting were certified on January 16, 2014, as the offical 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 PROJECT PLAN ON MAY 22, 2013, IN ROCKVILLE, MARYLAND

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_1/16/2014__
John W. Stetkar, Chairman
Reliability and PRA Subcommittee

Certified By: John W. Stetkar
Certified on January 16, 2014

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
MINUTES OF THE ACRS RELIABILITY AND PRA SUBCOMMITTEE MEETING
May 22, 2013

The ACRS Reliability and PRA Subcommittee held a meeting on May 22, 2013 in Room T-2B1, 11545 Rockville Pike, Rockville, Maryland. The meeting convened at 8:30am and adjourned at 11:59am. 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
William Shack, Member
Steve Schultz, Member

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
Mary Drouin, RES/DRA
Kevin Coyne, RES/DRA
(See attachment 1 for Attendant list)

Other Attendees
Jana Bergma, Scientech
Amir Afzali, Southern Nuclear Company
Stuart Lewis, Electric Power Research Institute

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
Members and Mary Drouin of RES discussed the sharepoint site for controlling the documents and how it is structured.	10-24
Members and the staff discussed how to treat the PRA model information supplied by Southern Company (Vogtle Plant).	26-32
Members and the staff discussed how the resolution process works if one finds an "error" in the Vogtle model.	33-42
Members and the staff discussed what should and should not be included in the present Vogtle model for the level 3 PRA study (e.g., how considerations of ongoing Vogtle hardware modifications and procedure changes affect the "freeze date" for the level 3 PRA model).	44-52
Chairman Stetkar suggested to group fires, internal and external floods, and seismic together for a single peer review topic. The effort of reviewing the low-power shutdown model will be the same as that of full power.	54
Chairman Stetkar and the staff discussed the resources to complete the review of the integrated level 3 PRA.	55-57
Don Helton of RES presented the plans for the spent fuel pool (SFP) and dry cask storage PRA studies.	57-64
Members and the presenter discussed the spent fuel pool configuration of the two Vogtle units and the inter-connection between these two pools.	65-66

Chairman Stetkar and the presenter discussed the importance of keeping a consistent number and definitions of the seismic hazard bins throughout the study.	68-70
Don discussed the postulated accident events for SFP studies and the process of creating the PRA model.	73-77
Don discussed the mitigating strategy and procedures for mitigation.	77-79
Members and Don discussed the integrated model and the process of relating the reactor operating states to the spent fuel pool events.	79-81
Members and Don discussed the heat loads for the SFP modeling.	81-83
Members and presenters discussed the importance of visualizing the integrated level 3 PRA modeling at the beginning of the project.	83-86
Felix Gonzalez of RES described the Dry Cask Storage (DCS) historical studies and proposed studies for the Vogtle DCS facility.	87-95
Felix described the proposed DCS PRA analysis, fuel and canister failure analysis for the Vogtle plant.	96-101
Member Bley and the staff stated that it may be beneficial to look for human failure events in the chemical industry that are relevant to cask handling and transport activities.	102-104
Susan Cooper of RES described the studies done in two NUREG reports regarding the fuel loading and dry cask loading events.	104-106
Felix described the challenges and major assumptions for the Vogtle DCS project.	107-111
Alan discussed the next steps for the level 3 PRA project. Members suggested to present the HRA methods for different stages of the project in the next meeting.	112-117
Alan described the activities in the level 1 PRA development.	118-122
Chairman Stetkar and the staff discussed how the walkdown of the plant was done.	122-124
Chairman Stetkar and staff discussed what and how the plant information will be used for seismic PRA analysis.	124-126

Chairman Stetkar and Member Bley stated that the states of configuration control during an outage and the treatment of correlated equipment unavailability are most important for the low-power shutdown model development.	126-130
Chairman Stetkar and the staff discussed the challenges of fire modeling at low-power shutdown condition.	131-133
The staff discussed the progress and challenges of level 2 PRA modeling.	134-136
Member Schultz and the staff discussed the effort of consequence analyses including visiting the emergency preparedness center at the Vogtle site.	137-139
The staff discussed the plan for moving the project forward.	140-144
Member Bley stated that the staff made good progress on the project and it is essential to link the important sequences together for the level 3 results.	145-146
Member Schultz suggested that the staff should continue to use the level 1 PRA results to explore the integration of the level 3 PRA model. It will help to get feedback from the external stakeholders early in the project.	146-147

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.0a – Working Draft , April 2013 (ML13112A444)

Attachment 1 List of Attendants

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETINGS ON RELIABILITY AND

PROBABILISTIC RISK ASSESSMENT

May 22, 2013
Date

NRC STAFF SIGN IN FOR ACRS MEETING

PLEASE PRINT

	NAME	NRC ORGANIZATION
1	Mary Drouin	RES/DRA
2	Alan Kuritzky	RES/DRA
3	Kevin Coyne	RES/DRA
4	Jose Pires	RES/DE/SGSEB
5	Dan Helton	RES/DRA/PRAB
6	Ed Fuller	RES/DSA
7	Susan E. Cooper	RES/DRA
8	David Brown	NMSS/WCD
9	Mike Weber	NMSS/WCD
10	Tim McCartin	NMSS/WCD
11	Felix Gonzalez	RES/DRA
12	Jack Guttmann	NMSS
13	Michael Gill	NMSS
14	Brian Wagner	RES/DRA
15	Hipolito Gonzalez	NMSS/SFAS
16	Banad Jagannath	NMSS/SFAS
17	Nathan Siu	RES/DRA
18	Y. James Chang	RES/DRA
19	ANDERS GILBERTSON	RES/DRA
20	Suzanne Schroer	NRO/DSRA
21	DOUG COE	RES/DRA
22	ERIC BOWMAN	NRR/DRR
23	Thomas Hiltz	RES/DE/SGSEB
24	Lauren Ning	RES/DRA/PRB
25	RICHARD LEE	RES/DSA/ESCB
26	Donnie Harrison	NRO/DSRA
27	Paul Yeamans	RES/DRA
28	Jeffrey Wood	RES/DRA/PRAB
	Tae Ahn	NMSS/SFAS
30	Michelle Gonzalez	RES/DRA/PRAB

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETINGS ON RELIABILITY AND

PROBABILISTIC RISK ASSESSMENT

May 22, 2013
Date

NRC STAFF SIGN IN FOR ACRS MEETING

PLEASE PRINT

	NAME	NRC ORGANIZATION
1	Bruce Lin	NMSS/SFST
2	Keith Compton	RES/DSA/AAB
3	Tina Ghosh	RES/DSA/AAB
4	David Tang	NRC/NMSS
5	YAWAR FARAZ	NRC/NMSS
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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: Wednesday, May 22, 2013

Work Order No.: NRC-4238 Pages 1-152

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

+ + + + +

RELIABILITY AND PRA SUBCOMMITTEE

+ + + + +

WEDNESDAY

MAY 22, 2013

+ + + + +

ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., John W. Stetkar, Chairman, presiding.

SUBCOMMITTEE MEMBERS:

JOHN W. STETKAR, Chairmann

DENNIS C. BLEY, Member

STEPHEN P. SCHULTZ, Member

WILLIAM J. SHACK, Member

NRC STAFF PRESENT:

JOHN LAI, Designated Federal Official

DOUG COE, RES

SUSAN COOPER, RES

KEVIN COYNE, RES/DRA /PRAB

MARY DROUIN, RES/DRA/PRB

FELIX GONZALEZ, RES/DRA/FRB

DON HELTON, RES/DRA/PRAB

ALAN KURITZKY, RES/DRA/PRAB

STEVE LAUER, NRR/DRA

BRIAN WAGNER, RES/DRA

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P R O C E E D I N G S

(8:31 a.m.)

CHAIR STETKAR: 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 are Steve Schultz, Dennis Bley and Bill Shack. John Lai of the ACRS Staff is the Designated Federal Official for this meeting.

The Subcommittee will hear the stats discussion of the Level 3 PRA technical analysis approach plan and quality assurance, spent fuel pool PRA and dry cask storage PRA.

There will be a phone bridge line. Is that still correct?

MR. COYNE: That is correct.

CHAIR STETKAR: To preclude interruption of the meeting, the phone will be placed in a listen-in mode during the presentations and committee discussions. We receive no written comments or requests for time to make oral statements from members of the public regarding today's meeting, and 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. 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.

Participants should first identify themselves and speak with sufficient clarity and volume so they may be readily heard. Now, I proceed with the meeting, and I call upon -- who do we have here?

MR. COYNE: Kevin Coyne.

CHAIR STETKAR: I can't remember your first name ever. I'm sorry, Kevin.

MR. COYNE: No problem. Kevin Coyne of the staff. Didn't want to give a light introduction, but thank you to the Committee Members for allowing the Subcommittee to discuss the technical analysis plan, and we'll quickly turn it over to Alan Kuritzky to start the briefing.

MR. KURITZKY: Thank you, Kevin. Thank

you, Subcommittee Members. Again, to echo Kevin's sentiments, we appreciate the opportunity to talk to you about this project. I'm Alan Kuritzky, Program Manager for the Level 3 PRA Project.

Essentially, this meeting is just a continuation of the briefing we had for the Subcommittee in December. We were discussing the technical analysis approach plan for the project. We only had time to discuss those aspects related to the reactors in December.

So, now we're going to continue on with the discussion on the spent fuel pool and dry cask storage. Also, we're going to first talk a little about our QA plan we discussed with you in December, but we've -- it's a living document.

It is still being worked on. It is a work in progress. We've made some substantial changes, particularly adding a section on documentation control, which is actually very important for the project.

So, Mary Drouin is going to talk a little about those changes and what's being done with that plan before we go onto the other aspects of the Technical Analysis Approach Plan.

Then we'll wrap it up. I'll just talk briefly about the project status, what we've accomplished

so far, what we're working on right now, and what will be coming up. So, with that, let me give it over to Mary.

MS. DROUIN: Okay, I'm Mary Drouin with the Office of Research. I serve as the Senior Advisor on the project. As Alan said, we had given you a previous presentation on quality assurance, and we had talked to you about some previous elements: the established methods, the personnel, configuration control and the different technical reviews that we'll be doing on the project.

But a very essential part of the quality assurance plan is the documentation control. How do we ensure on a project of this size that we are ensuring that everybody is using the same information? For example, the information isn't getting lost; it's not being corrupted. And how do we put some controls on that?

So, that is what we're going to try and go through, and show you what we have developed to control the various documentation. Next slide, please.

When we talk about the information that needs to be controlled, there's various types of information, the different methods being used, the tools, data, a lot of other information that gets more into the plant-specific information. You know, the plant design, operational information, operational data, test and

maintenance procedures, engineering calculations and design.

This all contributes to being a huge, tremendous amount of information. There's stuff that's not listed here and it should've been. It's also the working files, the calculations that are being done, the models that are being built, the assumptions that are being made, the decisions, etcetera.

All of that we need to have it both documented and to a sense controlled, and in controlling this, we need to be able to track the work and as I said we need to make sure that it's not inadvertently being deleted or corrupted.

So, we need some kind of medium to document this, to manage it, and we're going to be using the SharePoint site, and I'll talk a little bit about that in a minute. Next slide, please.

In looking at the SharePoint site and how we're going to manage all of this, we have two program team members that are going to be responsible for the documentation control. That doesn't mean to say that not everybody -- everybody has a role here. There's not a member of the team, but who is going to be managing it from a higher level? And we have a person we call the SharePoint manager who will be in charge of the various

tasks needed to ensure that SharePoint runs smoothly and remains organized.

Then we will have a documentation coordinator who will get the information on the SharePoint site, receive it, process it, etcetera.

So, now let's get into the specifics of what we mean by documentation control. As you notice here, there's lots of elements when we talk about documentation control: storing and accessing the project information, uploading the information, storing and controlling the licensing information, a non-disclosure agreement.

This is a very important aspect because we are receiving information from the licensee that is proprietary. And so, it's essential that we have controls to protect that proprietariness.

Documentation backup: how many times do our computers crash? More often than we'd like to. So, we need to be able to make sure we don't lose anything in the use of an external media as another backup system.

Personal working files: Everybody has their own way they'd like to work, but on a project this size, we have to ensure that the necessary backup is happening with everybody's personal areas.

Use of templates and forms for documentation: Again on a project this size, everybody

has their own little way but we have to think to the future and be able to retrieve this. There needs to be some kind of consistency and logic to how we document.

Documentation control for our contractors: We can't ignore that. Guidance for addressing potential technical issues; in any kind of analysis you're going to come up against questions and concerns, and, "How do you resolve that?" and, "How do you document that?" And that they were properly addressed, and then the organization of the various types of information.

We have a section at the end on how we organize on the SharePoint site, and who has access to what, etcetera. Next slide, please.

CHAIR STETKAR: Is all of that set up already?

MS. DROUIN: Excuse me?

CHAIR STETKAR: Do you have that set up already?

MS. DROUIN: Yes, yes.

MR. KURITZKY: Ninety percent.

MS. DROUIN: That's close enough.

CHAIR STETKAR: I used the word all.

MEMBER SCHULTZ: Mary, could you provide a perspective on what the timing has been? Ninety percent is set up. I see in the slides you've got some things

that are, "This is how it will be done." I'm trying to understand the schedule for implementation here, because it's very important in setting up such a program that at some point all the information is going into the system, and it is all controlled, and the process --

MS. DROUIN: I'm going to get to a slide that talks about that.

MEMBER SCHULTZ: Okay.

MS. DROUIN: So, can we wait until I get there?

MEMBER SCHULTZ: I will.

MS. DROUIN: Then if I don't thoroughly answer you, please let me know what I didn't address because I'm going to end on that note.

MEMBER SCHULTZ: Thank you.

MS. DROUIN: So, why did we select the SharePoint as the medium? Well, we have to be able to restrict the information and control it. So, we wanted a site that you can store and access, and what that means is that who would have access to this information and who would be able to retrieve it? Who would be able to edit it?

And so, SharePoint offers all of these features. So, the controls that we've put on there is that -- you know, the information on the SharePoint site

for this project is only accessible to the project team members, and that's a key point.

So, someone else from the agency does not have the right or the ability to go onto that site and look at the information. The site is stored on an NRC internal network drive. Most of the information --

MEMBER SHACK: That means those people will have to access it through SharePoint -- I mean through Citrix?

MS. DROUIN: No. They -- unless they're offsite.

MEMBER SHACK: That's what I meant.

MS. DROUIN: Yes. If they're outside, they have to go through Citrix, yes. But so far, that has not been an issue with the Citrix accounts.

MEMBER BLEY: Have you used it for other projects before?

MS. DROUIN: SharePoint?

MEMBER BLEY: Yes.

MS. DROUIN: I have on other projects.

MEMBER BLEY: You've been happy with it?

MS. DROUIN: We've been happy with it. And the thing is whether or not you're happy with it --

MEMBER BLEY: Well, I shouldn't have said that.

MS. DROUIN: Well, it's been effective. You have the ability to design it any way you want. Now, there are some limitations to it, but they aren't limitations that have affected us.

MEMBER BLEY: That's what I wanted.

MS. DROUIN: Any limitations we have is because we have not designed it or we haven't organized the folders as efficiently. So, we've been making some changes as we've learned from it.

MEMBER SCHULTZ: Is the information that comes in, from Vogtle for example, is that specifically for this project? Or, is this project duplicating the receipt and storage of information that comes in from Vogtle as a proprietary document?

MS. DROUIN: The information we receive comes in from Vogtle just to support this project. Now, they may be doing something else in other parts of agency, but we're not involved with that.

MEMBER SCHULTZ: So there's no need to centralize it otherwise?

MS. DROUIN: No.

MEMBER SCHULTZ: It's coming in for this purpose?

MS. DROUIN: Yes.

MEMBER SCHULTZ: Thank you.

MS. DROUIN: And it is only for this purpose.

MR. KURITZKY: Actually, just to follow on, that is the reason why you saw on that previous list we had that non-disclosure agreement, because information was coming in. Other people in the agency might be aware of it, and wanted to use it for other purposes. But because our agreement was nuclear and to use this just for this project, we set up that as a firewall to keep it from being used for other purposes.

That's why people click and acknowledge that they'll only use this for the purpose of this project. They don't get access to the folder that has proprietary information.

MS. DROUIN: Right, which is the next point on my slide. As you can see there, it --

MR. KURITZKY: I saved you time.

MS. DROUIN: Right. You saved me time. Great. I appreciate that. Most of the files are only read files, but I will get into the fact that we do have the personal working files, and I will explain that in a minute.

But since the SharePoint site is on the internet, it does -- okay, it does get periodically backed up, and I don't remember how often that is. I think it's

once a week, but we are also going to manually back it up on an external media device so that if the SharePoint site ever crashes, we do have a back up to it.

Okay, we have also set up on the SharePoint site these individual personnel folders, and we are requiring that each of the project team members do their work and share all their working files on the SharePoint site, and not on their own personal computers. That again is to ensure that we don't have a loss because our drive crashes and stuff like that.

It ensures that all the information, that decisions, notes, assumptions, all this information that you know is created in building this model is documented and backed up, but also more importantly it is accessible to the entire team. That's a way to make sure that this thing is going to fit together.

People need to be able to see what's happening in each other's respective areas. Of course they need to talk, and that is happening, but they also need to see this information. And so, when everybody is just doing it on their own personal little laptop, or their own personal hard drive, it makes it difficult for the entire team to see everything when they need to understand what another task is -- what is occluding on another task.

Now, it is only read accessible to other team members. So, on a personal working file, the only other person who has the ability to edit that information is the actual analyst, but it is open to be able to be read by the entire project team.

We also created guidelines for naming the various folders so that -- facilitate site navigation. You know, some people have very interesting logic, I will have to say, to how they name their files, and it doesn't make sense to another one.

So, the names of all these files and everything need to make some sense to another person so he doesn't have to go and open every single thing he sees on somebody's site.

MEMBER SCHULTZ: Mary, how about timing of access? In other words, if an engineer is working on a file and we want to have it open and saved, but if it's a working file then one would not want someone else to be able to read information and take information from it. Presume the file is complete until in fact the calculation is done so that we don't get into a mode where someone is working on a piece of the project; it may appear that the calculation is complete to some point, but it's not ready for someone else to take those results and use them.

How is that controlled? Is there some way to identify the status of completion of a particular piece of work?

MS. DROUIN: Yes. I mean we can put in a status field. We have not done that yet, but that's a good point.

MR. KURITZKY: Also, just to follow on, there's -- right now, as Mary mentioned, there is personal folders for each of the people on the team so that they can put their work on there. It's protected in case of crash, etcetera. But there's also folders for the different areas of the study, like spent fuel pool PRA or initiating event analysis. Different studies have their own folders also.

When things are completed, the intention is that when things are being worked on, they will be in the personal folder. But once something is completed, it would then get moved into the area folder for that area. That way, people going in there -- there's always that risk that if you go -- people go into someone else's folder and just look at their stuff. There's no guarantee or warranty that that's complete and final information. You don't even know if you're opening up the latest version of that file.

So, I think everybody on the team knows that

if they want to make sure they're getting the latest, they should talk to the team leader for that area. But also, the idea is that we would move things when they're completed. We could move them into the area folder.

MEMBER SCHULTZ: Okay, good.

MR. KURITZKY: The area folder. So, that would be an area to get more completed documents. Even there, I would obviously caution everybody that they would need to confirm that that is the latest or final.

That is one little separation though. We'll separate the draft/working stuff from stuff that is at least completed or draft completed. Whatever, but there's a little breakdown to the level of completeness for the product.

MEMBER SCHULTZ: Good. Thank you.

MS. DROUIN: So, yes, there are those two things. But I think perhaps we'll look at the benefit of doing some kind of status because something like this is hard to control. When is -- somebody might think something is more complete at a different stage than another analyst.

CHAIR STETKAR: Does often doesn't mean anything until the money runs out.

MR. KURITZKY: Or the ding goes, and the party's over.

MS. DROUIN: So, anyway, the -- these personal files, having them on the SharePoint, again allows the project team to keep abreast of the technical progress that is happening on the project.

Another aspect of documentation control is what you document, and I think as you're well aware, if you went around and asked ten people what they should document, you would get ten very different answers in terms of the scope and the level of detail of the information that gets documented.

So, what we've tried to do is create a series of templates. Now, these templates are meant to be flexible. So, we don't want our analysts to look at them as a check mark that, you know, "Check this off and you can turn your brain off in terms of what needs to be documented."

They are meant to be guidelines to ensure that we're getting the scope and the level of detail that we want documented. And so, the different types of documentation, and in terms of the templates we've created, is meetings, discussions, plant visit trip reports.

I mean a lot of decisions were made in meetings. You have telephone calls. You have casual conversations, and we're trying to get the team to

document those things because it's in a lot of those occurrences where you make some critical assumptions and critical decisions to the project, and we want the documented and the basis.

It's not just, "Well, I had this conversation with John Doe." It's, "We made this decision, and this was the basis for the decision." And that's what we're trying to get captured: the analysis work, your inputs, assumptions, calculations, etcetera.

As we talked back in December, we have three levels of technical reviews. We have the technical advisory group. They're going to be providing us comments. So, we want to get those comments, but more importantly, how did we address and resolve the comments they gave us?

We're performing self assessments, and there are going to be external peer reviews done. So, we want to capture all of that, and how the comments were resolved.

Technical issues are going to come up throughout the entire project. So, how do we resolve those technical issues? We want that documented.

So, this template is to help to identify what we want to be documented and some consistency. At the end of the day, we want to be able, in ten years from

now, if somebody asks a question, to easily be able to track and come up with the answer.

I can tell you right now on 1150 as people disappear you just aren't going to be able to understand -- you could not recreate 1150 today based on the documentation of it. Now, I don't want to criticize 1150 because in it's time it did a very good job, but we've grown way past what needs to be documented on these PRA's based on what we needed 25 years ago.

MEMBER SCHULTZ: Mary, looking at reviews, is the peer review or is there anything in the review that is specific to technical individual reviewing a calculation, and is the calculation part of the review and approval of the calculation by a supervisor or manager in detail? Or, are we really talking about a level of detail in terms of review that is focused on peer review for consistency, review for adequacy?

Is it a technical review of the calculation? I'm not sure what self assessment peer review is applying.

MS. DROUIN: Okay, it is trying to get into the technical adequacy of the PRA. So, right now the criteria against which they do the peer review is against the PRA standard.

MEMBER SCHULTZ: Okay.

MS. DROUIN: Now, where there is not a standard, the QA plan requires you to develop ahead of time the criteria for performing the peer review. But the peer review, the self assessment as it says, is a self assessment so the team does the self assessment.

MEMBER SCHULTZ: Got it.

MS. DROUIN: But the external peer review is an independent peer review. So, they would be using the criteria. They could always develop additional criteria if they think that the set is incomplete.

MEMBER SCHULTZ: As it would be for a PRA process with the external peer review, and this is a way to capture the documentation associated with that?

MS. DROUIN: Yes.

MEMBER SCHULTZ: The questions, the answers and so forth?

MS. DROUIN: Yes.

MEMBER SCHULTZ: Thank you.

MS. DROUIN: Documentation, when it comes to the NRC contractors, are required to have their own internal document control system, and the contracting project officer is required to make sure that their documentation control system meets the objectives of our documentation control.

All contractor information submitted is

stored on SharePoint. Some of it will also be stored in ADAMS, like for example final products, contract deliverables would also be put on ADAMS. But all the contract information is stored on the SharePoint site.

Okay, we do have a process because as I said throughout the development of the PRA model, there will becomes times where we have technical questions regarding the Vogtle PRA. The reason I say that, if you recall, is our level 1 model for internal events/internal flood, for example, is leveraging off the Vogtle Southern Nuclear PRA.

So, we have to understand that PRA as we use it to develop our own model. There may becomes questions where we don't understand something, and so we have to go and find out do we actually have a disagreement? So, we have a process for dealing with that.

Now, Steve, getting back to your earlier question about the types of information that is on the SharePoint site, here is -- we have four major folders on the SharePoint site.

One of them is the general Level 3 PRA project documents; you can see in the next column these are general documents relating to the work performed in support of this project. For example, briefings, the

technical analysis plan and over the next column it tells you who has access and what kind of access.

The other three folder areas are reference documents, and that would be like the standard -- I'm just drawing a blank on the reference documents. Then the next group is the task group technical documents, and the last group are the TAG, Technical Advisory Group, documents.

The last one is the personal -- sorry, the task group technical documents is where the personal working files are stored.

So, the QA plan in this part of it lists all the different -- how the SharePoint site is organized, what's in each of the different folders, and who has what kind of access control. Does that answer your question?

MEMBER SCHULTZ: Yes, it does.

MR. KURITZKY: Also, I think that reference folder also has -- that's where we store the Vogtle information we get from the licensee. I think there's two main subfolders there. There's stuff that we come up with internally from the NRC, various reference materials. It could be the standard or various guidelines or guidance documents that we have, as well as a separate folder for the proprietary information supplied by Southern Nuclear.

It is that folder that only members of the project can access if they acknowledge the agreement that we control the information.

MS. DROUIN: But again only people on the project, only staff on the project, can access the SharePoint site anywhere. Okay, let's go back to the technical questions and how we go about resolving them.

One of the reasons that we wanted this in the QA plan is that we recognized that -- you know, when you start building a PRA model, and you're using information, parts of a model already created and you're importing it in and it's necessary that we take ownership which means we have to be able to defend that model, that you're going to have questions because you're trying to understand what's in that model and why it's there.

Well, in doing that, we want to be able to contain that within the project team, and not for a piece of information that we're questioning. For that to get outside the project and all of a sudden people are misinterpreting that there's a problem when there may well not be any kind of problem.

So, we want to very tightly control how we identify and resolve the technical questions on the PRA model, but I also want to emphasize that we are not doing a regulatory review of the Vogtle PRA. We are only trying

to understand the parts that they have sent to us in terms of us building our Level 3 PRA to understand the technical basis behind it.

Southern has voluntarily submitted a tremendous amount of information, and we have committed that this information will not -- is not to be used to support other regulatory activities. This is strictly being given to us to build this Level 3 PRA model.

When a question does arise, we want to contain it as we explore, and so we ultimately want to know if it's a misunderstanding, a difference of opinion or some potential area. And if it's ultimately identified as a potential area -- sorry, error, and it is significant to the results, then we would communicate that of course to Southern. But we've been working with Southern all along to resolve this.

If it gets to the point where we think this is an error and it is significant, and that's an important aspect that I apologize is not on the slide, then that will be communicated to the appropriate NRC licensing staff.

MEMBER SCHULTZ: That's to address the case where licensing decisions may have already been made?

MS. DROUIN: Are being made.

MEMBER SCHULTZ: That are affected by that

error?

CHAIR STETKAR: Let's get to the next slide because I have a few questions in this area.

MS. DROUIN: Okay. So, does how this process actually work? Well, we want to clearly define the question. What are we not understanding where we may have a potential disagreement? We want to clearly lay that out.

Then we want to seek clarification from Southern Nuclear. Maybe there is a piece of information we're missing, but we want to have discussion and that might be several discussions that we go back and forth, and we ultimately want to come to some kind of resolution in the sense of did we get it clarified and we're now happy? Or, determine if this is a difference of opinion on how you model something, or it's an actual error.

Now, once that evaluation is done and we come to a conclusion, if that conclusion is that it's a potential error and it could significant impact the results, then we would communicate this back with Southern Nuclear, and we would communicate it to NRR.

Then we would proceed with our developing our model based on how we want to -- how we have addressed and resolved that issue, but we're not getting involved with what happens over on the regulatory side of the house.

We will just continue within the objectives of us building our Level 3 PRA model.

MEMBER BLEY: I think at a previous meeting Alan walked us through how you're going from their PRA over to your model, and I don't quite remember the details. Their model is in one of the softwares that's out there, and you have their model. You have the computer model.

MS. DROUIN: Yes.

MR. KURITZKY: I'll just rehash that a little bit because it might've even changed a little bit.

MEMBER BLEY: I'm a little vague. I don't quite remember that. What you have up there is how you're able to review it, and then how you're moving that over to --

MR. KURITZKY: You're right. So, first of all, this is what Southern Nuclear was able to supply. Southern Nuclear has a Vogtle PRA that covers Level 1 internal vents and internal floods, and they've also, even though they're not an NFPA 805 site, they have actually prepared a very detailed fire PRA, and they provided that to us also.

MEMBER BLEY: In software?

MR. KURITZKY: These are all -- and the internal vents internal vents/internal floods model is in CAFTA, and then the fire PRA uses the FRANKS code,

which is -- I'm not a fire PRA expert, but it's I think the current one that people are using. So, we get input from that. A lot of that we get is spreadsheet information too, because what we're doing -- the internal vents/internal floods, we've taken the CAFTA input and we've converted it over into Saphire, and we've used essentially the same logic that was used in --

MEMBER BLEY: Is that a manual process where you're doing data entry or are you able to port it over somehow?

MR. KURITZKY: Idaho National Lab is doing it for us. They have a routine to automatically convert over. Originally we were not going to have them do that. We were going to rebuild it ourselves to get people experienced in building fault trees, etcetera.

We did not end up doing that, and since we didn't do that, I -- and they ended up converting over directly the model from CAFTA, I don't know whether they building that -- whether they used that auto routine and just had to clean up whatever things that might not convert over properly, or whether they ended up having to re-enter all the data.

Either way, it converted over into Saphire, and what they do is they ran -- they have a type of a benchmarking exercise they do to see how well they

replicate what licensee's model was to see if they had any errors or things that didn't get converted over properly.

In doing that check, they had a very -- they showed very good alignment with what the licensee had. So, we were fairly comfortable when the conversion went very well. Then of course we started doing dominant cut sets to make sure that we understood exactly what was in the model, and seeing how it compares to the licensee's model.

Also, there are certain things that we do --

MEMBER BLEY: And when you do that, you're running your code on one machine faster on the other machine, and then looking at the --

MR. KURITZKY: Right. It doesn't have to be at the same time. We have the results from the CAFTA model, so we can -- we can look at those, and look at the results from our model, and we can see how well they compare in terms of CDF, frequencies in terms of dominant cut sets, etcetera.

There are also certain modeling conventions we have with our SPAR models that the NRC maintains and we'll use Saphire with. And so, some of those conventions we also wanted to use for the Vogtle -- the NRC's Vogtle

Level 3 PRA model.

So, we've adjusted some things with the licensee's model to the conventions we used with our SPAR models. So, things like common cause failure treatment may have adjusted; treatment of loss of offsite power and recovery we may have adjusted. There's certain conventions we use that we've changed over.

One of the things I was going to mention at the end of the meeting in data-wise is we -- we have our own way of dealing with the data. So, we're converting that over also and making changes with that. But essentially, we've taken their model from CAFTA, converted over to Saphire for the parts that -- for the internal vents and internal floods. For the fire, it's a different --

MEMBER BLEY: Are the Vogtle folks involved in QA'ing your model?

MR. KURITZKY: No, they are not. That's all been internal. Then we had the self-assessment, internal self-assessment, and we'll have an external peer review of it. We will have an external peer review, which we'll talk about later also.

So, that's the process of internal vents and internal floods. The fire is a little trickier because the fire is a huge effort. There's a tremendous

number of scenarios, much more than we would want to deal with in our own Vogtle model with the NRC.

So, we have an approach we map to Vogtle into a smaller subset of scenarios for our model, which captures all the key aspects that tries to preserve the frequency and get the dominant contributors in terms of both consequence and frequency. That process is something that we're working with right now, but that is -- I think we use mostly the output from the FRANKS files that the licensee has provided us.

So, that's the process. Then seismic, the other thing that we are also getting from Southern Nuclear is they are in the process of doing a seismic PRA. It's still ongoing.

So, we've got some information from them, preliminary information from them, on some of their seismic work. That we'll have to do more on our own because the -- Southern hasn't advanced that far to take it as we did with the other parts of the study, but there's a lot of information they've already done that we can make use of, and then we're going to take further ownership of it ourselves by doing some additional fragility calculations, doing a review of the various inputs to the seismic PRA.

That also will then be put into the Saphire

framework, Saphire platform. So, that's the general overview.

MEMBER BLEY: Okay.

MS. DROUIN: You know the point being is that again we need to -- this is now going to be our model. So, we need to understand. And it's not that we anticipate or we're looking for things to be wrong, but we just have to be prepared that if we do find something, how do we handle it and keep it controlled before it gets adequately addressed and resolved.

CHAIR STETKAR: I wanted to come back to this because something kind of bothered me about this that Vogtle has voluntarily given you a lot of information, their models, data and everything to support this project.

This notion of this project identifying, as it's called in the document issues, that now become items for regulatory concern troubles me a bit. For example -- and I don't understand how that process works.

For example, if Vogtle has already submitted a risk informed licensing submittal, and has submitted to the staff the underlying PRA models and data to support that risk informed licensing submittal, and the staff has accepted those as being technically adequate to support the licensing decision and conclusions that

staff has done, does this now draw into question all of those staff reviews and acceptance of adequacy?

MR. KURITZKY: That's not a call that we would make.

CHAIR STETKAR: Well, no, it is a call that you're making because you're raising your concern. You're raising a concern.

MS. DROUIN: We are the Office of Research, and we are providing information to NRR. It is their responsibility to determine whether or not that affects previous decisions. That's not our call at all.

We can't -- because we are the NRC and we are the regulator, we cannot afford on our end if we find something that is truly an error, and that's why we're talking about things that are truly error that would call into question the results of the PRA. We cannot ignore it. We are under an obligation to provide that information to NRR.

Once we provide that information, we have no more involvement in it, and it is now in NRR's hand to disposition as they see fit. Now, Southern Nuclear being a very responsible utility I'm sure would take the appropriate actions to address it.

MEMBER BLEY: I think you said at the beginning that you're agreements are that you will notify

them as well when you --

CHAIR STETKAR: Well, there's a whole process there that they actually go through. Research raises a concern and then it goes through a process. If it doesn't get resolved at that level, then it gets kicked up to become what they call an issue.

The problem is that -- I'll just raise it. It seems to dissuade these types of cooperative efforts because it raises the possibility that someone, somewhere in research may define something as an error. Could be a really subtle point that nobody understands except that individual who might be wrong.

There's a statement in the plan that says, "It will be assumed that any concern that is not resolved by the cognizant staff will be considered to be an issue unless the Level 3 project management unanimously determines," and it doesn't even get votes. It has to be everybody has to agree that this thing is resolved, otherwise it gets kicked up to licensing who probably doesn't understand the subtleties of PRA. So, now it becomes a licensing concern.

If I do a Bayesian update, and come up with 1.23 x 10 -7, somebody else does a different way of treating the data and comes up with 2.46 x 10 to the -- that's a factor of two difference. My god, that's wrong.

One of those numbers is wrong. How do we resolve this? Honestly, that -- it can become that level, and that's a bit of my concern that if it devolves into those types of discussions, technical errors being small differences in numbers, technical errors being differences in the way you might treat common cause.

MS. DROUIN: Let me -- because you're missing the major thing, and we said it only gets transferred over to NRR if also -- there's an "and," to that. It could significantly impact the results.

So, let's just say this extreme example, because I think this is an extreme example, and I don't see this ever coming up to that kind of level. But let's just say all the things we have in place fail.

If it doesn't impact the results, it doesn't go over. And in difference of opinion, you know, they are not things that are errors. They're difference of opinions.

MR. KURITZKY: Let me also clarify. I think the important part here is that this is not put in place to support fishing expeditions to identify errors with PRA and then pass them over to NRR. The reason that this entire process is put in place is actually to prevent analysts who think they've found some major problem with the PRA, which may in fact just be a difference of opinion,

may in fact be a misunderstanding or a lack of knowing the complete information, or a mischaracterization, or a misclarification; it's to prevent those types of things from being raised as major issues. So, the whole purpose of this approach is to contain within the project any issue until it is fully vetted internally, fully vetted with the licensee, and then only after that process if it is still believed to be a significant error with the PRA, and by significant I mean it can significantly impact the PRA results or insights, and it's -- we determined it is actually an error and not just a difference of opinion. Then it would get -- we would notify the licensee about this situation to let them know that we're going to go a different route on this in our study, and that we feel it is significant enough that we at least have to mention it to NRR because it's our regulatory obligation to do so.

One more second. The whole point of that unanimous -- the unanimous may sound very ominous, but there's three people that has to go through. It's going to be Kevin Coyne, Mary Drouin and myself. And we're just there as a last ditch to say, "Hey, is this really an issue that warrants a change? Is this just someone using a different updating approach and come up at a factor of two difference?" No. That doesn't warrant raising

a flag.

Okay, but if there's some major error, if they have done something totally incorrectly or left something out that was very important that totally changes the risk profile for the plant, then we will look at it, and say, "Okay, yes. This is something that does need to be raised. We have to notify Southern Nuclear and we have to let NRR know that we've notified Southern Nuclear about this."

So, really we'd be incumbent on Southern Nuclear to take the appropriate corrective action, and I have full faith that they will do the appropriate thing. They're very proactive with their PRA program. I have no doubt they will aggressively pursue anything that we identify to them.

But because we are part of the regulatory agency, we do need to also notify the division of projects that we've passed this item onto Southern Nuclear. So, it is really in there to prevent there from being an escalation of items that are thrown over to NRR, and only restricting to those things that are significant, that we've truly vetted, and that we feel are important for NRR to be aware of.

SHERRY: The sticking point for me, one sticking point, is that all of this in 3 and 4 focusing

on a potential error and that even a potential error would be brought to NRR's attention.

MR. KURITZKY: It's because we in this project cannot make the decision as to whether it is truly an error. We will leave that to the licensee. It will be based on all the information we have that all points at being error, and we want to let them know they'll have to do the appropriate analysis --

MEMBER SCHULTZ: The order you described it is to go to the licensee first because your intent is to develop a PRA that's common and consistent with what the licensee has already developed.

MR. KURITZKY: Well, it's not our intent to develop one that's common and consistent with theirs. We want to leverage their work as much as possible to reduce the burden on us. But we need to take ultimate ownership of the model we have and it may differ from theirs in several ways.

MEMBER SCHULTZ: But if you get different results, you're going to need to vet that in some way with licensing, no? Or are you going to go ahead and say, "Well, we just got different results. We have a better answer than they have."

MR. KURITZKY: Well, no. We'll document. If we find things that are different than the licensee's,

we'll document them in our report why we feel our things are coming out different than theirs, but that's not the same thing as raising issues that the regulatory part of the agency needs to address.

If we do see something that we do feel might warrant additional attention because it's significant enough, then that's why we passed the idea -- we passed the information onto Southern Nuclear.

We've already talked with them to get clarification. They haven't scratched our itch so to speak. So, now we say, "Okay, now we still think this is an issue. It's gone through the various levels of checks that we have put in place."

We let Southern Nuclear know we run this down as much as we can. We still think it's a potential error. We're going to do something different for our study. That's our own take. But we're letting you know this and we're letting NRR know that we're informing you that we have this supposedly significant potential error that will need to be addressed.

Then it'll be up to the licensee and NRR if they want to do anything about it. We are just doing our due diligence as regulators to get as much information as we can to take full ownership of the PRA that we're developing for our project and informing the other parties

if we find something that we think might be significant and that they should look at.

That is as far as we take it. We let Southern Nuclear know. We let NRR know. And it's up to them if they feel it's something that needs to be pursued.

CHAIR STETKAR: A couple questions. We have to be cognizant with the time here in a little bit. I guess I got confused because I was reading the words and not listening to an oral presentation. An issue as it is written in the document says, "A potential concern that, one, calls into question, the technical rigor or adequacy of the SNC Vogtle PRA related quality activities, two, may impact PRA results or insights, and three, has been validated after further information or explanation has been provided by the licensee and assessed by the staff.

Didn't read anything there about significance or really important stuff.

MS. DROUIN: Okay, let me --

CHAIR STETKAR: It just says, "May impact PRA results or insights." A factor of two or a different way of doing common cause may impact PRA results or insights. My concern revolves around that.

MS. DROUIN: Okay.

CHAIR STETKAR: I hear orally about, "It is only really, really important things that are really, really errors." But that's oral.

MEMBER SCHULTZ: That we can't resolve.

CHAIR STETKAR: That we can't resolve.

MS. DROUIN: You are not seeing an updated version of --

CHAIR STETKAR: I'm just looking at what I got at the end of March.

MS. DROUIN: Right, and I had it in my notes to mention the fact that in -- and we had gone back and re-read, and that part of the QA plan needs some improvement. Now, our slides are more up-to-date in terms of what we're trying to say, and we recognize we've got to go clean up words in the QA plan.

We had not had the chance to do that when we sent this out to you. So, it is out of date, and somewhat a little bit inconsistent to how you see this presentation. So, the point is for us we are going to update the plan to match the presentation.

CHAIR STETKAR: Thank you.

MEMBER BLEY: We like the presentation.

CHAIR STETKAR: We like this notion of --

MEMBER BLEY: We do have some things from May actually, a mark up from May.

CHAIR STETKAR: Actually, it is May. I misspoke. It's a May-dated version.

MR. KURITZKY: At the beginning of the presentation, I mentioned that was actually -- specifically that document was a work in progress because I was already aware that we were changing it since the time we --

MS. DROUIN: And so, along that same vain, if you go to the next slide, this is something that's not in the QA plan yet, at least in the version we sent out to you. This is future plant modifications. How do we take credit for them? Which ones do we do, and which ones we don't?

As you build a PRA model, it is not a model that you build in a day or a week or a month. It takes several years to do, and you don't want your PRA model to be out of date the minute that it is completed.

So, you need to look to the future a little bit, and see what changes are being planned in the design and operation of the plant and which one of those you're going to credit in your PRA model. So, we did come up with criteria for determining what future plant modifications we would put in the PRA model.

CHAIR STETKAR: This is just my input. You ought not to do that. You ought to just freeze the model.

The model is the plant as it was built and operated as of -- you pick the date. The date is some time before May 22nd, 2013. Might be December 31st, 2012. And just freeze it. You'll never finish this way.

MS. DROUIN: Well, we --

CHAIR STETKAR: This just inserts a point of everybody who has ever done a PRA has had to do that. They've had to grit their teeth. And it's important because it benchmarks and freezes the dates of procedures. It freezes the dates of the hardware. It freezes the dates of any modifications that are in progress, and people have to get over it.

When people update the PRA in the future, they have then a consistent starting point. They don't have December 31st, 2012 for this thing, but January 18th, 2016 for this other thing over here. It's just horrendous to try to track all of those differences.

Well, I disagree with you somewhat. You do pick a freeze date. You do. But you have to also -- if there is some major design change, and we might just have to disagree here. We did that on 1150. We had a freeze date, but we also incorporated some particular changes we knew that were going to occur.

We knew they were going to occur. In every PRA I've ever worked on we've done that. Now we haven't

blindly just taken into account and we don't keep changing. At our freeze date, we look at what is on the books and the next slide shows the criteria we're using to identify those that we want to take credit for.

First and foremost, it has to be we're significant. There is a regulatory commitment, and it will be completed by the time the PRA is done. If procedures in training are required, they meet the guidelines of RIS-200-815, and they are implemented within a time frame that it doesn't impact our schedule.

The effect of the modification has been evaluated by the NRC, and it has gotten a positive evaluation, and we have sufficient information such that we can incorporate. I don't think that these are -- I think this is a good set of criteria for taking into account -- when I say future, but it's imminent. These aren't things that are going to be done five years from now. These are things that are going to be done in like the next year that we do want to take credit for because they're going to be risk- significant.

MEMBER BLEY: The words you just used, if the design is there and you can analyze it now, then I agree with you. Of course some of our comments hinge on what you're going to tell us at the end about what the schedule is as of today. But there is a host of things

coming out of the work from Fukushima that will affect aspects of this plant, and especially if in your HRA you're going to try to cover the SAMGs. There's a whole rule-making coming out in that area, which probably won't be done or might be done before -- I mean it's going to be a horse race with you guys, and that could really change a lot.

So somehow you got to bracket this off. I'm in between you two. You got to bracket off the things that you're going to be able to do well and not do some of the -- even if it's important. I mean you can just have a catalog. Here's six things you got to fix up once this is done that we know are going to be important.

Again, our comment really depends on what you're going to tell us about schedule later.

MS. DROUIN: And again as I said, these are ands. These aren't ors. So, even though it may be risk significant, if there's not sufficient information for us to be able to model it, it doesn't get on the list.

CHAIR STETKAR: In many cases, you don't know that until after the fact though, and that's -- I support Dennis' idea because you run into this all the time. You freeze the date of the design and procedures. You build your PRA model. You don't trouble yourself in terms of project administration or having analysts

redo models on an ongoing basis as things evolve.

You build the PRA. You get the results, and then you look at what has evolved over the course of the PRA. They jacked up the containment and put a different containment in. Is that significant? Is the difference in the design significant?

Well, you can then measure that significance knowing what the design is, and what your results for your integrated model show from your frozen design. You can't necessarily make decisions on the fly whether a particular modification is going to be risk significant until you have the whole model built, and the results.

MEMBER BLEY: And for changes -- well, you've seen it. They tell you your design is about fixed, and then halfway through it changes. So, if you're trying to -- you're still going to -- whatever you try to do at the end, you'll be frantically trying to take care of these things, plus you're going to have a list of things you weren't able to do.

CHAIR STETKAR: Right. You're still going to have to do that comparison anyway because you'll have not included things that people will want you to look at on a delta basis.

MR. KURITZKY: Let me clarify for you. Our

intent is not to have -- make this a PRA on the fly and constantly incorporate things as they show up day-to-day. The issue here is that there are some major changes that we are already aware of that are clearly going to be risk-significant, and we don't need to wait until the PRA is done to know that.

Most things that would meet this criteria we will know well in advance if they're risk significant or not. The type of things we're talking about. Because the only thing we're trying to capture here are major significant changes, and I'll give you a case-in-point.

Reactor coolant pump seal design: they are going to be changed out. They are planned to be changed out at Vogtle before this period is completed, and they will completely and radically change the risk profile of the plant. I mean substantially. And I don't need to have the study done to know that because all the dominant cut sets right now are RCP seal LOCAs.

They are all going to go disappearing, and there's going to be a whole different set of dominant set cuts --

MEMBER BLEY: And you have enough confidence in the new design today to be able to say --

MR. KURITZKY: Well, that's exactly the

reason why I have these criteria. Because if you look at these five criteria, you will see that this sets an extremely high bar for something to be included, and in fact our decision has been made that the RCP seal design will not be incorporated in here.

Our decision right now, our tentative decision right now, is not to include flex equipment in the PRA. Okay, almost everything that has come down the pike that we know would be significant right now it does not meet these criteria because there's not certainty in the design procedures and training for them all, and implementation. Plans can change as you mentioned.

What the utility might plan to do with the next outage is things come up and they don't get around to it. So, right now there is nothing I can tell you right now on the books that meets these criteria.

So, the whole purpose of this was to give us justification for why we're not including these things. Now, things we know are going to be significant and they're likely to occur? We're going to want to probably do a sensitivity study on them.

The entire purpose of going through this exercise was the reactor coolant pump seal design because it changed the profile so much that every sensitivity study you do, you don't do them all in combinations with

each other. Unfortunately that is too research intensive.

So, you tend to have a base case, and you run -- you do one off that base case for the various sensitivity studies. Well, whether or not they all go off of the current seal design or the new seal design would make a huge difference in the results of all those sensitivity studies.

So, it was very important to identify which one would be the base case, because all the other sensitivities would work off of that. So, that's why we came up with these criteria. They're extremely strict, and so it was no intention to allow additional things to keep being fed into the PRA.

This in fact is kind of like a wall that prevents almost anything from changing from where it is right now. There would have to be something that would meet all these five criteria, and right now we don't know of anything. It's hard to imagine anything would meet these five criteria.

So, I think your worry -- you can put that worry to rest. I don't think that's going to be a big concern.

CHAIR STETKAR: You're biting off a lot of stuff to do here.

MR. KURITZKY: Exactly. Well, if you look at these criteria --

CHAIR STETKAR: I want to see that done well.

MR. KURITZKY: None of that stuff is going to meet these five criteria, which doesn't mean we wouldn't do a sensitivity study on them at the end, but it's --

CHAIR STETKAR: You're going to have to do that.

MR. KURITZKY: Right.

CHAIR STETKAR: I mean that's --

MR. KURITZKY: But it's not going to be in the base case.

CHAIR STETKAR: You know we have to be able to defend these decisions.

MS. DROUIN: It is real important that we have these criteria because we don't want to be criticized. You know, people come in and say, "Well, why didn't you include this? This change was done within the time period that you did your PRA."

We have to be able to go back and say, "Well, this is why we didn't do it."

MEMBER BLEY: I think that's good. You will be criticized but --

CHAIR STETKAR: That's fine. That's just the nature of doing risk assessment. I mean you know any risk assessment can be criticized.

MS. DROUIN: We need to be able to show that. We thought about it, and we didn't just blindly ignore these things.

MEMBER SCHULTZ: As you said, Alan, doing it the way you had planned will give more important risk insights about modifications that are planned, and once installed can be taken into account when they meet all of these criteria.

MS. DROUIN: Even though Vogtle is the plant for which this level 3 PRA is being done, this is not a regulatory PRA in the sense that we're developing a PRA with people at Vogtle to assess Vogtle. That's not occurring.

So, it's to get insights from the PRA, but more in a generic type of perspective.

CHAIR STETKAR: I had one question before you guys start on this stuff. I hate to do this, but we should've brought it up in December, but at that time we were running a little bit long on time and knew some of the QA stuff was going to change.

I had a couple of questions on the reviews, and these are only, again, my kind of input from kind

of going through this a few times. It is sort of organization and scheduling of the reviews.

If I look at the Level 1 PRA, and this is for the peer reviews because I know the internal reviews are ongoing. I can't find the right page here.

Anyway, let me just -- because of time. The reviews have -- the current thing says, "Upon completion of reactor Level 1 PRA analysis for internal events and internal floods at-power for a single unit." Then you go on for the -- I believe at-power, internal fires and external hazards.

I would put internal floods for the fires and external hazards because it requires the same information. You need spatial information. You need configuration of the plant. You need layout.

If you're going to do a -- convene a peer review group, they're going to look at walk downs. You're going to look at configuration of the plant. They're going to look at vulnerabilities to fires and floods and things falling down, and all of that kind of stuff at the same time.

The internal floods really belong in that category rather than -- even though because of IPE mind set floods for some reason were lumped with other internal events. So, that's just a recommendation.

MS. DROUIN: Okay, that --

MEMBER SHACK: I had another comment on that though. I thought that peer review was set up more for a figure 2.1 like process, where you sort of did all the Level 1 stuff; then you move to Level 2 and you did the Level 3. But you're going by the figure 2.2 process. You're sort of going up 1 all the way, and somehow this peer review seemed to be out of joint with the way that you were planning to work.

MS. DROUIN: Well, okay --

MR. KURITZKY: One second. I would like to point out that the list of peer reviews you see in that is not our current peer review set. We've been discussing --

CHAIR STETKAR: Then because of time, let's just table that and wait to see -- let me just give you my quick comments in case they might affect the next version. I would group together fires, floods and seismic or all external events together because you need the same disciplines of the review team.

You don't want to split those disciplines over two stages of the review.

The other thing that I would do is you seem to have presumed that it's an easy transition from the full power models to the low-power and shutdown models.

It is not. Get over it. You need more reviews in the low power and shutdown.

You need a review of the internal events at low-power and shutdown because you need to understand how you define the plant operating states, how you've mapped all the maintenance configurations into those plant operating states, how you've defined the initiating events, how you've quantified the initiating events, how you've treated human-induced heating events during low power and shutdown. It's not a simple mapping.

Those models look very different. So, I would recommend inserting that as a separate point, and then looking at fires and flooding and external events in the context.

The only other comment I had is that there was only one final review that says, "Upon completion of the level 3 PRA analyses of integrated site risk." Up until the last bullet at least in the current version, everything is disjoint and separate.

Then suddenly everything comes together for two units and the whole site, and fuel pools and dry casks and reactors, and there's one review of that. That isn't going to work.

Somebody needs to take a look at that integrated model before everything comes together at the

end, unless you're going to schedule three month review. Because you have not stitched together all of the things up until that point, at least in this review schedule until that last point. How do you treat human reliability during an external flood or an earthquake that affects both units at the site, and spent fuel pools at the same time.

Up until this point, people have developed little-bitty models for each of those as if they are in isolation, and if you just wait until the end, that's a horrendous scope of work to review. So, I think you might want at an interim point to take a look at that.

MR. KURITZKY: Mary?

MS. DROUIN: How many peer reviews we have is going to be very dependent on the PWR Owner's Group. If I understand --

CHAIR STETKAR: I'm not being practical from that standpoint. I'm trying to focus resources for technical issues.

MS. DROUIN: We just need to make clear that we are working with them for them to do these peer reviews for us, and we're having a meeting next week with them to start laying out. You know, how many are they willing to do?

We recognize from the very beginning that

we don't want a single peer review at the very end. That just doesn't make sense.

CHAIR STETKAR: Right.

MS. DROUIN: And we want ongoing peer reviews, but how often and when can they do them versus our schedule? All that needs to be worked out, and some of it just may not work out as practically as we would like.

CHAIR STETKAR: I understand. Resources area always a constraint. I was simply looking at the technical tasks and thinking about how to organize them perhaps better from that perspective. As I said, it's only a comment.

MR. KURITZKY: We appreciate your input.

CHAIR STETKAR: Thank you. Whatever. I could go on. I'm sorry.

MS. DROUIN: Is that your only --

CHAIR STETKAR: That was observations on those review points.

MR. KURITZKY: Thank you, Mary. Let's move forward with the spent fuel pool Level 1 and 2 PRA from the technical analysis approach plan. Don Helton.

MR. HELTON: My name is Don Helton, and I work in the Division of Risk Analysis in the Office of Research. Two points of preamble.

The first is what I'll present to you today is a combination of the TAAP that you received a while back, but in addition the thinking that has gone on since that time.

The other point is I do have a number of slides. What I'd like to do is move through them relatively quickly and let you guys be the judge as to which specific items you want to dive down into.

I didn't think you would need permission to interrupt me. So, on slide 18, just by way of background, the agency has performed a couple of spent fuel pool PRAs in the past: one in the last 80s and another one around 2000.

Since 2001, the agency has done some security related and safety related deterministic studies, some of which you've heard about recently. We've also done some experimentation over the last ten years at Sandia National Labs related to BWR and PWR hydraulic and ignition behavior following spent fuel pool accidents.

Again, by way of background, the last point I want to leave you with is the fact that in this case, we're not starting from a licensee model because there's not a spent fuel pool PRA. We've done the licensee's model, and we're also not starting with a US consensus

standard on how to perform a spent fuel pool PRA.

MEMBER BLEY: Just a quick question.

MR. HELTON: Yes?

MEMBER BLEY: Have you, in looking at Vogtle, are there any unique things about their spent fuel pool you're going to have to model that you haven't seen before?

MR. HELTON: No. I mean there's nothing that --

MEMBER BLEY: Either in the piping systems nor in the reactor design, any of that?

MR. HELTON: There's nothing that I've seen that was surprising to me, in the sense of, "Whoa, this is different than what we're used to. How are we going to do this?" There's nothing like that.

The biggest issue has to do with I'd say in that regard something I'll get into later, which is just the fact that because of the way the plant is operated, you can't really isolate one spent fuel pool and study it in detail without considering the other one, and that's something that is both a consideration of how the plant is operated as well as the fact that we're trying to do this site PRA.

MR. KURITZKY: Don, let me just interrupt. Just as a general cautionary note, some of the

information involved in some of these -- in the work that we're doing involves proprietary information from Southern, which we will not be able to divulge at this open meeting. We'll have other briefings for the subcommittee but they'll be part open, part closed, and we'll go into more of the plant's specific detail.

So, general things we can discuss in this meeting. If it gets to the specifics of a design and operations of a plant, some of that kind of stuff we might not be able to answer.

MR. HELTON: Slide 19 gets into the issue of how to manage -- how to set that scope for the spent fuel pool PRA and how to manage the interfaces it has with other parts of the PRA, as well as getting the scope of what we're trying to do to something that is manageable.

The first set of bullets just tries to orient you in terms of how we're describing what is within the spent fuel pool PRA, which is versus what is covered by other portions of the PRA.

In terms of the reactor and the spent fuel pool, that boundary is the physical containment boundary. So, the spent fuel pool: fuel comes into the scope of the spent fuel pool PRA as it comes out of the fuel transfer tube.

That being said, there are clear interfaces

during refueling between the low-power shutdown PRA and the spent fuel pool PRA.

On the dry cask storage side, the way we're treating that is by looking at the regulatory boundary between part 50, which covers the spent fuel pool, and part 72, which covers dry cask storage.

Next set of bullets is bringing up the issue of inadvertent criticality, and describing that in our study that's something that we're not going to explicitly model. Rather, we will, when we see accident scenarios that lead to sets of conditions where an inadvertent criticality might be more likely, then we'll highlight those.

But in terms of capturing the risk from the spent fuel pool, we have a -- we are making an argument that is consistent with past studies, as well as the accident management philosophy in general, which is that the potential for a zirconium fire in the spent fuel pool is the driver for offsite risk.

I've already mentioned the fact that we got to interface with the at-power reactor PRA, the low-power shutdown PRA, and the dry cask storage PRA. The other point I want to leave you with is that when we take the number of different initiating events we can have for the spent fuel pool, and we take the number of

configurations that the spent fuel pool may be in during the course of an operating cycle, and then we take the need to discretize the decay heat, which is constantly changing throughout the operating cycle, we end up with a very large number of unique initiating conditions.

And so, it is going to be important that we are able to pare that down to a manageable set that's going to represent and is going to accurately reflect the risk that's coming from the source of radiological material. You'll see in a little bit how we plan on doing that.

The next slid simply lists the technical elements that are within the TAAP in terms of how we're breaking down the spent fuel pool PRA. It's similar in a lot of respects to the way the reactor PRA is broken down, but there are some differences.

CHAIR STETKAR: Don?

MR. HELTON: Yes, sir?

CHAIR STETKAR: I'm trying to look through -- never mind. I'll wait until a later slide. Go on.

MR. HELTON: Slide, 21, just to give you a high level conceptual view of the model that we're building. Like I said, it mimics the basic structure of the reactor PRA with some exceptions, but the way that you move through the PRA is very similar to the reactor

analogy.

So, we have the event progression prior to fuel damage. So, prior to -- this is the analogy to core damage in the reactor. The collapsing of those down in the plant damaged states, the explosion again in number of sequences out from the post fuel damage event progression, leading into release category bins, leading into the Level 3 PRA.

We're going to attempt to do this using our Saphire tool, and having the Level 1 and Level 2 model combined into a single PRA project. We've discretized the a representative operating cycle for this plant. It's about a 17-month cycle is their typical operating cycle, and we've broken that up into 12 sort of high level phases in terms of different configurations that the spent fuel pool has in relation to its interface with the reactor and the dry cask storage.

Then with some of those 12, it then gets further decomposed into the different plant operating states. They go along with the reactor low-power shutdown PRA, and the different configurations or states that go along with dry cask storage processes.

Finally, getting to the point we discussed earlier, to the extent possible, we're focusing on the unit 2 spent fuel pool in terms of building the initial

model. But for reasons I'll talk about in a little bit, it's not possible to look at that pool in isolation.

So, by way of site familiarization for some information that is in the public domain, the site has two spent fuel pools. They're housed in a common fuel handling building. The refueling configuration for this plant is very similar to what those familiar with PWR refueling would expect to see in terms of movement of the fuel through the transfer into a fuel transfer canal, and from there into the spent fuel pool proper.

There are differences in this case between unit 1 and unit 2, both in terms of the number of rack sales in each pool, as well as the poison material that's used in the two pools. Then finally the operational considerations that I alluded to earlier: the plant is operated such that both pools are almost always hydraulically connected through the cask pit, which resides between the two spent fuel pools, and the licensee often moves assemblies between the two spent fuel pools.

The first of these, the fact that they're hydraulically connected, gets to the fact that at least prior to fuel damage it's particularly prior to fuel damage. And also for some considerations post fuel damage, you can't look at one pool and be blind to the fact that the other pool is there because they are

interfacing and interacting with each other during the course of a postulated accident.

With respect to the second one, the fact that assemblies may be moved between the pools, this gets in part to the earlier discussion about survey freeze date and exactly what it is that you're modeling.

MEMBER BLEY: Can the two be isolated?

MR. HELTON: They can be, yes.

MEMBER BLEY: That's with some big gate they have to drop down with a crane, or?

MR. HELTON: No. It's a gate that is either opened or closed.

MEMBER BLEY: Okay.

MR. HELTON: They are connected through the cask pit so they can be isolated from each other by isolating them each pool from the cask pit. Then they separately have their to the fuel transfer canals.

MEMBER SCHULTZ: And normally the gate is closed during operation, or normally it is open?

CHAIR STETKAR: It says almost always hydraulically confected. So, I'm assuming it's open most of the time.

MR. HELTON: Yes.

CHAIR STETKAR: Seems to be open in this picture, at least from this perspective.

MR. HELTON: Yes, the perspective I'm trying to leave you with is that normally those will be connected. Normally those gates will be open.

MEMBER BLEY: There's no forced circulation, though, between the two. It is just they communicate?

MR. HELTON: There -- in certain -- in terms of design, they are hydraulically connected. So, there will be some recirculation, but each has their own separate forced spent fuel pool cooling. There are two spent fuel pool cooling trains. There are configurations where there may be compensatory measures put in place if certain operations are in -- in play are being taken to where they would have equipment to be able to promote circulation between the two.

Okay, the next slide, slide 23, talks about the support that we've gotten from Southern Nuclear as we've scoped and started on the spent fuel pool PRA. First of all, they provided a tremendous amount of the operating history and design information of the fuel in both spent fuel pools, as well as the reactors.

You'll see in another slide how we've used that. They provided us many of the procedures that are in play during the spent fuel pool -- during a postulated accident with the spent fuel pool. We had a site visit

in March of 2013 that was focused on other aspects of the PRA, but two of the team members from the spent fuel pool PRA, myself included, were on that site visit because we're also involved in those other aspects of the PRA.

So, we leveraged that site visit to get eyes on aspects of the specifically configuration that were important to us. Finally we had a call with Southern Nuclear specifically to talk through our understanding of how they operate the spent fuel pool and get clarifications and make sure that we understand things correctly.

MEMBER BLEY: I'm just curious. Why do they end up moving assemblies from one pool to the other? Is there unique equipment in one of them?

MR. HELTON: No. It gives them operational flexibility in terms of the way that they're handling their refueling outages.

Slide 24 is a sample set of initiating events, just to orient us in terms of the types of things that we need to worry about. I won't go through them in detail. I don't think any of them would be surprising to you, except for of course because we're doing a site PRA, now we need to worry about some multi-source initiating event considerations that we might not have to worry about if we were strictly trying to study the

spent fuel pool.

CHAIR STETKAR: I noticed, and I'm sure you are sensitive to this; in the plan it specifically says, for example, you will, "Design four seismic hazard bins for the fuel pool." I don't know if you know how many seismic hazard bins you're going to have for the rest of the whole site.

You certainly want a consistent number, and consistent definitions, because you're going to have to put them together later. So, regardless of what any spent fuel pool scoping study might have said the number of bins, you need to have precisely the same number of bins for the entire site because otherwise the models will never stitch together at the end.

MR. HELTON: Right.

CHAIR STETKAR: Then the same thing with high winds and floods and everything else, because that's something that's -- I'm sure you're aware of it, but it --

MR. HELTON: We are. Yes, we are. What I would respond to that is first of all, the fact that the tab says 4 is not a reflection of the spent fuel pool scoping study. It is a reflection of sort of the best practices as we view them in reactor PRA space for applications --

CHAIR STETKAR: Other people have used seven or eight, for example.

MR. HELTON: Right. So, the thought there is I agree there needs to be a correlation between the two. Now, the decision on how many seismic bins you're going to have, as you know much better than I do, is a function of where -- how well you think you need to discretize the hazard as well as the fragility.

Now, if the -- and this is hypothetical, but if the reactor PRA goes off and defines 15 bends because they need that resolution on the fragility, spent fuel pool PRA may not need that resolution.

CHAIR STETKAR: You'll need exactly those 15 bins.

MR. HELTON: We'll be able to collapse those. We need to line up.

CHAIR STETKAR: You'll need exactly those 15 bins, otherwise you will not have consistency when you hit the site -- hit the site. Not spent fuel pool. Hit the site with a bin 1 seismic acceleration at a particular frequency, initiating event frequency.

You need to have an integrated site model that says, "How does the entire site respond to that initiating event?"

MEMBER BLEY: Before your two prescriptive

things, Don, might be -- you know, up to bin 6 on the reactor side. Nothing happens over here. So, he can group smaller, but he uses the results of 0 for those first six bins or something.

CHAIR STETKAR: But there are practicalities --

MR. HELTON: Yes. So, I think that's the concept I want to leave you with, but by the same token, at the moment I don't -- I don't foresee having a different number of events in the practice.

CHAIR STETKAR: I'm just trying to raise sensitivity --

MR. HELTON: I want to leave myself that flexibility, but I agree with the point you're making.

CHAIR STETKAR: It was one of the few places in the TAAP that I saw a specific number that -- I understand it's a living document, but it sort of raised a bit of a concern.

MR. KURITZKY: Probably should've had a number in there. Did you want that last bullet?

MR. HELTON: Yes. So, again, looking at this last point which I sort of focused on earlier, which is the fact that if we leave this to its own devices, it will explode on us in terms of the number of different conditions that we have to look at, and what this last

bullet is trying to bring out is the fact that if we allow it to explode, we could spend a lot of time analyzing scenarios that in the end do not contribute to offsite risk.

MEMBER BLEY: Are there some cases you've thought about where you need even better correlation between the plant model and this model? For example, for the same seismic bin, there's some chance of core damage. If in fact you're getting core damage in the plant model, it's going to radically impact your ability to take some recovery actions over on the spent fuel pool.

So, you're going to need some kind of linkage between the two models so that you can parse that out appropriately.

CHAIR STETKAR: And not only that, but the plan operations states, Don mentioned that. Eventually when they put the entire model together at a very high level, there are a four conditions at the site: both units operating one up and one down, the other up, one down and both -- there's some likelihood, albeit perhaps a small fraction of life, where both units might be down for some reason.

Actually we didn't bring -- Don actually put together a very detailed --

CHAIR STETKAR: And the number of how you

take your 17 or however many you had and group those together; you want to look forward to that because those will need to line up in your eventual integrated site models such that if this event happens when unit 1 is down, and unit 1 is a power, depending on what they do on the spent fuel pool under that configuration, and core damage occurs in -- pick your favorite unit.

How will that affect now mitigation actions for the spent fuel pool?

MR. KURITZKY: We've already done some looking into site operating states with all the different radiological sources and what different conditions they would be in. Don had put together an initial map of all the different kind of combinations.

CHAIR STETKAR: Good. That's really, really important because that ought to be an overriding or important consideration anyway in terms of making these decisions that Don needs to struggle with. Same thing with the low-power and shutdown models, which plant operating states are important.

When you're transferring fuel might be important, even though you might not think of it as being important strictly from the perspective of your low power and shutdown model.

MR. KURITZKY: Right. Good comment.

MR. HELTON: And as Alan said, we've started to -- we try to assemble those pieces at the front end, and that's something that we really had to wrestle with when we realized that, "Okay, if we're going to have to model these two pool concurrently, now all of a sudden my unit 1 being in refueling affects my unit 2 pool."

You know, the scope grew on me again. And so, we are -- good. The next slide is a sample attempt to take those different initiating events and group them into a more functional grouping in terms of what their impact to the spent fuel pool in terms of a postulated accident would be.

So, this simply takes a crack at breaking them down into those events that can lead into an inadvertent drain down or leakage, plus the boil off, versus those that are strictly boil off related. This becomes important in terms of being able to define what supporting information we need, as well as how we do our first look at the screening and prioritization of scenarios within the Level 1.

So, this is a leader into the next couple of slides, the first of which talks about the structural analysis just in terms of providing you some examples of the types of inputs that we are requesting that our structural analysts are looking at to provide the boundary

conditions, which we can use to then build the PRA as well as the deterministic modeling that underpins it.

Slide 27 talks a little bit about the scale analysis that we've had Oak Ridge perform. This uses the extensive amount of fuel design and operating history information that I mentioned earlier that Southern has provided us, and we've used that in conjunction with the SCALE code to develop decay heats as a function of tying the radio nuclide inventories and the radio nuclide activities that we need in order to conduct the melt core analyses that underpin the Level 1 and Level 2 part of the PRA and the MACCS 2 analysis that underpins the Level 3 portion of the PRA.

I also wanted to give a nod to the good work that Oak Ridge did at identifying a handful of the different uncertainties that could have an important impact on the way that they do these type of analyses, and then doing sensitivity analyses to show their effect.

So, now how am I going to get from hundreds of different initiating conditions to something, or thousands of different initiating conditions, to something that I can prioritize. My first order of business is prioritization. Then once I've done some more work, then I can look at potentially screening out some things.

First, I just need to know where is my risk most likely to come from. The way I can first get a handle on that is by doing sequence timing calculations within a Level 1 PRA context.

So, to do that we've developed a simplified MELCOR model, which rather than having sort of all the gory details that would go into a MELCOR model that was needed for calculating complex thermal hydraulics, as well as fission product release and fission product mechanisms, here what I've done is I basically treated the MELCOR code as my conservation of mass energy and momentum, and a representation of both spent fuel pools, as well as the fuel transfer canals, the cask pit, the containment and the reactor refueling cavity that they will at times be connected to, and I've defined all that in terms of water inventories, decay heats, air spaces, and this allows us to do timing calculations under different postulated conditions, and get that first feel of, "Is this event going to lead me into the potential for a release within a day, within three days? Within 10 days? Within a year?"

It gives me that first look at how much time we have to recover from this postulated accident, and thereby how likely when I end up going through the full accident sequence analysis, the full HRA, how likely is

it that this is as some point going to fall off the table frequency wise?

So, it doesn't give me definitive information about that, but it gives me indicators about that.

Next slide, slide 29, is an attempt to specify some specific figures of merit that I can use to parse the results from that simplified model. So, I will look at hundreds of initiating conditions, and I will follow those through the time of significant fuel uncovery.

There are a number of different things that can be going on that will affect the eventual sequence analysis and therefore affect this frequency issue. So, the ones that I've talked about here are the spent fuel pool water temperature, the water level in terms of its effect in resulting in a radiological hazard, and ultimately its effect in resulting in a loss of adequate cooling for the spent fuel.

The environmental conditions in the fuel handling building, which are important to the likelihood that someone will -- that actions will be successful under the more sever conditions, and then finally the last one is once we sort of reached that point where in effect we would be transitioning into a level 2 PRA, an indication

of what is it going to take to recover this?

If 15 GPM is going to recover this, that's a very different day than if I need a large capacity to recover.

The next slide just talks about some of the considerations related to mitigation. So, it talks about procedurally what space we're in with the AOP's and the EDMG's. I also wanted to give a nod to a document that was put out last year by EPRI as part of -- this is somewhat related to the activities ongoing under recommendation 8, although this was done separately under an industry initiative, which was to take the 1992 technical basis report that EPRI had generated, related to the promulgation of the severe accident management guidelines, and to update that.

That includes reflection on spent fuel pools that were not originally within the scope of the '92 document.

I wanted to point out that we are interfacing it with the site, as I talked about earlier, in terms of understanding the as-operated conditions, but we're also interacting with the human reliability analysts that are part of our team, as well as the fire protection engineers that we work with, to make sure that we have a good understanding of what factors are going

to affect the accident sequence analysis in HRA when we get there so that we don't prematurely discount things in this prioritization activity that would come back to haunt us later.

I want to point out that for spent fuel pool accidents, these tend to have a more protracted time frame in terms of how they evolve than reactor accidents, and so we are in the process of discussion as to how we're going to account for offsite resources in terms of their role in mitigating the accident.

Then finally, to talk about -- to rehash the point that we talked about earlier, we understand that there are a lot of things going on right now in regulatory space that affect the spent fuel pool, and I've listed the two orders here from March 2012 that are the most prominent of those, although recommendation 8 could've just as easily been on here, and so could've any number of other activities.

But this all goes back to that earlier discussion as to what is in place, and what can you act upon in terms of procedures and training, and the types of things that we consider in the HRA and the accident sequences.

MEMBER SCHULTZ: You're using the same criteria we discussed earlier?

MR. HELTON: Correct. I won't really -- I don't know that there's any benefit in walking through the next slide. There's a lot of words on there. It was just my attempt to try to convince myself that even though we don't routinely do spent fuel pool PRAs that you can create an event restructure that mimics the same sorts of things that you are concerned about in reactor space, but you're not focused on things that you care about for the spent fuel pool.

If there are any particular items you want to discuss, we certainly can do that. But again, this is just intended to be sort of an example of the way that you can construct an event to get at the same accident sequence analysis and HRA issues that you need to get to for the reactor.

CHAIR STETKAR: Too much detail, but again in terms of thinking out in the future, eventually you're going to have to integrate these models, and I -- how you do that, the mechanics, is something you need to think about. Because there will be scenarios that involve damage in both places.

You know, one or two reactors, one or two spent fuel pools, and somehow the models need to coherently sort that out when you hit the site with a particular initiating event tree.

Obviously, the external event is more important to that, but when you talk about developing event trees for the spent fuel pool, you're going to have event trees for the reactor during shutdown. You're going to have all of these bits and pieces that eventually will need to be stitched together somehow.

MEMBER BLEY: Have you thought about how you're going to do that? You tied these onto the end of the event trees, but I don't know what you thought about --

MR. HELTON: Actually, the whole idea of the integrated site risk is a topic that we -- when we come back in July, that is, as you're aware, one of the most challenging topics and it is -- we're doing some thinking on it, and that's going to be the main topic of our meeting in July.

CHAIR STETKAR: Because that's really important. I mean some of the stuff that you talked about Don doing in terms of setting out this big matrix, that's one part of it to kind of get your hands around different -- you want to call them operating states or plant configurations or whatever.

The other part is just the mechanics of the PRA software modeling, whatever you want to call it. Event tree sort of state.

MR. HELTON: So, yes. I don't want to talk about it too much now.

CHAIR STETKAR: No, no.

MR. HELTON: But when we come in July --

CHAIR STETKAR: We'll look forward to that. That is important.

MEMBER BLEY: You hinted at this one. I don't see another place to ask you this. If you said it and it slipped past me, I apologize. But you talked about having to set -- at some point defining these two pools and their condition.

It strikes me this is one place in the PRA model where at least if first treating it very conservatively that maximum loading over the next 20 years or something, then these pools might make sense. Because if you do it for the condition that we expect next year, then in a couple years your calculations just won't be meaningful anymore because of the changing heat load that you keep adding more fuel and filling up these pools.

Where do you stand on that? Have you talked much about that or thought about it?

MR. HELTON: I think that -- so, the plan right now is to analyze the pool as it existed in the fall of 2012. With respect to your specific concern, the two things that are sort of the most logical to

decompose that into are the decay heat and the fission product inventory.

The decay heat in 2016 at a particular point in the operating cycle isn't really going to be very different than it was in 2012 at that same point in the operating cycle because the decay heat is so driven by the last couple of off loads.

From that perspective, I'm not that concerned. In terms of fission product inventory, I'm also not that concerned in the sense that the plant has now operated for 20 years. They are moving to dry cask storage and as long as there is a continued industry commitment to maintain --

CHAIR STETKAR: You're going to get some sort of equilibrium --

MR. HELTON: Yes. I mean they're pretty close to equilibrium such that there's not going to be any radical difference in terms of --

MEMBER BLEY: I think that would be a good story, and I trust you'll include that story and define these states in the PRA because that'll be really important to convince people of its continuing viability.

MEMBER SCHULTZ: They're likely to be at a steady state for the next several years.

MR. KURITZKY: And also, you'll hear when

Felix talks about the dry cask storage too. We had to pick a point, you know, how much dry cask storage are we going to -- we might pick a particular amount. You know, you can pick when the whole facility is full. You can pick -- right now, they're just putting the facility together.

So, it could be when there's one or two casks in there. Could be when it is half full, all the way full, and that's something we're going to be looking at as part of the dry cask storage too.

MR. HELTON: The next slide, slide 32, just simply makes the point so we know that the simplified MELCOR model will take us a certain distance, but it won't take us as far as we need to go since we are doing a Level 2 PRA. So, we do plan on building a detailed MELCOR model that will have all the modeling necessary to handle fuel uncovery, and all of the severe accident phenomena associated with uncovery and a radiological release.

Then finally, the final slide, slide 33, is just an attempt to give you a sense of the time frame of all of this because as has already come up, some decision that are being made and some approaches are inherently affected by the time line of the project.

So, this just talks about the kind of work that's ongoing right now, which I covered in the previous

slides.

The more of the accident sequence analysis, human reliability analysis work in the summer and fall, moving into the finalization of the initial model quantification treatment of uncertainties and those aspects in the winter time frame hand off to the level 3 PRA, and then finally review and documentation in the spring.

MEMBER BLEY: Where in this thing do you do what I think is going to be fairly complex, how you're tying your model to the rest of the model? And just an aside, is this the same schedule we're going to see when we hear the status --

MR. HELTON: Well, the status -- you're not going to see an actually schedule when we do the status.

MEMBER BLEY: Okay, go ahead, Don.

MR. HELTON: Alan was smart enough not to put dates in here on the slides, and I made the mistake. If I was much smarter, I would've just not included the year and I --

CHAIR STETKAR: Bullets would be good.

MR. HELTON: Right. So, nevertheless the issue is that we're doing that. We're constantly wrestling with that as we go, but the actual connection of the models -- you know, there will be pieces of that

like the laying out of how the different operating states interface as we go, but the connection and the turning of the very large crank comes after this.

CHAIR STETKAR: I think what you're hearing though from Dennis and perhaps others is that we'll be really interested in July to see some details of how that will all come together, because you need -- in the same way, if you do a Level 3 PRA, you may organize and just pick a reactor at-power Level 3 PRA, knowing that you're doing a Level 3 PRA forces you to think about organizing your models and your analyses with that goal in life, and you know in this case you're going to do a site level, two units, integrated reactor spent fuel dry cask storage risk assessment.

You need to have that perspective in mind to organize all the little bits and pieces.

MEMBER BLEY: Some of you know this, but the planning you do now to set that up ahead of time will save you a tremendous amount of time on the tail end. If you don't get to it until the tail end, you're going to add a couple years just trying to make that whole thing --

CHAIR STETKAR: You're going to have to rework.

MEMBER BLEY: Or you're going to have to

do a lot of satisfying to make the things work together.

MR. KURITZKY: That's actually why the integrated site risk, even though it's the last thing on the calendar, on the schedule, because that's the thing that ties them together. One of the first things we worked on for the project as a whole. We immediately started working with the contractor on a white paper for that, as we did previously.

As you know, Marty Stutzke has been working on that ever since the beginning of the project. So, that's an ongoing effort. It's not something that's --

CHAIR STETKAR: It is really important.

MR. KURITZKY: Right.

CHAIR STETKAR: Because it just is.

MR. KURITZKY: Yes.

CHAIR STETKAR: Any other questions for Don on spent fuel pool? If not, we're miraculously fairly close to schedule. So, I'm going to call for a break, and we'll reconvene at 10:35.

(Whereupon, the above-entitled matter went off the record at 10:20 a.m., and resumed at 10:35 a.m.)

CHAIR STETKAR: We are back in session, as much as we may not want to be, but we are. Let's see if we can pick up on dry cask storage.

MR. GONZALEZ: Good morning. My name is Felix Gonzalez in the Division of Risk Analysis in the Office of Nuclear Regulatory Research. Also present is my colleague, Brian Wagner, which has been doing more of the thinking and work for this Level 3 PRA project, dry cask storage PRA. Next slide.

I'll give you a quick introduction on what is the current state of knowledge for dry cask storage PRA. In the last ten years, there has been two major PRA studies on dry cask storage systems at nuclear power plants.

These two studies have been NUREG-1864, which is a pilot probabilistic risk assessment of dry cask storage at nuclear power plants, and the EPRI risk assessment of bolted storage cask.

These two projects when they started, they coordinated and planned together in order to capture different hazards that apply to either a PWR and a PWR in dry cask storage operations, and also the hazards that apply to bolted casks versus welded casks.

In the case of NUREG 1864, the case that was selected was a HI-STORM 100 dry cask storage system and it was in a PWR setting. The site was an anonymous PWR site.

In the EPRI PRA, it was selected -- the cask selected was a transnuclear dry cask storage system in a PWR setting, and the site was a generic PWR site.

From what is publically available right now, and the information that we know from Vogtle, in the Level 3 PRA, the cask that's going to be selected, or what we know is that it's going to be a Hi-STORM 100 cask system, which uses a HI-TRAC and a multi-purpose caster, which is a welded cask similar to what NUREG 1864 selected; the fuel and the site. It's a PWR site.

We know that Vogtle is going to be putting fuel and loading fuel some time in October of this year. Basically later this year. So, we're going to have to be making some assumptions, as Alan suggested, in terms of the storage of the cask in the independent spent fuel storage installation, also known as the storage pad.

Some key items that the agency has -- dry cask storage PRA and it's the same case for the spent fuel pool. There is no standard for dry cask storage.

The focus of the study is going to be to measure risk, and the consequence of dry cask storage operations for Vogtle, and also we're going to be trying to use conservative assumptions at least in the highest risk contributor events that were identified in EPRI and NUREG 1864.

As a background and a summary of what a dry cask storage operation is, I'm going to do a quick explanation of what consists of dry cask storage.

You put your cask into the cask pit and you load it with fuel. Once you take it out of the cask pit, you take it into a preparation area where you basically seal the cask, dry it, and prepare it for storage.

Once you do that, you take this cask out of the fuel handling building, and you take it into the storage pad. Depending on the cask, if it's a welded cask or a bolted cask, the process varies substantially, and the hazards that can affect the cask during these different stages will also vary.

The hazard risk contributors for the previous studies, these being 1864 and the EPRI PRA, the 1864 identified drop of the canister into a storage cask since it's a welded canister inside the fuel handling building and when you're loading, you have what they call a transfer cask, which has the multi-purpose canister.

The multi-purpose canister is never by itself. It's always in the transfer overpack or the storage overpack. Once they have the fuel loaded into the MPC, which is the transfer overpack, they take it out of the pool -- or the cask pit. They put it into a preparation area. They seal it, and then they -- you

know, they inert it and test it to make sure the welds are performing as they should, and they take it -- they move the transfer cask on top of the storage cask in order to transfer the canister from the transfer overpack into the storage overpack.

They do that transfer, and that drop that happens when they transfer the canister from the transfer overpack into the storage overpack, which is roughly about 20 feet, that's when they identify as a high risk contributor.

The other drops that they identified as high risk contributors are the drops of transfer cask. In the PWR, they had to lower the transfer cask from the fuel pool level, which is about 100 feet above ground, into the ground level where they do the transfer from the canister into the storage overpack. Then another high risk contributor was an aircraft impact once the storage cask is outside in the pad. For the EPRI PRA, they -- the high risk contributors they identified is a horizontal drop, the -- the structural building to an earthquake, and also fires during the transfer or the storage phases.

These are the major assumptions that NUREG 1864 and EPRI PRA did, and a summary of different items that they didn't perform. For example, NUREG 184 did

not perform a human reliability analysis. They did not do an uncertainty analysis. The corrosion consideration was limited.

They basically screened it out because of their -- the inspected a similar cask through 14 year operation and based their screening of that event based on these data.

Also, when they did drop events, they modeled only one fuel bin and assumed that if this bin fails, then all fuel bins fail. In the EPRI PRA, they had a -- they went the other way in terms of the assumption of how many fuel fails.

Instead of monitoring one bin and failing all bins once that bin fails, that model says that if failed, they assume two bins failed. This was based on some transportation data that is available.

They also didn't perform an uncertainty analysis, and the corrosion was considered mostly due to a seal failure, and errors around the seal failure. Then in 1864 they said, "Well, the cask you don't have a seal."

Well, what we know about Vogtle right now is the spent fuel pool and -- what I can talk to you about Vogtle is that the spent fuel pool and dry cask storage preparation areas inside the fuel handing building, which

has a ventilation and filtration system: two major drop heights that we know by reviewing drawings and Vogtle FSAR is the cask pit, and if they use the similar cask as in Farley, they would have that transfer from the -- that drop from a transfer of the canister into a storage cask.

They don't have any other drops because the fuel handling building is fueled at ground level. Also, they have -- they currently have one what I call temporary secondary ISFSI, which is a smaller ISFSI that is currently constructed, and they'll planning to construct the bigger ISFSI some time in 2018.

Now, you might ask why they did this. One of the reasons, which is not related to Level 3 PRA is they had -- they were doing the construction of unit 3 and 4. So, they wanted to limit that impact of dry cask storage operations into the construction and vice versa.

As I said the cask similar to Farley, which is the HI-STORM 100 and its multi-purpose canister, and just another key item that might be important to our analysis is that Vogtle currently holds 25 percent of low-burn fuel and 75 percent of high-burn fuel in the pool.

Now, this might be important because when you do the structural analysis and you want to assume

failure of the fuel, the properties might be different. In 1864, they only assume high burn up fuel.

Now, one of the purposes of the PRA is to increase the realism of the study, and it's one of the things that we might consider when we're doing the fuel failure analysis.

CHAIR STETKAR: This is presumably all Zircaloy-2, or most of it. I don't know, Zircaloy-4.

MR. GONZALEZ: This is also site layout of the Vogtle site. It shows basically the location of the main -- some things that -- when you're doing the analysis that you want to consider is that are you -- do you have any fuel tanks close to the ISFSI that can affect the performance of the cask?

One other thing that I need to mention is in order to release fuel from a cask, you have to break its containment boundary of the canister or the cask. Also, you have to break the containment boundary of the fuel cladding.

If you don't break the canister, there's no way you can get fuel out. If you break the canister but don't break the fuel, which is improbable, you can get crud out, but you won't get radionuclides out. If you want to get radionuclides out, you have to break both boundaries.

Next slide. These are general approaches that we're going to be following for these -- for the Level 3 PRA. We're going to be using most of the information available from 1864 and the EPRI PRA to try to reduce the resources that we need for the Level 3 PRA. Also, that depends on the cask that Vogtle has for their operation.

Basically, this is just a general slide about how it works. You know you get dry cask description, the operational phases and different stages which hazards can affect different stages.

Data analysis, we'll speak about this a little bit later. The success criteria which basically the structural and thermal analysis in order to break the cask you have to either break the cask or submit to higher temperatures that could affect the properties of the materials that are used for cask construction.

The accident sequence analysis quantification and the uncertainty analysis and then the consequence analysis: As Mary mentioned, we're planning to perform a staff self-assessment, and also independent peer reviews within NRC and also within industry.

MEMBER BLEY: Did these kind of casks have any impact testing after they were designed?

MR. GONZALEZ: Yes.

MEMBER BLEY: Is there a specific fall they've been --

MR. GONZALEZ: Yes. For the requirements -- I don't remember for storage cask, but they do have to do some testing in order --

MEMBER BLEY: I'm real familiar with the shipping casks and what kind of testing they do, but do they do any dead drop tests?

MR. GONZALEZ: I'm not 100 percent sure for the storage casks and what are the specific requirements. I don't think they do for the canister itself, or a specific --

MEMBER BLEY: Okay, but you'll have to learn about that to analyze this.

MR. GONZALEZ: Yes, absolutely.

MEMBER BLEY: Okay.

CHAIR STETKAR: Felix, one thing that I just wanted to ask, and this might be larger for the entire project, but give -- under the release frequency, you've listed several bullets which look like standard PRA type casks.

Under the consequence analysis I see radionuclide release. I see consequence analysis. I don't see a bullet that specifically says uncertainty analysis. Are you doing uncertainty analysis on

consequences for the PRA?

MR. GONZALEZ: Yes, yes.

CHAIR STETKAR: Okay, that's all I wanted. Thank you.

MR. GONZALEZ: This basically is the interface of different technical elements. You can go to slide 2.

MEMBER SCHULTZ: How far did the earlier studies go with respect to consequence analysis?

MR. GONZALEZ: They calculate latent -- they have, I think if I remember correctly, the EPRI PRA did for 100 meters away from the cask. NRC did one mile to ten miles away from the cask. I'll discuss a little bit further the consequence analysis. We'll also depend a lot on the release fractions and also how many fuel rods fail.

So, you'll see that EPRI went one way; NRC went another way in terms of the fuel failure analysis, and that's an assumption that hopefully we're planning to address, and if we can somewhat improve their analysis and make it more realistic.

CHAIR STETKAR: Thank you.

MR. GONZALEZ: The -- here are basically the hazards of a failing cask. Basically you can have a structural failure, thermal failure or different other

failures like erosion. You can have external events that can affect the cask. You can have an earthquake that can tip over the cask in any of the stages.

You can have high temperature events, fires, vent blockage. You can have a misload that can affect the thermal performance of the cask.

Then another key item is that dry cask storage systems is protected by passive systems. So you don't have any active systems.

One of the items that 1864 credited was that if they have a drop in a fuel handling building, they credit the ventilation and filtration system. That's about how close you get to an active system protecting the cask, and also the filtration system of the pool if you get a drop inside the cask pit.

Here is basically a summary and a couple of drawings using the Hi-STORM 100 as an example. In the top right figure, you can see the storage cask with a canister inside. The bottom right figure is a representation of the transfer cask on top of the storage cask, and that cross where you're lowering a canister inside a storage cask.

NUREG 1864 identified this as high risk, where basically you are transferring the cask and something fails in the drain, and you drop the canister

inside the surface of the storage cask.

The main phases, as I explained earlier, are basically fuel loading. You get the cask handling where you move the cask around. You do the preparation for storage. You do the transfer of the cask, and make sure you get cask storage at the storage pad.

This slide is a fuel and canister failure analysis. Some of the tools that we're going to be using are similar to what NUREG 1864 did, and all the other PRAs have done, for example, for the deterministic element and ISFSI, using something like LS-DYNA, ANSYS LS-DYNA.

We're also going to be using the scale analysis that was on for the Vogtle pool, the spent fuel pool. Other tools that we might need for PRODIGAL for weld analysis that was also being used for NUREG 1864; the fuel failure analysis, which is what I was talking -- 1864 and EPRI PRA went different ways.

One of the things that we're planning to do and hopefully we're going to start some time this summer, late this summer, is performing a finite element analysis of the fuel assembly in order to account for the structural contribution of the fuel assembly and other components of the cask.

What 1864 did is they just modeled one bin, and if that bin failed, every bin failed, which seems

like over-conservative. Now, it might be the case that for this drop, even if you model the whole assembly or the whole cask, the force that the cask has been submitted you still get all bins failing.

So, we don't know what are going to be the results of that. Hopefully we'll get some insight and make the model more realistic. Now, another figure is conceptual figure of how it would look. Basically if you submit the strain is bigger than the results we got for the fuel element analysis, you would get all bins failing.

If it's somewhere in between, you may get a probability of failing; half the bins or maybe some percentage of the bins, rather than all the bins. Also, we're planning to take into consideration different properties if they're available, if data is available, for like high burn up fuel versus low burn up fuel.

CHAIR STETKAR: PRODIGAL is this thing that predicts the sort of distribution of flaws in the weld?

MR. GONZALEZ: Yes, right.

MEMBER SCHULTZ: And you are also referring to fuel performance, assembly performance, and transportation accidents? You're going to use that information in the analysis to --

MR. GONZALEZ: We're going to take into

account -- yes. What EPRI did in their analysis was they went into the transportation industry, and there is some testing, some Sandia testing, that was done in the 1990s. In those tests, they made a correlation of, okay, these -- or the forces that the transportation cask is submitted at during an accident in transportation.

So, they correlated that to the drop, or any drops that they would've seen in their plant of interest. In those tests, they saw -- the most they saw was two fuel rods failing in the whole cask.

So, they assume, "Okay, we're going to see 2E to the minus 4 probably failing the bins inside a cask. So you would get two bins failing in the storage casks they were analyzing."

That's what they used for their consequence analysis. Now, for analysis, I'll try to stay -- we're having this discussion with NMSS and different how you would do an analysis like this one, and maybe improve it, make it more realistic. This has been -- well, we have at the moment decided even the resources that we have available.

These are some of the other tools that we're planning to use for the for the quantification, MELCOR -- we would use MELCOR for accident progression during any of these drops, and also MACCS for consequence

analysis.

In terms of our human --

MEMBER SCHULTZ: Excuse me. We kind of dropped down to this fairly quickly, but you started off talking about PWR analyses that have been done in the past, PWR analyses. Is this focused specifically then for Vogtle? Is it specifically focusing on the PWR?

MR. GONZALEZ: We're focusing on the fuel that they have, and their specific --

MEMBER SCHULTZ: And their choice of current -- current choice of vendor for the cask?

MR. GONZALEZ: That is correct, yes. So, these would be site specific PRAs on dry cask storage operations in Vogtle.

MEMBER SCHULTZ: Thank you.

MR. GONZALEZ: And as much as we can avoid using generic data, we'll try to.

MEMBER SCHULTZ: That's what I thought. Just wanted to confirm. Thank you.

MR. GONZALEZ: Because otherwise you'll get something close to a NUREG 1864 or the EPRI PRA. Now, for the HRA, we're going to be using the NUREG/CR 7016 and 7017, which were published last year, and also from the EPRI report, which also consider HRA.

MEMBER BLEY: What kind of human actions

are you looking at here?

MR. GONZALEZ: Well, we don't have the procedures available at the moment because as I said Vogtle is -- is going to be doing their cask loading operations in October. So, they have all that information in draft format.

MEMBER BLEY: So, you'll primarily use HRA during the cask loading?

MR. GONZALEZ: That is correct, but I can give you an idea of different things that have been identified in these two NUREGs and what types of issues might occur during any cask loading. This would include inadequate procedures, inapplicable procedures, inadequate training or experience, like communication difficulties.

You got one person operating the crane, but he doesn't have like a full view of a cask and what other things are around the cask. Time, pressure, visual challenges, things like those. Those were --

MEMBER BLEY: Do you have an event history in this area of things gone wrong, these operations?

MR. GONZALEZ: Cask storage? Not to my knowledge.

MEMBER SCHULTZ: We do have a history, and it's pretty good.

MR. GONZALEZ: That would be correct.

MEMBER BLEY: Just looking for the bad parts if there were any. None at all that you're aware of?

MR. GONZALEZ: No.

MEMBER BLEY: Have you guys looked for it?

MR. GONZALEZ: We have been looking also into other areas. Corrosion is a big area where very little data is available. We have been looking into tanks and corrosion. We have also identified the transport of the cask itself and how it is stored at the plant side before being put in place, and those procedures that are used for being stored in terms of could you get in a situation which would contribute to corrosion during that time, and then would show up later during the life of the storage cask. But we haven't done much other than investigating possible scenarios.

MEMBER BLEY: For getting a basis in real events, it might be worth surveying the process chemical industries.

MR. GONZALEZ: We have been looking into chemical industries.

MEMBER BLEY: Look in there. There you'll find some events.

MR. GONZALEZ: That's why I say one of the

interesting events that we found was they had this storage tank that was being stored for like four years at the site. This was a coastal site also, which Vogtle isn't.

When they put the cask over the tank in place and in operation, it exploded. So, obviously the pressures that that tank was exposed to were bigger than the cask, but something like that where you have corrosion happening during the storage at the site could happen and show up later in life during the storage.

MS. COOPER: Susan Cooper, Office of Research. I'm also the project manager and co-author of the two NUREGs that are listed up there. The project that resulted in these two NUREG/CRs was performed for NMSS.

Their interest wasn't in developing a fully developed HRA method including quantification approach, but we did develop a qualitative analysis approach, and we also did include an extensive literature search and also event review.

The first NUREG, which unfortunately is 7017 and not 7016, looked at the entire fuel handling process, did a task analysis starting from fuel loading, all the way to the ISFSI. Then we used the event analyses

interviews of NRC inspectors who were reviewing cask handling operations, reviews of the two dry cask PRAs, NRC's and EPRI's, to develop an approach and develop candidate scenarios for misloads and cask drops.

Then the later report which again unfortunately is the lower number, 7016, focused in on cask drops only. Again, we developed scenarios that involved operations actions that would lead to cask drops, and Felix was mentioning some of the particular vulnerabilities that we were able to identify that are specific to the fuel handling operations, which are different than control room operations.

So, the overall project did a lot of digging into events, LERs and other things, reports that have been done. We had some crosstalk with the folks in NRR that are interested in crane failures.

So, there was extensive work done, at least in the time frame leading up to the publication of these reports to look at the operator/human performance aspects of those events.

MEMBER SHACK: Did you look at misloading too?

MS. COOPER: Yes.

MEMBER SHACK: Somewhere we saw that.

MS. COOPER: We looked at misloading in the

first report, and we did find some events that were -- that had that feature. One of the scenarios that we developed, or at least one maybe more than one, did look at misload scenarios and how that might occur.

We did have some trouble developing a failure criteria for what -- how many misloads mattered. So, we kind of developed our own set. One misload is not hard to imagine because there's an event history to support that.

However, there are -- there have been one or two events that have occurred where systematic misloads have occurred, for example due to an error in the fuel handling plan.

So, that is one of the scenarios that we developed in the first report, which is 7017.

MR. GONZALEZ: Thank you, Susan. Any other questions related to HRA? Next slide. These integrated risks for trying to consider the effects of dry cask in connection to other plant operations that if you get a cask drop, would you get a plant trip? Is it possible?

Also, effects of a -- you get a cask release and the effects on actions in the fuel handling building, and vice versa. Next slide.

Some of the biggest challenges we have is

HRA uncertainty and fabrication errors that were not considered in 1864 since this is what we're using as our main methodology. Also, the EPRI PRA study included HRA to a limited extent, but we have these other NUREGS that might provide insights into what -- into how to conduct an HRA.

Also, as I mentioned, the fuel failure analysis for each of those, of the previous PRA studies, are different. These are going to make a big effect into the consequence analysis. Obviously, if you fail two bins versus failing all fuel rods in the cask, it's going to be a big difference.

Then the proposed approach on the Level 3 has yet to be demonstrated. That was based on discussions with NMSS, also on recommendations that NUREG 1864 did on how you could improve that approach and the approach that they used, and how you can make it more realistic.

MEMBER SCHULTZ: What type of fabrication errors are you concerned about?

MR. GONZALEZ: Like they didn't follow procedures for the welds of the canister itself. I'm trying to think. Off the top of my head, I don't remember what type of errors. I mean they didn't consider any fabrication errors now. What would you consider in this? Of the top of my head I don't remember.

MEMBER SCHULTZ: Perhaps incorporate into some element of uncertainty might be appropriate, but it's pretty straightforward. I think you picked the welds as being one area that may be of some concern. I wouldn't expect to see very much variability.

Again, to go back to Dennis' comment, perhaps looking in other industry -- similar industry practices, you might be able to gain some level of confidence that could lead you to spend little time on that.

MR. GONZALEZ: We have been looking at different areas, like aircraft industry is one that they're usually concerned about corrosion and weld failures in airplanes. We have been looking a little bit in documents and different cases where they have similar failures to this, and we could somewhat relate to like pressure vessel storage. This is basically a pressure vessel.

In most of the other cases that we have seen in industry, you know, it's like 10 or sometimes 100 times bigger pressure wise compared to a dry cask storage --

MEMBER SCHULTZ: It's a container. It's not even a tank.

MEMBER BLEY: Aren't they vented?

MR. GONZALEZ: Yes, but the canister itself

is contained.

MEMBER SCHULTZ: It's sealed.

MR. GONZALEZ: Pressurized, yes. But you have vents that move air between the boundary from the canister or the -- and the storage cask in the case of HI-STORM 100. But that is correct, it's vented.

Then other challenges are the cask release fractions. This obviously also has a big effect in the consequence analysis. Seems like 1864 and the EPRI release fractions somewhat, but we haven't evaluated what are -- what we're going to be using for the Level 3 PRA.

Both of them were based on NUREG/CR 6672 if I remember correctly the methodology that I used for the release fractions. But the NRC report considered other like papers that have been published in this area and the data they provided.

Also, there's limited information available for Vogtle. As I said, they are planning on doing the first loading in October and most other procedures are in graph format. So, they have been concerned with sharing it, and most of the information we have has also been based on calls that we have had with them, but very little that we can reference.

The other challenge is data on cask erosion and failures are limited. As I said, we're considering

data from other industries.

Major assumptions that we have discussed at this moment that we're going to be using for the Level 3 PRA is that we're not going to be considering operations where you move or your prepare the canister or the cask for transporting offsite.

We're not considering that, and even if you consider that, the risk can increase substantially.

Also, we're going to be assuming a time period for analyzing the independent spent fuel storage -- obviously if you have no cask, you won't have any risk from it. Hopefully doing something like a couple casks at middle of life and end of life, or reporting the risk on a per cask basis.

Also, we're going to be using the results of the multi-purpose canister failure analysis or any other data that we can use from 1864 or the EPRI PRA in order to review the resources that we need for the Level 3 PRA.

So, I'm on a rough path forward -- I shouldn't have included this much detail, but I mean we have to start somewhere, and have somewhere to shoot for. In summary, continue to review on identifying information that we can use for our dry cask storage operation.

This includes any shading event analysis considering data from other industries, and also performing the structural analysis on the fuel and cask storage some time in the summer, performing the HRA on Vogtle dry cask storage operations some time in late 2013-early 2014, once we have the procedures available from Vogtle, and performing the quantification of each of the events that we identify and we analyze in 2014, and then eventually consequence analysis also.

Hopefully, you will be able to give input to the consequence analysis people some time in early 2014. That's it.

CHAIR STETKAR: Questions for Felix? If not, thank you. Good overview.

MR. KURITZKY: Okay, moving forward, I just wanted to take a few minutes to give the subcommittee an idea of where we are right now, what we're working on, and what's coming up.

Since we're now actually ahead of schedule in the meeting, that will afford you the opportunity to pound me on our project schedule, and why we're not making it, which of course I was clever enough not to give you an update schedule.

In any case, right now we have, as we discussed in a previous convert-over, the Level 1 internal

vents and internal flood model from CAFTA that the licensee provided us we've turned over into a Saphire model and made a number of changes, as I mentioned previously, about loss of offsite power and common cause failure and two other things. There's still some --

MEMBER SHACK: Does that mean there's three Level 1 models? There's the licensee model; there's your converted model, and there's your SPAR model?

MR. KURITZKY: There are three. Right.

MEMBER SHACK: You're not longer really using the SPAR models. You're really going to use the converted model as the basis for this?

MR. KURITZKY: Exactly. I only care about one, that middle one. Okay, so, there's still a few things that need to be done for that Level 1 model. It is close to being completed, but there was some work on human error probabilities.

We're still going through similar work there, and we're recalculating a number of human error events to come up with new probabilities that we'll be using in our model. Also, data-wise --

MEMBER BLEY: At one time, you told us the Level 3 PRA would be using a newly developed NRC HRA model, which doesn't exist yet. So, what are you using?

MR. KURITZKY: I don't think I actually

ever said that.

MEMBER BLEY: We have transcripts.

MR. KURITZKY: I can refer to them. Actually, for internal events, Level 1 at-power, that type of thing, we always proposed you stay at practice HRA methods.

Where we have mentioned in the past that we might have to push the envelope was more in the Level 2 area, possibly in the spent fuel pool area. There are obviously considerations related to integrated site risk that we'll have to figure out. Also, some of the area wide events like seismic, where we don't actually have an approved -- there's not a state of practice methodology.

For internal events and actually for internal fires now, we pretty much have a state or practice approach, but for those other areas, we either have to kind of expand on those or come up with some alternative type of approach.

I think the biggest concern is really the Level 2 area, because that's -- you have different types of decision makers dealing with stuff like SAMGs. You have different types of decision makers, different types of decisions.

It's not procedural based, where they're

going to just follow very prescriptive instructions. They have to evaluate a decision. There isn't always one clear right or wrong answer. There could be consequences, negative consequences, no matter what choice they make.

So, the whole paradigm there is a little bit different. So, that's an area that we have to see how well we can adapt the current approaches for that type of a context.

MEMBER BLEY: At our next meeting, since it's going to be substantive, is that an all-day meeting or --

MR. KURITZKY: Half-day.

MEMBER BLEY: Another half-day. Okay.

MEMBER SHACK: As I read the technical plan, the internal events HRA is going to more or less take from Vogtle; you're calling that state of practice.

MR. KURITZKY: We are, but as Mary mentioned earlier, anything that we take -- that we leverage from the licensee, we have to make it our own. This is going to be the NRC's level 3 PRA model. So, if we're going to use something from the licensee's model, we have to vet it and do significant shakedown of it, so to speak.

We are going to rely a lot on the external

peer review to give us confidence about how something is done in that model. We're also going to do spot checks of the other aspects of it, even the -- the external peer review is kind of a higher level. We still have to be comfortable with the work that was done.

We're okay for our purposes. Not for the licensee's purposes, but for our Level 3 PRA model. In doing so, we might find things that we want to do differently. Doesn't mean what the licensee did was wrong. It just means we want to go a different route.

One of the cases of that is with some of the HPP's, we're using a different -- let's say a different HRA method to generate the numbers. We might use some of the same data or inputs, but we're using a different approach. So, we should make them up with different values.

CHAIR STETKAR: Alan, put it on your agenda your list for July. Because we already mentioned that we'd really like to hear how you're stitching together the entire project. In particular, we'd like to really hear about how you're doing HRA across the whole project with some specific examples to -- so we can better understand both this issue in terms of how you used let's say different methods from the Level 1 at-power, but more concern is what are you going to use for Level 1 shutdown?

What are you going to use for Level 2 across the board so that we can have some assurance that indeed there will be a consistent perspective for treating humans because that's obviously something that we need to treat consistently across all of these transitions horizontal and vertical, if I can characterize them that way.

MR. KURITZKY: Okay.

CHAIR STETKAR: So, I think several of us would be really interested in hearing how you're going to do that, and not just generalities that we're going to look at various and sundry methods. Pick the best one.

MR. KURITZKY: Okay, I'm not going to commit to exactly what you want.

CHAIR STETKAR: Take it as a strong request.

MR. KURITZKY: Right.

CHAIR STETKAR: It's this stage in the PRA. You ought to have made that decision.

MR. KURITZKY: To the extent we have information we can share with you on that topic, we will certainly do so in July.

MEMBER SCHULTZ: Good. Clearly from the presentations today, but also just going forward, it's

expanding in terms of breadth and depth, however you want to describe it. Two dimensions: one is the HRA is being applied in fully new areas where it hasn't been addressed before; different activities associated with the site work.

Then in addition, as John just said, in Level 2 and Level 3, we really need to capture activities associated with plant activities and offsite activities as well.

MR. KURITZKY: Again, I'll go through the stats right now. What we've done so far in HRA is with the Level 1 internal events and internal floods. We haven't not done HRA evaluations or analysis in any of the other areas yet.

CHAIR STETKAR: Right.

MR. KURITZKY: I don't know to what extent we'll have something ready by the June cutoff for submitting stuff to the ACRS to put in the July meeting, but we certainly can be thinking about -- we certainly can share with you what thinking we've done in that area, though we might not have specific examples at that point.

In any case, like I said, whatever we have, we're certainly more than willing to share with you in July.

Okay, so, also for the Level 1 internal

at-power internal events model, we performed a self-assessment last month. That self-assessment did not include the HRA at that time because it wasn't complete yet.

Since then, we did perform the self-assessment of the HRA work just earlier this week. So, that will be included when we discuss the self assessment in July with the subcommittee.

Out of the self-assessment, there are a number of areas where we need more clarification from the licensees who are assembling a set of questions to send to them to get more clarification.

Internal floods is the one area that also was left out of the initial self-assessment. It was not complete yet. We are anticipating doing that self-assessment very soon. So, we should hopefully have those results when we talk to you in July also.

Jumping to the internal floods model, we -- again this is one that we are -- we have ported over from the licensee's model. However, there are several things that we're doing on our end. One of those things is updating the flood frequencies.

We're using a more recent EPRI report on rupture frequencies to update some of the flood frequencies. We also need to perform confirmatory walk

outs at the site, which we're hoping to schedule in the next month or two.

In the licensee's PRA, floods are extremely low contributors and we don't necessarily anticipate that they would be any different in our version of the PRA, but again we'll be using more updated frequencies, and we'll have to check to see that the reasons they are a very low contributor in the licensee's PRAs remain valid for our model.

With regard to the fire, seismic and other external hazards, back in March, Don mentioned that we have gone down to the site for a walk down for several aspects of the Level 2 -- actually Level 2 aspects, but we also were walking down for the seismic and high winds aspects.

We had an advantage at that time to be able to also go inside containment because unit 2 was down for refueling. So, we were able to do seismic walk downs inside containment.

We are preparing the trip report for that. There was a lot of photographs taken at that site visit. We just recently were able to get those from the licensee, which will support our trip report. But the information that we have received and the information we've gleaned from the site visit we're using to move forward in the

seismic and high winds area.

We also had our seismic and fire and high wind PRA team go down to Southern's headquarters in Birmingham I think last month, and met with their counterparts from Southern, and were able to get a lot of good information and understanding of what Southern had done in their work to help us I guess in leveraging so we can use as much as possible for our own modeling.

Because of that information and those visits, we've now been able to start doing some of the fire scenario mapping, which I alluded to earlier, where we'll take many of the scenarios that the licensee has done, and will probably map them into a subset for our model and integrate them with our Saphire internal events model.

At the same time, we're also reviewing and analyzing some of the work that was done by the licensee in terms of the fire modeling aspect itself, fire ignition frequencies and fire propagation, heat release rates, etcetera.

So, that work is ongoing and parallel. From a seismic point of view, we have started moving on developing our own seismic model. Again, as I mentioned before, the licensee is doing a seismic model right now, but it is not complete. But they were able to share with

us a fair amount of information that they had already prepared for their effort.

In addition, the seismic, which is typical -- well, is a shy example of the fact that this whole project, because of its huge breadth and scope, requires a tremendous amount of information from the licensee.

It's just a huge amount. The licensee has been very cooperative and forthcoming with information for us to help us get this study done. However, we have inundated them with requests for information. And so, it's not practical for them to be able to supply it at the snap of a finger.

So, it has been a long process of getting information as it becomes available and as they can hunt it down and provide it to us through our formal process. So, in particular with the seismic, which requires so much information, it's been a long time and some of that being able to supply to us.

So, the schedule for that work has been sliding, in addition to the fact that budget limitations have also limited what our contractors have been able to do for us over certain periods of time.

So, one of the reasons I don't have a new schedule for you is because it's a very dynamic schedule and it slides almost daily. We are in the process of

putting together a Microsoft project version of the schedule that will -- we can more dynamically update.

Right now, the schedule is moving so much that I haven't nailed something down on paper.

CHAIR STETKAR: Could questions, Alan. Let me get the easy one out. This slide mentions a couple of different walk downs. You said you've already completed a seismic high-wind walk down.

MR. KURITZKY: Yes.

CHAIR STETKAR: Under flooding, you say you need to perform a walkdown. I didn't hear you say anything about fires. Is the walkdown for flooding going to be a combined fire/flooding walk down, I hope?

MR. KURITZKY: No, actually it's not. Different people -- I did have a note to talk about the fire walkdown. I forgot to mention it.

CHAIR STETKAR: Okay.

MR. KURITZKY: The fire walkdown we're waiting until we do some initial work on the fire scenario mapping to try and nail down a little better which areas that we want to see.

The flooding is going to be a little easier walkdown. The fire walkdown could be fairly extensive. We're not going to recreate the work as if we're doing a PRA from scratch.

So, what we want to do is focus our walkdown on those areas based on information we've received from the licensee, as well as our own analysis, to tell us what things we want to focus on.

So, we're just kind of holding this off until we get that parallel effort that I was mentioning to you before about looking into fire modeling, as well as the this initial what I would call phase 1 fire qualification actually.

We want to get some insights from that first before we go down on walkdowns in specific areas.

CHAIR STETKAR: Of course the general warning is that if you only look at the important areas that were deemed to be important by someone else's analysis, you might miss the areas that were deemed to be unimportant by those analyses but ought to have been.

MR. KURITZKY: Right. That's when I mentioned that we were using the analysis that we're doing independently of that to help shape what we might look like. So, it's not --

CHAIR STETKAR: But without the walkdown information, how do you know? That's my point.

MR. KURITZKY: You can have a chicken-and-egg situation there. Obviously, we're going to take the walkdown when we feel it'll be most productive.

That's our plan.

MS. DROUIN: Part of the walkdown will be to confirm that areas that were screened out were appropriately done so.

CHAIR STETKAR: That's important. The only reason I ask is in terms of overall project efficiency, given the fact that you have to have some gaggle of people descend upon the foresight and walk through a reasonable fraction of the buildings with escorts and whatever.

Does it make sense to have that gaggle instead of six people being eight people, and kill two birds with one stone?

MEMBER SCHULTZ: Experts in operation.

CHAIR STETKAR: Experts, yes. It's just a question.

MS. DROUIN: We had talked about, on these site visits, where we can combine things that -- you know, if they're going to be doing this, can you check out this other group.

CHAIR STETKAR: Second question, and this is not walkdown stuff, but it addresses the comment you made about inundating the site with requests for information to support the seismic analyses.

In the project plan, there seems -- any time

I see discussions of structures or equipment, whether it's spent fuel pool analysis or whether it's dry cask storage or seismic analysis, there seems to be a very, very high emphasis on doing detailed finite element analyses of everything in the world.

Are your requests for information in the seismic area focused on very detailed information about structures and equipment and mounting so that you can develop finite element models to support the seismic analysis?

MR. KURITZKY: Let me respond a couple ways.

CHAIR STETKAR: Because there's easier ways to do that.

MR. KURITZKY: Right. So, let me respond. First off, my first response is I'm not a seismic expert. So, I can't respond intelligently to everything you've just asked. But I will say that there's a spectrum of information we requested from them. More general information in some cases, and more specific.

We've tried to focus our requests on those things that we think are the most important. We certainly do not plan to do finite element analyses on all the things, and not even necessarily many thing. There'd probably be a few things that we would do a finite element

analysis on. For those, we'd probably need to get more detailed information.

So, again, we'll do some finite element analyses in house for what we think are the most critical items. We'd like to make use of whatever the licensee has done to the extent we can, and to spot check their work, but by no means do we have the resources, the intent or would there be a value in doing such detailed analyses.

CHAIR STETKAR: Just trying to get a sense, because as I said as I read through the plan, a lot of places where it discussed structural failures for whatever reason, it tends to spend quite a bit of time emphasizing finite element analyses, which of course require a lot of detailed information.

MR. KURITZKY: Right, and a lot of resources.

CHAIR STETKAR: And a lot of resources, right.

MR. KURITZKY: Right. So, I think regardless I can't speak exactly in the TAAP what we've identified, but I -- I can almost assuredly say that whatever we identified a year ago as to what we'd like to do a finite element analysis on, I'm sure reality was going to limit that list.

CHAIR STETKAR: Well, it didn't have a

list. It just sort of --

MR. KURITZKY: Had general flavor to it?

CHAIR STETKAR: Had an emphasis on that type of analysis approach.

MR. KURITZKY: That'll be much more limited. Okay, as far as low-power shutdown, that's one area that we're just recently getting started on. Most of the work today we've just been looking into defining the plant operating states, plant configurations, kind of like we talked about before on having an overall matrix that kind of aligns the reactor with the spent fuel pool and the different units.

MEMBER BLEY: Do you have their outage plans for the last few outages?

MR. KURITZKY: We have the outage -- we have one outage plan right now. We're requesting several more. We have one already. So, the initial work was based on the initial outage plan that we requested a while back.

MEMBER BLEY: The thing I've seen some people miss in doing this is matching those states of maintenance to the process states that are involved in the refueling and overhaul outage. Those are really key risk factors in your shutdown studies.

CHAIR STETKAR: As Dennis said, the way to

think of it is a maintenance state or a plant maintenance configuration, not the average unavailability of this component through the maintenance, and the average unavailability of some other component due to maintenance. Because it's very likely that they're both out of service at the same time.

It's a correlated maintenance configuration that maps into the evolution of the plant operating states over the course of the outage. That's really challenging.

It sounds petty, but it's a really challenging - if I can call it - bookkeeping activity. But really, really important. It isn't .6 that this is out of service, independently with .6 that something else is out of service.

It is .6 or 1 that they're both out of service simultaneously. It's a separate, basic event. Then that bookkeeping; I wanted to ask you. You say the biggest challenge will be fires and external hazards. They certainly are a challenge. They're not necessarily the biggest challenge in setting up a full scope low-power shutdown model.

MR. KURITZKY: I think my point here is more that right now the low-power shutdown PRA modeling for internal events is fairly well established. There are

parts that are difficult, but there has been work done for low-power shutdown PRAs for internal events.

CHAIR STETKAR: For Vogtle?

MR. KURITZKY: Not for Vogtle, for other --

CHAIR STETKAR: Okay, generally people have always known that the draindown events and the one-plant operating state where you're at low level are the only contributor, and that's the only thing that people need to look at.

That's wrong. So, for example, if you're doing a full-scope Level 2 PRA, you don't rely on that work that has been done that has known that to be the only contributor. You need to do a full scope Level 2 PRA, and perhaps that's true for Vogtle, and perhaps it is not.

MEMBER BLEY: The one thing I'm sure you've picked up is that in the last three to five or six years, the outage schedules are much more coordinated and rapidly carried out. So, you get into vulnerable states much quicker than the earlier studies.

CHAIR STETKAR: Well, some plants, for example, don't -- I don't know how Vogtle runs their outages. I've seen some plants that don't draindown when older plants used to draindown. They do their work on

reactor -- they offload the whole core, and then they do the work on the reactor coolant pumps or steam generators or whatever they need.

So, they're not vulnerable to the same types of conditions, even if they do draindown, it is all plant-specific how they run that outage.

MR. KURITZKY: Right. So, to respond to both those comments, certainly we're going to have to make a lot of use of the outage reports, and what their philosophy is when they take equipment out. And to Dr. Bley's comment, some of the older outage reports may not be all that indicative because things may have changed, and because they're doing things much quicker. You have less time to spread stuff out, I'd say.

So, there is obviously going to be some uncertainty there. It's going to rely on the outage reports, particularly the most recent ones, a lot of talking over with the -- with the staff at Vogtle to get their philosophy on maintenance during outages, and then to the best we can modeling it all in our model.

Again, I didn't mean to demean some of the challenges for the internal events modeling. It is just rather there is at least some track record there, and not all of them have just focused on mid-loop operation, etcetera. There are some more complete shutdown PRAs.

It may not map totally into Vogtle, but at least there are insights to gain from some of those PRAs, whereas for the fire and the external hazards, it's kind of really walking into some -- at least my understanding is some new ground that hasn't been vetted that well.

MS. DROUIN: We have a low power shutdown standard that has been underway for many, many years, and it is ready to be published.

CHAIR STETKAR: Any minute now.

MS. DROUIN: But we have access to it. The point is that standard only covers internal events. It doesn't cover fire and seismic. So, that's why it's more of a challenge because at least we in industry have given a lot of thought to how to build a low-power shutdown model for internal events and internal flood; that same amount of thought has not been given to internal fires and seismic.

CHAIR STETKAR: Well, but on the other hand, if you have an internal fire model full power, the frequencies of fires are different. Not necessarily component specific. Component doesn't necessarily care. It doesn't know. Human related fire events --

MR. KURITZKY: Transient combustibles.

CHAIR STETKAR: Transient combustibles, distribution of transient combustibles; status of fire

barriers, for example, are different, but the basic plant configuration is the same. So, it's that if you do a walkdown and understand the inventory of the equipment in each location, that inventory anyway - derouting your cables - is invariable.

MR. KURITZKY: Right.

CHAIR STETKAR: So, a lot of that work for the fire PRA is available. Initiating events frequencies are different. Initiating event frequencies is a function of plant operating state may be different because of different types of activities that are going on in different parts of the plant.

Possible involvement if multi location events goes for fire and flooding are different. But when you say that we don't have standards to do that, the basic thought process is precisely the same depending on whether I'm at-power or whether I'm at shutdown.

In some cases, a door might not exist when I'm in shutdown where the door exists in power, but that doesn't affect how I think about fires.

MR. KURITZKY: One other thing to keep in mind is because we're not doing a full detailed fire PRA from scratch, and to the extent that we're going to do a low-power shutdown PRA is going to be limited based on our available time and resources.

So, we're going to be using insights from internal event low-power shutdown PRAs to help us in doing our work. We're going to leverage whatever information we can in all aspects of the study to try and get things done as well as we can within our project parameters.

We have less insights to draw from from the seismic and fire PRAs. So, things that could be more important may not be the same things that are important under fire or seismic conditions that would be under internal events. So, that requires us to do additional work in those area that we're not sure exactly what that involves. That's the reason why.

I don't want to say it's the biggest challenge, but it's the biggest unknown. Let me say it's the biggest unknown.

Okay, moving onto an area that's doing much better, Level 2. We're doing -- moving along very strongly in the Level 2 area, as I think Don mentioned and Felix may have mentioned before that we've done -- Oak Ridge has done SCALE analysis for us for reactor and spent fuel pool to support the MELCOR and MACCS calculations.

We have a MELCOR model for the one reactor containment. In fact, we have revision 2 in house now. We're working on revision 3. It's something that will

evolve as more information becomes available we'll be improving it and refining it as time goes on.

We have a finite element model of one containment. So, that's obviously an accomplishment. I don't know exactly how many more finite element analyses we're going to do, but we have that one in house.

We have walked down the ox and fuel handling building -- fuel handling buildings and unit 2 containment back in the March walkdown. We are planning to have HRA walkdown focus on Level 2 HRA, hopefully again in the next month or two to get some insights on how HRA will be modeled for the -- in the Level 2 modeling.

We have in-house a draft plant damage bidding tree, as well as draft containment event tree. So, we are moving forward on that. We also have a concept for doing the extended Level 1 event trees to incorporate the various containment systems. So, we're moving forward in that regard.

Some of the challenges we have is Saphire right now has not been used extensively for Level 2 work in the past. So, we have some growing pains in getting all the Level 2 features we want to use for the model to work in Saphire.

So, we have to kind of work through some of those issues shaking it down.

MEMBER BLEY: Just one in there, and I don't remember Saphire well enough, but the one thing you're really going to need is that it can abandon the rare event approximation. Because when you get in the containment tree, you're going to have to abandon that in several places.

CHAIR STETKAR: You're going to have to abandon it in a low-power shutdown too.

MEMBER BLEY: So, you need to be able to handle large probabilities if you're on one branch rather than another. It's not just failure things that put you there. It's phenomena and even modeling decisions. So, you got to be able to handle that.

MR. KURITZKY: That's on our radar, and --

MEMBER BLEY: I thought it was.

MR. KURITZKY: -- as you mentioned, it's not really unique to Level 2. It appears in the earlier version --

CHAIR STETKAR: Well, power and shutdown -- I mean there's different ways of skinning the cat.

MR. KURITZKY: Seismic.

CHAIR STETKAR: Seismic is also.

MR. KURITZKY: Okay, other challenges for Level 2. We mentioned HRA. There's some common ones: funding and staff availability are two issues that we're

running into. You heard Don talk at various times about Level 2. You heard him talk about the spent fuel pool. Heard him talk about a number of things, and there's only one of them, and there's also people supporting him on this area, and they're getting pulled onto a lot of other related projects.

There is spent fuel pool, scope studies and other things that are drawing the limited staff, experienced staff, into other areas. So, that's a challenge that we have and of course funding for contractors is another challenge.

In terms of Level 3, the consequence of that one -- the delta Level 3 consequence analysis, right now we've been working on improving the capabilities of MACCs, particularly in the area of emergency preparedness modeling. We're also working to identify and resolve potential code issues for modeling multi-source releases.

That's an expanded capability that we need to get into MACCS. We're also updating the population economic databases that go into the -- into the code.

We are planning to have, in June, the emergency preparedness team go down to Vogtle and also go talk to the state and local authorities, as well as Savannah River, which the Savannah River facility is just across the river from the plant.

So, from a consequences point of view and in an emergency preparedness point of view, it's obviously very important to --

MEMBER BLEY: Have you got DOE and the local folks on board?

MR. KURITZKY: I know we were scheduled to have a DOE contact, and we've been working to meet with them. Yes, and the local and state authorities I think we've set up meetings. I believe the DEP people have set up appointments. So, that will occur in I think the third week of June.

Again, with Level 3 the issues are the same that we see for many other areas: funding, staff availability and information availability.

MEMBER SCHULTZ: And so the EP team visit is going to focus on the basic understanding of the site and its environs to see whether there's any surprises?

MR. KURITZKY: Right. They're going to -- they're going to actually canvass the area. They're going to drive around the area to see what type of infrastructures there can be used for the evacuation or that could be impeded in a case of some events that could affect the availability of restructure, as well as discuss with the various offsite response organizations what type of approaches they would take in an emergency and then

coordinate what type of activities they would do, and what information they would input into the MACCS.

MEMBER SCHULTZ: Are they going to be also investigating the site capabilities in terms of the technical support center, the emergency centers, and so forth?

MR. KURITZKY: They're going to meet with the EP folks, the site EP folks. When Don went down for the Level 2, and I'll let him speak more to it, I think he talked with -- did you go see the TSC and talk with some of the folks who were there?

MR. HELTON: We looked at a little bit of that from the Level 2 perspective in terms of just going through the OSC and the TSC. The EP folks will be looking at some of the same stuff from a different perspective because the TSC doubles as part of the onsite accident management as well as part of the emergency plan functionality.

So, it serves some of this infrastructure -- serves dual purpose, and so we're looking at it from both perspectives.

MEMBER SCHULTZ: And with respect to multi-source releases, we're talking here about the pool as well as the core, or the --

MR. KURITZKY: Two pools, two cores, one

dry cask storage facility and all combinations thereof.

MEMBER SCHULTZ: All the combinations thereof.

MEMBER SCHULTZ: And better support for that means modeling? On the slide it says, "We need better support for multi-source releases." Is that -- is there something missing?

MR. KURITZKY: No, that's the part about -- for the MACCS, to improve MACCS.

MEMBER SCHULTZ: All right, thank you.

MR. KURITZKY: Okay, specifically and dry cask storage, you just heard about those earlier this morning. There's not much else to say there. I will mention that for the dry cask storage I think Felix quickly alluded to it.

Because that's a facility that's just being developed and built and implemented, information is hard to come by. And so, that was one of the things that was kind of dragging our ability to move forward on dry cask storage up until recently. But we did have a call with the licensee last week, right? We actually got quite a bit of information on the phone from them to help us move forward with our work. That was beneficial.

Integrated site risk: obviously a 600-pound gorilla in the room. It's obviously a big issue that's

going to require hard thinking. We recognize that. It is something, as I mentioned earlier, we've been thinking about since the very beginning of the project.

We in fact had a workshop last month where we brought in some consultants to try to throw some ideas around. We had some ideas about how we wanted to pursue it already. We wanted to bring in some more experts to talk about it further and get some more ideas, or confirm what we were already thinking, or give us some fresh ideas.

The workshop was very successful. I think we got some good information from going through that exercise, and we are in the process of preparing the technical analysis approach plan section for that topic, which again as I mentioned, we will be providing to the subcommittee in June before the July briefing. We'll discuss it in more detail there.

What essentially came out of the workshop and our thinking is that we're going to take some type of a scoping approach, where we look at all the different multi-source accident sequences that can occur, but then use some type of scoping and screening processes to help us focus down on those that are most risk significant.

As much as we would like to take the full unit 1, unit 2 reactor models and the spent fuel pool

model 1 and 2 and dry cask, take the whole thing and jam it all together, it is just not going to happen.

So, we have to be smart about how we go about integrating the pieces of the puzzle, how we integrate the various radiological sources onsite. And so, we'll talk to you in July about our thoughts on how we're going to accomplish that.

CHAIR STETKAR: We'll be really interested to hear about that.

MR. KURITZKY: Yes, and we're very interested to get your feedback.

Okay, last thing I want to mention, and I think Mary may have also mentioned this earlier. We've already started talking with the PWR owners group about trying to get their involvement in some of our external peer reviews.

We're meeting with them in a couple weeks with the risk management -- yes, the risk management subcommittee is going to be in town in a couple weeks. We'll talk to them about some of this.

As I mentioned before, their schedule -- what points we're going to have external peer reviews is still an ongoing debate. We had a list initially from well before in the TAAP. Already that list is being re-thought. Certainly the input from the owners group

has a big influence on that since we would like them to support those reviews. So, it's an open topic right now.

In terms of path forward, right now we actually are moving forward in all areas of the study. We at least have enough information and enough staff availability to essentially move in all areas of study.

Obviously some are moving more rapidly than others based on the need to have them done and completed, be completed sooner, or based on the availability of staff or information to do those areas sooner. But we are moving forward in all -- in all areas, and we have those same common elements that we have to overcome, which is the availability of staff, of information and of funding.

CHAIR STETKAR: Offline when we talked about this a little bit, in the last bullet there you show ACRS full committee briefing in December. But briefing Commission PAs in September,

We traditionally meet with the Commission twice a year. This year it is July, and usually in December. We may want to be able to discuss with the Commission this project in our briefing in December, which means the Committee will need to produce a letter no later than November to support that.

You may want to keep in mind some of the timing of the full ACRS briefing. I don't know. We can

do that offline.

MR. KURITZKY: Yes.

CHAIR STETKAR: It is one of the things that -- otherwise, our next Commission briefing will be June/July or so of 2014. The ACRS hasn't written a letter on this in three years. I think their last one was 2011 or something like that.

MR. KURITZKY: It's the one that kicked off --

CHAIR STETKAR: Yes.

MR. KURITZKY: Okay.

CHAIR STETKAR: Well, we can work that out as -- over the next couple months or so.

MR. KURITZKY: Right. John and I will be in contact.

CHAIR STETKAR: Okay.

MR. KURITZKY: Obviously you jump to the list of meetings. So, just a quick list of some of the bigger upcoming meetings. We're going to brief the office directors next month. We're coming back to the subcommittee in July to talk about integrated site risk and our self-assessment.

As you mentioned, the Commission assistants. We have to brief them every September, or at least once a year by September. We're planning to

come back for a full day meeting to the subcommittee in October to go over some of our preliminary results.

I'm always hopeful they'll have more results and then reality sets in. We never seem to get quite as far along as I would like. But whatever we have available, of course we will brief you on in October.

Like you mentioned, we had a tentative date to brief the full committee in December, but --

CHAIR STETKAR: We may want to --

MR. KURITZKY: You can discuss with John, and maybe we can --

CHAIR STETKAR: We'll work that out.

MR. KURITZKY: Right. And that's pretty much it.

CHAIR STETKAR: Great. We managed to meet the time constraints. Any other questions for the staff from the Subcommittee Members? If not, we'll open up the bridge line and ask if anyone out there has any questions or comments.

While we're doing that, I'll come around and ask if anyone in the room has any comments. I've been told the line is open. If -- since we have no actual indication of that, if someone is out there, would you just please say something so we confirm that it is.

MR. LAUER: Yes. This is Steve Lauer, NRR

DRA, and I have no comment.

CHAIR STETKAR: Thanks, Steve. At least we know the line is open. Shows our technical situation here. Now that we know it is open, is there anyone out there who has been on the bridge line who has any comments that they'd like to make?

Hearing none, as we usually do, what I'd like to do is go around the table and see if any of the Members have any final comments that they'd like to make. I'll start off with Dr. Shack.

MEMBER SHACK: No thank you.

CHAIR STETKAR: Dr. Bley?

MEMBER BLEY: Yes, I would. First, I'm glad to see that there's some significant work in place. I was beginning to think all you guys were doing was planning.

MR. KURITZKY: So were we.

MEMBER BLEY: And it is also good to see the efforts you put in on the process controls QA stuff. That's going to be very important to keep this all on track.

We'll do better than in the past I'm sure, but just reiterating the way you tie these models together is going to be critical. We're looking forward to that next meeting.

To me, the key issue is tracking all the conditionalities that are involved as you lay out that structure. Now, you're not going to wire the whole thing together, so you have to come up with some ways to do this, and those ways really need to make sure that those conditionalities that you would track if you had all the models tied together for the important sequences are picked up.

Finally, I was glad to hear Mary say that part of the walkdown will be to ensure that all those areas screened out were properly screened out. I think that's a crucial piece for this thing to work right. Thanks for the briefing. It was a good day. Thanks.

CHAIR STETKAR: Steve?

MEMBER SCHULTZ: I'd like to follow on Dennis' comments in terms of figuring the technical coordination of all those pieces that we heard about today. I'm happy that you had a workshop recently associated with getting industry together and getting new ideas on some of the other aspects.

I think this is another one where perhaps I'm glad we're meeting as a Subcommittee a few times before we meet with the full Committee. But I think that coordination is another area where it would be worthwhile to set up the over-arching structure, some of the things

we've discussed today of how it's going to be tied together because I can envision that that's where if it's not done in a way that's well understood, most of the questions associated with what this project produces will be aimed at.

That will be the target for discussion later on if it's not addressed early on. So, I'd recommend that to the extent possible with information that is now currently available from the work that has been done - good discussions today - that that be a focus of that next piece of thought on how that integration is going to be done, and get some buy in from stakeholders associated with that.

So, if you get a broad spectrum of ideas related to that, I think that will help later on.

MR. KURITZKY: Thank you.

CHAIR STETKAR: I don't have anything else. Kevin, do you have any final statements?

MR. COYNE: No. Just as always, thank you for your time and support in the Subcommittee meeting, and we very, very much appreciate the feedback. We're really looking forward to feedback on the integrated list approach in July. So, that should be a good meeting.

Now, instead we'll try to work on the HRA discussions as much as we can, but it's going to be a

pretty packed meeting. But we'll cover what we know at that point.

CHAIR STETKAR: Again, I don't have anything else to add personally other than what I've said already. I do look forward to the meeting in July. It is going to be more intense than these meetings have been. I think we're going to -- I hope we're going to hear about actual problems or solutions for some pretty difficult issues.

I'd like to thank you all. You covered a lot of material as usual very clearly, and we came in under schedule. So, I appreciate it, and the meeting is adjourned.

(Whereupon, the above-entitled matter went off the record at 11:59 a.m.)

Full-Scope Site Level 3 PRA

Advisory Committee on Reactor Safeguards
Reliability and PRA Subcommittee

May 22, 2013

Alan Kuritzky
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Outline

- Technical Analysis Approach Plan
  - Quality Assurance Plan (Section 18 – Updated)
  - Spent Fuel Pool PRA (Section 15)
  - Dry Cask Storage PRA (Section 16)
- Project Status and Path Forward

Technical Analysis Approach Plan – Quality Assurance

Advisory Committee on Reactor Safeguards
Reliability and PRA Subcommittee

May 22, 2013

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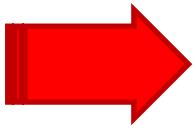
Previous Presentation on Quality Assurance (QA)

- QA involves the following five major elements:
  - Use of established methods, tools and data
  - Qualified personnel
  - PRA model configuration control
  - Technical review of the methods, tools, data, and developed models
  - **Documentation control**  **today's presentation**
- Documentation Control is a key factor in any analysis to ensure and demonstrate the technical acceptability of the analysis

Documentation Control

- Information subject to document control includes the following:
  - Methods
  - Tools
  - Data
  - Other information, including:
    - plant design information reflecting the normal and accident configurations of the plant
    - plant operational information such as plant procedures, training, and conduct of operations
    - plant operational data (plant, system and component performance)
    - plant test and maintenance procedures and practices
    - engineering calculations and designs
- Documentation Control is managed using the Level 3 PRA Project SharePoint site

Documentation Control (cont'd)

- Two Level 3 PRA project team members will primarily be responsible for document control
  - SharePoint Manager will be in charge of the various tasks needed to ensure SharePoint runs smoothly and remains organized
  - Documentation Coordinator will:
    - Receive, process, and distribute information from the licensee
    - Ensure information is placed on the SharePoint site and is forwarded to contractors in a reasonable timeframe
    - Routinely back-up information on the SharePoint site

Documentation Control (cont'd)

- Documentation Control involves the following elements:
  - Storing and accessing project information
  - Upload of information onto the SharePoint site
  - Storage and control of licensee information
  - Non-disclosure agreement for access to proprietary information
  - Documentation backup
  - Use of external media
  - Individual personal working files
  - Use of templates and forms for documentation
  - Documentation control for NRC Contractors
  - Guidance for addressing potential technical issues
  - Organization of the various types of information

Documentation Control (cont'd)

- SharePoint is the medium selected to store and access all the various types of information
  - It has the ability to store, retrieve, edit, and control the information
- The information stored on the SharePoint site will be controlled and is only accessible by the project team members.
  - Site is stored on the NRC internal network
  - Most files stored on the site are read only (e.g., proprietary plant specific information sent by Vogtle)
    - All project team members, including Technical Advisory Group (TAG) members and contractors, sign a non-disclosure agreement to allow access to proprietary information
- All information on the site is automatically backed-up on a periodic basis and manually backed-up to an external media device

Documentation Control (cont'd)

- The SharePoint site includes individual personal folders for each analyst to use and store their work during the project instead of using a network drive or their personal computer hard drives
  - Protects against loss of information caused by hard drive failure
  - Ensures that all decisions, notes, assumptions, etc. are documented and backed-up, and accessible to the entire project team
    - Read/write access for each analyst in their own folder
    - Read only access for all other team members
  - The QA plan includes guidelines for naming folders to facilitate site navigation

Documentation Control (cont'd)

- The QA plan includes documentation templates for recording various types of information, including:
  - Meetings, discussions, plant visit trip reports
  - Analysis work (e.g., inputs, assumptions, model uncertainties, calculations, etc.)
  - Reviews (Technical Advisory Group [TAG], self-assessment, peer reviews)
  - Technical issues and their resolution
- Templates will help establish consistency in what and level of detail of information is documented
  - Templates are guidelines and provide flexibility to the analyst

Documentation Control (cont'd)

- NRC contractors have their own internal document control system
- All contractor information (e.g., reports) submitted to NRC is stored on SharePoint (some will also be stored in ADAMS)

Documentation Control (cont'd)

- Process to address technical questions raised regarding the Vogtle PRA (addressed in following viewgraphs)
- Have identified what controls are in place for what information, for example

	Brief Description of Folder Contents	Access Control*
General L3PRA Project Documents	• General documents relating to the work performed in support of this project (e.g., briefings, TAAP documents)	Read/Write Access: SharePoint Manager Read-Only Access: All Level 3 PRA Project Team Members No Access: All other NRC staff

Technical Questions And Their Resolution

- It is recognized that technical questions may be identified by the NRC Level 3 PRA project staff regarding the Southern Nuclear Operating Company (SNC) Vogtle PRA.
  - The staff is not performing a regulatory technical review of SNC's Vogtle PRA model.
- SNC has voluntarily submitted substantial amounts of PRA and plant information to support the project and this information is not to be used to support regulatory decisionmaking.
- Only technical errors that could potentially impact the insights and results of the PRA will be communicated to the appropriate NRC licensing staff.
  - It is important to make a distinction between staff questions and a potential error.
  - Only after a question has been confirmed as a potential error, and discussed with SNC, will it be turned over to the appropriate regulatory organization.

Technical Questions And Their Resolution (cont'd)

- A process has been developed to ensure that potential errors are handled appropriately
  1. Define the question
  2. Seek clarification from SNC
  3. Evaluate if the question is a potential error
  4. If question is a potential error, forward it to SNC and NRR (Division of Operating Reactor Licensing) to be addressed
  5. Level 3 PRA team will proceed with a resolution consistent with project objectives

Future Plant Modifications into the Level 3 PRA Model

- One objective of the Level 3 PRA model is to ensure it reflects the as-built, as-operated plant
  - Level 3 PRA project will take several years to complete
  - Plant design and operation change over time
  - Potential exists that Level 3 PRA model may not reflect as-built, as-operated plant
- Criteria are needed to determine which future modifications under consideration by SNC are incorporated into the model
- The QA plan will be updated to address this topic and the criteria

Criteria for Future Plant Modifications into the Level 3 PRA Model

- The potential modification is risk significant
- There is a regulatory commitment that the proposed plant change will be completed by the time the PRA is completed
- If procedures and training are required, they meet the guidelines of RIS 2008-15 and are implemented in a timeframe that does not impede the overall PRA schedule
- The effect of the modification has already been evaluated by the NRC (e.g., safety evaluation report issued)
- There is sufficient information for the Level 3 PRA project to understand the proposed change

Technical Analysis Approach Plan – Spent Fuel Pool (SFP) Level 1&2 PRA

Advisory Committee on Reactor Safeguards
Reliability and PRA Subcommittee

May 22, 2013

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SFP Level 1&2 PRA – Background

- NRC has conducted SFP PRAs in the past:
  - NUREG-1353 / NUREG/CR-5281 – resolution of Generic Issue 82 – 1989
  - NUREG-1738 – reactor decommissioning – 2001
- Security-related and safety-related deterministic studies since 2001:
  - Improved deterministic modeling capabilities
  - Improved in-house analysis capability
- Recently completed PWR hydraulic (NUREG/CR-7144) and ignition phenomena experiments
  - Post-experiment validation still ongoing
  - Confirms aspects of previous MELCOR SFP PWR modeling (e.g., oxidation kinetics, effect of rod ballooning)
  - Enhancements to other aspects (e.g., friction losses, heat transfer correlation selection)
- Extensive international and domestic interest may provide opportunities for collaboration
- Licensee has no SFP PRA model

SFP Level 1&2 PRA – Managing interfaces and scope

- Interfaces:
  - Reactor/SFP – physical boundary between containment and fuel handling building
  - SFP/Dry Cask Storage (DCS) – scope of analysis delineated by interface between 10 CFR Parts 50 and 72 (e.g., cask loading belongs to DCS but cask drop effects on SFP structure belong to SFP)
- Inadvertent criticality not explicitly modeled
  - Specific instances where conditions with potential for inadvertent criticality event exist will be highlighted
  - Ongoing NRR-sponsored work may inform the appropriateness of this assumption
- Must interface with reactor at-power, reactor low-power/shutdown, dry cask storage PRAs
- The (# of initiating events) x (the # of SFP configurations) x (a reasonable discretization of the changes in decay heat) = hundreds of unique initiating conditions

SFP Level 1&2 PRA – Technical Elements

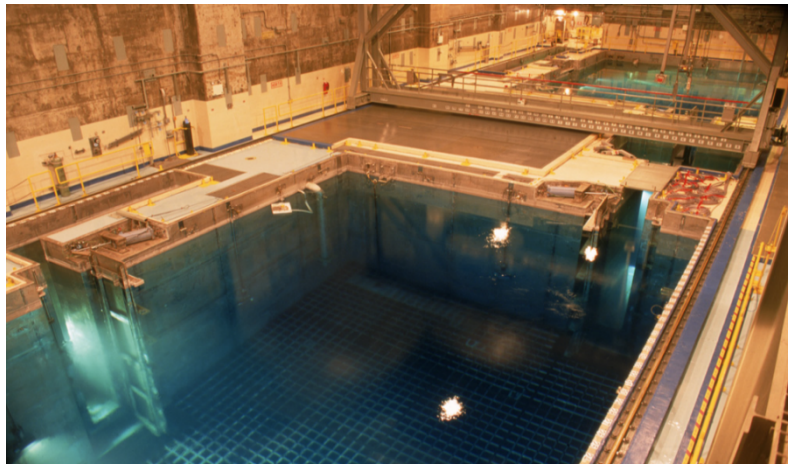
- Technical Elements:
  - Initiating event analysis
  - Structural analysis
  - Accident sequence analysis
  - Systems analysis
  - Human reliability analysis
  - Accident progression and source term analysis
  - Quantification
  - Uncertainty analysis
- No existing SFP PRA standard

SFP Level 1&2 PRA – Model structure at-a-glance

- Mimics basic structure of reactor PRA model
- Pre-fuel-damage event progression → plant damage states → post-fuel-damage event progression → release category binning → Level 3 PRA
- "Integrated" SAPHIRE Level 1 / Level 2 model
- Have defined a representative ~ 17-month operating cycle for the site, consisting of 12 phases
- Focuses on Unit 2 SFP – though both pools must be considered simultaneously

SFP Level 1&2 PRA – Site familiarization

- Two SFPs in a common Fuel Handling Building (FHB)
- Typical PWR refueling configuration
  - Refueling canal in containment
  - Fuel transfer tube
  - Fuel transfer canal in FHB



- Unit 1 / Unit 2 SFP differences:
  - U1 racks obtained from a decommissioned plant
  - U2 has ~40% more rack cells
  - Different rack poison materials
  - Different criticality technical specification storage requirements
- Important operational considerations:
  - Pools almost always hydraulically connected through the cask pit (which is located between the two SFPs)
  - Assemblies often moved between pools

SFP Level 1&2 PRA – Support from SNC

- Fuel history
  - Design and operating history for all assemblies in both SFPs and the U1 Cycle 17 reactor core
- Procedures
  - Some abnormal operating procedures (AOPs), all extensive damage mitigation guidelines (EDMGs), and some training material also provided
- Site visit
  - Leveraged a reactor Level 2 PRA site visit in March 2013 to see structures, systems, and components (SSCs) of interest for the SFP analysis
    - SFPs, FHB, and SFP cooling systems
    - EDMG equipment
- Phone call on as-operated assumptions
  - Assumptions related to SFP operation discussed in April 2013
    - typical SFP cooling configurations
    - typical approaches to meeting fuel storage pattern requirements
    - refueling practices

SFP Level 1&2 PRA – Sample initiating event list

- Internal hazards
  - Internal events (e.g., loss of instrument air)
  - Internal fires
  - Internal floods
  - Cask drop
  - Turbine missiles
- Other (external) hazards
  - Seismic
  - High winds
  - Inadvertent aircraft crashes
- (Unique) multi-source hazards
  - Inaccessibility due to other SFP or reactor accident (e.g., radiological hazard)
  - Interfaces with the reactor during shutdown

❖ Most events will take a long time to uncover fuel (e.g., days or weeks), providing significant time to implement mitigative actions.

SFP Level 1&2 PRA – Sample functional damage state listing

- Inadvertent drain-down / leaks + boil-off:
  - Various combinations of gate seal failures
    - During routine operations
    - During cask lift
  - Reactor coolant system LOCA during refueling
  - Leak due to very large seismic event
- Boil-off only:
  - Loss of AC power (during refueling or not)
  - Loss of AC w/ sloshing due to large seismic event
  - Loss of reactor decay heat removal during refueling

SFP Level 1&2 PRA – Structural analysis - example issues

- Characterization of fuel handling building over-pressure and temperature failure criteria and expected failure location(s)
- Seismic response characterization for each of the seismic bins in terms of fragility and expected leakage rate(s) / location(s)
- Effects of a cask dropped in the cask pit (during lift) on the gates or any other potentially-affected SSCs
- Seismic and high-wind fragility estimates for SFP cooling and EDMG/Operations Support Center structures
- Sloshing for large seismic events

SFP Level 1&2 PRA – SCALE Analysis

- Oak Ridge (Reactor and Nuclear Systems Division) has completed SCALE (v6.1.2) analysis (using updated ENDF/B-VII.1 nuclear data) to provide
  - Decay heat as a function of time
  - Radionuclide inventories as a function of time
  - Radionuclide activities as a function of time
- Analysis used the TRITON and ORIGEN modules
- All fuel in both SFPs in August 2012, plus fuel temporarily and permanently discharged during the fall 2012 outage
- Investigated uncertainties associated with:
  - Core operational history assumptions
  - Assembly design assumptions
  - Burnable absorber modeling assumptions
  - Assumed axial power distribution
  - Hardware activation modeling

SFP Level 1&2 PRA – Simplified MELCOR Model

- For "Level 1" timing calculations to support screening/prioritization, a simplified MELCOR model has been built, which includes:
  - Fuel handling building:
    - Unit 1 & 2 SFP and fuel transfer canals
    - Cask pit
    - Potential leak-to volumes
  - Unit 2 (or Unit 1) containment and reactor in refueling configuration
  - Relevant systems:
    - SFP cooling (4 trains total)
    - Effects of EDMG-guided water addition
    - FHB normal and emergency ventilation
- Uses MELCOR's control volume, flow path, and heat structure versatility to represent all of the above simply
- Uses volumetric heat generation rates instead of COR (nuclear fuel modeling) package
- Captures accident progression physics until onset of fuel heat-up
- Model is extremely fast-running (e.g., minutes to simulate days)

SFP Level 1&2 PRA – Example Level 1 Figures-of-merit

1. SFP water temperature = 212F	≈	Onset of SFP boiling
2. SFP water level < 4 feet above top of fuel	≈	Radiation levels on the refuel floor begin to noticeably increase
3. SFP water level reaches top of fuel	≈	Radiation levels on the refuel floor are reaching high levels
4. FHB bulk air temperature = 140F	≈	Personnel safety due to a hot, wet environment is a concern
5. FHB bulk air temperature = 200F	≈	Significant steam burns to personnel in the vicinity of the pool are an immediate concern
6. SFP water level reaches 2/3 active fuel height	≈	Adequate steam cooling is being lost and fuel heatup is commencing
7. Water-loss-rate when level reaches 2/3 active fuel height	≈	Provides a sense of whether mitigation deployed at that point would result in level recovery

SFP Level 1&2 PRA – Mitigation considerations

- Not covered in current emergency operating procedures or severe accident management guidelines
- Covered in AOPs, EDMGs
  - EDMGs can be entered via Emergency Director or senior operations personnel
  - NEI-06-12, Revision 2 provides publicly-available information about generic EDMG contents
- Industry accident management perspective updated in EPRI TR-1025295, "Severe Accident Management Guidance Technical Basis Report," Appendix EE
- Ongoing discussions with site, fire protection engineers, human reliability analysts, etc., to develop modeling basis
- Due to long timeframes, response from offsite assets may also need to be modeled
- Current project schedule may not support including plant modifications associated with Orders EA-12-049 / EA-12-051 (or other ongoing Japan Lessons Learned activities

SFP Level 1&2 PRA – Example Event Tree Modeling

Level 1:

- Does the initiating event cause an inadvertent criticality?
- Is access to the FHB limited?
- Has a loss of SFP cooling occurred?
- Has sloshing or spilling of some SFP water occurred?
- Is there a leak in the SFP liner?
- Is there a leak from the fuel transfer or cask pit gate?
- Are alternate "regular" injection paths available?
- Are EDMG actions to provide makeup/spray successful?
- Is offsite support to provide makeup/spray successful?
- Is leak repair successfully deployed?

Level 2:

- Does the baseplate clear prior to fuel ignition?
- If so, is the fuel air coolable?
- Does poison material melting cause an inadvertent criticality?
- How limited is access to the relevant SSCs?
- Is building ventilation running?
- Has building over-pressure failure occurred?
- Has a hydrogen combustion occurred?
- Is EDMG SFP makeup/spray successfully deployed?
- Is offsite SFP makeup/spray successfully deployed?
- Is leak repair successfully deployed?
- Does mitigation cause the baseplate to be covered again?
- Is significant molten core-concrete interaction (MCCI) averted?
- Does the SFP foundation fail?

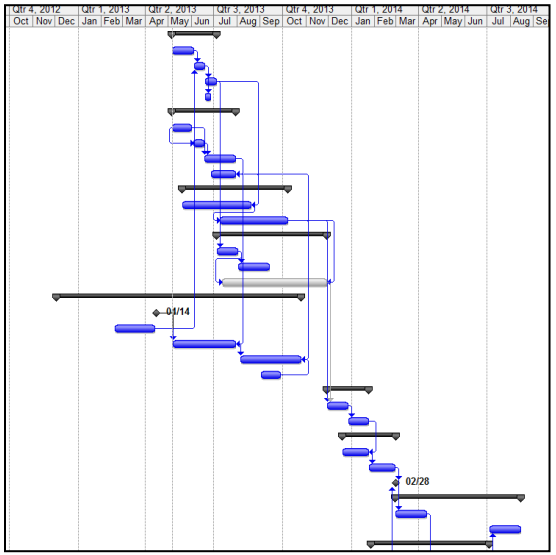
Phenomena
Operator Actions
Systems modeling

SFP Level 1&2 PRA – Detailed MELCOR Model

- Detailed model needed to:
  - Address accident progression after significant fuel uncovery
  - Provide radiological source term timing and magnitude information to the Level 3 PRA
- Would include modeling detail to address:
  - Fuel uncovery and heatup
  - Air/steam convection and radiative heat transfer
  - Baseplate clearing / natural circulation
  - Water level recovery due to mitigation; spray cooling effectiveness
  - Cladding and other metallic-component oxidation
  - Building temperature/pressure
  - Hydrogen generation, accumulation, and potential combustion
  - Fission product transport, behavior, and retention
  - Fuel failure and relocation; baseplate failure
  - MCCI

High-level timeline

- Spring/Summer 2013:
  - Initiating event analysis
  - Structural analysis
  - Accident sequence analysis
  - Systems analysis
  - Success criteria and sequence timing analysis
- Summer/Fall 2013:
  - Accident progression analysis
  - Human reliability analysis
- Winter 2013/2014:
  - Quantification
  - Treatment of uncertainty
  - Handoff of release categories to Level 3 PRA
- Spring 2014:
  - Review and documentation finalization



Level 3 PRA Project: Dry Cask Storage PRA

Advisory Committee on Reactor Safeguards
Reliability and PRA Subcommittee

May 22, 2013

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DCS PRA Background and Current State of Knowledge

- NUREG-1864 "A Pilot Probabilistic Risk Assessment of a Dry Cask Storage System at a NPP":
  - Holtec International Storage and Transfer Operation Reinforced Module (HI-STORM) 100 dry cask storage (DCS) system in a BWR setting
  - Site: Anonymous BWR site
- EPRI 1009691 "Probabilistic Risk Assessment of Bolted Storage Casks":
  - Transnuclear (TN) dry cask storage system in a PWR setting
  - Site: Generic PWR site
- Level 3 PRA:
  - Casks: Similar to Holtec International HI-TRAC and HI-STORM 100 used in Farley
  - Fuel: PWR
  - Site: Vogtle (cask storage operations dry run scheduled for September 2013, first cask loading in October 2013)
  - Licensee has no DCS PRA and there is no DCS PRA standard
  - Focus of this study will be on reducing simplifying modeling assumptions and site-specific assumptions of previous DCS PRA studies and measuring risk and consequence of dry cask storage operations

Highest Risk Contributors of Previous Studies

- Specific to welded canister in BWR Setting
  - Drop of canister into the storage cask
  - Drop of transfer cask
  - Aircraft impact
- Specific to bolted cask in a PWR setting
  - Horizontal drop (e.g., cask tip-over)
  - Seismically induced refueling building structural failure
  - Fires during transfer or storage phases

Major Assumptions and Limitations of Previous Studies

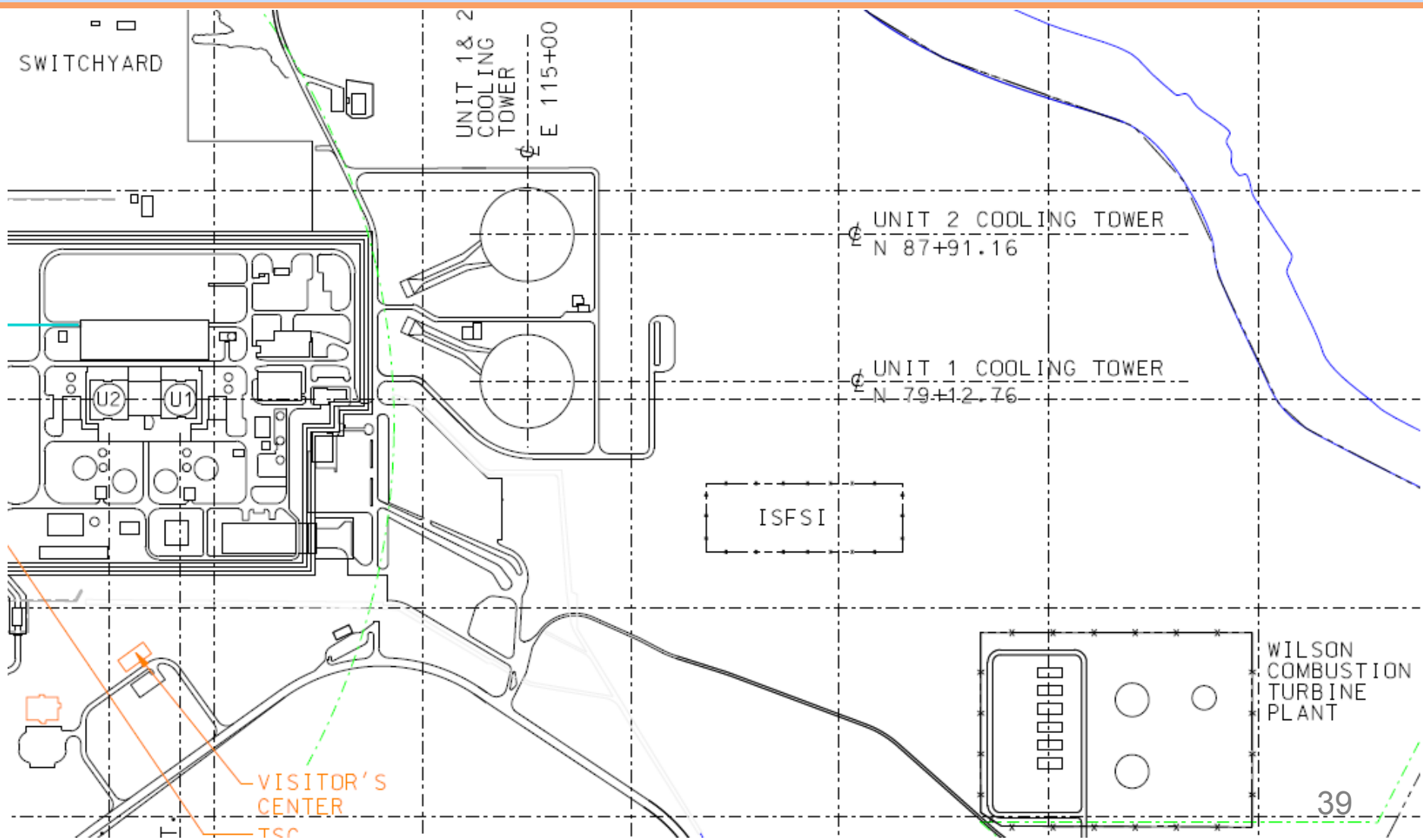
- NUREG-1864
  - No human reliability analysis (HRA)
  - No uncertainty analysis
    - Due to mostly to resource limitations, used best estimates (if available) or conservative or bounding assumptions
  - Corrosion consideration was limited (screened based on inspection of a similar cask thru 14 year operation)
  - Drop events: modeled one fuel pin and assumed if this pin fails, then all fuel pins fail

- EPRI's PRA
  - Drop events: assumed two pins failed per cask
  - No uncertainty analysis
    - Assumed principal uncertainty associated with frequency of occurrence of hazard, which is location-specific, and analysis was for a generic site
  - Corrosion was considered (mostly for seal performance)

Vogtle Site

- SFP and dry cask storage preparation area inside the Fuel Handling Building
- Two major drop heights (based on drawings and information from Vogtle FSAR):
  - Cask pit
  - Transfer of multi-purpose cannister (MPC) from transfer cask to storage cask
- Two Independent Spent Fuel Storage Installations (ISFSIs):
  - Temporary/secondary ISFSI (constructed)
  - Permanent ISFSI (to be constructed by approx. by 2018)
- Vogtle is selecting a similar cask system to the Farley NPP MPC and Holtec HI-STORM 100.
- Vogtle SFP currently holds about 25% low burn-up fuel and 75% high burn-up fuel.

Vogtle Site Layout

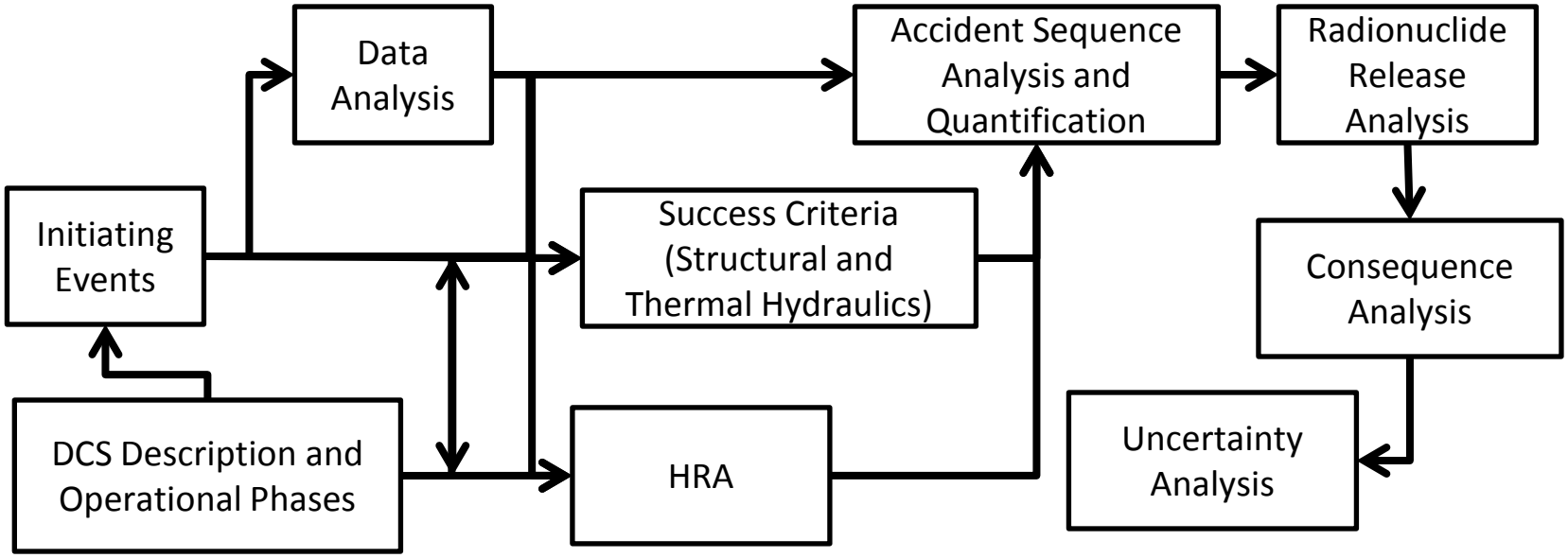


General Approach

- Methodology based on previous NRC and EPRI DCS PRAs
- Technical Analysis Approach Plan consists of two major technical tasks and their sub-tasks:
  - Dry cask storage PRA for cask damage (release frequency)
    - Dry cask description and operational phases
    - Initiating event analysis
    - Data analysis
    - Human reliability analysis
    - Success criteria (structural and thermal analysis)
    - Accident sequence analysis and quantification
    - Uncertainty analysis
  - Dry cask storage PRA for health effects (consequence analysis)
    - Radionuclide release (source term)
    - Consequence analysis
- Quality:
  - Perform staff self-assessment
  - Perform independent peer reviews (with industry and NMSS)

DCS PRA Technical Elements

- Technical Elements and their interfaces:

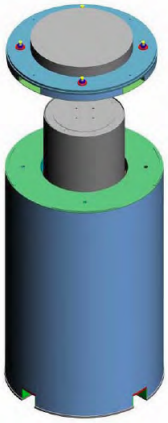


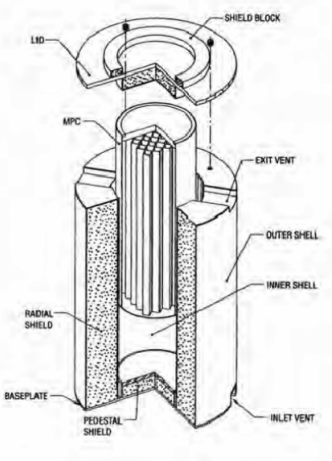
Cask Failures and Hazards

- Dry cask storage starts with loading of fuel and ends at the ISFSI
- Hazards: Environmental release due to failure of fuel cladding and failure of cask's containment function
  - Structural failure (e.g., cask drops, missile impact, tip-over)
  - Thermal failure (e.g., fires, high temperature events, mis-loading, vent blockage-loss of cooling)
  - Other (e.g. corrosion, seal failure, etc.)
- DCS is mostly protected by passive systems (structural integrity of the cask components and passive designs for heat removal)

Dry Cask Storage Phases

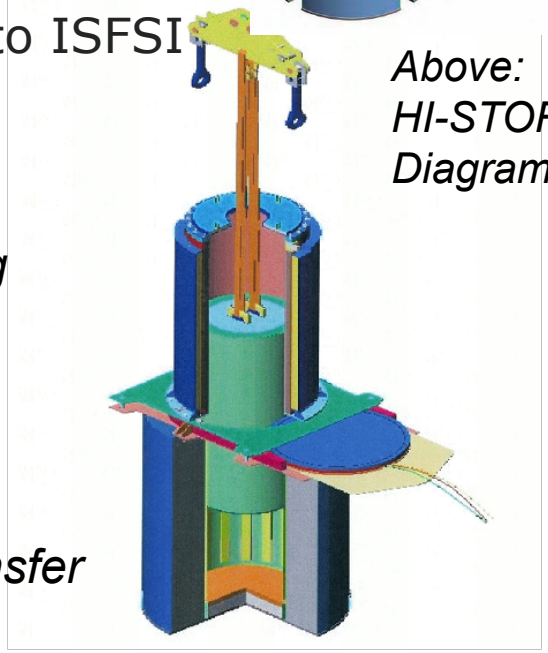
- Dry Cask Storage main phases
  - Fuel Loading in the MPC
  - Cask Handling
    - Cask handling: cask movement
    - Canister drying, inerting, and sealing
    - Canister Transfer to storage overpack
    - Transport of storage overpack to ISFSI
  - Cask Storage at ISFSI





Above: HI-STORM 100 Diagram

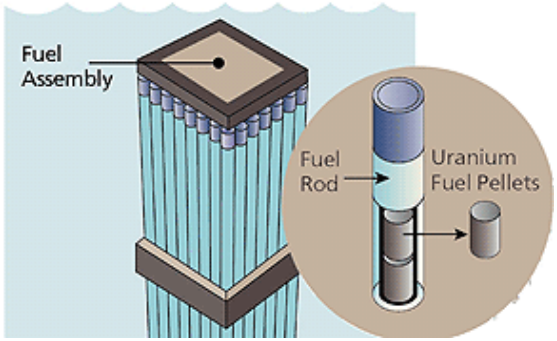
Left: Transporter moving Cask to ISFSI

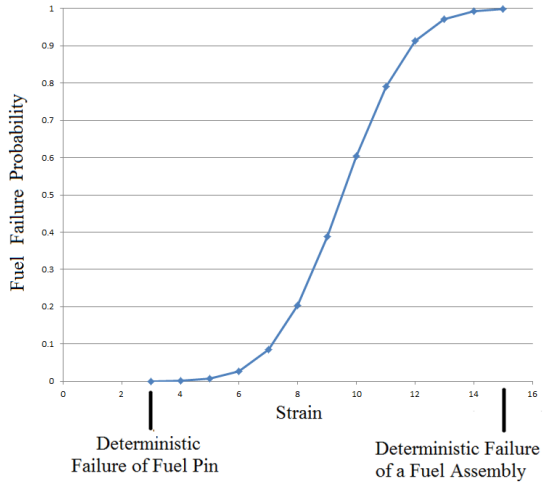


Right: MPC transfer

Fuel and Canister Failure Analysis

- Tools:
  - Finite element analysis code for DCS structural and thermal (e.g., ANSYS LS-DYNA)
  - SCALE (radionuclide inventories and residual decay heat)
- Other tools as needed (e.g., PRODIGAL for weld analyses)
- Fuel failure analysis: finite element analysis model of a fuel assembly and a fuel pin
- Take into consideration properties of high burn-up and low burn-up fuel.





Quantification and Consequence Analysis

- SAPHIRE 8
- MELCOR (accident progression and source term)
- MELMACCS (source term transfer from MELCOR to MACCS2)
- WinMACCS/MACCS2 (offsite consequence analysis)

HRA

- Current state of knowledge is limited on HRA for cask and fuel handling:
  - NUREG/CR-7016, "*Human Reliability Analysis-Informed Insights on Cask Drops*"
  - NUREG/CR-7017, "*Preliminary, Qualitative Human Reliability Analysis for Spent Fuel Handling*"
  - EPRI 1009691,"PRA of Bolted Storage Casks"
- Currently investigating an approach based on NUREG/CR-7016 and -7017, and modeling of crane failures

Integrated Site Risk

- The Level 3 PRA will consider effects of DCS event affecting other plant operations (e.g. cask drop causing plant trip, DCS release effect on operator actions) and vice-versa.

Challenges

- HRA, uncertainty, and fabrication errors were not considered in NUREG-1864.
- EPRI's PRA study included HRA to a limited extent.
- Previous analyses assume different failures of fuel rods based on structural analysis or modeling.
  - EPRI's PRA assumes a damage probability of 2E-4 failures per rod for all drop events.
  - NUREG-1864 models one rod and assumes that when one rod fails all rods fail.
  - Proposed approach for Level 3 PRA project (described earlier) has yet to be demonstrated.

Challenges (Cont.)

- Cask release fractions to be utilized for consequence analysis on containment breach
- Limited information available from Vogtle on their DCS operations (Vogtle is scheduled to start DCS operations on October 2013)
- Data on cask corrosion and failures is limited

Major assumptions

- The scope of the Level 3 PRA DCS study does not include plant operations related to off-site spent fuel transportation.
- Need to assume time period for DCS ISFSI storage operations (e.g. beginning, middle, or end of life of ISFSI)
- Use the results of the multi purpose canister failure analysis of NUREG-1864

DCS Path Forward

- Continue to review, identify and gather information from NRC and Vogtle (Summer 2013)
- Continue to work on the initiating event analysis and identify new initiating events
- Perform structural analysis on fuel and cask drops (Summer 2013)
- Perform HRA on Vogtle DCS operations (late 2013/early 2014)
- Quantification (early 2014)
- Consequence analysis (early 2014)

Project Status and Path Forward

Advisory Committee on Reactor Safeguards
Reliability and PRA Subcommittee

May 22, 2013

Alan Kuritzky
Division of Risk Analysis
Office of Nuclear Regulatory Research
(301-251-7587, Alan.Kuritzky@nrc.gov)

Project Status (1 of 3)

- Level 1, at-power, internal events model nearing completion
  - Some work remains on human reliability analysis (HRA) and data
  - Completed internal self-assessment (documentation is almost complete; some clarifications needed from licensee; currently excludes HRA)
- Level 1, at-power, internal floods model progressing
  - Need to update flood frequencies and perform walkdown
  - Will perform self-assessment shortly
- Level 1, at-power, fire, seismic, and other external hazards recently begun
  - Walked down Vogtle site and Unit 2 containment; visited SNC headquarters
  - Progressing with fire scenario mapping and integration
  - Beginning seismic modeling (based on licensee information and staff analyses)
  - Schedule pushed back a few months due to budget limitations and delays in receiving plant information

Project Status (2 of 3)

- Level 1, low power and shutdown modeling is just beginning to ramp up (biggest challenge will be fires and external hazards)
- Level 2, at-power, internal events model progressing
  - Completed SCALE analysis for reactor and spent fuel pool
  - Completed MELCOR model for Unit 1 reactor and containment
  - Completed finite element model of one Vogtle containment
  - Walked down Vogtle auxiliary and fuel handling buildings, and Unit 2 containment
  - Main challenges are funding, SAPHIRE capabilities, HRA, staff availability
- Level 3 (consequence analysis) work is progressing
  - MACCS2 development focused on improved emergency preparedness (EP) model capabilities, better support for multisource releases, and updated population and economic databases
  - EP team will visit site and surrounding areas in June 2013
  - Main challenges are funding, staff availability, and information availability

Project Status (3 of 3)

- Spent fuel pool modeling is progressing (main challenges are staff availability, HRA, offsite mitigation)
- Dry cask storage is progressing (main challenge is information availability)
- Integrated site risk is progressing
  - April 2013 workshop
  - TAAP section being prepared
  - Scoping approach being developed
- Dialogue begun with PWROG regarding external peer reviews

Path Forward

- Continue with technical work in all areas, based on staff availability, funding, and information availability
- Meetings and briefings:
  - Brief Office Directors on project status (June 2013)
  - Brief ACRS Subcommittee on approach for addressing integrated site risk and results of Level 1 PRA, at-power, internal events and floods self-assessment (July 2013)
  - Brief Commissioner assistants on project status (September 2013)
  - Brief ACRS Subcommittee on preliminary results (October 2013)
  - Brief ACRS Full Committee on project status and preliminary results (December 2013)