I. **NRC SPAR Models vs. Licensee CAFTA Models –**

a. Status of Licensee PRAs
   i. Licensee risk models are not "required" with the exception of NFPA-805 transitioning existing reactors, and new construction plants.
   ii. All existing plants have peer-reviewed internal events PRAs
   iii. Some plants have external events PRAs (internal fire and seismic of varying quality)
   iv. There are ASME standards and NRC regulatory guides for PRA quality, with varying requirements based on what the licensee is attempting to do with the model

b. As regulators, we need to remember that **the purposes of the CAFTA and SPAR models are at odds.** They are tools that are designed for very different goals and purposes. The SPAR models are in most cases attempting to characterize the risk within an order of magnitude or determine if greater than or less than a threshold (e.g., 5E-7 for NOED approval). The licensee's models are being used for very detailed work such as supporting licensee amendments and Maintenance Rule 50.65.a(4) characterizations. Using a "car analogy" the NRC SPAR model is a reliable sedan, maybe a little well-worn, that gets you to work reliably and consistently, whereas a licensee model is a tractor with many add-on attachments that can perform multiple tasks but one you wouldn't drive to work every day.

c. **The NRC SPAR models are being used by a variety of offices and are "woven into the fabric" of much of our everyday work.** Many individuals use these models and only a few of them are:

   i. Regional Offices – the SRAs use them for SDP, NOED, and MD8.3 evals
   ii. Office of Research – Accident Sequence Precursor reports to Congress and evaluation of thermal-hydraulic issues at various sites
   iii. Regional Offices – the Resident Inspectors and the DRS inspectors use the SPAR models for inspection sample selection

d. Non-Technical Downsides to Using the Licensee Models: **If we were to use the licensee's tool exclusively (or even for a majority) of our risk determinations, we could lose much of our independence and our credibility with the public. Further, our ability to critically scrutinize results would be adversely affected because in many ways the CAFTA models are "black boxes"**; "[I]ndependent oversight of licensee performance is critical for effective NRC oversight and is an important aspect of upholding public confidence in the [SDP] process" (letter from EDO to NEI, October 2007, ML072490566); also include references to our Principles of Good Regulation and ISOCCER

e. **Standardized models have some significant advantages:**
   i. Standard models facilitate plant specific changes
   ii. Ease of use for agency analysts, because naming conventions are similar, structure of the event trees and fault trees is nearly identical from model to model; eliminating this would mean steep learning curves on licensee models very frequently and this would be further challenging for SDP timeliness...

iii. Efficient model maintenance – this makes it easier for INL to customize a model for the SRAs or other analysts, and allows them to modify more models per year, which improves fidelity
iv. Quality control – without going into a great amount of detail, there exists a QA program for the SPAR models including a QA plan, a SPAR-PM handbook, Model Makers Handbook, the fact that SPAR models are benchmarked against licensee models once major updates have been performed, etc.

f. Key Messages to Convey
   i. No PRA (whether NRC SPAR or licensee CAFTA) can accurately capture every nuance of an event or condition
      1. Experienced risk analysts must make modeling decisions
      2. Process controls are being constantly performed "behind the scenes" to verify quality, compare models, peer reviews, etc.
   ii. The exchange of technical information between the NRC and licensees is expected as part of the SDP; though trying at times, rather than a weakness, this adversarial approach should be perceived as a strength because it's open & yields a better answer
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g. Background Information or Additional Slides
   i. Recommendations from 2006 OIG audit, "Evaluation of the NRC's Use of PRA in Regulating the Commercial Nuclear Power Industry, (OIG-06-A-24)"
      1. Develop and implement a formal, written process for maintaining PRA models that is sufficiently representative of the as-built, as operated plant to support model uses
      2. Develop and implement a fully documented process to conduct and maintain configuration control of PRA software
      3. Conduct a full V&V of SAPHIRE Version 7
   ii. Miscellaneous Information
      1. SPAR models are non-public
      2. Differences ideally between SPAR and licensee models would be resolved before an SDP issue, but this is difficult in practice
      3. RES/INL implement the QA plan for agency SPAR models of record, but agency risk analysts are responsible for making temporary changes on an as needed basis

Weber, Michael

From:	Weber, Michael
Sent:	Wednesday, December 02, 2015 6:21 PM
To:	Correia, Richard; Lund, Louise
Cc:	West, Steven
Subject:	FYI - SUMMARY ON THE USE OF RISK ESTIMATES TO SUPPORT REGULATORY DECISION-MAKING
Attachments:	Notes for EDO on NRC SPAR Models.docx

Good evening. Here is John Hanna's response to my request for the attachment. I will share with Glenn and Mike Johnson for their awareness.

From: Hanna, John
Sent: Wednesday, December 02, 2015 1:30 PM
To: Weber, Michael <Michael.Weber@nrc.gov>
Subject: RE: QUERY - SUMMARY ON THE USE OF RISK ESTIMATES TO SUPPORT REGULATORY DECISION-MAKING

Mike,

As requested attached is the document that I sent to Vic.

However, here are a couple of disclaimers. This information: 1) was developed in support of some risk training for SES managers that I was working on, 2) is not an exhaustive list of all the possible pitfalls to using the licensee's models – but it is in my opinion a good start, and 3) has not been formally reviewed and approved by Region II management or the NRC risk community, though it was developed with the assistance of others, e.g., Kevin Coyne in Research, Laura Kozak in RIII.

Here are a couple of additional thoughts to consider that I thought of since yesterday and aren't mentioned in the attached material:

- Because the licensee models for the existing fleet are not "required," they can be modified, deleted at the licensee's discretion
- The SRAs are comfortable, to some degree, with using the CAFTA models, but many others in the agency rely on SPAR models and don't have the training and expertise to make such a transition, e.g., Resident Inspectors
- In heavily relying on the licensee models, there may be some very real implementation difficulties. For example, would licensees willingly change their models to conform with the agency approach to Common Cause Failure (as detailed in RASP Manual Volume 1)? Would they apply reasonable values for operator actions ex-control room in B.5.b or FLEX scenarios? If the answers to these questions were "no," what would we do?

I hope this information will be helpful to you. Please let me know if I can assist further...

John

From: Weber, Michael
Sent: Wednesday, December 02, 2015 12:38 PM
To: Hanna, John <John.Hanna@nrc.gov>
Cc: Lund, Louise <Louise.Lund@nrc.gov>
Subject: QUERY - SUMMARY ON THE USE OF RISK ESTIMATES TO SUPPORT REGULATORY DECISION-MAKING

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Thanks,

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Michael Weber
Director of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission

301-415-1902
Mail Stop T-10B16

PROJECT AIM 2020
DELIVERING OUR FUTURE

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Weber, Michael

From: Weber, Michael
Sent: Wednesday, December 02, 2015 6:19 PM
To: Hanna, John
Subject: RESPONSE - SUMMARY ON THE USE OF RISK ESTIMATES TO SUPPORT REGULATORY DECISION-MAKING

Thanks, John. Quite helpful. We'll be in touch.

From: Hanna, John
Sent: Wednesday, December 02, 2015 1:30 PM
To: Weber, Michael <Michael.Weber@nrc.gov>
Subject: RE: QUERY - SUMMARY ON THE USE OF RISK ESTIMATES TO SUPPORT REGULATORY DECISION-MAKING

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Michael Weber
Director of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission

301-415-1902
Mail Stop T-10B16

PROJECT AIM 2020
DELIVERING OUR FUTURE

Correia, Richard

From: Lund, Louise
Sent: Wednesday, December 02, 2015 12:59 PM
To: Correia, Richard; Circle, Jeff
Subject: FW: RESPONSE - Information Only: NRC SPAR models

For your awareness

From: Weber, Michael
Sent: Wednesday, December 02, 2015 12:40 PM
To: Lund, Louise <Louise.Lund@nrc.gov>
Subject: RESPONSE - Information Only: NRC SPAR models

Thanks, Louise. Note that I queried John for a copy of the attachment in his original email. I plan to share this with Glenn and Mike Johnson for awareness and plan to attach the document for completeness in the message. It will also answer a question that arose yesterday during our Aim Steering Committee meeting regarding the scope of the reductions listed in priority C on the Common Prioritization (confirms what I explained to the committee).

From: Lund, Louise
Sent: Wednesday, December 02, 2015 11:34 AM
To: Weber, Michael <Michael.Weber@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>
Subject: FYI: FW: Information Only: NRC SPAR models

Mike,

As discussed ... provided so you can see Vic's response to the Region II SRA. Also note the two different aspects being discussed by folks in this thread ... reducing the number of routine updates per year (discussed in the context of Project AIM) vis-à-vis using licensee models in lieu of SPAR models.

Louise

From: Circle, Jeff
Sent: Wednesday, December 02, 2015 9:46 AM
To: Coyne, Kevin <Kevin.Coyne@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>
Subject: RE: Information Only: NRC SPAR models

Kevin,

Thanks for the info. I agree that slowing down the rate of update will not create an unmanageably large information gap between SPAR and licensees' models. What I am concerned over - and you correctly noticed this as well - is the assumption that SRAs are very familiar with licensees' models. Call it paranoia on my part but, I see in it the formation of the logic that we can use their models in lieu of SPAR since our SRAs already know them so well.

Jeff.

Jeff A. Circle
Chief (acting)
Probabilistic Risk Assessment Branch
RES /Division of Risk Analysis
(301) 415-1152
BB (b)(6)

From: Coyne, Kevin
Sent: Wednesday, December 02, 2015 8:53 AM
To: Circle, Jeff <Jeff.Circle@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>
Subject: RE: Information Only: NRC SPAR models

Jeff –

You need to be aware that we did offer up a modest reduction in funding for routine updates to SPAR – this was a relatively small amount of funding placed in the rebaselining category "c" to go from doing 12 updates a year to 6. As you are aware, you maintain a help desk and can make a wide variety changes when needed to deal with a specific assessment. So, it is likely that the move to reduce the number of routine updates each year would result in some inefficiencies, but I generally agree with Vic's assessment that it would not result in a significant handicap since we would still ensure that the SPAR model reflects the as-built, as-operated plant each time we use them for an assessment (and that is why it was offered up as part of the AIM rebaselining cuts – in fact, this was a proposed reduction that was essentially non-negotiable with NRR/DRA) –the reasons are different than what Viccited (i.e., the assistance INL can help with updating a SPAR model when needed, not the SRAs familiarity with licensee models).

Obviously this is a different animal than simply cutting the program (as has also been kicked around), but keep in mind that this particular proposed reduction for routine updates has been vetted through the RES organization.

Kevin

From: Circle, Jeff
Sent: Wednesday, December 02, 2015 8:30 AM
To: Appignani, Peter <Peter.Appignani@nrc.gov>; Ferrante, Fernando <Fernando.Ferrante@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>
Subject: FW: Information Only: NRC SPAR models

PRABers,

FYI.

In reference to what we heard on Monday, I had a conversation this morning with George MacDonald (R-II) and one yesterday with Laura Kozak (R-III) who both feel that we need to retain SPAR models. Checking the email thread below, Vic feels that there can be a reduction in funding for SPAR model updates. He is basing this opinion that regional SRAs have an intimate knowledge of licensees' models, which is not necessarily true. I'm assuming that the term SPAR model "inaccuracies" refers to lag in performing model updates due to reduced funding.

We need to put together documentation in support for a meeting with NRR on this subject and it should also cover the proposed development of a pilot project. I would appreciate it if any of you can forward Pete Appignani information that you feel can help us with our meeting. There will be more to follow on this topic.

Thanks,
Jeff.

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From: MacDonald, George
Sent: Wednesday, December 02, 2015 7:56 AM
To: Circle, Jeff <Jeff.Circle@nrc.gov>
Subject: FW: Information Only: NRC SPAR models

From: McCree, Victor
Sent: Tuesday, December 01, 2015 7:11 PM
To: Hanna, John <John.Hanna@nrc.gov>
Cc: Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>
Subject: Re: Information Only: NRC SPAR models

Hi John!

It's great to hear from you and I appreciate your timely insights.

During a very free flowing discussion today, we debated the wisdom of accepting a recommended cost reduction that could delay (not eliminate) updates to SPAR models. I opined that some reasonable delay in updating SPAR models would likely not represent a significant handicap due to Regional SRA familiarity with licensee risk models (and their strengths and limitations) relative to the SPAR. I offered that this could mitigate the impact of SPAR model "inaccuracies."

Your thoughts?

Vic

On: 01 December 2015 15:07, "Hanna, John" <John.Hanna@nrc.gov> wrote:

Vic,

The purpose of this e-mail is to provide you some background about NRC SPAR models and hopefully address some inaccurate information that may be circulating in HQ.

We had recently heard anecdotally that some views are being shared at your level that assert that the SRAs are in favor of eliminating the SPAR models and using the licensee's CAFTA models. This is not the opinion c the Region II SRAs. George MacDonald will be polling some of the other SRAs in different regions and sending you a separate e-mail, but we strongly suspect that they are also not in favor of eliminating SPAR models. If we are actively considering eliminating the SPAR models as a cost savings measure, I would recommend that we have a panel to discuss this option and all of the positives and negatives.

I have attached some additional information to this e-mail regarding this topic. (I developed this outline in support of some risk training for SES managers.) If you desire a bit more detail and why moving towards only using the licensee models would have some adverse effects, please read the attached document. The **highlights and key messages** are in **bolded type** so you can scan it quickly.

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Thanks. Hope all is well with you in Headquarters and that the transition up there went smoothly...

John

John David Hanna
Senior Reactor Analyst
US NRC, Region II Office
John.Hanna@nrc.gov
404-997-4552

Appignani, Peter

From: Gonzalez, Michelle
Sent: Wednesday, December 02, 2015 12:02 PM
To: Appignani, Peter
Subject: RE: Information Only: NRC SPAR models

Thank you, I wasn't aware of this proposed reduction either.

Michelle

From: Appignani, Peter
Sent: Wednesday, December 02, 2015 10:08 AM
To: Gonzalez, Michelle
Subject: FW: Information Only: NRC SPAR models

Michelle

FYI ...

To keep you in the loop.

Pete

From: Coyne, Kevin
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To: Circle, Jeff <Jeff.Circle@nrc.gov>
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Subject: RE: Information Only: NRC SPAR models

Pete,

Let me know if there is anything I can help you out with or if you need any specific info from my projects.

Michelle

From: Circle, Jeff
Sent: Wednesday, December 02, 2015 8:30 AM
To: Appignani, Peter; Ferrante, Fernando; Gonzalez, Michelle; Helton, Donald; Hudson, Daniel; Kuritzky, Alan; Leschek, Walter; Li, Ming; Ning, Lauren (Killian); Sancaktar, Selim; Wessels, Steven; Wood, Jeffery
Cc: Correia, Richard; Lund, Louise; Nakoski, John
Subject: FW: Information Only: NRC SPAR models

PRABers,

FYI.

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Thanks,
Jeff.

Jeff A. Circle
Chief (acting)
Probabilistic Risk Assessment Branch
RES /Division of Risk Analysis
(301) 415-1152
BB (b)(6)

From: MacDonald, George
Sent: Wednesday, December 02, 2015 7:56 AM
To: Circle, Jeff <Jeff.Circle@nrc.gov>
Subject: FW: Information Only: NRC SPAR models

From: McCree, Victor
Sent: Tuesday, December 01, 2015 7:11 PM
To: Hanna, John <John.Hanna@nrc.gov>
Cc: Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>
Subject: Re: Information Only: NRC SPAR models

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Your thoughts?

Vic

On: 01 December 2015 15:07, "Hanna, John" <John.Hanna@nrc.gov> wrote:

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Thanks. Hope all is well with you in Headquarters and that the transition up there went smoothly...

John

John David Hanna
Senior Reactor Analyst
US NRC, Region II Office
John.Hanna@nrc.gov
404-997-4552

Appignani, Peter

From: Helton, Donald
Sent: Wednesday, December 02, 2015 8:43 AM
To: Appignani, Peter
Subject: RE: Information Only: NRC SPAR models

Pete,

I'm sure you have a good handle on all this, and don't need any input from me on the impacts of SPAR model update delays.

The one thing I will offer is that you try to combat the misperception that SDPs lead to SPAR model 'corrections' while the licensee model is unchanged. As you know, licensees routinely modify their baseline model in reaction to SDPs to not only reflect the performance deficiency impacts, but also to 'enhance the realism' of their model for that particular application. Put more simply, licensees routinely seek to justify baseline model changes (typically success criteria or HEPs) in order to reduce the calculated risk.

Baseline SPAR model → SDP-specific SPAR model = OR /= SDP-specific licensee model ← Baseline licensee model

Don

From: Circle, Jeff
Sent: Wednesday, December 02, 2015 8:30 AM
To: Appignani, Peter <Peter.Appignani@nrc.gov>; Ferrante, Fernando <Fernando.Ferrante@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>
Subject: FW: Information Only: NRC SPAR models

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BB (b)(6) [redacted]

From: MacDonald, George
Sent: Wednesday, December 02, 2015 7:56 AM
To: Circle, Jeff <Jeff.Circle@nrc.gov>
Subject: FW: Information Only: NRC SPAR models

From: McCree, Victor
Sent: Tuesday, December 01, 2015 7:11 PM
To: Hanna, John <John.Hanna@nrc.gov>
Cc: Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>
Subject: Re: Information Only: NRC SPAR models

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Your thoughts?

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John David Hanna
Senior Reactor Analyst
US NRC, Region II Office
John.Hanna@nrc.gov
404-997-4552

Marksberry, Don

From: Helton, Donald
Sent: Wednesday, December 02, 2015 8:38 AM
To: Marksberry, Don
Subject: FW: Information Only: NRC SPAR models

FYI

From: Circle, Jeff
Sent: Wednesday, December 02, 2015 8:30 AM
To: Appignani, Peter <Peter.Appignani@nrc.gov>; Ferrante, Fernando <Fernando.Ferrante@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
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Circle, Jeff

From: Kuritzky, Alan
Sent: Wednesday, December 02, 2015 8:38 AM
To: Circle, Jeff
Subject: RE: Information Only: NRC SPAR models

Jeff – Do you have the attachment to John Hanna's original email? If so, could you forward it to the branch?

Thanks,
Alan

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Sent: Wednesday, December 02, 2015 8:30 AM
To: Appignani, Peter <Peter.Appignani@nrc.gov>; Ferrante, Fernando <Fernando.Ferrante@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
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Appignani, Peter

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Sent: Wednesday, December 02, 2015 8:34 AM
To: Coyne, Kevin (Kevin.Coyne@nrc.gov)
Subject: FW: Information Only: NRC SPAR models

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404-997-4552

Shen, Song-hua

From: Shen, Song-hua
Sent: Tuesday, December 01, 2015 3:44 PM
To: Wang, Zeechung
Subject: FW: Use of Licensee's Models

Song-Hua Shen, Ph.D., PE.
Sr. Reliability & Risk Engineer
U.S. Nuclear Regulatory Commission
RES/DRA/PRB
301-415-2034
T10B22
Song-Hua.Shen@nrc.gov

From: Circle, Jeff
Sent: Monday, November 30, 2015 1:47 PM
To: Demers, Jerrod <Jerrod.Demers@nrc.gov>; Gibbs, Russell <Russell.Gibbs@nrc.gov>; Hartle, Brandon <Brandon.Hartle@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Leech, Matthew <Matthew.Leech@nrc.gov>; Lyons, Sara <Sara.Lyons@nrc.gov>; Mitman, Jeffrey <Jeffrey.Mitman@nrc.gov>; Ng, Ching <Ching.Ng@nrc.gov>; Spore, Candace <Candace.Spore@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Wong, See-Meng <See-Meng.Wong@nrc.gov>; RES_DRA_PRB <RESDRAPRB@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Arner, Frank <Frank.Arner@nrc.gov>; Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; Cahill, Christopher <Christopher.Cahill@nrc.gov>; Cook, William <William.Cook@nrc.gov>; Deese, Rick <Rick.Deese@nrc.gov>; Freeman, Scott <Scott.Freeman@nrc.gov>; Hanna, John <John.Hanna@nrc.gov>; Kozak, Laura <Laura.Kozak@nrc.gov>; Loveless, David <David.Loveless@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>; Replogle, George <George.Replogle@nrc.gov>; Valos, Nicholas <Nicholas.Valos@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Ferrante, Fernando <Fernando.Ferrante@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>
Subject: Use of Licensee's Models

Dear PRA Colleagues,

Most of you know, as part of fiscal belt tightening (Project AIM 2020 and re-baselining), the agency is currently looking into various areas to reduce our budget. One area that has come up every couple of years, and has been a source of contention, is the feasibility of using licensee's PRA models in lieu of our SPAR models for SDP findings and possibly ASP. In support of that, a pilot program has been proposed to investigate its feasibility. RES is preparing to make a presentation to NRR management touching on various areas of consideration should the decision be made to embark on such a pilot program. This presentation is not intended to be forcing an opinion on whether or not to proceed but, will be advice on how to proceed with a program.

Over here in RES, I have heard conflicting opinions of what the internal stakeholders believe is the direction the agency should take on this topic. To that end, I'm sending his email out with a voting option with three selections – use only SPAR models, use only licensee's models, or use both. I would greatly appreciate it if

you each took the time and voted. And, since some of us are not wallflowers and have more to say than just vote, please feel free to take the opportunity to comment on the return email to me. This will help greatly in support to our end users.

I'm looking forward to hearing from you.

Jeff.

Jeff A. Circle
Chief (acting)
Probabilistic Risk Assessment Branch
RES /Division of Risk Analysis
(301) 415-1152
BB (b)(6)

Circle, Jeff

From:	Circle, Jeff	
Sent:	Tuesday, December 01, 2015 11:31 AM	
To:	Gibbs, Russell; Weerakkody, Sunil	
Subject:	RE: Use of Licensee's Models	
Tracking:	**Recipient**	**Read**
	Gibbs, Russell	Read: 12/01/2015 12:14 PM
	Weerakkody, Sunil	Read: 12/01/2015 2:05 PM

Russ,

I agree that it would be a good idea to ultimately hold a large internal stakeholder meeting to address the issues that might come out of such an undertaking. In addition to all the HQ and regional stakeholders, we need to include OGC. The lawyers may have a say in whether we can even consider doing this. However, before we do anything in that scale, Rich and Louise have asked me to get together at the office level here in RES to discuss this amongst ourselves. Afterwards, we can include more people to fine-tune our agency position.

My fear is that if we don't come up with a unified voice and position, industry will try to force us into their version of a pilot program which may not meet our needs or interests. I'll let you know how this progresses.

Jeff.

Jeff A. Circle
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From: Gibbs, Russell
Sent: Tuesday, December 01, 2015 10:29 AM
To: Circle, Jeff <Jeff.Circle@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>
Subject: RE: Use of Licensee's Models

Hi Jeff and Sunil,

I think it high time to have a conversation between those interacting with the industry for the proposed pilot and the internal risk community to allow people to share their views. How about an all hands meeting with Bill D. and Jennifer U. and possibly a regional administrator or two?

Our senior managers I hope would embrace such an initiative. We need to get this more out in the open.

Thoughts?

Russell

From: Circle, Jeff
Sent: Monday, November 30, 2015 4:32 PM

To: Ferrante, Fernando <Fernando.Ferrante@nrc.gov>; Demers, Jerrod <Jerrod.Demers@nrc.gov>; Gibbs, Russell <Russell.Gibbs@nrc.gov>; Hartle, Brandon <Brandon.Hartle@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Leech, Matthew <Matthew.Leech@nrc.gov>; Lyons, Sara <Sara.Lyons@nrc.gov>; Mitman, Jeffrey <Jeffrey.Mitman@nrc.gov>; Ng, Ching <Ching.Ng@nrc.gov>; Spore, Candace <Candace.Spore@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Wong, See-Meng <See-Meng.Wong@nrc.gov>; RES_DRA_PRB <RESDRAPRB@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Arner, Frank <Frank.Arner@nrc.gov>; Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; Cahill, Christopher <Christopher.Cahill@nrc.gov>; Cook, William <William.Cook@nrc.gov>; Deese, Rick <Rick.Deese@nrc.gov>; Freeman, Scott <Scott.Freeman@nrc.gov>; Hanna, John <John.Hanna@nrc.gov>; Kozak, Laura <Laura.Kozak@nrc.gov>; Loveless, David <David.Loveless@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>; Replogle, George <George.Replogle@nrc.gov>; Valos, Nicholas <Nicholas.Valos@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>
Subject: RE: Use of Licensee's Models

Fernando,

I agree that there are more complicated issues to consider with this. I wanted to make the question as a simple vote using Outlook's voting function. So, I skipped many of the issues that would have come to the surface in this undertaking. These issues can and will be discussed amongst ourselves and they are numerous.

This email sent to most of the stakeholders shows that this is not a move to protect one's interest but, one where RES, NRR, and the regions need to have an input to the decision-making process. It is wise to sit down and tabulate in some form the areas of concern we need to address before embarking on a pilot program.

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Jeff,

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By the way, my vote on the real question above is no.

Thanks,
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Subject: Use of Licensee's Models

Dear PRA Colleagues,

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Over here in RES, I have heard conflicting opinions of what the internal stakeholders believe is the direction the agency should take on this topic. To that end, I'm sending his email out with a voting option with three selections – use only SPAR models, use only licensee's models, or use both. I would greatly appreciate it if you each took the time and voted. And, since some of us are not wallflowers and have more to say than just vote, please feel free to take the opportunity to comment on the return email to me. This will help greatly in support to our end users.

I'm looking forward to hearing from you.

Jeff.

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From:	Drouin, Mary
To:	Circle, Jeff
Cc:	Nakoski, John
Subject:	Use both SPAR and Licensee"s Models: Use of Licensee"s Models
Date:	Tuesday, December 01, 2015 11:02:00 AM

I believe it violates our mission for us not to have an independent tool to assess our licensee's performance. I also believe that the cost of maintaining the SPAR models is much less resource intensive than only using the licensee's model. Taking lessons learned from the Level 3 PRA project, the resources used to understand the Vogtle PRA model was HUGH, the use of the SPAR models by the staff in event assessment, by the inspectors, etc. would not be possible, having no SPAR models and just relying on licensee's PRA would require the staff to review the licensees PRA models, this cost would be enormous, when we reviewed the IPE/IPEEEs, which was just a process review, the cost was about $500k per IPE/IPEEE and around .25 FTE per IPE/IPEEE, you can at least triple that cost to review the licensees PRA and that does not include the cost to review updates and upgrades of their models.

Appignani, Peter

From: Circle, Jeff
Sent: Tuesday, December 01, 2015 9:33 AM
To: Appignani, Peter
Subject: RE: Use of Licensee's Models

Pete,
Only if I can get it through tech editing. ☺

Yes, I plan on sharing the results once I get everyone's response.

Jeff.

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BB (b)(6)

From: Appignani, Peter
Sent: Tuesday, December 01, 2015 9:20 AM
To: Circle, Jeff <Jeff.Circle@nrc.gov>
Subject: Use only SPAR models: Use of Licensee's Models

Will you publish the results?

Ferrante, Fernando

From: Ferrante, Fernando
Sent: Tuesday, December 01, 2015 9:29 AM
To: Gibbs, Russell
Subject: Re: SPAR Models

The answer depends on what you mean by "owns". In a way, the NRC owns the models and INL maintains them. Being a contract, RES manages the contract based on a standing user need from NRR, to the benefit mainly of SRAs and risk analysts. Hence, no single person or group owns the models. There are several people responsible for the work, including Jeff Wood, Selim Sancaktar and others. At the end of the day, APHB and PRAB are responsible to ensuring the needs in the user need are met.

On: 01 December 2015 09:18, "Gibbs, Russell" <Russell.Gibbs@nrc.gov> wrote:

who owns the SPAR models in RES? Is it niw Jeff

On: 01 December 2015 09:08, "Ferrante, Fernando" <Fernando.Ferrante@nrc.gov> wrote:

Yes, he said at an all hands meeting with RES.

On: 01 December 2015 08:57, "Gibbs, Russell" <Russell.Gibbs@nrc.gov> wrote:

Didn't you mention that Vic told RES staff that SRAs were in favor of using licensee models?

Ferrante, Fernando

From:	Ferrante, Fernando
Sent:	Tuesday, December 01, 2015 9:22 AM
To:	Gibbs, Russell
Subject:	Re: SPAR Models

I think he was misinformed by those reporting to him.

On: 01 December 2015 09:14, "Gibbs, Russell" <Russell.Gibbs@nrc.gov> wrote:

I believe he mispoke...

On: 01 December 2015 09:08, "Ferrante, Fernando" <Fernando.Ferrante@nrc.gov> wrote:

Yes, he said at an all hands meeting with RES.

On: 01 December 2015 08:57, "Gibbs, Russell" <Russell.Gibbs@nrc.gov> wrote:

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Tetter, Keith

From: Tetter, Keith
Sent: Tuesday, December 01, 2015 7:51 AM
To: Circle, Jeff
Subject: Use only SPAR models: Use of Licensee's Models

Jeff,
I have said it before and will say it again: How are we an independent agency if we are using the licensee's models and how are we learning the lessons from Fukushima if we are getting too close to the licensees and using their models? It is my understanding that we have had the Vogtle model for three years now and still don't know all of their modeling. If we did decide to use the licensee's models, which is a bad idea and asking for another TMI or worse, then NRC would have to hire at least one additional PRA analyst (about 60 FTE) to stay at each site to become an expert on their specific model since they all use different programs and not a standardized model like we do with SPAR. This is a dangerous slope that we are heading down by even considering this in order to save less than a half of one percent of our budget and will cost us more in staff, money, and safety in the long run. Thank you,
Keith

Ning, Lauren (Killian)

From: Leschek, Walter
Sent: Tuesday, December 01, 2015 7:08 AM
To: Circle, Jeff; Ferrante, Fernando; Demers, Jerrod; Gibbs, Russell; Hartle, Brandon; Kichline, Michelle; Leech, Matthew; Lyons, Sara; Mitman, Jeffrey; Ng, Ching; Spore, Candace; Weerakkody, Sunil; Wong, See-Meng; RES_DRA_PRB; Coyne, Kevin; Arner, Frank; Bernhard, Rudolph; Cahill, Christopher; Cook, William; Deese, Rick; Freeman, Scott; Hanna, John; Kozak, Laura; Loveless, David; MacDonald, George; Replogle, George; Valos, Nicholas; Appignani, Peter; Gonzalez, Michelle; Helton, Donald; Hudson, Daniel; Kuritzky, Alan; Li, Ming; Ning, Lauren (Killian); Sancaktar, Selim; Wessels, Steven; Wood, Jeffery
Cc: Correia, Richard; Lund, Louise
Subject: NRC is an Independent Agency, Consequently the Atomic Energy Act of 1954 May Need to Be Amended Again to Permit the NRC to Use Licensee's PRA Models

Dear Jeff and All on Copy

Please remember that the NRC is an Independent Agency.

- As such, Congress is saying that the NRC knows more about Nuclear Reactor Safety than it does and should handle all actions pertaining to this item.

If the NRC permits use of the Licensee's PRA Models,

- It may inadvertently tell Congress that it no longer knows that much about Nuclear Reactor Safety.

Consequently Congress may again need to amend the Atomic Energy Act of 1954.

Take care,
Walt

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Sent: Monday, November 30, 2015 4:32 PM
To: Ferrante, Fernando <Fernando.Ferrante@nrc.gov>; Demers, Jerrod <Jerrod.Demers@nrc.gov>; Gibbs, Russell <Russell.Gibbs@nrc.gov>; Hartle, Brandon <Brandon.Hartle@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Leech, Matthew <Matthew.Leech@nrc.gov>; Lyons, Sara <Sara.Lyons@nrc.gov>; Mitman, Jeffrey <Jeffrey.Mitman@nrc.gov>; Ng, Ching <Ching.Ng@nrc.gov>; Spore, Candace <Candace.Spore@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Wong, See-Meng <See-Meng.Wong@nrc.gov>; RES_DRA_PRB <RESDRAPRB@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Arner, Frank <Frank.Arner@nrc.gov>; Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; Cahill, Christopher <Christopher.Cahill@nrc.gov>; Cook, William <William.Cook@nrc.gov>; Deese, Rick <Rick.Deese@nrc.gov>; Freeman, Scott <Scott.Freeman@nrc.gov>; Hanna, John <John.Hanna@nrc.gov>; Kozak, Laura <Laura.Kozak@nrc.gov>; Loveless, David <David.Loveless@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>; Replogle, George <George.Replogle@nrc.gov>; Valos, Nicholas <Nicholas.Valos@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
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Ning, Lauren (Killian)

From: Ning, Lauren (Killian)
Sent: Monday, November 30, 2015 4:59 PM
To: Circle, Jeff
Subject: Use both SPAR and Licensee's Models: Use of Licensee's Models

To clarify, I think that...

- NRC should keep SPAR models
- Going forward, it would be even better for the NRC to also gain full access to licensee models.
- Going forward, it would become much worse if we lost SPAR models and only used licensee models.
    - Mainly because...
        - Independence: the difficulty in staying independent without a separate NRC tool that NRC has full understanding and control over
        - Resources: the enormous resources that would be needed to properly understand each licensee model (e.g., note the Level 3 PRA project resources needed for this purpose, versus a peer review that should only be considered a spot check compared to the understanding and confidence in the licensee models that would be needed for NRC decisions based on them) and resources needed to adjust and use licensee models to understand NRC modeling concerns that would most definitely arise if NRC truly understands the models well enough

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From: Ferrante, Fernando
Sent: Monday, November 30, 2015 3:01 PM
To: Cook, William <William.Cook@nrc.gov>; Kozak, Laura <Laura.Kozak@nrc.gov>; Gibbs, Russell <Russell.Gibbs@nrc.gov>; Circle, Jeff <Jeff.Circle@nrc.gov>; Demers, Jerrod <Jerrod.Demers@nrc.gov>; Hartle, Brandon <Brandon.Hartle@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Leech, Matthew <Matthew.Leech@nrc.gov>; Lyons, Sara <Sara.Lyons@nrc.gov>; Mitman, Jeffrey <Jeffrey.Mitman@nrc.gov>; Ng, Ching <Ching.Ng@nrc.gov>; Spore, Candace <Candace.Spore@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Wong, See-Meng <See-Meng.Wong@nrc.gov>; RES_DRA_PRB <RESDRAPRB@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Arner, Frank <Frank.Arner@nrc.gov>; Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; Cahill, Christopher <Christopher.Cahill@nrc.gov>; Deese, Rick <Rick.Deese@nrc.gov>; Freeman, Scott <Scott.Freeman@nrc.gov>; Hanna, John <John.Hanna@nrc.gov>; Loveless, David <David.Loveless@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>; Replogle, George <George.Replogle@nrc.gov>; Valos, Nicholas <Nicholas.Valos@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>
Subject: RE: Use of Licensee's Models

He didn't say, but I suspect it comes from NRR's upper management.

From: Cook, William
Sent: Monday, November 30, 2015 3:00 PM
To: Kozak, Laura; Gibbs, Russell; Ferrante, Fernando; Circle, Jeff; Demers, Jerrod; Hartle, Brandon; Kichline, Michelle; Leech, Matthew; Lyons, Sara; Mitman, Jeffrey; Ng, Ching; Spore, Candace; Weerakkody, Sunil; Wong, See-Meng; RES_DRA_PRB; Coyne, Kevin; Arner, Frank; Bernhard, Rudolph; Cahill, Christopher; Deese, Rick; Freeman, Scott; Hanna, John; Loveless, David; MacDonald, George; Replogle, George; Valos, Nicholas; Appignani, Peter; Gonzalez, Michelle; Helton, Donald; Hudson, Daniel; Kuritzky, Alan; Leschek, Walter; Li, Ming; Ning, Lauren (Killian); Sancaktar, Selim; Wessels, Steven; Wood, Jeffery
Cc: Correia, Richard; Lund, Louise
Subject: RE: Use of Licensee's Models

First we have heard of it in Region I, as well. Where and from whom did Vic get the impression that the majority (or any) of the SRAs want to do away with SPAR?

From: Kozak, Laura
Sent: Monday, November 30, 2015 2:58 PM
To: Gibbs, Russell <Russell.Gibbs@nrc.gov>; Ferrante, Fernando <Fernando.Ferrante@nrc.gov>; Circle, Jeff <Jeff.Circle@nrc.gov>; Demers, Jerrod <Jerrod.Demers@nrc.gov>; Hartle, Brandon <Brandon.Hartle@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Leech, Matthew <Matthew.Leech@nrc.gov>; Lyons, Sara <Sara.Lyons@nrc.gov>;

Mitman, Jeffrey <Jeffrey.Mitman@nrc.gov>; Ng, Ching <Ching.Ng@nrc.gov>; Spore, Candace <Candace.Spore@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Wong, See-Meng <See-Meng.Wong@nrc.gov>; RES_DRA_PRB <RESDRAPRB@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Arner, Frank <Frank.Arner@nrc.gov>; Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; Cahill, Christopher <Christopher.Cahill@nrc.gov>; Cook, William <William.Cook@nrc.gov>; Deese, Rick <Rick.Deese@nrc.gov>; Freeman, Scott <Scott.Freeman@nrc.gov>; Hanna, John <John.Hanna@nrc.gov>; Loveless, David <David.Loveless@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>; Replogle, George <George.Replogle@nrc.gov>; Valos, Nicholas <Nicholas.Valos@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>
Subject: RE: Use of Licensee's Models

Can the SRA community get some information on this initiative? I have not heard anything and so I am unable to brief my management.

From: Gibbs, Russell
Sent: Monday, November 30, 2015 1:56 PM
To: Ferrante, Fernando; Circle, Jeff; Demers, Jerrod; Hartle, Brandon; Kichline, Michelle; Leech, Matthew; Lyons, Sara; Mitman, Jeffrey; Ng, Ching; Spore, Candace; Weerakkody, Sunil; Wong, See-Meng; RES_DRA_PRB; Coyne, Kevin; Arner, Frank; Bernhard, Rudolph; Cahill, Christopher; Cook, William; Deese, Rick; Freeman, Scott; Hanna, John; Kozak, Laura; Loveless, David; MacDonald, George; Replogle, George; Valos, Nicholas; Appignani, Peter; Gonzalez, Michelle; Helton, Donald; Hudson, Daniel; Kuritzky, Alan; Leschek, Walter; Li, Ming; Ning, Lauren (Killian); Sancaktar, Selim; Wessels, Steven; Wood, Jeffery
Cc: Correia, Richard; Lund, Louise
Subject: RE: Use of Licensee's Models

Suggestion - RES and NRR/DRA working with the regions might consider arranging an all hands meeting with NRC leadership on this important and seemingly controversial issue.

Russell

From: Ferrante, Fernando
Sent: Monday, November 30, 2015 2:32 PM
To: Circle, Jeff <Jeff.Circle@nrc.gov>; Demers, Jerrod <Jerrod.Demers@nrc.gov>; Gibbs, Russell <Russell.Gibbs@nrc.gov>; Hartle, Brandon <Brandon.Hartle@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Leech, Matthew <Matthew.Leech@nrc.gov>; Lyons, Sara <Sara.Lyons@nrc.gov>; Mitman, Jeffrey <Jeffrey.Mitman@nrc.gov>; Ng, Ching <Ching.Ng@nrc.gov>; Spore, Candace <Candace.Spore@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Wong, See-Meng <See-Meng.Wong@nrc.gov>; RES_DRA_PRB <RESDRAPRB@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Arner, Frank <Frank.Arner@nrc.gov>; Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; Cahill, Christopher <Christopher.Cahill@nrc.gov>; Cook, William <William.Cook@nrc.gov>; Deese, Rick <Rick.Deese@nrc.gov>; Freeman, Scott <Scott.Freeman@nrc.gov>; Hanna, John <John.Hanna@nrc.gov>; Kozak, Laura <Laura.Kozak@nrc.gov>; Loveless, David <David.Loveless@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>; Replogle, George <George.Replogle@nrc.gov>; Valos, Nicholas <Nicholas.Valos@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>
Subject: RE: Use of Licensee's Models

Jeff,

Thanks for the opportunity to vote on this important issue. However, I don't think this question is being framed correctly. The vote should be: should the NRC get rid of SPAR models and INL support? I say this because I think there is too much miscommunication about this issue going on to the point where I don't think upper management is properly informed of the challenges and consequences. Today, we heard Vic McCree state at an all hands RES meeting that SRAs are in agreement with industry to get rid of SPAR models. I also don't think RES should be the sole presenter at this management briefing. I would suggest the Regions and NRR risk analysts to be involved in presenting their views. This is key as (1) I don't think most staff in NRR and the Regions are in alignment with upper management's views on this (i.e., either staff is not being listened to or is afraid to speak), (2) the impacts on changing the current framework, even if we all agreed to do so, are non-trivial and could impact both the NRC's ability to perform a critical function but also end up costing more than they intend to safe, and (3) I am concerned that opposition to getting rid of SPAR models is being portrayed as RES trying to protect a project it is responsible for, since NRR management appears to have aligned in getting rid of SPAR models.

By the way, my vote on the real question above is no.

Thanks,
Fernando

From: Circle, Jeff
Sent: Monday, November 30, 2015 1:47 PM
To: Demers, Jerrod; Gibbs, Russell; Hartle, Brandon; Kichline, Michelle; Leech, Matthew; Lyons, Sara; Mitman, Jeffrey; Ng, Ching; Spore, Candace; Weerakkody, Sunil; Wong, See-Meng; RES_DRA_PRB; Coyne, Kevin; Arner, Frank; Bernhard, Rudolph; Cahill, Christopher; Cook, William; Deese, Rick; Freeman, Scott; Hanna, John; Kozak, Laura; Loveless, David; MacDonald, George; Replogle, George; Valos, Nicholas; Appignani, Peter; Ferrante, Fernando; Gonzalez, Michelle; Helton, Donald; Hudson, Daniel; Kuritzky, Alan; Leschek, Walter; Li, Ming; Ning, Lauren (Killian); Sancaktar, Selim; Wessels, Steven; Wood, Jeffery
Cc: Correia, Richard; Lund, Louise
Subject: Use of Licensee's Models

Dear PRA Colleagues,

Most of you know, as part of fiscal belt tightening (Project AIM 2020 and re-baselining), the agency is currently looking into various areas to reduce our budget. One area that has come up every couple of years, and has been a source of contention, is the feasibility of using licensee's PRA models in lieu of our SPAR models for SDP findings and possibly ASP. In support of that, a pilot program has been proposed to investigate its feasibility. RES is preparing to make a presentation to NRR management touching on various areas of consideration should the decision be made to embark on such a pilot program. This presentation is not intended to be forcing an opinion on whether or not to proceed but, will be advice on <u>how</u> to proceed with a program.

Over here in RES, I have heard conflicting opinions of what the internal stakeholders believe is the direction the agency should take on this topic. To that end, I'm sending his email out with a voting option with three selections – use only SPAR models, use only licensee's models, or use both. I would greatly appreciate it if you each took the time and voted. And, since some of us are not wallflowers and have more to say than just vote, please feel free to take the opportunity to comment on the return email to me. This will help greatly in support to our end users.

I'm looking forward to hearing from you.

Jeff.

Jeff A. Circle

Chief (acting)
Probabilistic Risk Assessment Branch
RES /Division of Risk Analysis
(301) 415-1152
BB (b)(6)

Coyne, Kevin

From: Coyne, Kevin
Sent: Monday, November 30, 2015 4:50 PM
To: Ferrante, Fernando
Subject: Re: Use of Licensee's Models

Thank you for the cc...

Sent from an NRC Blackberry
Kevin Coyne
(b)(6)

From: Ferrante, Fernando
Sent: Monday, November 30, 2015 04:32 PM
To: Helton, Donald; Circle, Jeff
Cc: Stutzke, Martin; Siu, Nathan; Nakoski, John; Coyne, Kevin
Subject: RE: Use of Licensee's Models

Don,

You have identified two key problems I observed extensively in NRR (but not exclusive to it):

- There is a misunderstanding of the difference between the goals, scope, and, ultimately, the tools needed for licensing and oversight. Some folks believe oversight should be no different than licensing (i.e., rely on licensee models) and that PRA technology is so "mature" that it can cover all aspects and issues. Some of this misunderstanding may be due to:
  - a philosophical view (i.e., that the NRC should not be in the business of analyzing; the licensees should do it and tells us the result),
  - a defensive posture (e.g., oversight sometimes highlights flaws and gaps in original licensing decisions and can be seen as threatening),
  - a resource issue (getting more funding and staff for specific projects),
  - a perception issue (e.g., "plants are safe", so why is risk being evaluated?), or
  - a mixture or all of the above

- Risk-informed has become a mythical term that means different and, sometimes, directly contradictory views to many individuals and organizations (within and outside NRC). It is also being used to validate or prop positions that are driven by some of the factors above. For example, the mantra of "we are risk-informed, not risk-based" is often used by individuals that don't agree and/or don't understand how risk is used and that invariably believe risk has usurped the use of deterministic approaches and their gut-based decisionmaking (i.e., they don't want to be risk-informed, they want to be more deterministic-informed). This also gets intertwined with the view that the NRC can do less, i.e., by being more "risk-informed", we can rely more on licensee tools. This is why I have heard conflicting statements in recen multiple public meetings where (a) PRA cannot be trusted due to "uncertainties and assumptions" or (b PRA technology is so "mature" that the NRC should not be in the business of asking detailed questions or performing independent analyses.

These are great issues that must be addressed. However, I am afraid we are no longer willing to have an ope discussion and that dissenting views are excluded by tight control of information channels. Project Aim 2020 is also being used to vent fissures at the NRC that have probably always simmered near/under the surface and are now being exposed under stress and towards different purposes.

Fernando

From: Helton, Donald
Sent: Monday, November 30, 2015 4:03 PM
To: Circle, Jeff
Cc: Ferrante, Fernando; Stutzke, Martin; Siu, Nathan; Nakoski, John
Subject: RE: Use of Licensee's Models

Jeff et al. (I've highly limited this reply-to-all on the assumption that this particular opinion is not of wider interest)…

I think that there are lot of organizational dynamics at play (SRAs' not being in the loop, RES appearing defensive, etc.), and I'm glad that you and others are trying to confront some of the misunderstandings that these dynamics are instilling. I also think that a lot of the misalignment stems from a fundamental difference of viewpoint on what tools one needs to be "more risk-informed" (independent tools vs. licensee tools vs. qualitative judgments)

But separately, I think it would also be helpful to simultaneously look at SPAR/SAPHIRE in the context of the full set of NRC's independent tools. Why do we use SPAR for oversight, but not licensing? Why does NRC maintain a suite of independent tools to study DBAs that pose little risk (thanks to all of the great regulatory work of the past 4 decades), but seek to eliminate the tools that deal with the broader range of accident sequences? Put differently, in making decisions in the Common Prioritization initiative, do we have a holistic view of where the agency's funds are well-spent, and/or do we have criteria as to what regulatory areas require more or less independence (e.g., regulatory requirement trumps voluntary initiative regardless of risk)? Perhaps that's not a tractable framing of the problem (although I've made a weak attempt below), but if it is, it would present an opportunity to make these decisions more objective.

Stepping down from the soap box now…

Don

Operating Reactors – THIS IS A SAMPLE (IT IS POTENTIALLY INACCURATE AND DEFINITELY INCOMPLETE)				
	Independent NRC-developed models used	Rely on NRC analysis using commercial codes	Rely on audit/review of licensee models	Computer models not used
Risk assessment – Licensing			X	
Risk assessment - Oversight	X (SAPHIRE/SPAR)			
Severe accidents	X (MELCOR, MACCS)			
Design-basis accident analysis	X (TRACE, SNAP, RELAP5, SCALE, PARCS, FRAPCON, FRAPTRAN)			
Fire protection		X (FDS, etc.)		
Emergency preparedness			X	
Incident response	X (RASCAL)			
Radiation protection	X (RADTRAD, VARSKIN, HABIT)			
Spent Fuel Pools	X (MELCOR, SCALE)			

Dry cask storage	X (SCALE, MCNP)			
Environmental modeling	X (RESRAD)			
Cross-cutting		X (FLUENT, ANSYS)		
...				

From: Ferrante, Fernando
Sent: Monday, November 30, 2015 2:32 PM
To: Circle, Jeff <Jeff.Circle@nrc.gov>; Demers, Jerrod <Jerrod.Demers@nrc.gov>; Gibbs, Russell <Russell.Gibbs@nrc.gov>; Hartle, Brandon <Brandon.Hartle@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Leech, Matthew <Matthew.Leech@nrc.gov>; Lyons, Sara <Sara.Lyons@nrc.gov>; Mitman, Jeffrey <Jeffrey.Mitman@nrc.gov>; Ng, Ching <Ching.Ng@nrc.gov>; Spore, Candace <Candace.Spore@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Wong, See-Meng <See-Meng.Wong@nrc.gov>; RES_DRA_PRB <RESDRAPRB@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Arner, Frank <Frank.Arner@nrc.gov>; Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; Cahill, Christopher <Christopher.Cahill@nrc.gov>; Cook, William <William.Cook@nrc.gov>; Deese, Rick <Rick.Deese@nrc.gov>; Freeman, Scott <Scott.Freeman@nrc.gov>; Hanna, John <John.Hanna@nrc.gov>; Kozak, Laura <Laura.Kozak@nrc.gov>; Loveless, David <David.Loveless@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>; Replogle, George <George.Replogle@nrc.gov>; Valos, Nicholas <Nicholas.Valos@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
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By the way, my vote on the real question above is no.

Thanks,
Fernando

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Sent: Monday, November 30, 2015 1:47 PM
To: Demers, Jerrod; Gibbs, Russell; Hartle, Brandon; Kichline, Michelle; Leech, Matthew; Lyons, Sara; Mitman, Jeffrey; Ng, Ching; Spore, Candace; Weerakkody, Sunil; Wong, See-Meng; RES_DRA_PRB; Coyne, Kevin; Arner, Frank; Bernhard

Rudolph; Cahill, Christopher; Cook, William; Deese, Rick; Freeman, Scott; Hanna, John; Kozak, Laura; Loveless, David; MacDonald, George; Replogle, George; Valos, Nicholas; Appignani, Peter; Ferrante, Fernando; Gonzalez, Michelle; Helton, Donald; Hudson, Daniel; Kuritzky, Alan; Leschek, Walter; Li, Ming; Ning, Lauren (Killian); Sancaktar, Selim; Wessels, Steven; Wood, Jeffery
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Jeff A. Circle
Chief (acting)
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RES /Division of Risk Analysis
(301) 415-1152
BB (b)(6)

From: Helton, Donald
To: Circle, Jeff
Cc: Ferrante, Fernando; Stutzke, Martin; Siu, Nathan; Nakoski, John
Subject: RE: Use of Licensee"s Models
Date: Monday, November 30, 2015 4:02:00 PM

Jeff et al. (I've highly limited this reply-to-all on the assumption that this particular opinion is not of wider interest)...

I think that there are lot of organizational dynamics at play (SRAs' not being in the loop, RES appearing defensive, etc.), and I'm glad that you and others are trying to confront some of the misunderstandings that these dynamics are instilling. I also think that a lot of the misalignment stems from a fundamental difference of viewpoint on what tools one *needs to be "more risk-informed"* (independent tools vs. licensee tools vs. qualitative judgments)

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Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>
Subject: RE: Use of Licensee's Models

Jeff,

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By the way, my vote on the real question above is no.

Thanks,
Fernando

From: Circle, Jeff
Sent: Monday, November 30, 2015 1:47 PM
To: Demers, Jerrod; Gibbs, Russell; Hartle, Brandon; Kichline, Michelle; Leech, Matthew; Lyons, Sara; Mitman, Jeffrey; Ng, Ching; Spore, Candace; Weerakkody, Sunil; Wong, See-Meng; RES_DRA_PRB; Coyne, Kevin; Arner, Frank; Bernhard, Rudolph; Cahill, Christopher; Cook, William; Deese, Rick; Freeman, Scott; Hanna, John; Kozak, Laura; Loveless, David; MacDonald, George; Replogle, George; Valos, Nicholas; Appignani, Peter; Ferrante, Fernando; Gonzalez, Michelle; Helton, Donald; Hudson, Daniel; Kuritzky, Alan; Leschek, Walter; Li, Ming; Ning, Lauren (Killian); Sancaktar, Selim; Wessels, Steven; Wood, Jeffery
Cc: Correia, Richard; Lund, Louise
Subject: Use of Licensee's Models

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Jeff.

Jeff A. Circle
Chief (acting)
Probabilistic Risk Assessment Branch

RES /Division of Risk Analysis
(301) 415-1152
BB (b)(6)

Yeilding, Dale

From: Yeilding, Dale
Sent: Monday, November 30, 2015 3:30 PM
To: Circle, Jeff
Cc: Nakoski, John
Subject: Vote SPAR Only - Use of Licensee's Models

Jeff,
I vote SPAR models only.

As a staffer that analyzes events for the ASP program, I would be overwhelmed to learn new PRA software program(s) besides SAPHIRE and then I have to understand the event and fault tree structure that Licensees may do differently than the methods INL uses in the SPAR models. INL also has excellent documentation for each SPAR model that the Licensees may not consistently include in their model. I would also miss the INL help line that paves the way for an analysis, when questions about the model surface.
---Dale

PS: Could you break out the voting results for just the SRAs in response to the EDOs statements at today's all hands meeting?

PSS: Might also pursue documentation of the history of this initiate to use Licensee models to determine if there are any underlying hidden agendas, such as eliminate the RES ASP second check of the NRR SDP event analysis.

From: Circle, Jeff
Sent: Monday, November 30, 2015 1:47 PM
To: Demers, Jerrod; Gibbs, Russell; Hartle, Brandon; Kichline, Michelle; Leech, Matthew; Lyons, Sara; Mitman, Jeffrey; Ng, Ching; Spore, Candace; Weerakkody, Sunil; Wong, See-Meng; RES_DRA_PRB; Coyne, Kevin; Arner, Frank; Bernhard, Rudolph; Cahill, Christopher; Cook, William; Deese, Rick; Freeman, Scott; Hanna, John; Kozak, Laura; Loveless, David; MacDonald, George; Replogle, George; Valos, Nicholas; Appignani, Peter; Ferrante, Fernando; Gonzalez, Michelle; Helton, Donald; Hudson, Daniel; Kuritzky, Alan; Leschek, Walter; Li, Ming; Ning, Lauren (Killian); Sancaktar, Selim; Wessels, Steven; Wood, Jeffery
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Ning, Lauren (Killian)

From: Leschek, Walter
Sent: Monday, November 30, 2015 3:07 PM
To: Ferrante, Fernando; Circle, Jeff; Demers, Jerrod; Gibbs, Russell; Hartle, Brandon; Kichline, Michelle; Leech, Matthew; Lyons, Sara; Mitman, Jeffrey; Ng, Ching; Spore, Candace; Weerakkody, Sunil; Wong, See-Meng; RES_DRA_PRB; Coyne, Kevin; Arner, Frank; Bernhard, Rudolph; Cahill, Christopher; Cook, William; Deese, Rick; Freeman, Scott; Hanna, John; Kozak, Laura; Loveless, David; MacDonald, George; Replogle, George; Valos, Nicholas; Appignani, Peter; Gonzalez, Michelle; Helton, Donald; Hudson, Daniel; Kuritzky, Alan; Li, Ming; Ning, Lauren (Killian); Sancaktar, Selim; Wessels, Steven; Wood, Jeffery
Cc: Correia, Richard; Lund, Louise
Subject: Are the SRAs Forgetting Who They Work for When They Suggest Use of Licensee's PRA Models?

Dear Jeff

With reference to the email messages below, my question is:

- Are the Senior Reactor Analysts (SRAs) forgetting who they work for when they suggest that the NRC use Licensee's PRA Models?

As an aside, when I arrived at the NRC in early 1990s:

Non Responsive

Take care,
Walt

From: Ferrante, Fernando
Sent: Monday, November 30, 2015 2:32 PM
To: Circle, Jeff <Jeff.Circle@nrc.gov>; Demers, Jerrod <Jerrod.Demers@nrc.gov>; Gibbs, Russell <Russell.Gibbs@nrc.gov>; Hartle, Brandon <Brandon.Hartle@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Leech, Matthew <Matthew.Leech@nrc.gov>; Lyons, Sara <Sara.Lyons@nrc.gov>; Mitman, Jeffrey <Jeffrey.Mitman@nrc.gov>; Ng, Ching <Ching.Ng@nrc.gov>; Spore, Candace <Candace.Spore@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Wong, See-Meng <See-Meng.Wong@nrc.gov>; RES_DRA_PRB <RESDRAPRB@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Arner, Frank <Frank.Arner@nrc.gov>; Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; Cahill, Christopher <Christopher.Cahill@nrc.gov>; Cook, William <William.Cook@nrc.gov>; Deese, Rick <Rick.Deese@nrc.gov>; Freeman, Scott <Scott.Freeman@nrc.gov>; Hanna, John <John.Hanna@nrc.gov>; Kozak, Laura <Laura.Kozak@nrc.gov>; Loveless, David <David.Loveless@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>; Replogle, George <George.Replogle@nrc.gov>; Valos, Nicholas <Nicholas.Valos@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>
Subject: RE: Use of Licensee's Models

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By the way, my vote on the real question above is no.

Thanks,
Fernando

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BB (b)(6)

Ning, Lauren (Killian)

From: Ferrante, Fernando
Sent: Monday, November 30, 2015 2:56 PM
To: Gibbs, Russell; Circle, Jeff; Demers, Jerrod; Hartle, Brandon; Kichline, Michelle; Leech, Matthew; Lyons, Sara; Mitman, Jeffrey; Ng, Ching; Spore, Candace; Weerakkody, Sunil; Wong, See-Meng; RES_DRA_PRB; Coyne, Kevin; Arner, Frank; Bernhard, Rudolph; Cahill, Christopher; Cook, William; Deese, Rick; Freeman, Scott; Hanna, John; Kozak, Laura; Loveless, David; MacDonald, George; Replogle, George; Valos, Nicholas; Appignani, Peter; Gonzalez, Michelle; Helton, Donald; Hudson, Daniel; Kuritzky, Alan; Leschek, Walter; Li, Ming; Ning, Lauren (Killian); Sancaktar, Selim; Wessels, Steven; Wood, Jeffery
Cc: Correia, Richard; Lund, Louise
Subject: RE: Use of Licensee's Models

Outstanding suggestion, Russ.

From: Gibbs, Russell
Sent: Monday, November 30, 2015 2:56 PM
To: Ferrante, Fernando; Circle, Jeff; Demers, Jerrod; Hartle, Brandon; Kichline, Michelle; Leech, Matthew; Lyons, Sara; Mitman, Jeffrey; Ng, Ching; Spore, Candace; Weerakkody, Sunil; Wong, See-Meng; RES_DRA_PRB; Coyne, Kevin; Arner, Frank; Bernhard, Rudolph; Cahill, Christopher; Cook, William; Deese, Rick; Freeman, Scott; Hanna, John; Kozak, Laura; Loveless, David; MacDonald, George; Replogle, George; Valos, Nicholas; Appignani, Peter; Gonzalez, Michelle; Helton, Donald; Hudson, Daniel; Kuritzky, Alan; Leschek, Walter; Li, Ming; Ning, Lauren (Killian); Sancaktar, Selim; Wessels, Steven; Wood, Jeffery
Cc: Correia, Richard; Lund, Louise
Subject: RE: Use of Licensee's Models

Suggestion - RES and NRR/DRA working with the regions might consider arranging an all hands meeting with NRC leadership on this important and seemingly controversial issue.

Russell

From: Ferrante, Fernando
Sent: Monday, November 30, 2015 2:32 PM
To: Circle, Jeff <Jeff.Circle@nrc.gov>; Demers, Jerrod <Jerrod.Demers@nrc.gov>; Gibbs, Russell <Russell.Gibbs@nrc.gov>; Hartle, Brandon <Brandon.Hartle@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Leech, Matthew <Matthew.Leech@nrc.gov>; Lyons, Sara <Sara.Lyons@nrc.gov>; Mitman, Jeffrey <Jeffrey.Mitman@nrc.gov>; Ng, Ching <Ching.Ng@nrc.gov>; Spore, Candace <Candace.Spore@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Wong, See-Meng <See-Meng.Wong@nrc.gov>; RES_DRA_PRB <RESDRAPRB@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Arner, Frank <Frank.Arner@nrc.gov>; Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; Cahill, Christopher <Christopher.Cahill@nrc.gov>; Cook, William <William.Cook@nrc.gov>; Deese, Rick <Rick.Deese@nrc.gov>; Freeman, Scott <Scott.Freeman@nrc.gov>; Hanna, John <John.Hanna@nrc.gov>; Kozak, Laura <Laura.Kozak@nrc.gov>; Loveless, David <David.Loveless@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>; Replogle, George <George.Replogle@nrc.gov>; Valos, Nicholas <Nicholas.Valos@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>
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Fernando

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(301) 415-1152
BB (b)(6)

Coyne, Kevin

From: Coyne, Kevin
Sent: Monday, November 30, 2015 2:53 PM
To: Ferrante, Fernando
Subject: RE: Use of Licensee's Models

Well said...

From: Ferrante, Fernando
Sent: Monday, November 30, 2015 2:32 PM
To: Circle, Jeff <Jeff.Circle@nrc.gov>; Demers, Jerrod <Jerrod.Demers@nrc.gov>; Gibbs, Russell <Russell.Gibbs@nrc.gov>; Hartle, Brandon <Brandon.Hartle@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Leech, Matthew <Matthew.Leech@nrc.gov>; Lyons, Sara <Sara.Lyons@nrc.gov>; Mitman, Jeffrey <Jeffrey.Mitman@nrc.gov>; Ng, Ching <Ching.Ng@nrc.gov>; Spore, Candace <Candace.Spore@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Wong, See-Meng <See-Meng.Wong@nrc.gov>; RES_DRA_PRB <RESDRAPRB@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Arner, Frank <Frank.Arner@nrc.gov>; Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; Cahill, Christopher <Christopher.Cahill@nrc.gov>; Cook, William <William.Cook@nrc.gov>; Deese, Rick <Rick.Deese@nrc.gov>; Freeman, Scott <Scott.Freeman@nrc.gov>; Hanna, John <John.Hanna@nrc.gov>; Kozak, Laura <Laura.Kozak@nrc.gov>; Loveless, David <David.Loveless@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>; Replogle, George <George.Replogle@nrc.gov>; Valos, Nicholas <Nicholas.Valos@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
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BB (b)(6)

Circle, Jeff

From: MacDonald, George
Sent: Monday, November 30, 2015 2:37 PM
To: Circle, Jeff
Subject: RE: Use of Licensee's Models

By rethinking and reading Fernandos email I change my vote to no. On anything we do we usually compare with them anyway so in essence we are using both models . Also for the MD8.3/IMC 0309 quick response we will not have time to rely on ;licesee models and use of SPAR will be critical. Where did Vic get the idea that all SRAs want to get rid of SPAR models?

From: Circle, Jeff
Sent: Monday, November 30, 2015 1:47 PM
To: Demers, Jerrod <Jerrod.Demers@nrc.gov>; Gibbs, Russell <Russell.Gibbs@nrc.gov>; Hartle, Brandon <Brandon.Hartle@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Leech, Matthew <Matthew.Leech@nrc.gov>; Lyons, Sara <Sara.Lyons@nrc.gov>; Mitman, Jeffrey <Jeffrey.Mitman@nrc.gov>; Ng, Ching <Ching.Ng@nrc.gov>; Spore, Candace <Candace.Spore@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Wong, See-Meng <See-Meng.Wong@nrc.gov>; RES_DRA_PRB <RESDRAPRB@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Arner, Frank <Frank.Arner@nrc.gov>; Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; Cahill, Christopher <Christopher.Cahill@nrc.gov>; Cook, William <William.Cook@nrc.gov>; Deese, Rick <Rick.Deese@nrc.gov>; Freeman, Scott <Scott.Freeman@nrc.gov>; Hanna, John <John.Hanna@nrc.gov>; Kozak, Laura <Laura.Kozak@nrc.gov>; Loveless, David <David.Loveless@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>; Replogle, George <George.Replogle@nrc.gov>; Valos, Nicholas <Nicholas.Valos@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Ferrante, Fernando <Fernando.Ferrante@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>
Subject: Use of Licensee's Models

Dear PRA Colleagues,

Most of you know, as part of fiscal belt tightening (Project AIM 2020 and re-baselining), the agency is currently looking into various areas to reduce our budget. One area that has come up every couple of years, and has been a source of contention, is the feasibility of using licensee's PRA models in lieu of our SPAR models for SDP findings and possibly ASP. In support of that, a pilot program has been proposed to investigate its feasibility. RES is preparing to make a presentation to NRR management touching on various areas of consideration should the decision be made to embark on such a pilot program. This presentation is not intended to be forcing an opinion on whether or not to proceed but, will be advice on <u>how</u> to proceed with a program.

Over here in RES, I have heard conflicting opinions of what the internal stakeholders believe is the direction the agency should take on this topic. To that end, I'm sending his email out with a voting option with three selections – use only SPAR models, use only licensee's models, or use both. I would greatly appreciate it if you each took the time and voted. And, since some of us are not wallflowers and have more to say than just vote, please feel free to take the opportunity to comment on the return email to me. This will help greatly in support to our end users.

I'm looking forward to hearing from you.

Jeff.

Jeff A. Circle
Chief (acting)
Probabilistic Risk Assessment Branch
RES /Division of Risk Analysis
(301) 415-1152
BB (b)(6)

Circle, Jeff

From: MacDonald, George
Sent: Monday, November 30, 2015 2:28 PM
To: Circle, Jeff
Subject: RE: Use of Licensee's Models

Not wanting to be forever labelled a "Wallflower" I will give you my two cents worth. Getting rid of the SPAR models in my opinion would be a bad idea. They are very useable and all SRAs are trained on their use. They also have features which help us in our job evaluating the risk impact of PDs with the ECA module which rapidly gets you to the dominant sequences and relevant cutsets which you know well is not a strength of the CAFTA. The benefit of having our own tool and risk assessment capability gives us credibility with the public that we are not relying on the licensee for our ability to gain the risk insight level results to inform management properly to render a regulatory decision. We of course don't need relay contact level data here, we are trying to decide to inspect some more. Then you have the legal problems of using the licensee's model and trying to keep up to date on it and make changes when we can do it ourselves with SPAR. Then there is the concern about abandoning SPAR and the licensee's getting what they want and then after SPAR is gone, how do we know that they will even keep the models. We don't even have a requirement that they have a PRA after all. This needs to be presented correctly. Just think if we get rid of SPAR and the licensee decides to deny us access to their models or abandons them. If we find problems with the licensee's models what do we do. There needs to be a legal requirement for the licensee's to have a PRA and it be of proper quality and we get access etc before embarking on this.

From: Circle, Jeff
Sent: Monday, November 30, 2015 1:47 PM
To: Demers, Jerrod <Jerrod.Demers@nrc.gov>; Gibbs, Russell <Russell.Gibbs@nrc.gov>; Hartle, Brandon <Brandon.Hartle@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Leech, Matthew <Matthew.Leech@nrc.gov>; Lyons, Sara <Sara.Lyons@nrc.gov>; Mitman, Jeffrey <Jeffrey.Mitman@nrc.gov>; Ng, Ching <Ching.Ng@nrc.gov>; Spore, Candace <Candace.Spore@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Wong, See-Meng <See-Meng.Wong@nrc.gov>; RES_DRA_PRB <RESDRAPRB@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Arner, Frank <Frank.Arner@nrc.gov>; Bernhard, Rudolph <Rudolph.Bernhard@nrc.gov>; Cahill, Christopher <Christopher.Cahill@nrc.gov>; Cook, William <William.Cook@nrc.gov>; Deese, Rick <Rick.Deese@nrc.gov>; Freeman, Scott <Scott.Freeman@nrc.gov>; Hanna, John <John.Hanna@nrc.gov>; Kozak, Laura <Laura.Kozak@nrc.gov>; Loveless, David <David.Loveless@nrc.gov>; MacDonald, George <George.MacDonald@nrc.gov>; Replogle, George <George.Replogle@nrc.gov>; Valos, Nicholas <Nicholas.Valos@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Ferrante, Fernando <Fernando.Ferrante@nrc.gov>; Gonzalez, Michelle <Michelle.Gonzalez@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Hudson, Daniel <Daniel.Hudson@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Leschek, Walter <Walter.Leschek@nrc.gov>; Li, Ming <Ming.Li@nrc.gov>; Ning, Lauren (Killian) <LaurenKillian.Ning@nrc.gov>; Sancaktar, Selim <Selim.Sancaktar@nrc.gov>; Wessels, Steven <Steven.Wessels@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>
Subject: Use of Licensee's Models

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intended to be forcing an opinion on whether or not to proceed but, will be advice on how to proceed with a program.

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I'm looking forward to hearing from you.

Jeff.

Jeff A. Circle
Chief (acting)
Probabilistic Risk Assessment Branch
RES /Division of Risk Analysis
(301) 415-1152
BB (b)(6)

Li, Ming

From: Li, Ming
Sent: Monday, November 30, 2015 2:21 PM
To: Circle, Jeff
Subject: Use both SPAR and Licensee's Models: Use of Licensee's Models

Jeff,

I echo Don Helton's concerns on independency issue of licensee's models and vote to use both SPAR and licensee's models in regulation, in particular for SDP and ASP. It is a no-brainer and common practice in digita world that having an independent review (also called independent verification and validation – IV&V) during the life cycle, for rigorous application developments. For instance, NASA has an IV&V facility located in West Virginia to review all Class A and B missions. I view the use of our SPAR models as the IV&V for licensee's models.

If the regulation only uses licensee's models, the IV&V of these models becomes mandatory. The effort and cost for such IV&V activities might be greater than maintaining current SPAR models, I believe.

This is just my two cents.

Thanks
Ming

Hudson, Daniel

From: Hudson, Daniel
Sent: Monday, November 30, 2015 2:08 PM
To: Circle, Jeff
Subject: Use both SPAR and Licensee's Models: Use of Licensee's Models

Jeff:

I think this is a great idea to using the voting options and to solicit feedback from internal stakeholders on this issue.

While I can certainly understand the value in using licensee PRA models for addressing questions related to plant-specific issues, there still seems to be a need for standardized PRA models that could be used to address questions related to generic or industry-wide issues; the SPAR models appear to be a potentially useful tool in this regard. While PRA standards exist to ensure different requirements are met for various PRA technical elements, there can be significant variability across the industry with respect to assumptions, methods, models, data, and analytical tools that are used to meet different capability categories and to address assessments of PRA technical adequacy.

Please let me know if you have any questions or concerns about my feedback.

Dan

Daniel W. Hudson, CAP, CPH
Reliability and Risk Engineer
U.S. Nuclear Regulatory Commission (RES/DRA/PRAB)

Office Location: TWFN/ T10 D37
Mail Stop: TWFN/ T10 A12
Phone Number: 301-415-2411

Nakoski, John

From: Nakoski, John
Sent: Monday, November 30, 2015 2:09 PM
To: Circle, Jeff
Subject: Use both SPAR and Licensee's Models: Use of Licensee's Models

SPAR models should be used exclusively for any ASP analysis. Both SPAR and Licensee models (or more to the point – results) should have an input into the SDP.

John

Gilbertson, Anders

From: Gilbertson, Anders
Sent: Monday, November 30, 2015 2:01 PM
To: Circle, Jeff
Subject: Use both SPAR and Licensee's Models: Use of Licensee's Models

Anders Gilbertson
Reliability and Risk Analyst
Division of Risk Analysis
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Phone: 301-415-1541
Fax: 301-415-6671
Anders.Gilbertson@nrc.gov

Circle, Jeff

From: Circle, Jeff
Sent: Monday, November 30, 2015 1:47 PM
To: Demers, Jerrod; Gibbs, Russell; Hartle, Brandon; Kichline, Michelle; Leech, Matthew; Lyons, Sara; Mitman, Jeffrey; Ng, Ching; Spore, Candace; Weerakkody, Sunil; Wong, See-Meng; RES_DRA_PRB; Coyne, Kevin; Arner, Frank; Bernhard, Rudolph; Cahill, Christopher; Cook, William; Deese, Rick; Freeman, Scott; Hanna, John; Kozak, Laura; Loveless, David; MacDonald, George; Replogle, George; Valos, Nicholas; Appignani, Peter; Ferrante, Fernando; Gonzalez, Michelle; Helton, Donald; Hudson, Daniel; Kuritzky, Alan; Leschek, Walter; Li, Ming; Ning, Lauren (Killian); Sancaktar, Selim; Wessels, Steven; Wood, Jeffery
Cc: Correia, Richard; Lund, Louise
Subject: Use of Licensee's Models

Tracking:

Recipient	Delivery	Read	Response
Demers, Jerrod	Delivered: 11/30/2015 1:47 PM		
Gibbs, Russell	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 1:58 PM	Use both SPAR and Licensee's Models: 11/30/2015 2:00 PM
Hartle, Brandon	Delivered: 11/30/2015 1:47 PM	Read: 12/01/2015 9:11 AM	Use only SPAR models: 12/01/2015 11:44 AM
Kichline, Michelle	Delivered: 11/30/2015 1:47 PM		Use only SPAR models: 11/30/2015 2:51 PM
Leech, Matthew	Delivered: 11/30/2015 1:47 PM	Read: 12/01/2015 6:29 AM	Use only SPAR models: 12/01/2015 11:52 AM
Lyons, Sara	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 1:58 PM	
Mitman, Jeffrey	Delivered: 11/30/2015 1:47 PM	Read: 12/01/2015 8:41 AM	Use only SPAR models: 12/01/2015 8:43 AM
Ng, Ching	Delivered: 11/30/2015 1:47 PM		
Spore, Candace	Delivered: 11/30/2015 1:47 PM	Read: 12/01/2015 7:23 AM	
Weerakkody, Sunil	Delivered: 11/30/2015 1:47 PM	Read: 12/01/2015 12:14 PM	
Wong, See-Meng	Delivered: 11/30/2015 1:47 PM		
RES_DRA_PRB			
Coyne, Kevin	Delivered: 11/30/2015 1:47 PM		
Arner, Frank	Delivered: 11/30/2015 1:47 PM	Read: 12/01/2015 3:34 PM	
Bernhard, Rudolph	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 2:07 PM	Use both SPAR and Licensee's Models: 11/30/2015 2:18 PM
Cahill, Christopher	Delivered: 11/30/2015 1:47 PM		

Recipient	Delivery	Read	Response
Cook, William	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 2:45 PM	Use only SPAR models: 12/01/2015 7:40 AM
Deese, Rick	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 1:57 PM	Use both SPAR and Licensee's Models: 11/30/2015 1:59 PM
Freeman, Scott	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 9:05 PM	Use both SPAR and Licensee's Models: 12/02/2015 7:50 PM
Hanna, John	Delivered: 11/30/2015 1:47 PM		Use both SPAR and Licensee's Models: 12/02/2015 3:08 PM
Kozak, Laura	Delivered: 11/30/2015 1:47 PM		Use only SPAR models: 11/30/2015 3:46 PM
Loveless, David	Delivered: 11/30/2015 1:47 PM		Use both SPAR and Licensee's Models: 12/01/2015 10:36 AM
MacDonald, George	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 2:17 PM	Use only SPAR models: 11/30/2015 2:35 PM
Replogle, George	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 3:12 PM	Use only SPAR models: 11/30/2015 3:14 PM
Valos, Nicholas	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 1:49 PM	
Appignani, Peter	Delivered: 11/30/2015 1:47 PM		Use only SPAR models: 12/01/2015 9:20 AM
Ferrante, Fernando	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 1:55 PM	
Gonzalez, Michelle	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 1:49 PM	Use only SPAR models: 12/01/2015 1:05 PM
Helton, Donald	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 1:58 PM	
Hudson, Daniel	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 1:55 PM	Use both SPAR and Licensee's Models: 11/30/2015 2:08 PM
Kuritzky, Alan	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 1:49 PM	Use only SPAR models: 11/30/2015 1:59 PM
Leschek, Walter	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 2:02 PM	Use only SPAR models: 12/01/2015 7:40 AM
Li, Ming	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 2:00 PM	Use both SPAR and Licensee's Models: 11/30/2015 2:21 PM
Ning, Lauren (Killian)	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 2:01 PM	Use both SPAR and Licensee's Models: 11/30/2015 4:59 PM
Sancaktar, Selim	Delivered: 11/30/2015 1:47 PM		

Recipient	Delivery	Read	Response
Wessels, Steven	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 3:54 PM	Use only SPAR models: 11/30/2015 6:05 PM
Wood, Jeffery	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 1:48 PM	Use only SPAR models: 11/30/2015 1:49 PM
Correia, Richard	Delivered: 11/30/2015 1:47 PM		
Lund, Louise	Delivered: 11/30/2015 1:47 PM	Read: 11/30/2015 2:36 PM	
David.Aird@nrc.gov	Delivered: 11/30/2015 1:47 PM		
Song-hua.Shen@nrc.gov	Delivered: 11/30/2015 1:47 PM		
Christopher.Hunter@nrc.gc	Delivered: 11/30/2015 1:47 PM		
Erulappa.Chelliah@nrc.gov	Delivered: 11/30/2015 1:47 PM		
Keith.Tetter@nrc.gov	Delivered: 11/30/2015 1:47 PM		
Dale.Yeilding@nrc.gov	Delivered: 11/30/2015 1:47 PM		
Brian.Wagner@nrc.gov	Delivered: 11/30/2015 1:47 PM		
Ian.Gifford@nrc.gov	Delivered: 11/30/2015 1:47 PM		
Anders.Gilbertson@nrc.gov	Delivered: 11/30/2015 1:47 PM		
Mary.Drouin@nrc.gov	Delivered: 11/30/2015 1:47 PM		
Don.Marksberry@nrc.gov	Delivered: 11/30/2015 1:47 PM		
John.Nakoski@nrc.gov	Delivered: 11/30/2015 1:47 PM		
Gilbertson, Anders		Read: 11/30/2015 1:48 PM	Use both SPAR and Licensee's Models: 11/30/2015 2:01 PM
Aird, David		Read: 11/30/2015 1:52 PM	Use only SPAR models: 12/01/2015 7:29 AM
Hunter, Christopher		Read: 11/30/2015 1:59 PM	Use both SPAR and Licensee's Models: 11/30/2015 2:14 PM
Nakoski, John		Read: 11/30/2015 2:07 PM	Use both SPAR and Licensee's Models: 11/30/2015 2:09 PM
Chelliah, Erulappa		Read: 11/30/2015 7:00 PM	Use both SPAR and Licensee's Models: 11/30/2015 7:10 PM

Recipient	Delivery	Read	Response
Tetter, Keith		Read: 12/01/2015 7:37 AM	Use only SPAR models: 12/01/2015 7:51 AM
Shen, Song-hua			Use only SPAR models: 12/01/2015 8:38 AM
Drouin, Mary		Read: 12/01/2015 10:37 AM	Use both SPAR and Licensee's Models: 12/01/2015 11:02 AM
Wagner, Brian			Use only SPAR models: 12/02/2015 12:58 PM

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Jeff.

Jeff A. Circle
Chief (acting)
Probabilistic Risk Assessment Branch
RES /Division of Risk Analysis
(301) 415-1152
BB (b)(6)

Wood, Jeffery

From: Ferrante, Fernando
Sent: Friday, November 20, 2015 10:57 AM
To: Circle, Jeff; Wood, Jeffery
Subject: RE: Summary of Meeting with Russ
Attachments: Summary notes for SDP Streamlining Public Meeting on November 17.docx; ROP WG Comments 11-17-15.docx

Jeff,

See attached. I also added notes from Michelle Kichline on this. Suggest sharing with Rich Correia and Louise Lund, as they like to be appraised when anti-SPAR comments are raised.

Thanks,
Fernando

From: Circle, Jeff
Sent: Wednesday, November 18, 2015 7:10 AM
To: Ferrante, Fernando
Subject: Summary of Meeting with Russ

Fernando,

When you get a chance (after the uncertainty workshop), could you please send me a summary of what went on with your meeting with Russ (and the ROP monthly presentation)?

Thanks,
Jeff.

Jeff A. Circle
Chief (acting)
Probabilistic Risk Assessment Branch
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(301) 415-1152
BB (b)(6)

Summary notes for SDP Streamlining Public Meeting on November 17

Participants: SDP Streamlining Team, NRC Staff, Industry

Notes:

- During introductions, Scott Morris stated that:
  - SDP is not perfect.
  - SDP is not meeting the original principles of the ROP.
  - SDP is not always predictable.
  - There is overreliance on imperfect quantitative models with too many uncertainties and assumptions (too risk-based); as well as questions about model inadequacies. There is too much. churning to get to the "perfect" answer and that there are issues with internal discipline
  - He agrees with assessments that we are using too many resources in a time of declining budgets and that we need to reassess where we are as a regulator. That there are ways to be more efficient and that Project Aim 2020 is giving a push to do so.
  - He believes the Commission has given the staff a mandate to change SDP.
  - Not all performance deficiencies are created equal but more uniformity is needed on determination.
  - Time it takes to identify a PD is a problem.
  - BPI effort on SDP had 14 recommendations but left him wanting; effort did not get to core issues.
  - There is pushback from one Commissioner that this sounds like a SALPish effort to get rid of PRA models. The Commissioner was identified as Svinicki by Scott.
  - NRC SDP Streamlining Team Charter will be made public.
  - Wants to "get on with it"

- Industry expressed concerns about use of qualitative aspects. Asked if a lean sigma six process was performed.
-
- Scott Morris stated that we need to recognize when model has entry conditions (?) and what are the inherent unknowns in the model and that we have not been good about that (?). Stated that model can be useless on the outcome and that this is not SALPish and that we are advertising this as a risk-informed effort.

- Industry said it wants to be forward-looking.

- Scott stated that SDP is not predictive and that what industry is saying is counter to the ROP purpose. That what we need is to get to narrower probability distributions with a small sigma (?). But that we are willing to contemplate an incentive for findings to not stay in the action matrix for as long as they currently are.

- Scott stated that we looked at data since 2000, and that number of GTG findings is about the same amount while resources have gone up. Stated this has to stop.

- NEI stated that scope is not clear, i.e., is this about SDP once PD is defined or something else. They also questioned whether we understand that the real issue is the time it takes for industry to get a clear statement from the NRC on what the PD is.

- Russ stated that SDP is not PRA and that he wants to pursue this (?).

- Russ made a presentation where it was stated that:
    - SDP is not broken
    - NRC is not following process
    - Using PRA can be quite objective but needs other factors
    - We are not going to depart from PRA; in some cases PRA works quite well. We need to retain this.
    - We have significant outliers (15 months).
    - External flooding and external events in general is a problem.
    - Received 100 suggestions from Regions and HQ.

- NEI requested to see data on SDP. NRC stated this may be difficult. NEI pressed on the issue.

- TVA rep questioned whether NRC Regions are consistent on SDPs or if there are differences. Russ stated that there are differences and consistency problems; and that risk analysts vary in experience. TVA rep questioned if SRAs are being managed differently. Russ stated that this is the case. NEI again asked to see the data.

- Scott Morris stated we have played games with the clock.

- PWROG rep stated that he sees the problem as an issue of properly identifying the PD.

- Russ stated concept that having more experience should lead to less resources. NEI questioned this premise. Another industry rep stated that White Findings today are not the same as 10 years ago, so this idea may be questionable.

- NextERA rep stated that he is not convinced there is a problem or that NRC has identify causal analysis of what is producing delays; and that there is a need for debate on complicated issues.

- Questions about use of SPAR models were discussed. Russ stated that we need SPAR models. Fernando provided supporting arguments. Some industry reps indicated fatigue with the discussion of SPAR models versus licensee models. PWROG rep indicated he agrees that SPAR models are OK. Another industry rep raised issues on external events. Fernando responded.

- Industry questioned potential use of OpE. Concerned about unintended consequences. Several reps expressed concern that move towards qualitative will produce more subjective decisions and less objectivity provided by PRAs. Industry again questioned meaning of White Findings today as opposed to 10 years ago.

- Industry pressed on specific factors for delays. Column movement in the action matrix, findings staying in the books for too long were cited; as well as PD definition taking too long. Recommendation on SDP/MSPI overlap was discussed.

- An issue was raised on why the NRC is resisting discussions on use of CCDP versus delta CDF. Strong dissatisfaction was expressed on outcome of May 2015 meeting and questions were brought up on current NRC path on this and lack of discussions with industry.

- Industry stated they are piloting the aggregation report effort in January 2016 and asked if NRC had read report. Fernando responded.

- Industry questioned if NRC should be so focused on metric of 90 days and if it should consider time it takes for complicated factors, once a clear causal factor is identified.

- Industry questioned inclusion of "regulatory implications" in the list on RG1.174 and its meaning.

- PWROG rep stated that SDP Phase 2 spreadsheets should be brought back, that they were good communication tools.

- Industry said there is a wrong level of communication taking place and that Site VP are discussing SDP issues with NRC inspectors. They stated NRC should improve this and that high level NRC management should be the ones doing the communication work, not the site inspectors.

- TVA rep expressed concern at amount of work done for fire and Appendix F and whether we plan to make qualitative arguments for fire-related issues. Russ stated that we are not going to toss the PRA.

- Industry questioned why the NRC is not planning to "back-test" new ideas with previous SDPs or if tabletops are planned before a pilot takes place. Multiple questions surfaced on NRC's plan to perform a pilot.

- Russ stated at the conclusion that another meeting with industry, including a potential workshop would be pursued to get more ideas. NEI rep stated that he was not clear on what the

NRC was planning or asking for. Russ stated that we need another meeting to discuss how do we get process to deliver what it is supposed to be already doing today (?).

ROP Working Group Public Meeting
Comments and Concerns Regarding SDP Streamlining Project
November 17, 2015

- It takes too long to get a clear statement of the performance deficiency (PD).
- The regional offices each deal with SDPs differently.
- The NRC should use licensee PRA models to determine SDP risk significance like was done before the NRC had SPAR models.
- Use of SPAR models makes the SDP take longer because the SPAR models are inaccurate.
- Licensee PRA models and NRC SPAR models often has very similar results when the same assumptions are used. The licensee and NRC need to understand and agree on the assumptions associated with the PD.
- Assumptions related to common cause failure (CCF) and human reliability analysis (HRA) are often highly debated between the NRC and licensees.
- SPAR models are unnecessary because they cannot model external hazards and the licensee can submit their risk results under oath and affirmation.
- How will the NRC ensure that the SDP changes do not result in a different regulatory outcome?
- Will the use of qualitative factors in decision making lead to more white findings?
- Use of Appendix M is tantamount to the NRC just picking a color.
- Some SDPs are redundant to what is counted in MSPI.
- The best available information is not always accurate. For example, for the flooding findings the only available information was from the IPEEEs and new calculations were necessary in order to understand the hazard.
- Color ranges don't overlap in SDP.
- Sometimes testing is needed in order to determine the impact of a PD on the equipment. For example, when clam shells were found in the suction line to a pump, testing was necessary to determine the impact on the operation of the pump. Testing identified the pump could pump clam shells.
- No ideas were offered regarding other factors that could be used in risk-informed decision making (RIDM).
- The scope of the regulatory conference is too narrow and does not allow the licensee to present the arguments they really want to present. The regulatory conference should allow discussion of additional factors if the factors used to determine the significance is changed.
- Bring back the Phase 2 SDP worksheets to simplify the process.
- NRC senior management should engage with plant senior management earlier in the process because the site starts to expend considerable resources when PD is identified.
- The process should be run as a tabletop before it is piloted.

Nakoski, John

From:	Coyne, Kevin
Sent:	Wednesday, November 18, 2015 11:50 AM
To:	Lai, John
Cc:	Nourbakhsh, Hossein; Circle, Jeff; Nakoski, John
Subject:	Follow-up from Today's Meeting on PRA Research
Attachments:	NUREG-1925 Draft Rev 3 PRA Info Sheets.pdf; Letter to NEI on use of SPAR Models_ML072490540.pdf; FCXFI-26100-1751494-1-PSAM-11-ESREL-2012-Risk communication rev7d.pdf

John –

Thanks for setting up the meeting with John Stetkar – good discussions. In the way of follow-up, here's the additional materials we discussed:

- I've attached all the draft PRA info sheets for the next version of NUREG-1925. I realized I had also left out the seismically induced fires and floods sheet in addition to the digital I&C PRA sheet. You should have them all electronically now.

- I've attached the letter to NEI discussing SPAR models vs. licensee models for agency use. Although the lette is several years old, the issue comes up every few years. As I indicated, the staff is reevaluating the issue in lig of recent questions that have been raised. The biggest issues that need to be considered are maintaining independence in our assessments, the efficiencies we gain by having a standardized set of modeling conventions in SPAR (which greatly assists our risk analysts in being able to competently use numerous models), and accessibility of licensee PRA models to the staff.

- The link to the publically available pre-publication version of NUREG-1855, Revision 1, can be found at: https://adamsxt.nrc.gov/WorkplaceXT/getContent?id=current&vsId=%7B8A6F2A54-F994-468F-8568-A5C1C9168351%7D&objectStoreName=Main. .Library&objectType=document (note that this is not the final published NUREG-1855, Rev 1)

- The paper on risk communication that discuses an example of communicating uncertainty information is attached. The paper was presented at PSAM-11 in Helsinki in 2012. The uncertainty example I discussed is near the end of the paper.

- OECD NEA/CSNI reports can be found at: https://www.oecd-nea.org/nsd/docs/indexcsni.html The following recent WGRISK reports may be of interest:
  - NEA/CSNI/R(2015)12, "International Workshop on FIRE PRA Workshop Proceedings" (not on web page ye but will be posted soon)
  - NEA/CSNI/R(2015)1, "Joint CSNI WGHOF/WGRISK report on Establishing Desirable Attributes of Current Human Reliability Assessment (HRA) Techniques in Nuclear Risk Assessment," (https://www.oecd-nea.org/nsd/docs/2015/csni-r2015-1.pdf)
  - NEA/CSNI/R(2014)16, "WGRISK Task DIGREL - Failure modes taxonomy for reliability assessment of digi I&C systems for PRA" (https://www.oecd-nea.org/nsd/docs/2014/csni-r2014-16.pdf)
  - NEA/CSNI/R(2014)9, "PSA OF NATURAL EXTERNAL HAZARDS INCLUDING EARTHQUAKE Workshop proceedings" (https://www.oecd-nea.org/nsd/docs/2014/csni-r2014-9.pdf)
  - NEA/CSNI/R(2014)2, "Use of OECD Data Project Products in Probabilistic Safety Assessment" (https://www.oecd-nea.org/nsd/docs/2014/csni-r2014-2.pdf)
  - NEA/CSNI/R(2012)17, "A Joint Report on PSA for New and Advanced Reactors" (https://www.oecd-nea.org/nsd/docs/2012/csni-r2012-17.pdf)
  - NEA/CSNI/R(2012)15, "PSA KNOWLEDGE TRANSFER" (https://www.oecd-nea.org/nsd/docs/2012/csni-r2012-15.pdf)
  - NEA/CSNI/R(2012)11, "Use and Development of Probabilistic Safety Assessment An Overview of the situation at the end of 2010" (https://www.oecd-nea.org/nsd/docs/2012/csni-r2012-11.pdf)

There are many other reports on the webpage that may also be of interest. As I mentioned, the NRC is a very active contributor to WGRISK and has either led or served on the core project team for most of the above activities.

Let me or Jeff know if you have any other questions or need additional information –

Kevin

Kevin Coyne, P.E., Ph.D.
Acting Deputy Director, Division of Preparedness and Response
Office of Nuclear Security and Incident Response
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
(301) 415-2478 (work)
(b)(6) *(cell)*

Ferrante, Fernando

From: Kozak, Laura
Sent: Tuesday, November 17, 2015 5:28 PM
To: Shuaibi, Mohammed
Cc: Ferrante, Fernando
Subject: SDP Streamlining
Attachments: Findings.docx; lochbaum-20151117.pdf

Mohammed, Fernando

I listened to the public meeting today. Very interesting with some good feedback from industry. I have a number of thoughts but need to collect them and will provide more feedback.

But, one thing really struck me – the idea that the use of the "other factors" is needed because we spend excessive resources arguing over the green-white threshold. I have found no evidence that this is the case or is driving the NRC to be untimely. I have attached a quick analysis that I did on the last 5 years of findings in RIII that looked at our data. You have probably seen this before. As you know, 8/16 findings in RIII would not have met the "new" metric. In no case, was it because of arguing about the threshold or trying to pinpoint the risk. In many cases, we are significantly different from licensees (largely due to input assumptions, as discussed).

Just to refresh, the drivers of the "untimeliness" were mostly time spent to define the PD and impact to the plant and the licensee distractions. The licensees were very clear today – a white finding is not just 40 hours of inspection and they will spend a lot of effort to avoid them. But that is an action matrix issue, not an SDP issue.

I also attached a presentation from David Lochbaum at today's Commission meeting. Page 15 presents a table which compares NRC risk estimates with licensee risk estimates. Although not completely accurate, it is good enough for discussion. It shows that not only are we not near thresholds, but we are not really very close to the licensee at all, similar to my analysis.

I copied Fernando since of all on the working group, he is in the best position to help identify the real problems with timeliness and potential solutions. Fernando – if you have any questions on the table I developed, give me a call.

Laura

Conclusions

- 8/16 findings did not meet the 150 day metric from event/degraded condition known to NRC.

- **Based on a review of SDP cases since 2010, there is no evidence to support a claim that excessive time is being spent evaluating and analyzing SDP results that are close to a color threshold.** Of the 16 findings, the NRC and licensee risk estimates were close (e.g., within a half order of magnitude) in only one case – LaSalle LOCHS. Note that this risk evaluation was straightforward. The cause of the extra time from the event to preliminary determination was related to PD/finding definition and not to the time required to perform a detailed risk analysis or due to excessive interaction with the licensee.

Non Responsive

- **Licensees are significantly adding extra time and resources by providing information and perspectives that by current IMC 0609 process is required to be considered.** 5 of the 16 findings were at NextEra plants (Duane Arnold, Point Beach). In all cases, NextEra repeatedly engaged regional staff and managers to provide new/additional engineering or PRA information. This has occurred with other licensees as well but to a lesser extent.

- Non Responsive

Actions to Streamline

- Non Responsive

Greater than Green Findings involving Detailed Risk Analysis – 2010 – 2015

Finding	Regulatory Conference Held?	NRC Estimate	Licensee Estimate	Difference in NRC – licensee risk estimates	Days from event/condition identified to preliminary determination letter	Factors Influencing Time to Issuing Preliminary Determination
Clinton Service Water Pump	Y	5.5E-6	No specific estimate.	N/A	242	Needed ACE to determine if failure was the result of a PD. Significant interaction with licensee engineering staff on root cause Other – Appears finding was identified during LER closeout.
DAEC Torus Delamination	N	1.0E-5	5E-7 – draft analysis; not submitted on docket	Over one order of magnitude	124	SIT initiated per MD8.3 process. PD clearly identified during the inspection. Significant interaction with licensee engineering staff on past operability
Dresden ERV	N	2.85E-6	4.4E-6	No real difference	62	Needed ACE to determine if the failure was the result of a PD.
DAEC RCIC	Y	3.5E-6 (preliminary) 1.7E-6	3.0E-7	One order of magnitude	146	Other - Government shutdown occurred during the preliminary

Finding	Regulatory Conference Held?	NRC Estimate	Licensee Estimate	Difference in NRC – licensee risk estimates	Days from event/condition identified to preliminary determination letter	Factors Influencing Time to Issuing Preliminary Determination
		(final)				risk evaluation of this finding.
LaSalle Loss of Condenser Heat Sink	N	1.6E-6	9.7E-7	No real difference	204	Other - Risk evaluation of this finding very straightforward. Other – Finding appeared to be identified through LER closeout. Likely that RCE/ACE needed to identify PD.
DAEC EDG	Y	3.7E-6	6.2E-8	Over one order of magnitude	206	RCE needed to determine if the failure was due to a PD. Significant interaction with licensee engineering on root cause. Significant interaction with licensee PRA
Point Beach External Flooding	Y	1.8E-5 (preliminary) Final White	3E-7 (preliminary) 1.0E-8 (regulatory conference)	Over one order of magnitude	197	Other - Initially a URI issued to gather more information from the licensee to determine if PD existed. Then an AV/TBD was issued, followed by a preliminary determination letter.

Finding	Regulatory Conference Held?	NRC Estimate	Licensee Estimate	Difference in NRC – licensee risk estimates	Days from event/condition identified to preliminary determination letter	Factors Influencing Time to Issuing Preliminary Determination
						Appendix M used. Significant interaction with licensee engineering staff Significant interaction with the licensee PRA staff
Dresden External Flooding	N	7.5E-8 to 3.6E-5 (White)	No specific estimate. Provided perspectives on NRC assumptions. (Green)	N/A	167	Other - Finding evolved from observations during the TI on flooding walk downs. Two rounds of docketed questions to the licensee followed Appendix M used.
Monticello External Flooding	N	3.6E-5	8.9E-7 to 2.6E-6	Over one order of magnitude	116	Other - Performance deficiency clearly identified as a result of the TI on flooding walkdowns. Appendix M used.
Point Beach TDAFW pump	N	8.7E-6	Draft 5E-7 with "qualitative" fire risk	Over one order of magnitude	197	Root cause need to determine if the failure was a result of the PD.

Finding	Regulatory Conference Held?	NRC Estimate	Licensee Estimate	Difference in NRC – licensee risk estimates	Days from event/condition identified to preliminary determination letter	Factors Influencing Time to Issuing Preliminary Determination
						Significant interaction with licensee PRA staff
Palisades loss of DC bus event	Y	1.6E-5	Draft 5E-6 At regulatory conference 6E-6	Half an order of magnitude	65	SIT initiated per MD8.3 process. PD clearly identified during inspection.
Palisades SW coupling failure	Y	5.4E-6	9.3E-7	Half an order of magnitude	112	RCE and additional testing results needed to determine if failure was the result of a PD.
Palisades TDAFW pump	N	3.4E-6	4.8E-7	Almost one order of magnitude	171	ACE needed to determine if failure was the result of a PD.
Prairie Island Battery Chargers	Y	1.9E-6	4.5E-8	Over one order of magnitude	130	Significant interaction with licensee engineering staff Significant interaction with licensee PRA staff
Prairie Island Internal Flooding	Y	E-5 (preliminary GTG) Final – White	E-6 (but argued baseline risk due to no PD)	No real difference (final)	295	Significant interaction with licensee engineering staff Significant interaction with licensee PRA staff
Byron EDG	N	2.9E-6	None provided. Licensee indicated result would be greater than 1E-6	N/A	86	ACE needed to determine if failure was caused by a PD.

Notes on table:

Most data on times taken from NRR spreadsheet. Some of the times may be longer than indicated because a URI was initially used to track the issue.

Influencing Factors Defined

Root/Apparent Cause evaluation needed to determine if failure is caused by a PD – Was the cause evaluation needed to determine if the failure was the result of a PD or was the PD obvious during the initial inspection of the event/failure?

SIT performed – If an SIT was performed it was noted.

Significant interaction with licensee engineering staff - Licensees conducted additional engineering analyses and engaged NRC to show 1) no PD; 2) no impact of degraded condition on function of the SSC; or 3) to limit the scope of a risk evaluation to a limited set of scenarios (e.g., exposure time limited).

Significant interaction with licensee PRA staff – Licensee repeatedly engaged the SRAs with new/additional risk information or questions about NRC preliminary analysis

Appendix M used – Was Appendix M used in the SDP evaluation?

Other factors – Miscellaneous factors that may have influenced the timing.

From: Helton, Donald
To: Siu, Nathan
Subject: holistic view of code development/use
Date: Tuesday, November 17, 2015 9:20:00 AM

Nathan,

You were so kind as to seek my thoughts on a half-formed idea (Siri-risk), so now I want to get your kneejerk on a much simpler item...part of what has been bothering me about the rebaselining activities, the SDP streamlining, and the related to-kill-SPAR-or-not-to-kill-SPAR discussions, is that I've no basis to judge the value of the risk assessment tools against other things that we spend equivalent resources on. A holistic view is perhaps not feasible, fine...but have you seen anything like the table I threw together below (just an example, it is wildly incomplete), and if not, do you see any value in something like this?

Thx,
Don

Operating Reactors			
	Independent models used	Rely on audit/review of licensee models	Computer models not used
Risk assessment – Licensing		X	
Risk assessment - Oversight	X (SAPHIRE/SPAR)		
Severe accidents	X (MELCOR, MACCS)		
Design-basis accident analysis	X (TRACE, SNAP, RELAP5, SCALE, PARCS, FRAPCON, FRAPTRAN)		
Fire protection	X (FDS, etc.)		
Emergency preparedness		X	
Incident response	X (RASCAL)		
Radiation protection	X (RADTRAD, VARSKIN, HABIT)		
Spent Fuel Pools	X (MELCOR, SCALE)		
Dry cask storage	X (CFD, SCALE, MCNP)		
Environmental modeling	X (RESRAD)		
Component Integrity			
...			

Don Helton
Office of Nuclear Regulatory Research
US Nuclear Regulatory Commission
(301) 415-1545

Tetter, Keith

From: Weerakkody, Sunil
Sent: Friday, November 13, 2015 7:27 AM
To: Circle, Jeff
Cc: Coyne, Kevin; Nakoski, John; Hunter, Christopher; Tetter, Keith; Lane, John; Correia, Richard; Lund, Louise; Peters, Sean; Appignani, Peter; Mitman, Jeffrey; Montecalvo, Michael; Humberstone, Matthew
Subject: RE: Key Messages on the Crediting Mitigating Strategies.docx

Thanks Jeff. We understand and agree with the perspective provided.

Sunil D Weerakkody, Chief
PRA Operations & Human Factors Branch
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission

Address: Mail Stop O-10 C-15, US NRC, Washington DC 20005-0001

Tel: 301-415-2870
Black Berry: (b)(6)

From: Circle, Jeff
Sent: Friday, November 13, 2015 7:05 AM
To: Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>
Cc: Coyne, Kevin <Kevin.Coyne@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>; Hunter, Christopher <Christopher.Hunter@nrc.gov>; Tetter, Keith <Keith.Tetter@nrc.gov>; Lane, John <John.Lane@nrc.gov>; Correia, Richard <Richard.Correia@nrc.gov>; Lund, Louise <Louise.Lund@nrc.gov>; Peters, Sean <Sean.Peters@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>
Subject: RE: Key Messages on the Crediting Mitigating Strategies.docx

Sunil,

Since I don't plan on attending the meeting, I would like to add to what John has said in the attachment with one simple thought which had been brought up by Marty Stutzke earlier. My concern, independent of whether we decide to use SPAR vs. licensees' models for SDP, is that we might be faced with a situation where each licensee has a unique method and application of FLEX as their ELAP mitigation strategy. Since these are highly dependent on operator action, the complexity lies in modeling HRA. And, this is clearly not a 'one size fits all' situation. We do know since licensees have invested a great deal in making these preparations, it's obvious that they would want to credit these measures outside of the beyond-design-basis events such as with the SDP. Unlike risk-informed license amendments, models used for SDP currently do not have a R.G. 1.200 requirement. My feeling is that the workshop should explore other, more cost effective methods and guidelines that we (the agency) could employ in modeling and reviewing any future credit for FLEX outside of its original intended function.

Jeff.

From: Nakoski, John
Sent: Thursday, November 12, 2015 6:21 PM
To: Weerakkody, Sunil
Cc: Coyne, Kevin; Circle, Jeff; Hunter, Christopher; Tetter, Keith; Lane, John; Correia, Richard; Lund, Louise; Peters, Jean; Appignani, Peter
Subject: Key Messages on the Crediting Mitigating Strategies.docx

unil,

tached are my thoughts on crediting mitigating strategies in risk informed decision making. They are my dependent thoughts and do not reflect the more intuitive understanding of the challenges that we would counter to give credit that others in my branch may have. I will use these as the foundation for my scussions at tomorrow's meeting.

ɔn

Key Messages on the Crediting Mitigating Strategies and equipment in risk-informed decision making with regard to risk-informed decision-making and the ASP Program:

1. Mitigating Strategies and the use of associated equipment can conceptually be given credit in the ASP Program to assess operating events, equipment failures, and performance deficiencies.

2. Information is needed on the procedures, training, reliability, and conditions under which the equipment and operators will be required to implement the mitigating strategies and equipment.

3. Effective implementation would likely require a standardized modelling approach to PRA, like the SPAR models. The use of licensee models would likely be far less effective and efficient as the time it takes and the required knowledge and skills to be able to understand and manipulate licensee models would exceed the current capabilities of the NRC PRA community.

4. Credit given is likely not to be the same as safety related equipment and will be driven by the data available to demonstrate the reliability of the equipment and the demonstrated performance of the operators in using the equipment under the conditions expected to be encountered during the beyond design basis events. This is akin to the credit given to compensatory measures during a NOED – short term fixes to allow continued operation in a degraded state using alternative means to achieve a desired safety objective.

5. Use of the mitigating strategies associated equipment and procedures to compensate for the failure of installed safety related equipment is probably a good idea – it will train the operators to think about how to use this equipment, help them become familiar with it, and given them confidence in its ability to effectively mitigate beyond design basis events.

6. Conceptually, the staging and planning to use non-traditional, non-safety-related equipment for beyond design basis events enhances public health and safety by given the operators additional tools to help them cope with events that could occur for which we have not planned in advanced (cope with the unknown or unknowable).

7. Developing the tools and models to support the crediting of mitigating strategies in risk-informed decision-making is likely to be very complex and challenging, warranting the commitment of significant staff and contractor resources over a number of years.

Appignani, Peter

From: Appignani, Peter
Sent: Tuesday, November 10, 2015 8:42 AM
To: Coyne, Kevin (Kevin.Coyne@nrc.gov)
Subject: FW: SPAR Vs Lic PRA cost comparison - initial draft
Attachments: Cost comparison SPAR vs Lic models.xlsx

Kevin

The email thread to get you up to date (see below) and my cost estimates attached

Pete

From: Correia, Richard
Sent: Tuesday, November 10, 2015 6:43 AM
To: Circle, Jeff <Jeff.Circle@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Schroer, Suzanne <Suzanne.Schroer@nrc.gov>; Siu, Nathan <Nathan.Siu@nrc.gov>; Stutzke, Martin <Martin.Stutzke@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>
Cc: Helton, Donald <Donald.Helton@nrc.gov>
Subject: RE: SPAR Vs Lic PRA cost comparison - initial draft

Thanks all for making this a high priority. I supports Jeff's recommendations.

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Circle, Jeff
Sent: Monday, November 09, 2015 1:53 PM
To: Appignani, Peter <Peter.Appignani@nrc.gov>; Correia, Richard <Richard.Correia@nrc.gov>; Schroer, Suzanne <Suzanne.Schroer@nrc.gov>; Siu, Nathan <Nathan.Siu@nrc.gov>; Stutzke, Martin <Martin.Stutzke@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>
Cc: Helton, Donald <Donald.Helton@nrc.gov>
Subject: RE: SPAR Vs Lic PRA cost comparison - initial draft

Pete,

Thanks. That is a good start, I like it. Whatever is decided, this will help in giving the decision-makers a complete picture of what the various issues are. To help facilitate the decision and how to proceed with the inevitable pilot project, I was thinking of including a sheet of all the compiled assumptions that were made in developing the spreadsheet along with areas that can increase (or decrease) the added cost. One important one which had crossed my mind is item 7 on technical support. We know that SRAs will need to have someone support them on making changes to the model for those more esoteric findings. In the past, it was Bob Buell, Jim Knudsen, or John Schroeder. Who will it be on a licensee-sourced model? How much will it cost us in development costs? Also, are we assuming that the models that we get will from licensees have the same scope as what is currently out there? For example, what will happen in the future should a licensee with an internal events only model decide to develop an all-hazards model? How much additional work will be required on our part to ensure that the model is compatible with our needs? All these should be added to the assumptions list.

At the risk of sounding too gung-ho, my feeling is that we should all plan to meet in the near future to further discuss this and other related issues.

Jeff.

Jeff A. Circle
Chief (acting)
Probabilistic Risk Assessment Branch
RES /Division of Risk Analysis
(301) 415-1152
BB (b)(6)

From: Appignani, Peter
Sent: Monday, November 09, 2015 12:18 PM
To: Correia, Richard <Richard.Correia@nrc.gov>; Schroer, Suzanne <Suzanne.Schroer@nrc.gov>; Siu, Nathan <Nathan.Siu@nrc.gov>; Stutzke, Martin <Martin.Stutzke@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>; Circle, Jeff <Jeff.Circle@nrc.gov>
Cc: Helton, Donald <Donald.Helton@nrc.gov>
Subject: SPAR Vs Lic PRA cost comparison - initial draft

All

As requested at last week's meeting, please find attached my initial draft comparing the current costs of the SPAR models to the costs associated with using the licensee's PRAs.
The spreadsheet contains two worksheets; one for the current costs and one assuming we use the licensee's models(s). Current costs are based on the costs of the current contracts with INL (Kevin's Summary)
I included a basis (an assumption) for each cost associated with using the licensee's models and also segregated initial costs from ongoing costs.
I have not figured out how to handle Technical Support costs for tech support similar to the support INL is currently providing, thus it is blank for now.

Pete

Initial costs	Ongoing Annual costs	
$12,864,000		1.Review Licensee PRAs (assumes 80 different PRAs) - A typical Level 1 industry peer review takes approximately 75 person/days (5 people for about 3 weeks) Staff will need to gain an in-depth understanding of each unique model, including • Modeling assumptions • Modeling conventions • Naming schemes (basic events, fault trees, event tress, etc.) • Post processing rule construction Note: loss of standardization may require additional SRAs - see item 8 below
	$1,286,400	Review updated/revised PRAs (assume 10%/year)
$2,229,760	$1,114,880	2. Coordinate logistics with industry and staff (assumes 4 FTE initially, then 2 FTE ongoing) Receive and process submittal (assumes the models will be proprietary) Create and manage reference library (assumes both digital and hardcopy) Coordinate review of revised PRA Duplicate and distribute models and software Industry User Groups (software, others) Provide limited Technical Support to SRAs
$1,672,320	$836,160	3. RASP Handbook Revisions- Provides for uniformity of assessments - based on the Standardized SPAR Models Assumes 3 FTE for initial major revision and 1.5 FTE for at least the first few years
		4. Software Licensee's
$10,000	$10,000	CAFTA (EPRI) - includes FTREX, actual current cost
$10,000	$10,000	WinNUPRA (Scientech) - estimated
$10,000	$10,000	Riskman (ABS Consulting) - estimated
$10,000	$10,000	RiskSpectrum (Lloyd´s Register Consulting, Sweden) - estimated (may not be needed)
		5. Training on new software (initial training assume 5 days each for 25 staff)
$268,000	$53,600	CAFTA (EPRI)
$268,000	$53,600	WinNUPRA (Scientech)
$268,000	$53,600	Riskman (ABS Consulting)
$268,000	$53,600	RiskSpectrum (Lloyd´s Register Consulting, Sweden) (may not be needed)
	$385,920	6. Loss of SAPHIRE reporting features and other automation tools (assume 36 in-depth SDPs/year) Additional time required to perform and document each analyses (assumes 40 extra hours per evaluati Includes offline computation reviews
	$0	*7. Technical support - similar to current support provided by INL*
$17,878,080	**$3,877,760**	**TOTAL assuming no additional SRAs**
	$2,229,760	8. One additional SRA per Region
$17,878,080	**$6,107,520**	**Total if additional SRAs are required**

Assumptions;
$268/hour Fed Register hourly rate 6/30/2015, 80 FR 37431
2080 hours = 1 FTE

Current SPAR Model Costs

		Per year costs
<u>Base Resources (i.e., minimum requirements for the program):</u>		
• SPAR Model Configuration/Quality Control and User Support Help Desk ~$500k/year – Help desk handles ~ 2 calls/day from SRAs – Ensures model version control and maintains INL Website – Performs model updates to support specific SDP/ASP activities (~30 models were updated to support a specific analysis in FY2015). These updates are often highly specific to the event/condition that occurred and would also need to be performed for a licensee PRA model		$500,000
• SAPHIRE QA and User Support ~$300k/year – Maintain NUREG/BR-0167 QA program – User help desk Support		$300,000
	SUBTOTAL	$800,000
<u>Resources needed to Support Specific User Enhancements:</u>		
• Model Updates to Reflect Significant Plant Changes (~12 models/year) - ~$250k – Incorporate station blackout EDGs – Battery charging generators – Significant model upgrades		$250,000
• External Hazard and Fire Models - ~ $400k/year – Add NFPA 805 fire modeling – Add seismic and high wind model capabilities		$400,000
• SAPHIRE Enhancements ~$300k /year – New reporting features and code capabilities		$300,000
• Data Updates (performed every 3 years) - ~$500k (every three years) – Upgrade SPAR models to reflect most recent operating data – Update model documentation and Plant Risk Information eBooks (PRIBs) – General model cleanup/improvements		$166,667
	SUBTOTAL	$1,116,667
	TOTAL	$1,916,667

Coyne, Kevin

From: Coyne, Kevin
Sent: Monday, November 09, 2015 4:54 PM
To: Kuritzky, Alan
Subject: RE: EDO Update

On the bright side, the Level 3 PRA project is in the clear...

From: Kuritzky, Alan
Sent: Monday, November 09, 2015 4:21 PM
To: Coyne, Kevin <Kevin.Coyne@nrc.gov>
Subject: RE: EDO Update

Hmmm.....Dumping the SPAR models made it into the EDOs update as an example of something to streamline the ROP. Not particularly encouraging.

From: EDO Update [mailto:nrc.announcement@nrc.gov]
Sent: Monday, November 09, 2015 3:35 PM
To: Kreuter, Jane <Jane.Kreuter@nrc.gov>
Subject: EDO Update

EDO Update

Monday, November 9, 2015

Today I want to talk more about the progress we are making on Project Aim 2020 — specifically re-baselining.

As I mentioned in my Monday, October 5, 2015, update, the Project Aim Team solicited ideas from staff and external stakeholders regarding what the NRC could shed, do better, do faster, and do with fewer resources. In addition to comments provided by external stakeholders, we received over 300 creative re-baselining suggestions from NRC staff. In the regulatory program area, the predominant themes involved rulemaking and the Reactor Oversight Process (ROP). Within rulemaking, we received many suggestions for improving the rulemaking prioritization process and to re-evaluate the merit of some individual NRC rulemaking efforts. Suggestions regarding changes to the ROP included reducing inspection hours, modifying the Force-on-Force inspection program, reducing the time spent on mid-cycle reviews, and leveraging industry risk models in place of using NRC standardized plant analysis risk models.

In the non-regulatory program area, comments addressed several topics including opportunities to save money, time, and resources by using a digital correspondence process. Some of these suggestions represent "quick wins" that can achieve cost savings in relatively short order. One suggestion provided was to create electronic NRC letterhead document templates. Those templates exist and we are improving them. Over the coming weeks, you will see announcements about the availability and use of these templates. Other suggestions involve saving paper and reducing the size of briefing packages by printing on both sides (already being implemented) and using a projector rather than printed slides. Another area of feedback was to consider alternative approaches to our current annual performance appraisal process. The Project Aim Team forwarded all suggestions received to the cognizant offices for their consideration as they implement re-baselining and common prioritization (the Project Aim activities for identifying potential efficiencies and work that can be shed).

Thanks again to everyone who contributed their insightful and innovative suggestions for sheds, improvements, and efficiencies. As results are achieved, we will be sharing more on the outcomes of the re-baselining and common prioritization effort, as well as other Project Aim 2020 tasks that are being implemented now and in the near future. You can find more information, including the latest monthly update, here.

Victor McCree, EDO

Siu, Nathan

From: Circle, Jeff
Sent: Monday, November 09, 2015 1:53 PM
To: Appignani, Peter; Correia, Richard; Schroer, Suzanne; Siu, Nathan; Stutzke, Martin; Nakoski, John
Cc: Helton, Donald
Subject: RE: SPAR Vs Lic PRA cost comparison - initial draft

Pete,

Thanks. That is a good start, I like it. Whatever is decided, this will help in giving the decision-makers a complete picture of what the various issues are. To help facilitate the decision and how to proceed with the inevitable pilot project, I was thinking of including a sheet of all the compiled assumptions that were made in developing the spreadsheet along with areas that can increase (or decrease) the added cost. One important one which had crossed my mind is item 7 on technical support. We know that SRAs will need to have someone support them on making changes to the model for those more esoteric findings. In the past, it was Bob Buell, Jim Knudsen, or John Schroeder. Who will it be on a licensee-sourced model? How much will it cost us in development costs? Also, are we assuming that the models that we get will from licensees have the same scope as what is currently out there? For example, what will happen in the future should a licensee with an internal events only model decide to develop an all-hazards model? How much additional work will be required on our part to ensure that the model is compatible with our needs? All these should be added to the assumptions list.

At the risk of sounding too gung-ho, my feeling is that we should all plan to meet in the near future to further discuss this and other related issues.

Jeff.

Jeff A. Circle
Chief (acting)
Probabilistic Risk Assessment Branch
RES /Division of Risk Analysis
(301) 415-1152
BB (b)(6)

From: Appignani, Peter
Sent: Monday, November 09, 2015 12:18 PM
To: Correia, Richard <Richard.Correia@nrc.gov>; Schroer, Suzanne <Suzanne.Schroer@nrc.gov>; Siu, Nathan <Nathan.Siu@nrc.gov>; Stutzke, Martin <Martin.Stutzke@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>; Circle, Jeff <Jeff.Circle@nrc.gov>
Cc: Helton, Donald <Donald.Helton@nrc.gov>
Subject: SPAR Vs Lic PRA cost comparison - initial draft

All

As requested at last week's meeting, please find attached my initial draft comparing the current costs of the SPAR models to the costs associated with using the licensee's PRAs.
The spreadsheet contains two worksheets; one for the current costs and one assuming we use the licensee's models(s). Current costs are based on the costs of the current contracts with INL (Kevin's Summary)
included a basis (an assumption) for each cost associated with using the licensee's models and also segregated initial costs from ongoing costs.
have not figured out how to handle Technical Support costs for tech support similar to the support INL is currently providing, thus it is blank for now.

Pete

Siu, Nathan

From: Siu, Nathan
Sent: Friday, November 06, 2015 7:46 AM
To: Appignani, Peter
Subject: RE: Incoming NRR request on FLEX in SPAR

Thanks Pete.

From: Appignani, Peter
Sent: Thursday, November 05, 2015 11:44 AM
To: Siu, Nathan <Nathan.Siu@nrc.gov>
Subject: FW: Incoming NRR request on FLEX in SPAR

From: Stutzke, Martin
Sent: Thursday, November 05, 2015 9:56 AM
To: Appignani, Peter <Peter.Appignani@nrc.gov>
Cc: Coyne, Kevin <Kevin.Coyne@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Circle, Jeff <Jeff.Circle@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>; Peters, Sean <Sean.Peters@nrc.gov>; Correia, Richard <Richard.Correia@nrc.gov>
Subject: RE: Incoming NRR request on FLEX in SPAR

A few thoughts about modeling the MBDBE (FLEX) strategies in the SPAR models, based on the CPRR risk evaluation:

1. Curious that NRR is asking to model the MBDBE strategies in SPAR while also suggesting that we abandon the SPAR models in favor using the licensee PRA models!

2. We need to clearly understand why NRR wants us to do this work. Is this necessary to support the SDP? Support the justification (after-the-fact) of the MDBDE strategies rulemaking?

3. Need plant-specific models: I surveyed licensee responses to Order EA-12-049 (mitigation strategies) for BWR plants with Mark I and Mark II containments, and learned that there was a wide variety of approaches for implementing the strategies. The CPRR risk evaluation only addressed a "generic" BWR Mark I plant with a RCIC system. I made a quick look at Sequoyah's MBDBE strategies in the context of the SOARCA follow-on study, and learned that it was more complicated (three sets of pumps having various heads, two sets of emergency generator having different voltages). A simple copy-and-paste approach will not work.

4. Need to address external events: The CPRR results show that seismic events are dominant contributors to loss of UHS and ELAPs. The MDBDE strategies are implemented in three phases. Phase 1 relies on existing plant systems (while the portable equipment is being aligned). Phase 2 allows to use of on-site portable equipment. Phase 3 considers the use of resources from the regional response centers (Memphis and Phoenix). Seismically induced failures of existing plant equipment potentially affect all three phases (for example, how can you connect a portable emergency generator if the existing ac or dc switchgear has been damaged by an earthquake?). Note that we did not consider any other type of external event (fires, floods).

5. Need to interface with containment venting strategies: In the CPRR risk evaluation, we looked at anticipatory containment venting (part of Order EA-13-109) for BWR plants with Mark I and Mark II containments. The idea is to vent the containment prior to core-damage (we assumed 15 psig) in order to extend the operation of the RCIC pump which, in turn, minimizes operation of the portable FLEX pump. Anticipatory venting is important for implementing Phase 2 of Order EA-13-109 since licensees do not have to install a drywell vent if they can show that they an approach that precludes submergence of the wetwell vent.

6. Need HRA models: For BWRs, the FLEX implementation guidelines will become part of the SAMGs. There are variety of modeling issues involved.

   - There's a need for HRA to address command-and-control between the control room and the onsite emergency organization (located in the TSC).
   - SPAR-H primarily applies to in-control-room operator actions whereas the MBDBE strategies involve numerous actions throughout the site.
   - There's a potential need to consider multi-unit impacts (simultaneous initiating events, sharing of resources between units, etc.).
   - The SAMGs are voluntary (the SRM to SECY-15-0065 removed the SAMGs from the scope of the MDBDE strategies rulemaking), which raises questions about how to probabilistically credit them.
   - There's a need to consider the reliability of instrumentation during ELAP events.

   The CPRR risk evaluation used a simple scoping approach for HRA (all in-CR actions set of 0.1; all ex-CR actions set to 0.3). The proposal to use placeholder events seems similar to the CPRR approach. I computed importance measures to gain an understanding of which operators were significant; however, the results are conditional (you can change the importance of one operator action by adjusting other probabilities in the PRA model!) I also did a HEP sensitivity study in order to show that the regulatory decision we were making (let EA-13-109 stand as-is, codify EA-13-109, codify EA-13-109 with a requirement for post-accident water addition, and/or install filtered containment vents) did not depend on the HEPs used in the risk evaluation. This result occurs because hardware failure probabilities (specifically seismic failures) are roughly the same as the scoping HEP values. In fact, the results of the HEP sensitivity analysis could be used to argue that the MDBDE strategies do not pass the safety goal evaluation (Chapter 3 of NUREG/BR-0058), i.e., they do not provide a substantial safety enhancement. This realization continues to disturb me because the mitigating strategies (EA-12-049) were justified on the basis of adequate protection.

n short, it would require considerable effort to incorporate the MDBDE strategies into the SPAR models. Let's be sure we understand why this is necessary before determining how to do it.

Marty

From: Appignani, Peter
Sent: Wednesday, October 21, 2015 10:18 AM
To: Stutzke, Martin
Subject: FW: Incoming NRR request on FLEX in SPAR

Marty

FYI

From: Helton, Donald
Sent: Wednesday, October 21, 2015 10:16 AM
To: Coyne, Kevin <Kevin.Coyne@nrc.gov>
Cc: Appignani, Peter <Peter.Appignani@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>; Peters, Sean

<Sean.Peters@nrc.gov>
Subject: Incoming NRR request on FLEX in SPAR

Kevin,

I listened in to this morning's SRA counterpart discussion on Mitigating Strategies (a.k.a., FLEX) for general awareness. In particular, the discussion focused at times on the inability to know whether FLEX implementation is having an overall positive or negative effect on risk without PRA model quantification, despite statements by NRC and industry that it is having a positive effect. During that discussion, Sunil indicated that he is going to ask RES (you specifically) about the feasibility of conducting an emergent task, which I will try to characterize as best I can:

- Using an existing project, direct INL to take one (or more) SPAR models and build in the accident sequence logic to capture the ongoing FLEX implementation for that plant, using plant-specific information to be provided by an SRA. It was unclear if this would be limited to SBO/ELAP, or across al initiators. It would include the potential effect of deep load shedding on misdiagnosed non-ELAP events.
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I just wanted to give you a heads up. There is no action per se, as Sunil clearly considered the ball to be in his court.

Dale Yielding and Keith Tetter were also on the bridge line.

Don

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Don Helton
Office of Nuclear Regulatory Research
US Nuclear Regulatory Commission
(301) 415-1545

Nakoski, John

From: Circle, Jeff
Sent: Thursday, November 05, 2015 10:40 AM
To: Stutzke, Martin; Appignani, Peter
Cc: Coyne, Kevin; Helton, Donald; Nakoski, John; Peters, Sean; Correia, Richard
Subject: RE: Incoming NRR request on FLEX in SPAR

Marty,

I share most of your concerns. However, right now, no one has planned to abandon the SPAR models. I realize that I'm addressing this issue with feet in both offices but, I do have a unified position. It is my understanding that NRR is investigating developing a pilot where they (I'm using the 3rd person) will look at the feasibility of using licensee's models. It's not a *fait accompli* and there are many pitfalls in going down that path. The NRR staff tried to articulate their concerns to senior management over the years but, it appears that a pilot might be the only way we can demonstrate this and scratch that itch. There is more to the story but, I want to wait until all the dust settles on how the agency will proceed.

As for FLEX and the SDP, I agree that we need to look more closely at external events. I'm sure you know the concern in NRR is that licensees have invested a great deal in developing their mitigating strategies. They would want a return on their investment by trying to tie them in to non-BDBE's modeling such as their internal events models. There is no R.G. 1.200 requirement in the SDP. But, as you pointed out, this is heavily dominated by ex-control room HRA I don't believe that we need to have a detailed analysis for the SDP. This will be an issue that will have to be worked out by our two offices.

Jeff.

Jeff A. Circle
Chief (acting)
Probabilistic Risk Assessment Branch
RES /Division of Risk Analysis
(301) 415-1152
BB (b)(6)

From: Stutzke, Martin
Sent: Thursday, November 05, 2015 9:56 AM
To: Appignani, Peter <Peter.Appignani@nrc.gov>
Cc: Coyne, Kevin <Kevin.Coyne@nrc.gov>; Helton, Donald <Donald.Helton@nrc.gov>; Circle, Jeff <Jeff.Circle@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>; Peters, Sean <Sean.Peters@nrc.gov>; Correia, Richard <Richard.Correia@nrc.gov>
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To: Coyne, Kevin <Kevin.Coyne@nrc.gov>
Cc: Appignani, Peter <Peter.Appignani@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>; Peters, Sean <Sean.Peters@nrc.gov>
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Don

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Don Helton
Office of Nuclear Regulatory Research
US Nuclear Regulatory Commission
(301) 415-1545

Stutzke, Martin

From: Coyne, Kevin
Sent: Friday, October 30, 2015 4:58 PM
To: Appignani, Peter; Correia, Richard; Schroer, Suzanne; Siu, Nathan; Stutzke, Martin; Nakoski, John
Subject: RE: For the SPAR vs Licensee PRA meeting next Thursday (11/5/15)
Attachments: Key Talking Points for the SPAR Models_Rev 2.docx

Attached....

From: Appignani, Peter
Sent: Friday, October 30, 2015 2:01 PM
To: Correia, Richard <Richard.Correia@nrc.gov>; Schroer, Suzanne <Suzanne.Schroer@nrc.gov>; Siu, Nathan <Nathan.Siu@nrc.gov>; Stutzke, Martin <Martin.Stutzke@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>
Cc: Coyne, Kevin <Kevin.Coyne@nrc.gov>
Subject: For the SPAR vs Licensee PRA meeting next Thursday (11/5/15)

All

Attached is the latest version of Considerations' for using other than SPAR models outline.
Please review and bring a copy to the meeting.

Kevin,

Would appreciate getting a copy of your latest summary on this topic.
Would you please share with all on this distribution

Thanks

Pete

Considerations for using other than the Standardized Plant Analysis Risk (SPAR) models Outline

1. **Summary of Key Considerations for using licensees' PRA Models**
   - 1.1. Regulatory Processes
   - 1.2. PRA Policy Statement
   - 1.3. Model Quality
   - 1.4. Maintain independence of NRC
   - 1.5. Standardization of modeling and assessment techniques
   - 1.6. Use by the NRC staff of licensees' PRA models
   - 1.7. Effect on other NRC Programs
   - 1.8. Costs

2. **Regulatory Processes**
   - 2.1. Reactor Oversight Process (ROP)
     - 2.1.1. ROP is an NRC process
   - 2.2. Significance Determination Process (SDP)
     - 2.2.1. Today's SDP outcomes using NRC versus licensee PRA
       - 2.2.1.1. The PRA models are often in close agreement.
       - 2.2.1.2. Differences in SDP outcomes between the NRC and the licensee are driven by factors other than the baseline PRA model
         - 2.2.1.2.1. Engineering assumptions
         - 2.2.1.2.2. Modeling assumptions
         - 2.2.1.2.3. Human reliability assumptions
         - 2.2.1.2.4. Other...
       - 2.2.1.3. These issues are also applicable to the other regulatory processes and other risk-informed licensing related activities
   - 2.3. MD 8.3 - NRC Incident Investigation Program
   - 2.4. Notice of Enforcement Discretion (NOEDs)
   - 2.5. Technical basis for rulemaking
   - 2.6. Generic issues
   - 2.7. Other risk-informed licensing related activities

3. **PRA Policy Statement**
   - 3.1. The PRA Policy Statement encouraged the NRC to increase the use and application of PRA to the greatest extent practical.
   - 3.2. SPAR models are one of the key incarnations of that effort.

3.3. Eliminating SPAR models would violate the spirit of that policy because it could undermine confidence in PRA-based findings.

4. **Model Quality**

4.1. SPAR models have been peer reviewed by industry led peer review teams[1]

4.1.1. SPAR models were determined to be adequate for their intended application

4.1.2. Confidence on the part of staff and industry that the current generation of SPAR models accurately portray the plants that they model.

5. **Maintain independence of NRC**

5.1. ROP provides for an independent regulatory assessment of licensee performance

5.1.1. Staff may lose ability to verify - "trust but verify"

5.1.2. Licensee's initially indicate an event as low safety significance in LERs that are later established as a greater than Green finding

5.2. Conflict of interest issues

5.2.1. Since the ROP is an NRC process, how will the appropriate level of independence be established if the licensee's PRA is used?

5.2.1.1. Does the independent manipulation of the licensee's model by NRC staff/contractors establish an appropriate level of independence?

5.2.2. OGC may need to endorse use of licensee PRA

5.2.3. OGC may need to endorse allowing the licensee to perform the assessment

5.3. Public confidence

5.3.1. Use of licensee PRA and/or allowing the licensee to perform the assessment could erode public confidence

5.3.2. In effect, the licensee is communicating events and degraded plant conditions to the public and other stakeholders if they perform the analysis.

6. **Standardization of modeling and assessment techniques**

6.1. Standardization provides for:

6.1.1. Efficiency

6.1.2. Consistency

6.1.3. Automation

6.2. Efficiency of standardization

---

[1] One typical BWR and one typical PWR SPAR model was peer reviewed since they are standardized. Recently completed a multi-year peer review resolution activity to address peer review findings across all SPAR models.

6.2.1. Modeling assumptions

6.2.2. Modeling conventions

6.2.3. Naming schemes (basic events, fault trees, event tress, etc.)

6.2.4. Post processing rule construction

6.2.5. Reporting functions (built into SAPHIRE)

6.2.6. Consistency in event tree/fault tree construction

6.2.7. Single Software platform

6.3. Consistency

6.3.1. Uniformity of assessments (RASP Handbooks)

6.3.1.1. Risk Assessment Standardization Project (RASP) Handbooks

6.3.1.2. Uniform because SPAR models are standardized

6.4. Automation

6.4.1. Software platform is standardized (SAPHIRE)

6.4.1.1. SAPHIRE was developed and modified specifically to support the regulatory processes

6.4.1.2. SAPHIRE has evolved over the years to meet the needs of the NRC analyst to help them better perform their tasks when utilizing the SPAR models. These features were built directly into SAPHIRE to eliminate the analyst performing offline calculations and then placing those calculated probabilities back into the SPAR model.

6.4.1.3. Reporting functions (built into SAPHIRE)

6.5. Experience indicates the use of NRC developed standardized models supports the principles of good regulation: independence, openness, efficiency, clarity, and reliability.

7. Use by the NRC staff of licensees' PRA models

7.1. Additional logistical and resource requirements

7.1.1. Seventy (70) plus licensee PRAs

7.1.1.1. No standardization

7.1.2. Four (4) different commercial software platforms

7.1.2.1. CAFTA (EPRI)

7.1.2.2. WinNUPRA (Scientech)

7.1.2.3. Riskman (ABS Consulting)

7.1.2.3.1. Cutsets are problematic (used to gain understanding of risk insights)

7.1.2.4. RiskSpectrum (Lloyd's Register Consulting, Sweden)

7.1.3. All lack reporting features of SAPHIRE

7.1.4. All lack automation and easy to use analysis tools in SAPHIRE

7.2. Need for additional NRC risk analysts

7.2.1. Additional staff training requirements

7.3. Management and control of licensee models and model updates

7.3.1. Non-uniform modeling assumptions and limitations

7.3.1.1. Each model will need to be examined and understood

7.3.2. Availability of PRA models and supporting documentation

7.3.2.1. Will all of the licensees formally submit their PRA to NRC?

7.3.2.1.1. Under oath and affirmation?

7.3.2.1.2. Subject to 10 CFR 50.9?

7.3.3. How will staff ensure NRC has the latest licensee model?

8. Effect on other NRC Programs

8.1. Accident Sequence Precursor (ASP) program

8.1.1. Abnormal occurrence report to Congress

8.2. Industry trends/operating experience programs

8.3. New Reactors (PRA & licensing)

8.4. Inspection programs

8.4.1. Inspection resources

8.4.2. Inspection decisions will become reactive based on deterministic criteria alone

8.5. Use of SPAR models to support system and component studies

8.5.1. Would inhibit our ability to develop tailored models when new situations arise.

8.6. SPAR models are used to develop Plant Information Risk eBooks (PRIBS) – superseded the SDP Notebooks

8.7. SPAR Models used for other purposes

8.7.1. Answer Commission questions

8.7.2. Japan Lesson Learned related issues (flooding, vents, seismic)

8.7.2.1. SPAR model results (CDFs) used to assist in the resolution of Fukushima NTTF Rec. 5.2 (containment venting for plants other than BWR with Mark I and Mark II containments), and Rec. 6 (hydrogen control and mitigation).

8.7.2.2. SPAR model data (equipment failure rates) supported the risk evaluation of Fukushima NTTF Rec. 5.1 (containment venting in BWR Mark I and Mark II plants)

8.7.3. SPAR-EE models supported GI-199 (updated seismic hazard curves for plants east of the Rocky Mountains)

8.7.4. Gain understanding of key basic events in the SPAR fire PRA models

8.7.5. SPAR models used to identify the most likely core-damage sequences for SOARCA analysis, as well as other important input.

8.7.6. SPAR models and data (equipment failure rates) supported staff's analysis of containment accident pressure (CAP) credit in BWR plants.

8.7.7. Gain understanding of CDFs as estimated by SPAR (supported work for Commissioner Apostolakis, 2013).

8.7.8. NRR made heavy use of the SPAR models (event trees) while reviewing the Browns Ferry extended power uprate (EPU) license amendment request.

9. Costs

9.1. Costs to both NRC and Industry

9.2. NRC

9.2.1. Licensee model reviews

9.2.2. Logistical requirements

9.2.3. Training

9.2.4. Commercial Software licenses

9.2.4.1. Commercial PRA software typically requires additional software (licenses) to be comparable to SAPHIRE (e.g. CAFTA/FTREX)

9.2.5. Additional analyst staff

9.2.6. Other

9.3. Industry

9.3.1. Cost for licensee to submit their PRA to NRC

9.3.1.1. Will ALL licensees voluntarily submit there PRA to NRC?

9.3.1.1.1. If not, we will need to maintain limited number of SPAR models.

9.3.2. Cost for a minimum of model standardization

9.3.3. Cost to implement a single RG 1.200 compliant standardized modeling approach across multiple analysis platform

9.3.3.1. Re-invent a RASP Handbook for uniformity of assessments

9.3.4. Cost to implement SAPHIRE reporting features and other automation tools

9.3.5. How will industry provide support to NRC Analysts?

9.3.5.1. INL is currently responding to approximately 2 requests for assistance per day via the Technical Support contract

9.3.6. Other

Key Talking Points for the Standardized Plant Analysis Risk (SPAR) Model Program

- Program provides **independent** risk analysis capability for NRC in support of reactor oversight process (ROP) and a variety of risk-informed technical applications
- Plant-specific SPAR models (99 operating plants are represented by 75 SPAR models) use **standardized** modeling and naming conventions. Standardization increases analyst efficiency and accuracy and supports cross comparison across models.
- SPAR models and the SAPHIRE PRA code are **designed to support event and condition analyses** by performing "delta-risk" analyses (e.g., change in CDF from base case to performance deficiency). Licensee developed models and supporting codes lack this capability (requiring additional calculations and manual sequence/cutset result comparisons)
- The program leverages available licensee PRA information to reduce program costs, but includes validation of licensee modeling assumptions and integrates licensee model conventions into standardized SPAR modeling framework. Although SPAR models use some simplifying assumptions compared to licensee models, in several areas most pertinent to ROP applications, the SPAR models are generally more detailed (e.g., CCF, LOOP, and support system initiators)
- All models run on a single code platform (SAPHIRE). SAPHIRE can be updated and configured to directly support NRC risk assessment activities through coding changes and customized reporting functions. Use of licensee models would require the NRC to maintain licensees and network environmental approval for multiple commercial software codes and eliminate the ability to revise these code to support NRC-specific applications.
- Although licensees have made progress in developing RG 1.200 compliant PRA models, these models lack the standardization and ROP-specific features that are essential to the agency's needs for performing event and condition analyses.

SPAR Model Uses

- Significance Determination Process (Reactor Oversight) - **Regions**
- Accident Sequence Precursor Program (used as an input metric to the performance budget process) - **RES**
- Evaluation of Notices of Enforcement Discretion – **Regions, NRR** *
- MD 8.3 Incident Investigation Program Risk Evolutions (e.g., determine level of inspection response to an event) – **Regions** *
- Establish technical basis for rulemaking – **RES, NRR**
- Evaluate generic issue safety significance - **RES**
- Perform system and component studies - **RES**
- Inspection Planning (e.g., risk insights from Plant Risk Information eBooks) - **Regions**

These applications typically are performed with limited time, highlighting the importance of model standardization for SPAR

SPAR Model Annual Budget

The SPAR/SAPHIRE annual budget for **FY2015 was ~$2.2 million.** This amount is scalable depending on agency needs and available resources. Major activities include:

Base Resources (i.e., minimum requirements for the program):

- SPAR Model Configuration/Quality Control and User Support Help Desk ~$500k/year
  - Help desk handles ~ 2 calls/day from SRAs
  - Ensures model version control and maintains INL Website

- Performs model updates to support specific SDP/ASP activities (~30 models were updated to support a specific analysis in FY2015). These updates are often highly specific to the event/condition that occurred and would also need to be performed for a licensee PRA model

- SAPHIRE QA and User Support ~$300k/year
  - Maintain NUREG/BR-0167 QA program
  - User help desk Support

Resources needed to Support Specific User Enhancements:

- Model Updates to Reflect Significant Plant Changes (~12 models/year) - ~$250k
  - Incorporate station blackout EDGs
  - Battery charging generators
  - Significant model upgrades

- External Hazard and Fire Models - ~ $400k/year
  - Add NFPA 805 fire modeling
  - Add seismic and high wind model capabilities

- SAPHIRE Enhancements ~$300k /year
  - New reporting features and code capabilities

- Data Updates (performed every 3 years) - ~$500k (every three years)
  - Upgrade SPAR models to reflect most recent operating data
  - Update model documentation and Plant Risk Information eBooks (PRIBs)
  - General model cleanup/improvements

Letter to NEI from OEDO on Use of SPAR models (2007, ML072490566)

This letter addressed an NEI proposal to use licensee PRA models instead of SPAR models. A detailed review was conducted and concluded that SPAR was needed to:

- Maintain **independence** of NRC analyses. Differences between NRC and Licensee assessments is not due to the base model, but by the assumptions for each specific event or condition analysis
- Provide **standardized model framework** for efficient analyses - industry does not use a standardized modeling approach
- Avoid inefficiencies in having agency risk analysts learn the conventions of over 70 licensee developed PRAs (utilizing up to four different software platforms)

The basis for the staff conclusion remains valid today.

Feedback from Regional SRAs on Potential Use of Licensee Models vice SPAR

- More efficient and objective to use SPAR models for risk assessments.
- It would take a significant increase in resources to use licensee models for event and condition assessment activities due to their lack of standardization and need for SRAs to understand unique modeling conventions and new code platforms.
- Use of licensee models would cause delays in the SDP process due to need to engage in additional requests for information to understand licensee PRA modeling assumptions.
- NRC's ability to perform independent regulatory assessment activities will be eroded by not having a centralized system evaluating Generic Safety Issues, SBO/LOOP studies, etc.

Wood, Jeffery

From: Ferrante, Fernando
Sent: Friday, October 23, 2015 1:52 PM
To: Wong, See-Meng; Arner, Frank; Circle, Jeff; Demers, Jerrod; Kichline, Michelle; Mitman, Jeffrey; Montecalvo, Michael; Ng, Ching; Spore, Candace; Nakoski, John; Kuritzky, Alan; Wood, Jeffery; Coyne, Kevin
Cc: Gibbs, Russell; Weerakkody, Sunil
Subject: RE: SDP Streamlining Ideas - Headquarters
Attachments: HQ SDP Streamlining Ideas 10-8-15 smw_FF.docx

See-Meng,

See attached some additional suggestions stemming from the last discussions.

Thanks,
Fernando

From: Wong, See-Meng
Sent: Tuesday, October 13, 2015 11:56 AM
To: Arner, Frank <Frank.Arner@nrc.gov>; Circle, Jeff <Jeff.Circle@nrc.gov>; Demers, Jerrod <Jerrod.Demers@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Mitman, Jeffrey <Jeffrey.Mitman@nrc.gov>; Montecalvo, Michael <Michael.Montecalvo@nrc.gov>; Ng, Ching <Ching.Ng@nrc.gov>; Spore, Candace <Candace.Spore@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>; Kuritzky, Alan <Alan.Kuritzky@nrc.gov>; Ferrante, Fernando <Fernando.Ferrante@nrc.gov>; Wood, Jeffery <Jeffery.Wood@nrc.gov>
Cc: Gibbs, Russell <Russell.Gibbs@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>
Subject: SDP Streamlining Ideas - Headquarters

All,

Attached are the results from the brainstorming session we conducted here at HQ on 08 October, 2015. We really appreciate the lively and constructive discussion, and look forward to making appropriate changes to improve the efficiency and effectiveness of the SDP. Please take a look and revise as needed and add more if you like.

Once all suggestions are compiled from all the regions, DRA and OE, and a multi-disciplined team being established, will review the suggestions and make the appropriate changes to the SDP to be used for the pilot to be conducted next year.

Please provide your response to me by 23 October, 2015. If I had missed any other interested attendee, please forward this email.

SDP Streamlining Ideas
Headquarters
October 08, 2015

Ideas for Streamlining SDP

1. Use the range of risk thresholds, similar to the MD 8.3 process, for NRC decisions on regulatory response.
2. Limit the term of SERP members.
3. Articulate definitions of risk thresholds in the development of a decision matrix for making risk-informed decisions.
4. To account for uncertainty of external events risk contribution in the SDP assessment, add an order of significance to the internal events risk contribution.
5. Develop a new enforceable "timeliness" matrix for licensees to provide requested information for NRC review.
6. Use the key components of IMC 0609 Appendix M in the development of Integrated Risk-Informed Decision Making (IRIDM) model.
7. Make final decisions at the Regulatory Conference.
8. Use the Phase 2 SDP Worksheets for preliminary assessment of significance.
9. Increased additional licensee information provided after the SDP deadline should be turned over to ASP analyst for detailed review to support timely ASP analysis.
10. Provide training to inspectors on importance of timeliness and root cause determination in the characterization of the licensee performance deficiency.
11. Limit DRA/APHB peer reviews only to selected Greater than Green findings that are greater than White significance.
12. Establish sufficient time for HQ peer reviews by early communication with management to prevent delays; clarify the role of risk analyst and engagement with assigned SRA on the scope of peer review; establish ground rules for efficient peer review in a timely manner.
13. Start the SDP timeliness clock as soon as the "proximate cause" of performance deficiency is identified.
14. Use RES staff in a support role as Subject Matter Experts for technical insights on special topics during HQ peer review(s).
15. The Decision Maker or SES issue sponsor should interact with the SRA on the scope and "who has the assignment" of the SDP assessment.
16. Use junior risk analysts to support the "screening analysis" of low risk significant issues.
17. Resolve PRA and/or technical issues using panel of technical experts that is separate from the SERP meeting.
18. The SRA/peer reviewer should develop a one-page summary of SDP issue early on for sharing information and feedback; distribute and place on Sharepoint site.
19. Develop a database of SDP evaluations with feedback loop of lessons learned.
20. HQ/APHB perform self-assessment of White findings determined by the Regions to assess consistency.

21. Communicate pre-Regulatory Conference expectations to licensees regarding the scope of NRC review of information submitted for regulatory decision making.
22. Conduct pre-Regulatory Conference meeting on technical issues to resolve differences in opinion and understanding of SDP evaluation.
23. NRC decision makers should not be unduly concerned with the possibility of licensee Appeals to NRC Final Significance Determinations.
24. Reactor transient events with complications should be evaluated outside of SDP, and their significance assessed under MD 8.3 event assessment program.
25. The SERP meeting should be optional if all involved SERP members are in concurrence with the preliminary and/or final decision.
26. Establish an efficient "briefing" process for informing all involved SERP members to avoid unintended "gaps" in details when conducting separate individual briefings.
27. Develop a standardized SERP package for use with the streamlined SDP process. In the past, we had experiences where the SERP package included too much information or not enough information. Both are an impediment to an efficient timely review. An evaluation of what a streamlined SERP package should be performed and updated into the guidance. Again, early involvement between the SRA and HQ counterpart should obviate the need for an in-depth SERP package to be developed. However, if HQ reviewers are not involved early in the process, then an streamlined SERP package could actually be counterproductive. Hence, this should be balanced carefully and enforced across all Regions, as some cases indicated the standard format is not always followed.
28. There should be proper accounting of the SDP clock in the process. It should be structured to begin with the identification of the specific issue or event, it should then follow the inspection time needed to identify a PD, and then break down the time needed for analyses by the Regions, HQ analysts, and management. This should be easy to establish via a front page attachment to the SERP documentation that lists the dates and signatures of the responsible parties. For example, once a Region completes the SERP package and officially submits it to HQ, the SRA(s) in charge would sign the completion data. When the HQ reviewer is done, he or she signs with the date of completion and so forth. This would provide real accountability as to when completion times occur, bottlenecks, and motivation for meeting the metrics appropriately (or knowing in advance when additional time will be needed with proper justification). Currently, there is no accountability except for the final metric, and this is a major problem that is masking inefficiencies and allowing for these to be tackled head on.
29. The expectations on the amount of time spent on SDPs should be understood and clarified upfront. There is currently a statement on the problems that indicates a "surprisingly high" amount of resources is being used by HQ analysts for SDP. A cursory review of some of the time applied to MA9166 appears to indicate variability as well as some reasonable amount of time from a risk analyst perspective (e.g., ~700 hours per year, ~ 35% per year). For APHB (which has a mission to support SDP, NOEDs, MD8.3s), such a percentage should appear reasonable if not somewhat lower than expected (it needs to be pointed out that for several SDPs, Regions will explicitly ask for support from HQ staff). Hence, the statement of "surprisingly high" speaks to different

expectations on what should be the time spent by HQ analysts, and, understandably, may seem high when the focus is to streamline and reduce the amount of time spent on SDPs. Hence, there needs to be a frank and open discussion about what a reasonable expected amount of time is, how the time is charged (and whether it should be structured and tracked differently) and whether there are outliers that merit addressing inefficiencies.

30. There should be a unified, concise, and interactive database of SDP findings. This should be structured (e.g., in Sharepoint) and should include all the major milestones, documents, SPAR models, and references used for greater than green decisions (including decisions that started as greater than green and were reduced to green). They should be indexed by key criteria (e.g., internal versus external, initiators, major systems affected, specific drivers
31. Specifically identify sections of RASP that need to be improved to provide more specific, objective guidance to help streamline the process. For example, specific sections on RASP regarding external events could be modified with more practical guidance on how to make a decision on this items or at least indicate the level of effort that may be needed for a particular issue.

Ideas for Pilot Project

1. Pilot project should involve participation from all Regions.
2. The Working Group should include a RES representative.
3. The pilot project should start with the first identified inspection finding.
4. The pilot project should involve the use of licensee's PRA model.
5. Conduct tabletop exercises on past Yellow or Red findings in the development phase of pilot project.
6. The scope of the pilot project should be focused on at-power findings for the Initiating Events, Mitigating Systems, and Barrier Integrity safety cornerstones; only a couple of Regions support the scope of pilot project to include shutdown findings.

Wood, Jeffery

From: Coyne, Kevin
Sent: Sunday, October 11, 2015 4:27 PM
To: Wood, Jeffery; Ferrante, Fernando; Kuritzky, Alan
Cc: Nakoski, John
Subject: Re: Meeting on SDP Streamlining

Jeff, Fernando -

Thanks for the feedback - great summary. Hope your trips go well this week...

Kevin

From: Wood, Jeffery
Sent: Friday, October 9, 2015 2:11 PM
To: Ferrante, Fernando; Coyne, Kevin; Kuritzky, Alan
Cc: Nakoski, John
Subject: RE: Meeting on SDP Streamlining

Thanks for the summary, Fernando. I'll just add a few impressions that I had.

- As Fernando noted, the 7-8 person team that will be developing the "streamlined SDP" was not intending to include RES participation. John strongly urged that RES be represented. This was noted, but I still felt that DIRS was lukewarm to the idea of RES participating.
- The bulk of the meeting was focused on ideas to streamline or improve the efficiency of the SDP. There was little discussion of piloting the use of licensee models. This was discussed at the end of the meeting and at a high level with no details on how the pilot would be performed. It seemed the "streamlining" effort and the piloting of the licensee models are two parallel, but separate efforts. I may be wrong but that was my impression. My going in assumption was that streamlining = getting rid of SPAR models, but that was not how it was presented at the meeting.
- The "streamlining" discussion was focused on improving timeliness, communication, consistency, etc. There were plenty of good suggestions. At least from the participants in the room, there seemed to be no intention of radically changing how the significance of events would be assessed. It was just making the process more efficient. Maybe there are other motivations or expectations for this "streamlining" effort, but that is not how the discussion was presented at this meeting.

I haven't been involved in much of the past discussions on this (I guess that goes for RES as a whole), so take these comments for what they're worth.

Jeff

From: Ferrante, Fernando
Sent: Friday, October 09, 2015 12:55 PM
To: Coyne, Kevin; Kuritzky, Alan
Cc: Nakoski, John; Wood, Jeffery
Subject: Meeting on SDP Streamlining

Nakoski, John

From: Wood, Jeffery
Sent: Friday, October 09, 2015 2:12 PM
To: Ferrante, Fernando; Coyne, Kevin; Kuritzky, Alan
Cc: Nakoski, John
Subject: RE: Meeting on SDP Streamlining

Thanks for the summary, Fernando. I'll just add a few impressions that I had.

- As Fernando noted, the 7-8 person team that will be developing the "streamlined SDP" was not intending to include RES participation. John strongly urged that RES be represented. This was noted, but I still felt that DIRS was lukewarm to the idea of RES participating.
- The bulk of the meeting was focused on ideas to streamline or improve the efficiency of the SDP. There was little discussion of piloting the use of licensee models. This was discussed at the end of the meeting and at a high level with no details on how the pilot would be performed. It seemed the "streamlining" effort and the piloting of the licensee models are two parallel, but separate efforts. I may be wrong but that was my impression. My going in assumption was that streamlining = getting rid of SPAR models, but that was not how it was presented at the meeting.
- The "streamlining" discussion was focused on improving timeliness, communication, consistency, etc. There were plenty of good suggestions. At least from the participants in the room, there seemed to be no intention of radically changing how the significance of events would be assessed. It was just making the process more efficient. Maybe there are other motivations or expectations for this "streamlining" effort, but that is not how the discussion was presented at this meeting.

I haven't been involved in much of the past discussions on this (I guess that goes for RES as a whole), so take these comments for what they're worth.

Jeff

From: Ferrante, Fernando
Sent: Friday, October 09, 2015 12:55 PM
To: Coyne, Kevin; Kuritzky, Alan
Cc: Nakoski, John; Wood, Jeffery
Subject: Meeting on SDP Streamlining

Kevin,

I attended the meeting on SDP streamlining yesterday (along with John Nakoski and Jeff Wood), held by DIRS (Russ Gibbs) to inform NRR/DRA/APHB staff of the current effort (this meeting was held because of internal concerns raised by NRR/DRA/APHB staff that they were being excluded from the process). Some FYI notes:

- The meeting was actually positive in many respects, Russ was open to comments by all involved (including RES staff).
- The meeting was still contentious at times between Russ, NRR/DRA/APHB staff, and the SRA currently on rotation to HQ. One person stormed out of the meeting and there was some shouting at some point (i.e., it was a run of the mill meeting by NRR/DRA/APHB standards, I almost felt nostalgic). In all seriousness, it shows there is significant internal discontent in NRR and the Regions.
- One staff from NRR/DRA/APHB did bring up getting rid of SPAR models in lieu of licensees as part of this effort
- We (RES staff) provided recommendations that I believe are consistent with Agency needs and interjected on some of the ideas that appear intended to exclude RES from the loop

- On this last item, a team on this effort will be developed with 7-8 staff representing various stakeholders with an SES sponsor. RES is not currently included but Russ said our participation could be possible (John strongly indicated we would like to be involved and I fully suggest we push for this). I think this may be an item to pursue to make sure RES is not excluded from critical decisions on this program.
- The bottom line is that Russ feels he has the mandate to change the ROP process for reactor safety issues in a significant way and that a pilot will be developed and implemented next year. The amount of work being contemplated will be extremely complex and messy but NRR plans to charge ahead regardless, and the team is expected to be functioning by December with a charter for "fixing" ROP in the long term.
- On a related note, NRR/DRA/APHB recently released draft guidance for the RASP Handbook on external flooding to the SRAs (I was not directly informed). Some SRAs contacted me to express strong disappointment, to which I made sure to state that this is not an RES-related product. No action for us now on this specific item (I don't plan to pursue anything unless officially requested with RES management approval), but I wanted to let you know as some folks are asking why didn't RES get involved (I told them to talk to NRR).

Thanks,
Fernando

Nakoski, John

From: Lee, Samson
Sent: Thursday, October 01, 2015 11:14 AM
To: Nakoski, John; Weerakkody, Sunil; Giitter, Joseph
Cc: Correia, Richard; Coyne, Kevin; Kichline, Michelle; Circle, Jeff
Subject: RE: RES ASP and SPAR Model Status SECY

John,

Jeff and I can come over to your office at 2 pm. I spoke with Bill this morning and he said that Brian agreed to make changes. The big one is to include the Project AIM language that Jennifer has suggested.

When we spoke with Bill yesterday, his other changes were:

(1) delete the sentence about NRR preparing a separate paper to the Commission. <a decision has not been made yet on how to implement a pilot with industry>

(2) Regarding Web-based SAPHIRE, replace the sentence, "After successful demonstrating a prototype....to benefit near-term updates to the current version of SAPHIRE." with "The SAPHIRE team developed a plan and design specification describing how an enhanced version of SAPHIRE could be developed with the capabilities of a web-based tool. A demonstration version of an Internet-based SAPHIRE was completed <we need to discuss this>. The team continues to enhance the quantification and analysis capabilities to remain consistent with industry-wide accepted PRA practices and tools."

Please let Jeff and I know when and where you'd like to meet.

Thanks,
Sam

From: Nakoski, John
Sent: Thursday, October 01, 2015 9:56 AM
To: Lee, Samson <Samson.Lee@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Giitter, Joseph <Joseph.Giitter@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>; Circle, Jeff <Jeff.Circle@nrc.gov>
Subject: RE: RES ASP and SPAR Model Status SECY

Sam,

I am available this afternoon at 2pm through the end of the day. I understand that Brian and Bill have met and come to agreement on the two major issues that were not resolved at the staff level. The attached files have the latest versions of the SECY and its two enclosures (in redline/strikeout) that incorporate all of the changes made from the concurrence version sent out earlier (i.e., comments from NRO, NRR, and OGC), and the RES responses to all of the NRR ET comments. Let me know when you would like to meet this afternoon.

Regards,

John Nakoski

From: Lee, Samson
Sent: Thursday, October 01, 2015 7:46 AM
To: Nakoski, John; Weerakkody, Sunil; Giitter, Joseph
Cc: Correia, Richard; Coyne, Kevin; Kichline, Michelle
Subject: RE: RES ASP and SPAR Model Status SECY

John,

We (Michelle, Jeff, and me) met with Bill Dean yesterday right before he met with Brian Sheron. Please let us know when you would like to meet.

Thanks,
Sam, x2884

PS: Michelle and Sunil are out the remainder of the week. Jeff and I are out Friday.

From: Nakoski, John
Sent: Wednesday, September 30, 2015 5:59 PM
To: Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Giitter, Joseph <Joseph.Giitter@nrc.gov>; Lee, Samson <Samson.Lee@nrc.gov>
Cc: Correia, Richard <Richard.Correia@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>; Kichline, Michelle <Michelle.Kichline@nrc.gov>
Subject: RES ASP and SPAR Model Status SECY

SECY-15-0124 is publicly available as ML15188A104.

Joe, Sam, and Sunil,

This morning I sent you RES staff responses to the NRR comments on the RES SECY providing the Commission with an update on the status of the ASP Program and the SPAR Models. Have you had a chance to review and discuss the RES response and will NRR be in a position to concur on the paper tomorrow morning, if not later today? Would you like to meet tomorrow to discuss the RES response further? Please let Kevin Coyne and I know as soon as practical. I appreciate your continued support on this action.

Best regards,

John A. Nakoski

Chief, Performance and Reliability Branch
Division of Risk Analysis
Office of Research
301-415-2480 (w)
(b)(6) (c)

Tetter, Keith

From:	Nakoski, John
Sent:	Wednesday, September 30, 2015 10:11 AM
To:	Weerakkody, Sunil; Giitter, Joseph; Lee, Samson
Cc:	Kichline, Michelle; Tetter, Keith; Coyne, Kevin; Correia, Richard; Monninger, John
Subject:	RES Commission Paper on ASP and SPAR Status
Attachments:	SECY-15-XXXX Enclosure 2 - Status of the SPAR Models_Changes 9-30-15.docx; SECY-15-XXXX Enclosure 1_Changes 9-30-15.docx; SECY-15-XXXX_Changes 9-30-15.docx; NRR ET Comments on ASP SECY_RES responses_r3.docx

Joe, Sam, and Sunil,

I am sharing with you the most up-to-date information on the RES Commission Paper on the ASP Program and SPAR Model status. The information is current as of this morning and reflects the position of RES on this paper. Should you have additional input that you would like to share or have feedback on the comment responses, please let me know as soon as you can. Time is of the essence, so I would appreciate your comments or NRR concurrence by COB today so that we can resend the paper to OGC to confirm that it still has no legal objections to the paper. Once we have NRR's concurrence and OGC's confirmation of its NLO, I will be send the final version of the paper to Brian Sheron for his review and approval. The paper is due to the Commission no later than October 6, 2015.

The attached files provide RES' responses to NRR's comments on the RES Commission Paper on the status of the ASP Program and the SPAR Models; and redline/strikeout versions of the body of the SECY and both enclosures that reflects all of the changes made to the version sent for Office Level review and concurrence based on comments from NRR, NRO, and OGC.

Kevin Coyne and I have briefed Brian Sheron and Steve West on our responses to NRR's comments. The most significant comments were explicitly discussed with Brian and Steve, and they are aligned with our responses to the NRR comments raised with regard to Project AIM 2020 and incorporating the NRR proposal to do a pilot using licensee PRA models for the SDP.

I look forward to working with you to resolve any outstanding issues.

Best regards,

John A. Nakoski
Chief, Performance and Reliability Branch
Division of Risk Analysis
Office of Research
301-415-2480 (w)
(b)(6) (c)

FOR: The Commissioners

FROM: Brian W. Sheron, Director
Office of Nuclear Regulatory Research

SUBJECT: STATUS OF THE ACCIDENT SEQUENCE PRECURSOR PROGRAM AND THE STANDARDIZED PLANT ANALYSIS RISK MODELS

PURPOSE:

To inform the Commission of the status, accomplishments, and results of the Accident Sequence Precursor (ASP) Program, including quantitative ASP results, and to communicate the status of the development and maintenance of the Standardized Plant Analysis Risk (SPAR) models. This paper does not address any new commitments or resource implications.

BACKGROUND:

In a memorandum to the Chairman dated April 24, 1992, the staff of the U.S. Nuclear Regulatory Commission (NRC) committed to report periodically to the Commission on the status of the ASP Program. Subsequently, in SECY-02-0041, "Status of Accident Sequence Precursor and SPAR Model Development Programs," dated March 8, 2002, the staff expanded the annual ASP status report to include: (1) an expanded evaluation of precursor data trends and insights, and (2) the development of associated probabilistic risk assessment (PRA) models (e.g., SPAR models).

CONTACT: Keith M. Tetter, RES/DRA
301-415-2407

The ASP Program systematically evaluates U.S. nuclear power plant (NPP) operating experience to identify, document, and rank the operating events most likely to lead to inadequate reactor core cooling and severe core damage (i.e., precursors).[1] The ASP Program provides a comprehensive and integrated assessment of plant risk associated with ~~important~~ operating events. The ASP Program provides insights into the NRC's risk-informed and performance-based regulatory programs; ~~monitors~~evaluates performance against performance indicators in the agency's Congressional Budget Justification[2] and Industry Trends Program;[3] and reports to Congress events of high safety significance in accordance with "abnormal occurrence" criteria.[4]

Under the SPAR Model Program, the staff develops and maintains independent risk-analysis tools and capabilities to support NPP-related risk-informed regulatory activities. The staff uses SPAR models for the Reactor Oversight Process (ROP) Significance Determination Process (SDP); the ASP Program; the Management Directive (MD) 8.3, "NRC Incident Investigation Program," event assessment process; and the MD 6.4, "Generic Issues Program," resolution process. In addition, the staff uses the SPAR models to risk inform NRC inspection activities, to gain risk insights in support of reactor-related rule-making, and to support other risk assessment studies, such as system and component reliability studies.

DISCUSSION:

This section summarizes the status, accomplishments, and results of the ASP Program and SPAR Model Program since the previous status report, SECY-14-0107, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," dated October 6, 2014.

ASP Program

Program Scope. The ASP Program is one of three agency programs that assess the risk significance of events. The other two programs are the ~~Significance Determination Process (SDP)~~ and the event-response evaluation process, as defined in MD 8.3. Currently, the ASP Program provides integrated analyses of complex operating events not evaluated by the SDP or finalized by MD 8.3 evaluations. The SDP evaluates the risk significance of a single licensee performance deficiency, while risk assessments performed under MD 8.3 are used to determine, in part, the appropriate level of reactive inspection in response to an event. An SDP assessment has the benefit of information obtained from the inspection, whereas the MD 8.3 assessment is expected to be performed within a day or two after the event notification. In contrast to the other two programs, a comprehensive and integrated risk analysis under the ASP Program includes all anomalies[5] observed at the time of the event or discovered after the event.

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1 Enclosure 1 provides background on the process used by the staff to identify precursors.

2 See NUREG-1100, Volume 31, "2016 Congressional Budget Justification," issued January 2015.

3 See SECY-15-0061, "Fiscal Year 2014 Results of the Industry Trends Program for Operating Power Reactors," dated April 8, 2015.

4 See Appendix A of NUREG-0090, Volume 37, "Report to Congress on Abnormal Occurrences—Fiscal Year 2014," issued May 2015.

5 These anomalies or conditions may include unavailable and degraded plant structures, systems, and components (SSCs); human errors; and an initiating event (reactor trip). In addition, an unavailable or degraded SSC does not have to be a performance deficiency or an analyzed condition in the plant's licensed design basis.

There are similarities in the risk assessments conducted by the three programs. All programs use SPAR models, the same documented methods and guidance, and similar analysis assumptions, except where program objectives deviate from one another. To minimize overlap and improve efficiency, ~~S~~since 2006, SDP results have been used in lieu of independent ASP analyses~~,~~ to the extent practical and consistent with the overall objectives of both programs ~~if the SDP analyses considered all concurrent degraded conditions or equipment unavailabilities that existed during the time period of the condition~~. Typically the SDP analyses are used in the ASP Program when the analysis performed addresses the major contributors to risk for the event based on a review conducted by an ASP Program risk analyst. Typically for initiating events, many of the modeling assumptions made for MD 8.3 analyses can be adopted by ASP analyses. However, some modeling assumptions are revised as detailed information about the event becomes available when inspection activities are completed. These key similarities provide opportunities for significant ASP Program efficiencies. For a potential *significant* precursor (defined below), analysts from the three programs work together to provide a timely determination of plant risk. As such, duplication between programs is minimized to the extent practical within program objectives.

Status and Results. The staff continues to review operational events from licensee event reports (LERs) and NRC inspection reports (IRs) to identify potential precursors to a reactor core damage event. Operational events that exceed the ASP thresholds, mentioned in the Background section of Enclosure 1, are considered precursors in the ASP Program. *Significant* precursors have a conditional core damage probability (CCDP)[6] or a change in core damage probability (ΔCDP)[7] greater than or equal to 1×10^{-3}. The staff has identified 16 precursor events for fiscal year (FY) 2014. The staff did not identify any *significant* precursors for FY 2014 and has not identified any potentially *significant* precursors for FY 2015 to date, although the reporting of FY 2015 events in LERs and NRC IRs are still in progress.

In addition to the identification of precursor events, the staff performs trend analyses on precursors for additional insights. Trend analyses are performed on the following precursor groups:

- all precursors
- precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4}
- precursors involving an initiating event
- precursors involving degraded conditions
- precursors involving a complete loss of offsite power (LOOP)
- precursors that occurred at boiling-water reactors (BWRs)
- precursors that occurred at pressurized-water reactors (PWRs)

For the period of FY 2005 through FY 2014, the staff found a statistically significant increasing trend in the mean occurrence rate of precursors resulting from a LOOP initiating event. This increasing trend resulted from the occurrence of 20 LOOP precursor events in the last 4 years after 7 precursor occurrences in the previous 6 years.

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6 The term CCDP is the probability of the occurrence of core damage given that an initiating event has occurred.

7 The term ΔCDP is the increase in probability of core damage (from the baseline core damage probability) due to a failure of plant equipment or an identified deficiency during the time the failure or deficiency existed.

In the FY 2012 and FY 2013 annual report, statistically significant increasing trends were identified in the mean occurrence rate of precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4}. However, with no additional precursor observed in this group in FY 2013 and FY 2014, the trend is no longer statistically significant. As reported in last year's status report (SECY-14-0107), six of the seven precursors in this group were caused by multiple electrical failures during a 3-year period. Based, in part, on the observed increases in electrical- and LOOP-related precursors over the past few years, the staff initiated a detailed study in FY 2014 to better understand the contribution of electrical system and associated component failures on risk at NPPs. Results for this study should be available in FY 2017.

The staff found no statistically significant trends for any of the other precursor groups during the FY 2005 through FY 2014 period. Enclosure 1, "Results, Trends, and Insights of the Accident Sequence Precursor Program," provides additional details on results and trends of the ASP Program.

SPAR Model Program

The SPAR models provide agency risk analysts with an independent risk assessment tool to support a variety of risk-informed agency programs, including the ROP and the ASP program. SPAR models are built with a standard modeling approach, using consistent modeling conventions, that enables staff to easily use the models across a variety of U.S. NPP designs. Unlike industry PRA models, SPAR models are run on a single software platform, the Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) computer code. The staff currently maintains and updates ~~the~~ 75 SPAR models representing 99 commercial NPPs.[8] The scope of every SPAR model includes logic modeling covering internal initiating events at power through core damage (i.e., Level-1 PRA model). In FY 2015, the staff modified all SPAR models to take advantage of new SAPHIRE features and to improve the usability of ~~make~~ the models ~~more understandable to users~~. In addition to these global changes, approximately 30 models were updated to support specific SDP or ASP activities. The staff also performeds more comprehensive updates to selected SPAR models to reflect recent plant modifications and to incorporate significant modeling updates. In FY 2015, the staff performed significant updates to six SPAR models to reflect changes such as the addition of logic for new station blackout generators, battery charging generators, and expansion of electrical power distribution modeling. During FY 2015, the staff continued to perform a comprehensive data update to all 75 SPAR models to reflect recent operating experience and implement other enhancements to improve the usability and functionality of the models.

In addition, the staff continued to expand SPAR model capability beyond internal events at full-power operation. For example, 22 of the SPAR models, representing 28 nuclear power reactors, include other hazard groups and are referred to as SPAR All-Hazard (SPAR-AHZ) models.[9] Currently, 18 of the SPAR-AHZ models include hazards such as fires, internal

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8 The SPAR models associated with NPPs that have recently permanently shut down (Kewaunee, San Onofre Units 2 and 3, Crystal River Unit 3, and Vermont Yankee) are no longer being updated, but remain available for agency use.

9 These models were formerly named SPAR external event (SPAR-EE) models, but have been renamed SPAR-AHZ to reflect recent improvements in external hazard modeling efforts and for consistency with the ASME PRA Standard model scope.

floods, and seismic events based on assessments conducted for Supplement 5, "Individual Plant Examination of External Events for Severe Accident Vulnerabilities," to Generic Letter 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities—10 CFR 50.54(f)" (dated September 8, 1995), and other readily available information. The staff ~~has~~ also ~~completed~~ incorporated~~ion of~~ internal fire scenarios from the fire PRAs done in compliance with National Fire Protection Association (NFPA) 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," for the Shearon Harris Nuclear Power Plant, the Donald C. Cook Nuclear Power Plant, and the Virgil C. Summer Nuclear Generating Station. In addition to more detailed fire PRA modeling, the SPAR models for these NPPs include improved external hazard modeling and model validation. The staff has also leveraged the ongoing Level-3 PRA project for the Vogtle Electric Generating Plant, Units 1 and 2, to develop improved external hazard and fire modeling for the Vogtle SPAR model. In FY 2015, a new SPAR-AHZ model for the Point Beach site was created, and the SPAR-AHZ model for the Sequoyah site underwent~~has undergone~~ a major revision.

In the new reactor area, the staff has developed SPAR models for the AP1000 Advanced Boiling-Water Reactor (ABWR) (for both the Toshiba and General Electric-Hitachi designs), U.S. Advanced Pressurized-Water Reactor (US-APWR), and the U.S. Evolutionary Power Reactor (U.S. EPR). The staff has expanded the capability of the AP1000 SPAR model to include hazards such as seismic, fire, flooding, and low-power shutdown events. A post-core damage severe accident logic model (i.e., Level-2 PRA model) is also being developed for the AP1000 SPAR model.

The Office of Nuclear Regulatory Research (RES) staff continues to work with the Regions, the Office of Nuclear Reactor Regulation (NRR), and the Office of New Reactors (NRO) to identify future enhancements to the SPAR models, including continuing the development of new SPAR-AHZ models. Further, NRR is considering how it can improve the efficiency and effectiveness of the SDP process. These improvements may include pilot activities to assess the use of alternatives to the SPAR models. The use of alternatives to the SPAR models has other implications that will need to be assessed and addressed in support of any pilot activity that may be undertaken. NRR will address its plans to pilot alternatives to the SPAR model in a separate paper to the Commission.

In FY 2010, the staff completed PRA standard-based peer reviews of a representative BWR SPAR model and a representative PWR SPAR model. It performed these peer reviews in accordance with American Society of Mechanical Engineers (ASME)/ American Nuclear Society (ANS) RA-S-2008, "Standard for Level-1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," and Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities." The peer-review teams concluded that, within the constraints of the program, the SPAR model is an efficient method to offer qualitative and quantitative insights for applications, SDP evaluations, inspections, event assessments, and model evaluations. The peer review teams also noted that the SPAR model structure was robust and well developed, model fault trees were streamlined with an appropriate level of detail for the model's intended users, and the model structure and the SAPHIRE computer software are at the state of the technology. The teams also identified a number of enhancements for the SPAR models and supporting documentation. Major activities undertaken to address the high priority~~se~~ –peer-review items include the following:

- Structuring the SPAR model documentation to more closely align with the structure

of ASME/ANS PRA standard. A majority of the peer review comments were related to documentation issues.

- Incorporating improved LOOP modeling and support system initiating events modeling into the SPAR models (e.g., loss of service water or component cooling water).

- Expanding the SAPHIRE Web site to better log and track model change requests.

The staff completed these PWR and BWR SPAR Model peer-review enhancements in August 2015.

On July 14–15, 2015, RES, in collaboration with Idaho National Laboratory staff, held a 2-day public workshop on the agency's SPAR model program. Workshop discussions included the objectives of the SPAR model program; data collection and analysis; human reliability analysis; LOOP modeling; and SPAR model maintenance and quality assurance. The workshop participants included representatives from NPPs, industry contractors, international partners, and public interest groups. In addition, NRC staff from NRR, NRO, and the Regions attended. A meeting summary of the workshop can be found in Agencywide Documents Access and Management System (ADAMS) at Accession No. ML15198A191.

The staff continues to maintain and improve the SAPHIRE software to support the SPAR Model Program. SAPHIRE is a personal-computer-based software application used to develop PRA models and perform analyses with SPAR models. During FY 2015, significant SAPHIRE activities included the following:

- Oversight of the SAPHIRE software quality-assurance program, including performance of an annual audit of software quality-assurance activities, tools, and documents in accordance with NUREG/BR-0167, "Software Quality Assurance Program and Guidelines."

- Implementation of new SAPHIRE features, including the capability to easily sort model results by their contribution to different accident sequences and improvements to the reporting functions for external hazard model results.

- Evaluation of~~Research on~~ code infrastructure improvements necessary to support a multi-user Web~~server~~-based platform for SAPHIRE.

Enclosure 2, "Status of the Standardized Plant Analysis Risk Models," provides a detailed status of SPAR models and related activities.

Planned ASP and SPAR Model Activities

- The staff will continue the screening, review, and analysis (preliminary and final) of potential precursors for FY 2015 and FY 2016 events.

- The staff will continue the detailed study of electrical system and component failure contribution to the risk at operating NPPs.

- The staff will continue to implement enhancements to the internal event SPAR models for full-power operations. Planned enhancements include model updates based on

insights from ongoing thermal-hydraulic analyses and a comprehensive update of all SPAR models to reflect recent operating experience.

- The staff will continue quality-assurance activities for both the agency SPAR models and the SAPHIRE code. This will ensure that agency risk tools continue to be of sufficient quality for performing SDP, ASP, and MD 8.3 event assessments in support of the staff's risk-informed regulatory activities.

- The staff will continue to evaluate the need for additional SPAR model capability (beyond full-power internal events) based on experience gained from risk assessment activities and feedback from users. In addition, the staff intends to continue to develop new external hazard capabilities with new SPAR-AHZ models.

SUMMARY:

Under the ASP Program, the staff continues to evaluate the safety significance of operating events at NPPs and to provide insights into the NRC's risk-informed and performance-based regulatory programs. The staff identified no *significant* precursors in FY 2014 and in the FY 2015 events evaluated to date. The staff identified one statistically significant increasing trend involving the occurrence rate of LOOP precursor events for the period FY 2005 through FY 2014. The SPAR Model Program is continuing to develop and improve independent risk-analysis tools and capabilities to support the use of PRA in the agency's risk-informed regulatory activities.

COORDINATION:

The Office of the General Counsel reviewed this Commission paper and has no legal objection.

Brian W. Sheron, Director
Office of Nuclear Regulatory Research

Enclosures:
1. Results, Trends, and Insights of the ASP Program
2. Status of the SPAR Models

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OFFICE	RES/DRA/PRB	SUNSI Review	RES/DRA/PRA	RES/DRA/PRB	Tech Editor
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Results, Trends, and Insights of the Accident Sequence Precursor Program

1.0 Introduction

This enclosure discusses the results of accident sequence precursor (ASP) analyses conducted by the U.S. Nuclear Regulatory Commission (NRC) staff as they relate to events that occurred during fiscal years (FYs) 2014 and 2015. Based on those results, this document also discusses the staff's analysis of historical ASP trends and the evaluation of the related insights.

2.0 Background

The NRC established the ASP Program in 1979 in response to recommendations made in NUREG/CR-0400, "Risk Assessment Review Group Report," issued September 1978 (Ref. 1).[1] The ASP Program systematically evaluates U.S. nuclear power plant (NPP) operating experience to identify, document, and rank the operational events that have a conditional core damage probability (CCDP) or an increase in core damage probability (ΔCDP) greater than or equal to 1×10^{-6}. That is, for any given operational event analyzed, the likelihood of inadequate core cooling and severe core damage was greater than or equal to one in one million.

Program Process. To identify potential precursors, the staff reviews operational events, including the impact of external events (e.g., fires, floods, and seismic events), from licensee event reports (LERs) and inspection reports (IRs) on a plant unit basis (i.e., a single event that affects a multiunit site is counted as a precursor for each unit). The staff then analyzes any identified potential precursors by calculating the probability of an event leading to a core damage state. The analyses of operational events are conducted using the NRC's Standardized Plant Analysis Risk (SPAR) models and the Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) software. The SPAR models are a plant-specific set of risk models that rely on a set of standardized modeling conventions (e.g., naming scheme, modeling approaches, and logic structure). Figure 1 illustrates the complete ASP analysis process.

Program Metrics. An operational event can be one of two types: (1) an occurrence of an initiating event, such as a reactor trip or a loss of offsite power (LOOP), with or without any subsequent equipment unavailability or degradation, or (2) a degraded plant condition characterized by the unavailability or degradation of equipment without the occurrence of an initiating event.

For the first type of event, the staff calculates a CCDP. This metric represents a conditional probability that a core damage state is reached given the occurrence of the observed initiating event (and any subsequent equipment failure or degradation). For the second type of event, the staff calculates a ΔCDP. This metric represents the increase in core damage probability for the

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[1] The NRC formed the Risk Assessment Review Group (commonly referred to as the Lewis Committee) in 1977 to perform an independent evaluation of the Reactor Safety Study (WASH-1400) that was completed 3 years earlier. That committee made a number of recommendations in 1978, including that more use be made of operational data to assess the risk from nuclear power plants. The review group's report stated, "It is important, in our view, that potentially significant (accident) sequences, and precursors, as they occur, be subjected to the kind of analysis contained in WASH-1400." The first major report of the ASP program, "Precursors to Potential Severe Core Damage Accidents: 1969–1979, A Status Report" (NUREG/CR-2497, Volume 1), was formally released in June 1982.

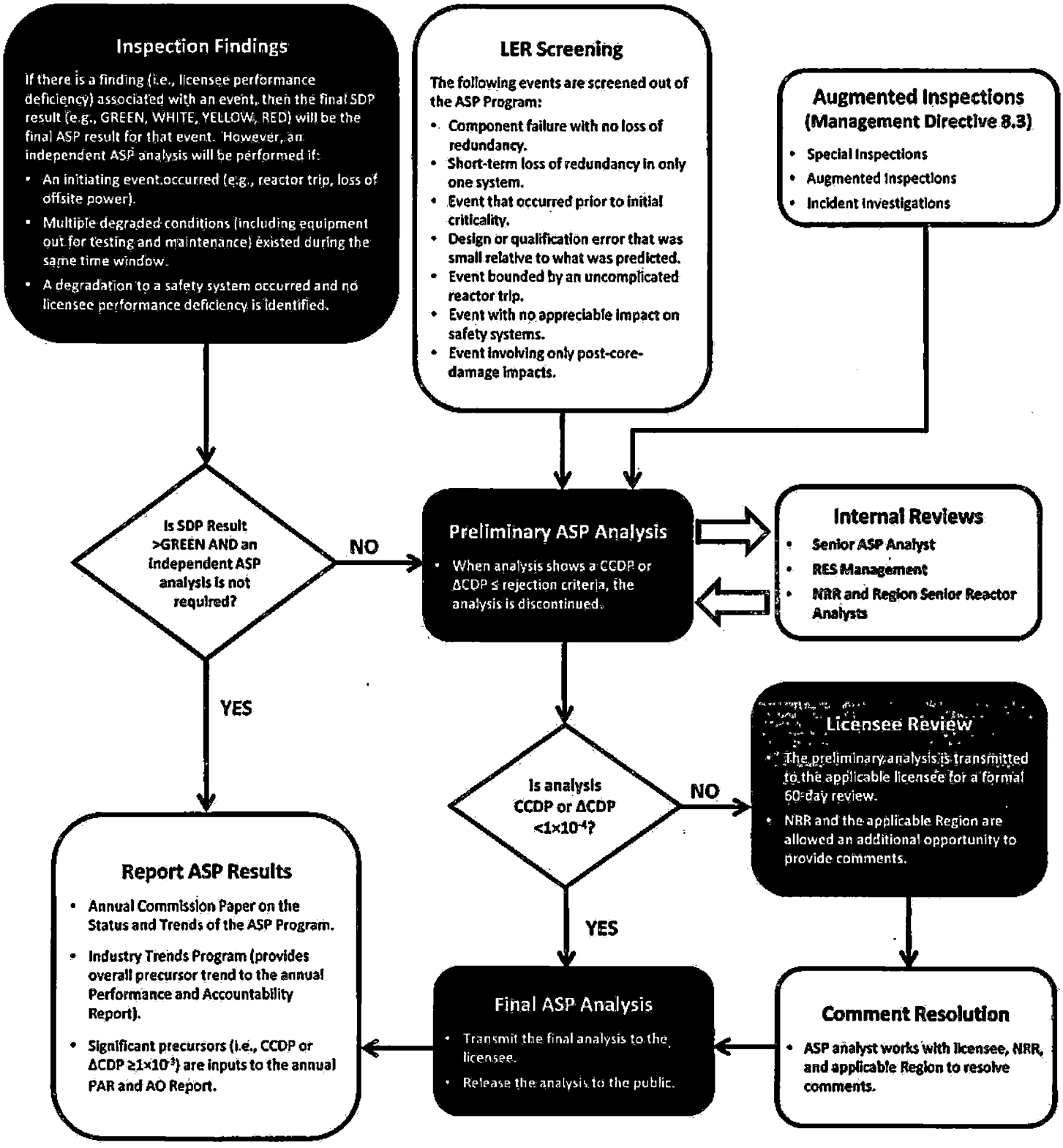

Figure 1. ASP Process Flowchart.

time period during which a component or multiple components were deemed unavailable or degraded.

Program Thresholds. The ASP Program defines an event with a CCDP or a ΔCDP greater than or equal to 1×10^{-6} to be a precursor. ~~For initiating event analyses, and to focus analyses on the more safety significant events, the ASP Program excludes as precursors reactor transients whose results would be similar to or less significant than the nonrecoverable loss of feedwater and condenser heat sink, with no degradation of safety-related equipment. Therefore, t~~The ASP Program uses the plant-specific CCDP for the nonrecoverable loss of feedwater and condenser heat sink, with no degradation of safety-related equipment, as the~~an~~ initiating-event precursor threshold if it is greater than~~of a CCDP of~~ 1×10^{-6} ~~or the plant-specific CCDP for the nonrecoverable loss of feedwater and condenser heat sink, whichever is greater.~~[2] This ensures the more safety-significant events are analyzed. Since 1988, this initiating-event precursor threshold has screened out uncomplicated trips (reactor trips with no losses of safety-system equipment) from being precursors because of their relatively low risk significance. The ASP Program defines a *significant* precursor as an event with a CCDP or ΔCDP greater than or equal to 1×10^{-3}.

Program Objectives. The ASP Program has the following objectives:

- Provide a comprehensive, risk-informed view of NPP operating experience and a measure for trending core damage risk.
- Provide a partial validation of the adequacy of current ~~state of practice in~~probabilistic risk assessment (PRA) standards and guidance.
- Provide feedback to regulatory activities.

The NRC also uses the ASP Program results to monitor performance against performance indicators in the agency's Congressional Budget Justification (Ref. 2) and Industry Trends Program (ITP) (Ref. 3), as well as in reports to Congress on events of high safety significance in accordance with "abnormal occurrence" criteria (Ref. 4). Specially, the ASP Program provides the following inputs to programs and reports:

- Number of *significant* precursor events for the annual Congressional Budget Justification. ASP Program results are used as one of several inputs to the performance indicator "Number of malfunctions, deficiencies, events, or conditions at commercial nuclear power plants (operating or under construction) that meet or exceed abnormal occurrence (AO) criteria II.A though II.D."
- Trend of all precursor events for the ITP.
- Number of precursor events with a CCDP or ΔCDP greater than or equal to 1×10^{-5} for the ITP. ASP program results are used, along with other inputs from other programs, in the ITP to evaluate the trend of the "significant events" industry-level indicator.
- Description of *significant* precursor events for the annual abnormal occurrence report to Congress in accordance with Criterion II.C of NUREG-0090, "Report to Congress on Abnormal Occurrences Fiscal Year 2014," Volume 37 (Ref. 4).

~~[2] The plant-specific CCDP is determined using the SPAR models to analyze the nonrecoverable loss of the main feedwater and condenser heat sink initiating events for each plant. If the results from either of these analyses are greater than 1×10^{-6}, the highest value is used as the precursor threshold for the subject plant.~~

Program Scope. The ASP Program is one of three agency programs that assess the risk significance of events at operating NPPs. The other two programs are the Significance Determination Process (SDP) (Ref. 5) and the event-response evaluation process, as defined in Management Directive (MD) 8.3, "NRC Incident Investigation Program" (Ref. 6). The SDP evaluates the risk significance of a single licensee performance deficiency, while the risk assessments performed under MD 8.3 are used to determine, in part, the appropriate level of reactive inspection in response to an event. An SDP assessment has the benefit of information obtained from the inspection, whereas the MD 8.3 assessment is expected to be performed within a day or two after the event notification.

In contrast to the other two programs, a comprehensive and integrated risk analysis under the ASP Program includes all anomalies observed at the time of the event or discovered after the event. These anomalies may include unavailable and degraded plant structures, systems, and components (SSCs); human errors; and an initiating event (reactor trip). In addition, an unavailable or degraded SSC does not have to be a performance deficiency (e.g., SSCs out for test and maintenance) or an analyzed condition in the plant design basis. The ASP Program has time to complete an analysis of a complex issue and thus produces a more refined estimate of risk. Analyses schedules provide time so that NRC or licensee engineering evaluations can be made available for review. State-of-the-art methods can be developed or current techniques can be refined for unique conditions when necessary. In addition, the SPAR model can be modified for special considerations (e.g., seismic, internal fires, flooding).

There are similarities in the risk assessments conducted by the three programs. All programs use SPAR models, the same documented methods and guidance, and similar analysis assumptions, except where program objectives deviate from one another. ASP and SDP analyses assumptions are typically the same for single performance deficiencies. To minimize overlap and improve efficiency, Ssince 2006, SDP results have been used in lieu of independent ASP analyses to the extent practical and consistent with the overall objectives of both programs~~, if the SDP analyses considered all concurrent degraded conditions or equipment unavailabilities that existed during the time period of the condition~~. Typically the SDP analyses are used in the ASP Program when the analysis performed addresses the major contributors to risk for the event based on a review conducted by an ASP Program risk analyst. Typically for initiating events, many of the modeling assumptions made for MD 8.3 analyses can be adopted by ASP analyses. However, some modeling assumptions are revised as detailed information about the event becomes available when inspection activities are completed. In addition, there are program differences on how certain modeling aspects are incorporated (e.g., SSCs out for testing or maintenance). These key similarities provide opportunities for significant ASP Program efficiencies. For a potential *significant* precursor, analysts from the three programs work together to provide a timely determination of plant risk. As such, duplication between programs is minimized to the extent practical within the program objectives.

In addition~~Currently~~, the ASP Program provides integrated analyses of complex operating events that are not evaluated by the SDP or finalized by MD 8.3 evaluations. Two notable examples include the degraded reactor vessel head with multiple degraded conditions at Davis-Besse in FY 2003 (LERs 346/02-002, 346/02-005, and 346/03-002) and the complicated LOOP event at Byron Unit 2 in FY 2012 (LER 454/12-001).

The Davis-Besse precursor event involved (1) a potential loss-of-coolant accident (LOCA) due to reactor pressure vessel head erosion from the leakage of a circumferential cracked control rod drive mechanism nozzle, (2) the potential unavailability of sump recirculation due to screen plugging following a postulated LOCA from unqualified containment coatings and other debris

(e.g., insulation) inside containment, and (3) the potential unavailability of high-pressure safety injection pumps during the recirculation phase of a postulated LOCA due to potential debris generated by certain postulated LOCAs and entrained in pumped fluid. The SDP cited three licensee performance deficiencies. Analyzed separately, the equivalent ΔCDP for the three deficiencies were 4×10^{-4}, 3×10^{-5}, and 3×10^{-6}, respectively. The ASP Program analysis integrated these deficiencies and aggregated the risk which resulted in a ΔCDP of 6×10^{-3} identifying this as a significant precursor that was reportable to Congress. The ASP analysis result confirmed the risk significance of this event following a systematic and repeatable process that, in part, undergirded the substantial regulatory response that was undertaken. The regulatory response included issuance of Order EA-03-009 requiring all licensees with plants susceptible to reactor pressure vessel head degradation to perform visual inspections for indications of degradation or boric acid leakage, worked with the American Society of Mechanical Engineers (ASME) to incorporate reactor pressure vessel head inspections into the ASME code, adopted a new operating experience program, and enhanced the NRC's ability to detect declining plant performance by changing several NRC inspection and management programs.

The Byron Unit 2 precursor event resulted from a LOOP and unprotected under-voltage conditions on safety-related electrical buses for eight minutes. The loss of one of three phases (Phase "C") of 345 kilovolts offsite power to the two unit station auxiliary transformers (SATs) did not result in an automatic under-voltage protection signal, because the under-voltage protection scheme did not provide adequate protection from a single loss of Phases "A" and "C". As a result, all running safety equipment powered by the safety buses had tripped on over-current conditions. These conditions existed until operators manually opened (from the main control room) the SAT feeder breakers about eight minutes after the event had initiated. Following the opening of the SAT feeder breakers, both emergency diesel generators started and loaded supplying power to the safety buses, as designed. The MD 8.3 risk assessment of the event that was performed on the day of the event occurrence resulted in a CCDP of 7×10^{-6}. The assessment did not include the aspects of the under-voltage condition of the safety buses that was identified as the result of a special inspection. The inspection identified no performance deficiencies; therefore, no SDP assessment was required. The ASP analysis of this complicated LOOP event resulted in an aggregated plant risk ~~of~~ CCDP of 1×10^{-4}. This realization contributed to the basis for the ongoing staff efforts on the system study of electrical system and component failures to risk. In addition, the NRC staff issued Bulletin 2012-01, "Design Vulnerability in Electric Power System," and Information Notice (IN) 2012-03, "Design Vulnerability in Electric Power System" highlighting the potential significance of a single-phase open circuit condition.

3.0 ASP Program Status

The following subsections summarize the status and results of the ASP Program (as of September 30, 2015).

FY 2014 Analyses. The staff completed its screening and review of 501 LERs and their associated inspection findings for FY 2014. On the basis of that review, 36 events were selected and analyzed for potential precursors. Of these, the ASP analyses have identified 6 precursors (initiating events) and the SDP identified 10 precursors (degraded conditions). For 10 of the 16 precursors, the performance deficiency identified under the Reactor Oversight Process documented the risk-significant aspects of the event completely. In these cases, the SDP significance category (i.e., the "color" of the finding) is reported in the ASP Program. For the remaining events, an independent ASP analysis was performed to determine the risk

significance of three LOOP initiating events, two electrical transformer failures, and a 13 kilovolts bus failure.

Table 1 presents the results of the staff's ASP analyses for FY 2014 precursors that involved initiating events. Table 2 presents the analysis results for FY 2014 precursors that involved degraded conditions.

FY 2015 Analyses. The staff performs an initial review of all events to determine if they have the potential to be *significant* precursors. Specifically, the staff reviews LERs (reported by licensees in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.73, "Licensee Event Report System") and daily event-notification reports (reported by licensees in accordance with 10 CFR 50.72, "Immediate Notification Requirements for Operating Nuclear Power Reactors") to identify potential *significant* precursors. The staff has completed the initial review of FY 2015 events and identified no potentially *significant* precursors (as of September 30, 2015). The staff will inform the Commission if a *significant* precursor is identified during the more detailed evaluations of events.

Table 1. FY 2014 Precursors Involving Initiating Events

Event Date	Plant	Description	CCDP
10/14/13	Pilgrim	LOOP and Reactor Scram. ***LER 293/13-009***	3×10^{-5}
12/9/13	Arkansas Nuclear One, Unit 2	Fire and Explosion of the Unit Auxiliary Transformer. ***LER 368/13-004***	2×10^{-6}
1/18/14	Shearon Harris	Manual Reactor Trip due to Indications of a Fire. ***LER 400/14-001***	6×10^{-6}
1/21/14	Calvert Cliffs 2	Reactor Trip due to Inadequate Protection Against Weather-Related Water Intrusion. ***LER 318/14-001***	5×10^{-6}
5/25/14	Millstone 2	Dual Unit LOOP and Reactor Scram. ***LER 336/14-006***	1×10^{-5}
5/25/14	Millstone 3	Dual Unit LOOP and Reactor Scram. ***LER 336/14-006***	2×10^{-5}

Table 2. FY 2014 Precursors Involving Degraded Conditions

Condition Duration	Plant	Description	ΔCDP/ SDP Color
39 years[5]	Fort Calhoun	Harsh Environment Due to Postulated High-Energy Line Breaks Could Lead to the Failure of Equipment Needed to Safely Shutdown the Plant. ***Enforcement Action (EA)-14-187***	WHITE[3]
31 years[5,6]	Ginna	Unanalyzed Condition for Potential Floodwater Intrusion into Vital Battery Rooms. ***EA-13-247***	WHITE
10 years[5]	Oconee 1	High Cycle Fatigue Resulted in Reactor Coolant Leak and Unit Shutdown. ***EA-14-091***	WHITE

[3] A WHITE finding corresponds to a licensee performance deficiency of low–to–moderate safety significance and has an increase in core damage frequency in the range of greater than 10^{-6} to 10^{-5} per reactor year.

Condition Duration	Plant	Description	ΔCDP/ SDP Color
36 years[5,6]	St. Lucie 1	Internal Reactor Auxiliary Building Flooding During Heavy Rain Due to Degraded Conduits Lacking Internal Flood Barriers. ***EA-14-131***	WHITE
40 years[5,6]	Arkansas Nuclear One, Unit 1	Inadequate External Flood Protection for Safety-Related Equipment Located Below the Design Basis Flood Elevation. ***EA-14-088***	YELLOW[4]
40 years[5,6]	Arkansas Nuclear One, Unit 2	Inadequate External Flood Protection for Safety-Related Equipment Located Below the Design Basis Flood Elevation. ***EA-14-088***	YELLOW
1 year	Millstone 3	Turbine Driven Auxiliary Feedwater Pump Operability Impacted by Incorrect Bearing. ***EA-14-092***	WHITE
23 years[5]	Oyster Creek	Technical Specification Prohibited Condition Caused by Two Electromagnetic Relief Valves Inoperable for Greater Than Allowed Outage Time. ***EA-14-178***	YELLOW
9 years[5]	Oyster Creek	Technical Specification Prohibited Condition Caused by Emergency Diesel Generator Inoperable for Greater than Allowed Outage Time. ***EA-14-186***	WHITE
109 days	Clinton	Failure of a Shutdown Cooling Water Pump Due to Damaged Bushing. ***EA-15-064***	WHITE

4.0 Trends and Insights

This section defines a statistically significant trend, defines the data period used in trending analyses, and discusses the results of trending analyses and insights for all precursors and *significant* precursors.

Statistically Significant Trend. Statistically significant is defined in terms of the "p-value." A p-value is a probability indicating whether to accept or reject the null hypothesis that no trend exists in the data.[7] A p-value less than or equal to 0.05 indicates that there is 95 percent confidence that a trend exists in the data (i.e., leading to a rejection of the null hypothesis that there is no trend).

Data Coverage. The data period for the ASP trending analyses is a rolling 10-year period, which is aligned with thea rolling 10-year period used in the ITP.

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4 A YELLOW finding corresponds to a licensee performance deficiency of moderate–to–high safety significance and has an increase in core damage frequency in the range of greater than 10^{-5} to 10^{-4} per reactor year.

5 Note that although these degraded conditions lasted for many years, ASP and SDP analyses limit the exposure period to 1 year.

6 These four events were identified from the efforts undertaken by licensees and NRC inspectors as part of the Fukushima Near-Term Task Force Recommendation 2.3 walkdown inspections (Ref. 7).

7 For the purposes of this analysis, the null hypothesis is based on a constant-rate Poisson process producing the observed data set. A lower p-value indicates a lower likelihood that the observed data could be produced by this constant-rate process.

4.1 Occurrence Rate of All Precursors

The NRC's ITP ~~monitors~~evaluates trends in licensee safety performance using industry-level indicators. The mean occurrence rate of all precursors identified by the ASP Program is one indicator used by the ITP to assess industry performance.[8]

Results. The mean occurrence rate of all precursors does not exhibit a statistically significant trend (p-value = 0.59) for the 10-year period from FY 2005 through FY 2014 (see Figure 2).

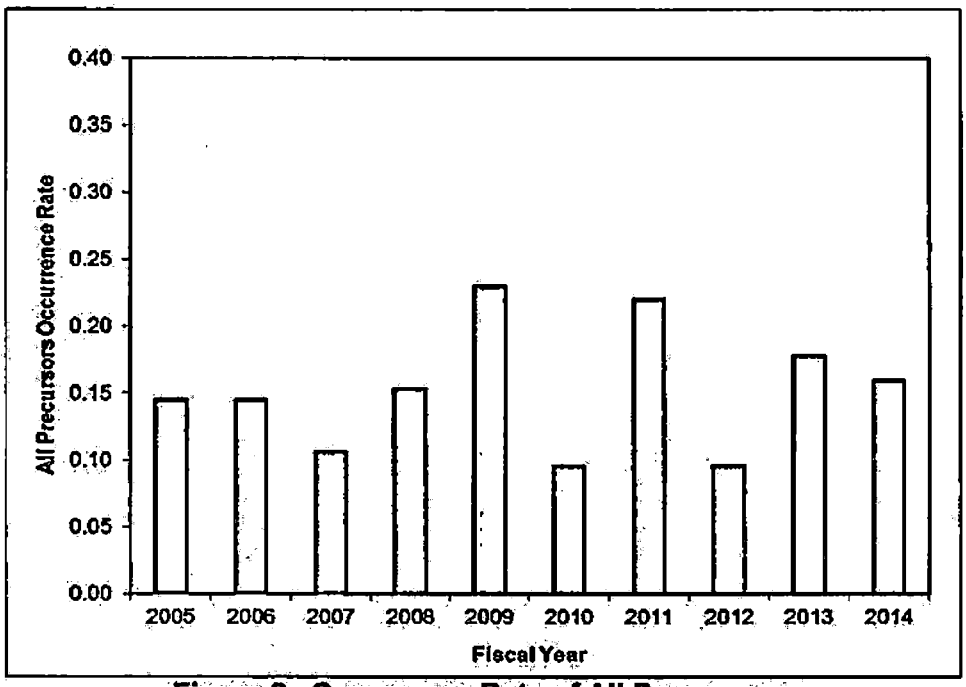

Figure 2. Occurrence Rate of All Precursors.

4.2 *Significant* Precursors

The NRC's Congressional Budget Justification (NUREG-1100, Volume 31) provides performance indicators used to measure and evaluate~~monitor~~ performance as part of the NRC's planning, budget, and performance management process. The number of *significant* precursors identified by the ASP program is one of several inputs to a performance indicator used to monitor the agency's strategic safety goal (Ref. 2).

Results. A review of the data for the 10-year period from FY 2005 through FY 2014 reveals the following insights:

- No *significant* precursors have been identified during FY 2005 through FY 2014. The staff has completed the initial review of FY 2015 events and identified no potentially *significant* precursors (as of September 30, 2015).
- The last *significant* precursor was identified in FY 2002 and involved concurrent, multiple degraded conditions at the Davis-Besse nuclear power plant.[9]

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8 The occurrence rate is calculated by dividing the number of precursors by the number of reactor years.

9 Commission Paper SECY-10-0125, "Status of the Accident Sequence Precursor Program and the Standardized

4.3 Occurrence Rate of Precursors with a CCDP or ΔCDP ≥ 1×10^{-4}

Precursors with a CCDP or ΔCDP ≥ 1×10^{-4} are considered important in the ASP Program because they generally have a CCDP higher than the annual CDP estimated by most plant-specific ~~probabilistic risk assessments~~ (PRAs).

Results. A review of the data for the 10-year period from FY 2005 through FY 2014 reveals the following trend and insights:

- The staff did not identify any precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4} for FY 2013 or FY 2014.
- The mean occurrence rate of precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4} does not exhibit a statistically significant trend (p-value = 0.11; see Figure 3).

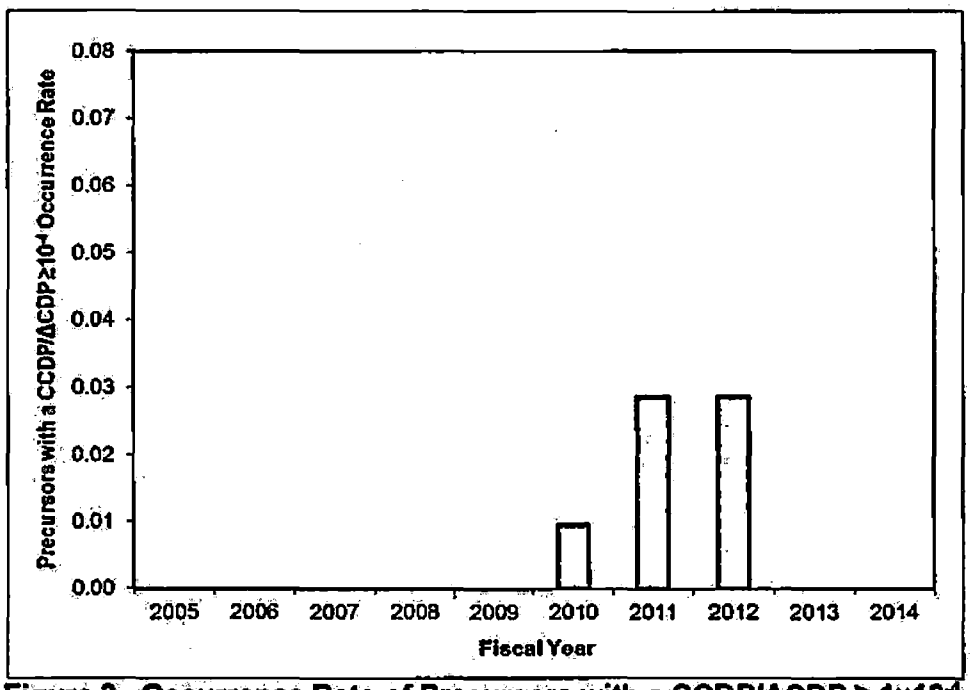

Figure 3. Occurrence Rate of Precursors with a CCDP/ΔCDP ≥ 1×10^{-4}.

- For FY 2012 and FY 2013, statistically significant increasing trends were observed in each respective 10-year period (FY 2003 through FY 2012 and FY 2004 though FY 2013, respectively). However, with no additional precursors observed in FY 2013 and FY 2014, the trend is no longer statistically significant.
- Over the past 10-year period (FY 2005 through FY 2014), a total of 7 precursors with CCDP or ΔCDP greater than or equal to 1×10^{-4} were identified: in FY 2010 (1 precursor), FY 2011 (3 precursors), and FY 2012 (3 precursors). As reported to the Commission last year, 6 of the 7 precursors involved electrical events in electrical distribution systems. See Enclosure 1 to SECY-14-0107, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," for a listing of these precursor events and a summary of insights (Ref. 9).

Plant Analysis Risk Models" (Ref. 8), provides a complete list of all *significant* precursors from 1969 through 2010.

4.4 Precursors Involving Initiating Events and Degraded Conditions

A review of the data for the 10-year period from FY 2005 through FY 2014 reveals the following insights for precursors involving initiating events and degraded conditions.

Initiating Events

- The mean occurrence rate of precursors involving initiating events does not exhibit a statistically significant trend (p-value = 0.26) (see Figure 4).

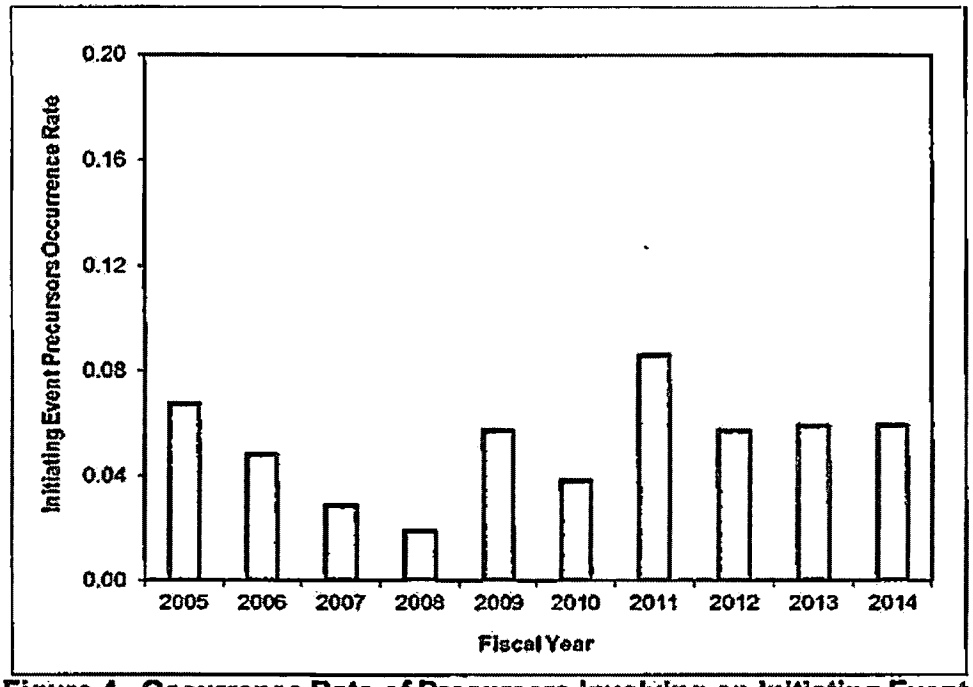

Figure 4. Occurrence Rate of Precursors Involving an Initiating Event.

- Of the 54 precursors involving initiating events, 27 precursors (50 percent) were LOOP events. While the frequency of complicated trips[10] (27 precursors) is about the same as the frequency of LOOPs (27 precursors), the CDP~~core-damage probability risk~~ estimates for LOOPs are somewhat higher.

Degraded Conditions

- The mean occurrence rate of precursors involving degraded conditions does not exhibit a statistically significant trend (p-value = 0.94) (see Figure 5).
- Over the past 10 years, precursors involving degraded conditions (104 precursors) outnumbered initiating events (54 precursors) by 93 percent.
- Of the 104 precursors involving degraded conditions, 35 precursors (34 percent) involved degraded conditions existing for a decade or longer.[11] Of these 35 precursors,

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[10] A complicated trip is a reactor trip with a concurrent loss of safety-system equipment.

[11] Note that although these degraded conditions lasted for many years, ASP and SDP analyses limit the exposure period to 1 year.

15 precursors ~~(43 percent)~~ involved degraded conditions dating back to initial plant construction.

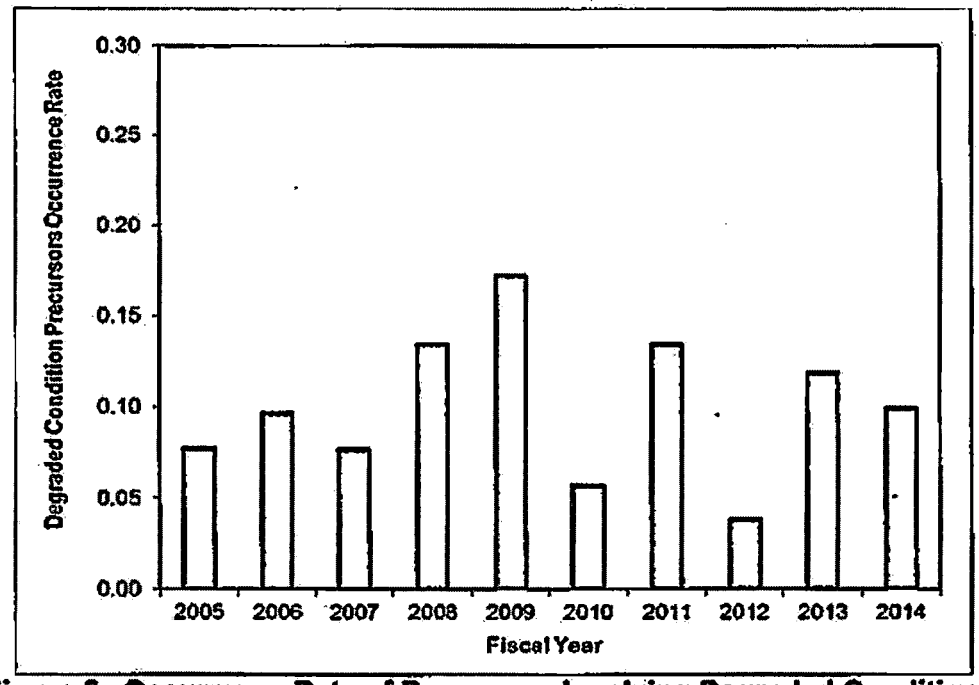

Figure 5. Occurrence Rate of Precursors Involving Degraded Conditions.

4.5 Precursors Involving a Complete Loss of Offsite Power Initiating Event

In FY 2014, 3 precursors from 2 NPP sites resulted from a complete LOOP initiating event.[12] In FY 2015, 3 complete LOOP initiating events occurred at 2 NPP sites.[13] Typically, all complete LOOP initiating events meet the precursor threshold.

Results. A review of the data for the 10-year period from FY 2005 through FY 2014 reveals the following insights:

- *Trend.* The mean occurrence rate of precursors involving LOOP precursor events exhibited a statistically significant increasing trend (p-value = 0.01; see Figure 6). The increasing trend of LOOP precursor events became significant in FY 2014 when 6 LOOP precursor events dropped out of the rolling 10-year trend period and 3 LOOP precursor events occurred in FY 2014.
- *Precursor Counts.* Of the 158 precursors that occurred during the FY 2005 through FY 2014 period, 27 precursors (17 percent) were LOOP precursor events that occurred at 19 NPP sites. Of the 27 LOOP precursor events, 20 ~~(74 percent)~~ precursors occurred during

[12] A LOOP initiating event involves a reactor trip and the simultaneous loss of electrical power to all unit safety buses (also referred to as emergency buses, Class 1E buses, and/or vital buses) requiring all emergency power generators to start and supply power to the safety buses. The non-safety buses may (or may not) be deenergized as a result of the LOOP initiating event. (Ref. 10)

[13] Precursor analyses of events occurring in FY 2015 are not final. Three LOOP initiating events occurred in FY 2015 and will most likely meet the ASP threshold (i.e., CCDP $\geq 1 \times 10^{-6}$). These events are not included in the trending analysis. These FY 2015 LOOP events occurred at Pilgrim on January 27, 2015 (LER 293/15-002) and Calvert Cliffs Units 1 and 2 on April 7, 2015 (LER 317/15-002).

the last 4 years (FY 2011 through FY 2014).

- *Concurrent Unavailability of an Emergency Power Train.* Of the 27 LOOP precursor events, 2 (7 percent) precursors involved a concurrent unavailability of an emergency power system train during the FY 2005 through FY 2014 period. One precursor involved an emergency diesel generator (EDG) failure to run due to a leak in the EDG coolant system and 1 precursor involved an EDG out of service due to maintenance. In FY 2015, a LOOP initiating event (and potential precursor) occurred involving an EDG failure to start due to a fault in the EDG startup circuity and the shutdown sequencer failure for the other EDG to automatically restart selected equipment (see Calvert Cliffs LER 317/15-002).
- *External Hazards.* Of the 27 LOOP precursor events, 12 (44 percent) precursors resulted from external hazards, including: 2 tornados (5 precursors), Hurricane Katrina (1 precursor), 3 other weather-related events (4 precursors), and the 2011 Virginia earthquake (2 precursors). All plant-units at the 5 multi-unit NPP sites involved in these events were affected by the external events. Of these 12~~1~~ LOOP precursor events, 7 (58~~64~~ percent) occurred in FY 2011.[14]
- *Outside Plant Boundary.* Of the 27 LOOP precursor events, 3 (11 percent) precursors resulted from an electrical fault either in the plant switchyard or offsite power transmission line to the switchyard.
- *Multi-unit NPP Sites.* Of the 27 LOOP precursor events, 15 precursors occurred at all units at a multi-unit NPP site, 5 precursors occurred at a single unit at a multi-unit site, and 7 precursors occurred at a single-unit site.

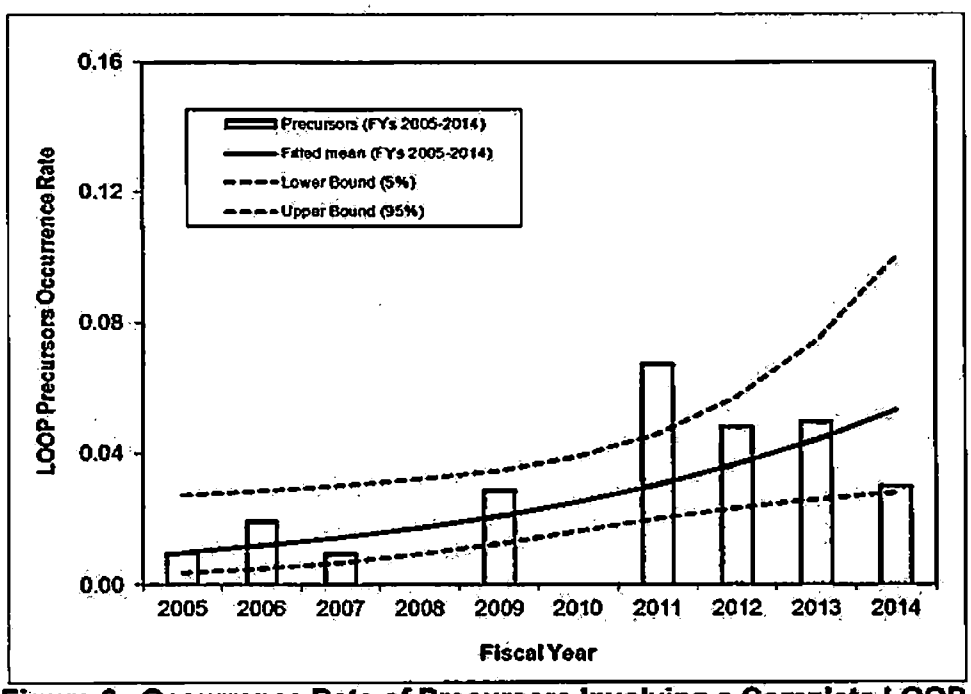

Figure 6. Occurrence Rate of Precursors Involving a Complete LOOP.

4.6 Precursors at BWRs and PWRs

[14] These FY 2011 events were the Surry Units 1 and 2 tornado precursor events that occurred on April 16, 2011; the Browns Ferry Units 1, 2, and 3 tornado precursor events that occurred on April 27, 2011; and the North Anna Units 1 and 2 earthquake precursor events that occurred on August 23, 2011.

A review of the data for the 10-year period from FY 2005 through FY 2014 reveals the following insights for boiling-water reactors (BWRs) and pressurized-water reactors (PWRs).

BWRs

- The mean occurrence rate of precursors that occurred at BWRs does not exhibit a statistically significant trend (p-value = 0.41; see Figure 7).

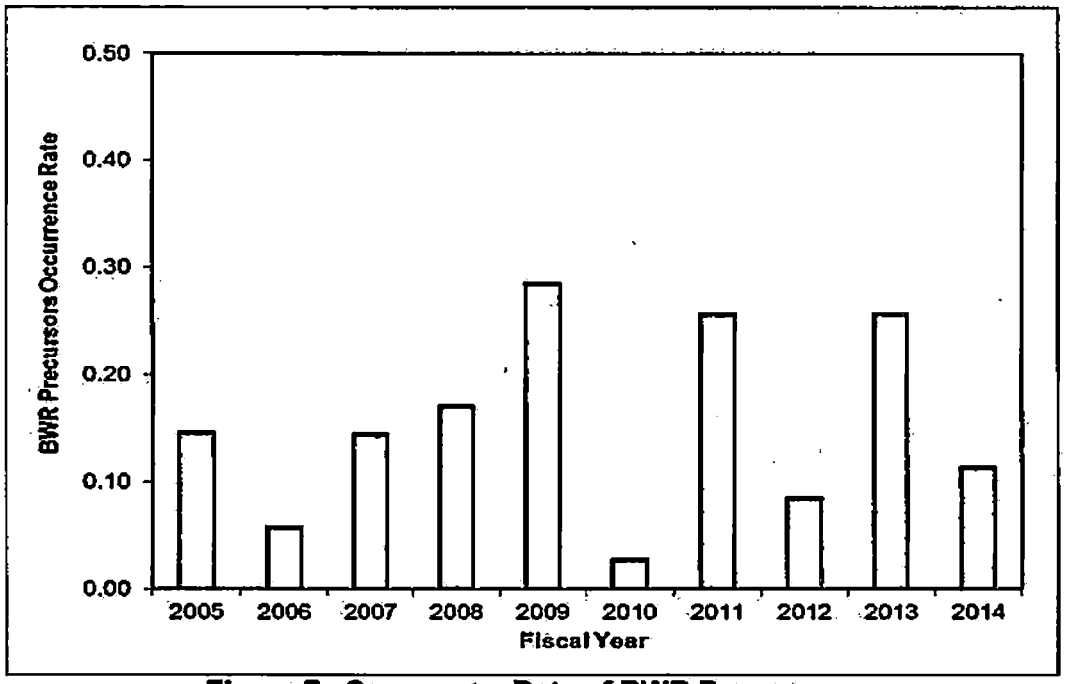

Figure 7. Occurrence Rate of BWR Precursors.

- Of the 21 precursors involving initiating events at BWRs, 11 precursors (52 percent) were complete LOOP events.
- Of the 33 precursors involving the unavailability of safety-related equipment that occurred at BWRs, most were caused by failures in the emergency power system (12 precursors or 36 percent), emergency core cooling systems (7 precursors or 21 percent), electrical distribution systems (2 precursors or 6 percent), or safety-related cooling water systems (1 precursor or 3 percent).

PWRs

- The mean occurrence rate of precursors that occurred at PWRs does not exhibit a statistically significant trend (p-value = 0.95; see Figure 8).
- Of the 33 precursors involving initiating events at PWRs, 16 precursors (48 percent) were complete LOOP events.
- Of the 71 precursors involving the unavailability of safety-related equipment that occurred at PWRs, most were caused by failures in the emergency power system (17 precursors or 24 percent), auxiliary feedwater system (10 precursors or 14 percent), electrical distribution system (10 precursors or 14 percent), safety-related cooling water systems (7 precursors or 10 percent), or emergency core cooling systems (5 precursors or 7 percent).

- Of the 5 precursors involving failures in the emergency core-cooling systems, 3 precursors (60 percent) were because of conditions affecting sump recirculation during postulated loss-of-cooling accidents of varying break sizes.

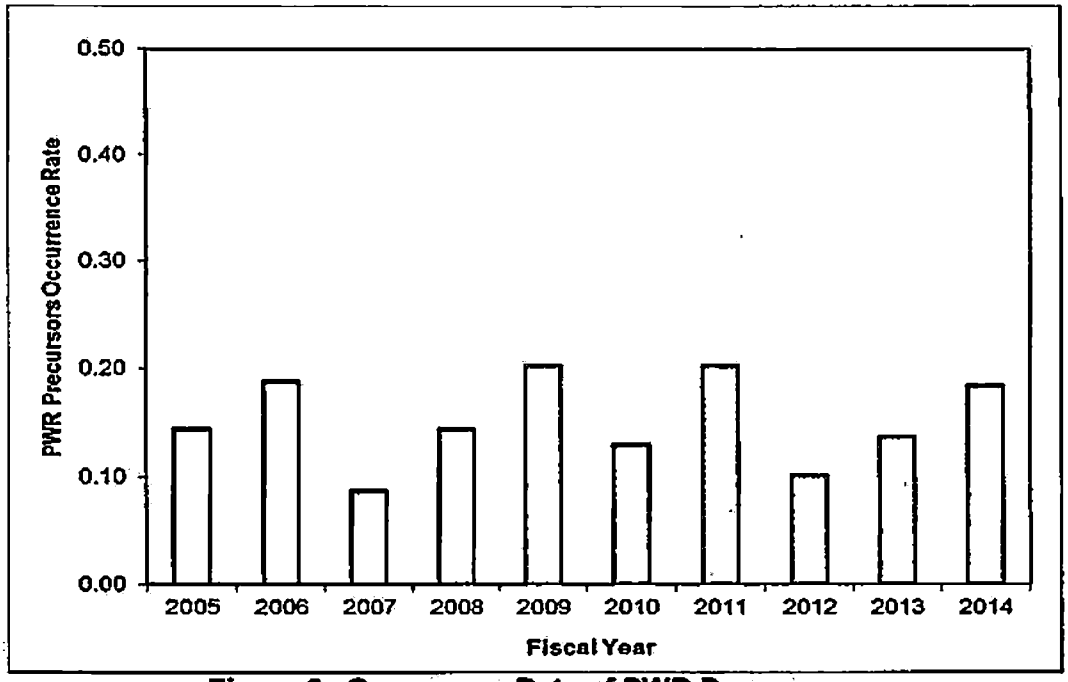

Figure 8. Occurrence Rate of PWR Precursors.

- Of the 10 precursors involving failures of the auxiliary feedwater system, random hardware failures (7 precursors or 70 percent) and design errors (2 precursors or 20 percent) were the largest failure contributors. Nine of the 10 precursors (90 percent) involved the unavailability of the turbine-driven auxiliary feedwater pump train.
- Of the 17 precursors involving failures in the emergency power system, 14 precursors (82 percent) were from hardware failures.
- Design errors contributed to 2 precursors involving the unavailability of safety-related equipment that occurred at PWRs.

4.7 Operating Experience Insights Feedback for PRA Standards and Guidance

One objective of the ASP Program is to provide insights into the adequacy of current PRA standards and guidance~~state-of-practice in risk-assessment~~. ASP event analyses, both precursors and events that did not exceed the ASP Program threshold, from FY 2014 were reviewed against the ~~approaches to~~ PRA elements described in the American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications" (Ref. 11), as endorsed in Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities" (Ref. 12). This review sought to identify aspects of the event analyses for which the risk-significant ASME/ANS PRA Standard did not provide adequate guidance.

Results. None of the FY 2014 event analyses indicated an inadequacy in the ~~state of~~ PRA

elements~~practice~~ as described in ASME/ANS RA-Sa-2009. The staff continues to work with ASME/ANS on refining the standard to ensure that it provides sufficient guidance~~ to assess the risk significance of external events, including external flooding~~.

5.0 Summary

This section summarizes the ASP results, trends, and insights:

- ***Significant Precursors.*** The staff identified no *significant* precursors (i.e., CCDP or ΔCDP greater than or equal to 1×10^{-3}) in FY 2014. The staff identified no potentially *significant* precursors in FY 2015 (as of September 30, 2015).
- ***Occurrence Rate of All Precursors.*** The occurrence rate of all precursors does not exhibit a trend that is statistically significant from FY 2005 through FY 2014.
- ***Additional Trend Results.*** During the same period, a statistically significant increasing trend was observed in precursors involving LOOP precursor events. No statistically significant trend was observed in precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4}, precursors involving initiating events or degraded conditions, or~~and~~ precursors at BWRs or PWRs.

6.0 References

1. U. S. Nuclear Regulatory Commission, "Risk Assessment Review Group Report to the U. S. Nuclear Regulatory Commission," NUREG/CR-0400, Volume 37, September 1978, Agencywide Documents Access and Management System (ADAMS) Accession No. ML072320423.

2. U. S. Nuclear Regulatory Commission, "2016 Congressional Budget Justification," NUREG-1100, Volume 31, February 2015, ADAMS Accession No. ML15030A093.

3. U. S. Nuclear Regulatory Commission, "Industry Trends Program," Inspection Manual Chapter (IMC) 0313, May 29, 2008, ADAMS Accession No. ML102500670.

4. U. S. Nuclear Regulatory Commission, "Report to Congress on Abnormal Occurrences, Fiscal Year 2014," NUREG-0090, Volume 37, May 2015, ADAMS Accession No. ML15140A285.

5. U. S. Nuclear Regulatory Commission, "Significance Determination Process," IMC 0609, June 2. 2011, ADAMS Accession No. ML101400479.

6. U. S. Nuclear Regulatory Commission, "NRC Incident Investigation Program," Management Directive 8.3, June 25, 2014, ADAMS Accession No. ML13175A294.

7. U. S. Nuclear Regulatory Commission, "Recommendations for Enhancing Reactor Safety in the 21st Century: The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," July 12, 2011, ADAMS Accession No. ML112510271.

8. U. S. Nuclear Regulatory Commission, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," SECY-10-0125, September 29, 2010, ADAMS Accession No. ML102100386.

9. U.S. Nuclear Regulatory Commission, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," SECY-14-0107, October 6, 2014, ADAMS Accession No. ML14230A084.

10. U. S. Nuclear Regulatory Commission, "Reevaluation of Station Blackout Risk at Nuclear Power Plants, Analysis of Loss of Offsite Power Events: 1986-2004" NUREG/CR-6890, Volume 1, December 2005, ADAMS Accession No. ML060200477.

11. American Society of Mechanical Engineers/American Nuclear Society, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," ASME/ANS RA-Sa-2009, March 2009.

12. U.S. Nuclear Regulatory Commission, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," Regulatory Guide 1.200, Revision 2, March 2009, ADAMS Accession No. ML090410014.

Status of the Standardized Plant Analysis Risk Models

1.0 Background

The objective of the U.S. Nuclear Regulatory Commission's (NRC's) Standardized Plant Analysis Risk (SPAR) Model Program is to develop standardized risk analysis models and tools ~~for staff analysts~~ to support various regulatory activities, including the Accident Sequence Precursor (ASP) Program and ~~Phase 3 of~~ the Significance Determination Process (SDP). The SPAR models have evolved from two sets of simplified event trees initially used to perform precursor analyses in the early 1980s. Today's SPAR models for internal events are far more comprehensive than their predecessors. For example, the revised SPAR models include improved loss of offsite power (LOOP) and station blackout model~~ule~~s; an improved reactor coolant pump seal failure model; new support system initiating event models; and updated estimates of accident initiator frequencies and equipment reliability based on recent operating experience data.

The SPAR models consist of a standardized, ~~plant-specific~~ set of plant-specific risk models that use the event-tree and fault-tree linking methodology. Although the SPAR models are plant-specific models, they rely on a set of standardized modeling conventions (e.g., standardized naming conventions, standard modeling approaches, and logic structure). They employ a standard approach for event-tree development, as well as a standard approach for initiating event frequencies, equipment performance parameters, and human performance data. These input data can be modified to be more plant- and event-specific, when needed. SPAR standardization is needed to allow agency risk analysts to efficiently use SPAR models for a wide variety of nuclear power plants (NPPs) without having to relearn modeling conventions and basic assumptions. Although the system fault trees contained in the SPAR models generally are not as detailed as those in licensee probabilistic risk assessments (PRAs), in some cases SPAR models may contain more sophisticated modeling, such as for common-cause failures, support systems, and losses of offsite power. The staff maintains 75 SPAR models representing all 99 operating commercial NPPs. The SPAR models for NPPs that have recently permanently ceased operation (Kewaunee, Crystal River, San Onofre, and Vermont Yankee) are no longer being updated but remain available for staff use. All SPAR models are developed under a comprehensive quality assurance (QA) program and have been benchmarked against licensee PRAs through either onsite QA~~quality assurance~~ reviews or other information provided by the licensee.

The staff initiated the Risk Assessment Standardization Project (RASP) in 2004. A primary focus of RASP was to standardize risk analyses performed in SDP ~~Phase 3~~, in ASP, and under Management Directive (MD) 8.3, "NRC Incident Investigation Program." Under this project, the staff initiated the following activities:

- Enhance SPAR models to be more plant-specific and improve the Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) code used to manipulate the SPAR models.
- Document consistent methods and guidelines for risk assessments of internal events during power operations; internal fires and floods; external hazards (e.g., seismic events and tornadoes); and internal events during low-power and shutdown (LPSD) operations.
- Provide on-call technical support for staff involved with licensing and inspection issues.

This effort resulted in the development of the Risk Assessment of Operational Events Handbook (commonly referred to as the RASP Handbook) and better alignment between the SDP and ASP Program event assessment processes.

2.0 SPAR Model Program Status

The SPAR Model Program continues to play an integral role in the ASP analysis of operating events. Many other agency activities, such as the SDP analyses and MD 8.3 evaluations, also involve the use of SPAR models. All SPAR models include logic modeling covering internal events at power through core damage (i.e., Level-1 PRA model). The NRC is developing new SPAR modules for assessing plant risk for internal fires, external hazards (e.g., high wind and seismic events), and for assessing post-core damage severe accident progression (i.e., Level-2 PRA modeling).

The staff has completed the following activities in model and method development since the previous status report (SECY-14-0107, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," dated October 6, 2014), as described below.

Technical Adequacy of SPAR Models. The staff implemented a ~~quality assurance (QA)~~ plan covering the SPAR models in 2006. It updated the SPAR QA plan in fiscal year (FY) 2013. The main objective of this plan is to ensure that the SPAR models continue to represent the as-built, as-operated NPPs and continue to be of sufficient quality for performing event assessments of operational events in support of the staff's risk-informed activities. In addition to model development, the QA plan provides mechanisms for internal and external peer review, validation and verification, and configuration control of the SPAR models. The staff has processes in place to verify, validate, and benchmark these models according to the guidelines and standards established by the SPAR Model Program. As part of this process, the staff performs reviews of the SPAR models and results against the licensee PRA models, when applicable. The QA plan also provides a feedback process from the model users for error reporting, tracking, and resolution. The staff also has processes in place for the proper use of these models in agency programs such as the ASP Program, the SDP, and the MD 8.3 process. These processes are documented in the RASP ~~h~~Handbook, which serves as a desktop guidance document for agency risk analysts.

In 2010 the staff (with the cooperation of industry experts) performed a peer review of SPAR models for a representative boiling-water reactor (BWR) and a representative pressurized-water reactor (PWR) in accordance with American Society of Mechanical Engineers/American Nuclear Society RA-S-2008, "Standard for Level-1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," and Regulatory Guide (RG) 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities" ADAMS Accession No. ML090410014.

The peer review teams noted a number of strengths for the SPAR models, including:

- The SPAR model structure is robust and well developed.
- The SPAR model fault trees are streamlined with an appropriate level of detail for its intended uses.

- The SPAR model structure and the SAPHIRE software are "state of the technology."
- The SPAR models are an efficient method to develop qualitative and quantitative insights for risk-informed applications, SDP evaluations, inspections, event assessments, and model evaluations.

The peer review teams also noted a number of enhancements that could be made to the SPAR models. The staff reviewed and prioritized the peer review comments in order to identify potential improvements to the SPAR models. Enhancements that improved the usability, capabilities, and technical adequacy of the models in a cost effective manner were given high priority and the staff initiated projects to address these comments. Specific enhancements that have been completed include structuring the SPAR model documentation to more closely align with the structure of the PRA standard, incorporation of improved LOOP modeling, development of new support system initiating event models, and expanding the SAPHIRE Web site to better log and track model change requests. All high priority BWR and PWR SPAR peer review enhancements were completed by August 2015.

It should be noted that the SPAR models are generally used to categorize and prioritize operational events and conditions, including licensee non-compliance issues with existing regulations. Licensee PRA models developed to support licensing basis changes must meet the technical adequacy requirements of RG 1.200. Although the SPAR models are not maintained under a RG 1.200 program, the SPAR QA~~quality assurance~~ program and other process controls (such as internal and external reviews) help to ensure that SPAR-based analyses appropriately reflect the as-built, as-operated NPP.

Routine SPAR Model Updates. Existing SPAR models for operating plants need to be updated regularly as a result of any significant plant changes that may affect the risk profile of the plant. In general, the staff goal is to perform significant updates to approximately 10 to 12 SPAR models per year. As SPAR models are updated, their documentation (i.e., the model report and the plant risk information eBook summary reports) is also updated to represent the latest PRA information included in each SPAR model. Comparisons between the SPAR model baseline results and licensee model results (when voluntarily submitted by the licensee) are also performed. These comparisons include baseline core damage frequency, conditional core damage probability for each initiator type, top cut sets, and importance measures. These comparisons help ensure that SPAR models and associated risk assessments that support the SDP process are of high quality and reflect the as-built, as-operated plants. In FY 2015, the staff performed significant updates to six SPAR models to reflect changes, such as the addition of logic for new station blackout generators, battery charging generators, and broad expansion of electrical power modeling detail. Although the level of effort in FY 2015 was less than the staff goal due to resource limitations, the effort is expected to~~will~~ be increased again in FY 2016 to complete approximately 10 model updates per year.

In FY 2015, the staff also modified all SPAR models to take advantage of new SAPHIRE features and to improve the usability of the~~make~~ models~~more understandable to users~~. Among these new SAPHIRE features is the ability to eliminate most event tree linkage rules. SAPHIRE now automatically merges multiple overlapping rules, thus precluding the need to manually generate multiple explicit rule sets. Automatic generation and application of convolution

correction factors is another SAPHIRE enhancement that eliminates multiple manual actions each time a model is updated.

Approximately 30 SPAR models were also updated to support specific SDP or ASP activities. These more limited SPAR model updates are performed when requested by agency risk analysts. These updates are normally required to better model specific features of an operational event that are not normally captured in a base PRA or to reflect an enhanced understanding of the as-built, as-operated plant as a result of event followup activities.

During FY 2015, the staff continued to perform a comprehensive data update to all 75 SPAR models to reflect recent operating experience and implement other enhancements to improve the usability and functionality of the models. In addition to updating SPAR model parameters, this activity will improve~~comprehensive update will also update~~ model documentation; ~~provide an~~ integrated hazard categories (i.e., internal events, external hazards, Level-2, and LPSD models) into a single report for each SPAR model report; and resolve ~~structural modeling~~ issues associated with the SPAR logic modeling framework. Other data updates include modification of common cause events to more closely follow the guidance in the RASP Handbook. A plant-specific model convergence analysis (to assess the appropriate truncation level to run the model) and documentation of the results is also included in this task.

SPAR Models for the Analysis of All Hazards (External Events). Development of SPAR All-Hazard (SPAR-AHZ) models, ~~—~~which contain accident scenarios from all hazard categories (including seismic, high wind, and internal fire) applicable to a given site, ~~—~~has continued during FY 2015, although at a lower intensity than the previous year. The lower intensity was due to~~because of~~ budgetary constraints and the balancing of limited staff resources to work on other projects, such as the Commission- directed site Level-3 PRA project for the Vogtle site. Currently, 22 of the 75 SPAR models, representing 28 NPPs, include internal fire and external hazard groups. Eighteen of the SPAR-AHZ models are based on assessments conducted for Supplement 5, "Individual Plant Examination of External Events for Severe Accident Vulnerabilities," to Generic Letter 88 20, "Individual Plant Examination for Severe Accident Vulnerabilities 10 CFR 50.54(f)," and other readily available information. In FY 2015, one new SPAR-AHZ model, which includes internal fire models extracted from the National Fire Protection Association (NFPA) Standard 805- compliant fire model for the Vogtle plant, has been constructed and placed in the SPAR model library for use by NRC risk analysts. SPAR-AHZ models for the Shearon Harris, D.C. Cook, and V.C. Summer NPPs had been previously completed. Because the licensee-developed NFPA 805-compliant fire PRA models contain thousands of quantified fire sequences, a significant focus of the SPAR-AHZ effort was combining similar sequences to enhance model usability while ~~maintaining the ability to~~ retaining the resolution contained in the licensee models.

Recently, a new SPAR-AHZ model for the Point Beach site was~~has been~~ developed, and the SPAR-AHZ model for the Sequoyah site underwent~~has undergone~~ a major upgrade. The staff is currently working on a major update to the Peach Bottom SPAR-AHZ model. Development of the Peach Bottom SPAR-AHZ model includes licensee site visits to gather information and discuss modeling assumptions and results. Currently, the Office of Nuclear Regulatory Research (RES) and the Office of Nuclear Reactor Regulation (NRR) are working together to identify ways to improve the efficiency and therefore increase the pace of SPAR-AHZ model development, given expected resource constraints in FY 2016 and beyond.

New Reactor SPAR Models. Before new plant operation, the staff may perform risk assessments to inform potential risk-informed applications for combined licenses, focus construction inspection scope, or assess the significance of construction inspection findings. Once the plants begin operation, independent assessments using SPAR models will be used by the staff for the evaluation of operational findings and events similar to the assessments performed for current operating reactors.

There are currently five new reactor internal hazard SPAR models. These include one model for the AP1000, two Advanced Boiling-Water Reactor (ABWR) models (one for the Toshiba design and one for the General Electric-Hitachi design), one model for the U.S. Advanced Pressurized-Water Reactor (US-APWR), and one model for the U.S Evolutionary Power Reactor (U.S. EPR). In addition to these internal events models, there is a seismic model for the AP1000 and a LPSD model for the Toshiba ABWR. Since FY 2013, the staff has been extending the capabilities for the AP1000 reactor design SPAR model. The AP1000 SPAR-AHZ model includes an internal flooding model (completed in FY 2013) and an internal fire model (completed in FY 2014). The staff is in the process of completing a LPSD model and developing a new severe accident model (Level-2 PRA model) for the AP1000 reactor design.

The staff plans to continue developing new reactor SPAR models, including AHZ and LPSD models, as needed, to support licensing and oversight activities.

MELCOR Thermal Hydraulic Analysis for SPAR Model Success Criteria. The staff continues to perform MELCOR analyses to investigate success criteria associated with specific Level-1 PRA sequences. In some cases, these analyses confirm the existing technical basis, and in other cases they support modifications that can be made to increase the realism of the agency's SPAR models. The latest round of activity is documented in two reports: (1) soon to be published NUREG-2187, "Confirmatory Thermal-Hydraulic Analysis to Support Specific Success Criteria in the Standardized Plant Analysis Risk Models—Byron," and (2) NUREG/CR-7177, "Compendium of Analyses To Investigate Select Level-1 Probabilistic Risk Assessment End-State Definition and Success Criteria Modeling Issues," published in May 2014 (ADAMS Accession No. ML14148A126). The results of these studies will be used to confirm specific success criteria for a suite of four-loop Westinghouse plants, which are similar to Byron, with appropriate consideration of the design and operational differences of these plants. They also will be used to support application-specific consultation on the use of the SPAR models.

This effort directly supports the agency's goal of using state-of-the-art tools that promote effectiveness and realism. The NRC is communicating the project plans and results to internal and external stakeholders through mechanisms such as the Regulatory Information Conference and the industry's Modular Accident Analysis Program Users' Group.

3.0 Additional Activities

SAPHIRE Maintenance and Improvements. In FY 2015, new features and capabilities were~~have been~~ implemented in SAPHIRE to better support NRC regulatory activities. The new features include:

- SAPHIRE offers multiple methods for solving PRA models. Models can be assessed by solving individual accident sequences or by grouping sequences by common end states. A new capability in SAPHIRE allows users to trace the contribution of individual accident sequences regardless of the solving method that is used.
- Improvements to the reporting capabilities for external hazard model results.
- Improved tools for modelers to update and maintain the SPAR models.

All of these improvements to SAPHIRE have been performed in accordance with the SAPHIRE software QA program. A set of software QA documents has been developed for SAPHIRE. These documents cover topics such as the software development plan, configuration management, requirements tracking, and testing and acceptance. The NRC project manager performs an annual audit of the SAPHIRE software QA program. The most recent audit was completed on January 15, 2015, and no significant issues were identified. The NRC project manager confirmed that the maintenance and implementation of the SAPHIRE software QA program is consistent with the guidance contained in NUREG/BR-0167, "Software Quality Assurance Program and Guidelines," dated February 1993 (ADAMS Accession No. ML15043A791).

The SAPHIRE developers continue to explore advanced features and enhancements that may be implemented in future SAPHIRE revisions. The SAPHIRE team has developed a demonstration version of a Web-based SAPHIRE application. A Web-based SAPHIRE application is envisioned to have several advantages that are not available with a desktop application, such as improved configuration management of models and analyses, enhanced collaboration capabilities, and remote access to high-performance computing resources. After successfully demonstrating a prototype version of the application, the SAPHIRE team is developing an implementation plan to describe how a fully functional Web-based version could be completed and made available to users as a replacement to the current version of SAPHIRE. The implementation is expected to occur in a phased approach over the next several years. The work on the Web-based version has also helped the SAPHIRE team to explore new ways to use parallel computing resources to reduce code runtimes for complex analyses. These methods may even be able to benefit near-term updates to the current version of SAPHIRE. In addition to this work, the SAPHIRE team continues to remain cognizant of academic and international research activities on advanced PRA quantification techniques.

Cooperative Research for PRA. The staff has executed an addendum to the memorandum of understanding with the Electric Power Research Institute (EPRI) to conduct cooperative nuclear safety research for PRA. Several of the initiatives included in the addendum are intended to help resolve technical issues that account for the key differences between NRC SPAR models and licensee PRA models.

During FY 2015, significant efforts have been made in implementing PRA methods for support system initiating event (SSIE) analysis and treatment of LOOP in PRAs. The SSIE PRA modeling approach was developed in collaboration with EPRI and is documented in EPRI Report 1016741, "Support System Initiating Events," published December 19, 2008. These methods are being implemented in the SPAR models as one of the activities associated with addressing the peer review comments. To date, all SPAR models have been enhanced with the improved SSIE modeling methodology. Various LOOP methodology enhancements have been added to all models, with the remaining enhancements expected to be completed in conjunction with routine SPAR model updates. The staff plans to continue these cooperative efforts with EPRI and other stakeholders to address the remaining issues over the next several years.

On July 14–15, 2015, RES, in collaboration with Idaho National Laboratory staff, held a two-day public workshop on the agency's SPAR model program. Workshop discussions included the objectives of the SPAR model program; data collection and analysis; human reliability analysis; loss of offsite power modeling; and SPAR model maintenance and QA~~quality assurance~~. The workshop participants included representatives from NPPs, industry contractors, international partners, and public interest groups. In addition, NRC staff from NRR, Office of New Reactors, and the Regions attended. A meeting summary of the workshop can be found in ADAMS at Accession No. ML15198A191.

4.0 Conclusion

SPAR models are one of the primary risk tools for the agency and support a wide variety of regulatory uses. The staff maintains and updates the suite of SPAR models to help ensure that agency-performed risk assessments represent the as-built, as-operated reactor plants. Recent activities have focused on the development of external hazard models, updates to model parameter estimates to reflect recent plant operating experience, and increased public outreach to promulgate information about the SPAR model program.

	NRR Comment	RES Response
SECY, pg 2, para 1, line 5	Underline "important" – risk significant?	Deleted "important" – The ASP Program scope includes assessment of all operating events, not just those that are risk significant or important.
SECY, pg 2, para 2, line 6	Underline "the staff uses the SPAR models to risk inform inspection activities," – How? The licensee develops their ISI, etc...	The intent of this phrase was that SPAR models are used to risk inform NRC's inspection activities. Inserted "NRC" between "inform" and "inspection".
SECY, pg 2, para 4, lines 6 & 7	Underline – "while risk assessments performed under MD 8.3 are used to determine, in part, the appropriate level of reactive inspection in response to an event." For example single deficiency? And uses what to evaluate the significance?	The criteria for evaluating the significance of an event, including a single event, are included within MD 8.3. No change made.
SECY, pg 3, para 1, lines 4, 5, & 6	Underline – "if the SDP analyses considered all concurrent degraded conditions or equipment unavailabilities that existed during the time period of the condition." But the SDP does not do that.	Modified the text of the sentence to read: "To minimize overlap and improve efficiency, since 2006, SDP results have been used in lieu of independent ASP analyses to the extent practical and consistent with the overall objectives of both programs. Typically the SDP analyses are used in the ASP Program when the analysis performed addresses the major contributors to risk for the event based on a review conducted by an ASP Program risk analyst."
SECY, pg 3, add new 2nd para before Status and Results	Paraphrased – insert Project AIM 2020 rebaselining work to evaluate different programs and determine how best to further reduce duplication of effort and potentially propose to the Commission to modify the criteria used in the CBJ as a means of improving efficiency.	No change made. RES OD believes this is a statement that the Commission is already fully aware of and does not need to be repeated in this Commission Paper.

	NRR Comment	RES Response
SECY, pg 4, para 1. Last sentence	What is the result of the review? Any change in the	In the last Commission paper, a trend was identified in electrical component failures contributing to precursors. As a result RES initiated an electrical system and component study that is still ongoing. The LOOP trend provides additional support to the continuation of this study. A sentence was added that the results for this study should be available in FY 2017.
SECY, pg 4, last paragraph, line 8	They have not yet been updated to include the seismic information being developed under Fukushima Near Term Task Force Recommendation 2.1	This statement is partially correct. Information that is being developed by licensees to update their seismic bases, including in response to Fukushima, is used in the SPAR models once it is made available to the NRC. As resources have permitted, the SPAR-AHZ models have been updated with seismic data (as stated previously in the SECY). Most of the licensees have not developed their seismic PRAs in response to Fukushima, therefore it is premature to expect this information to be included. As this information becomes available, it will be incorporated into the SPAR-AHZ models consistent with the planned and routine process to update SPAR models or in response to SPAR model user needs to support risk assessment of operating events.
SECY, pg 6, 3rd bullet under 2nd paragraph	Modify sentence to read: "Evaluation of code infrastructure improvements necessary to support a multi-user server-based platform for SAPHIRE."	Modified the bullet as suggested. Also, the word "server" was changed to "Web" per NRO comment.

	NRR Comment	RES Response
SECY, pg 6, new paragraphs at the end of the page	Paraphrased Add a discussion of NRR's plans to pilot the use of licensee PRAs for the SDP.	This is a policy issue that does not belong in an information paper on the status of the ASP Program and the SPAR Models. This issue should be brought to the attention of the Commission in a Notation Vote paper prepared by NRR proposing the pilot activity. Recognizing that NRR is considering this pilot activity, the following has been added to the SECY on page 5, 3rd paragraph at the end of the paragraph. "Further, NRR is considering how it can improve the efficiency and effectiveness of the SDP process. These improvements may include pilot activities to assess the use of alternatives to the SPAR models. The use of alternatives to the SPAR models has other implications that will need to be assessed and addressed in support of any pilot activity that may be undertaken. NRR will address its plans to pilot alternatives to the SPAR model in a separate paper to the Commission."
Enclosure 1, pg 4, para 3, lines 5, 6, & 7	Only if no other equipment was OOS, etc...	A conforming change was made to modify the text of the sentence to be consistent with the main body of the SECY to read: "To minimize overlap and improve efficiency, since 2006, SDP results have been used in lieu of independent ASP analyses to the extent practical and consistent with the overall objectives of both programs. Typically the SDP analyses are used in the ASP Program when the analysis performed addresses the major contributors to risk for the event based on a review conducted by an ASP Program risk analyst."

	NRR Comment	RES Response
Enclosure 1, pg 4, last paragraph, last line	As a result of this safety significance, the NRC did . . .	Changed the last sentence and added additional information so that it reads: ". . . The ASP Program analysis integrated these deficiencies and aggregated the risk which resulted in a ΔCDP of 6×10^{-3} identifying this as a significant precursor that was reportable to Congress. The ASP analysis result confirmed the risk significance of this event following a systematic and repeatable process that, in part, undergirded the substantial regulatory response that was undertaken. The regulatory response included issuance of Order EA-03-009 requiring all licensees with plants susceptible to reactor pressure vessel head degradation to perform visual inspections for indications of degradation or boric acid leakage, worked with the American Society of Mechanical Engineers (ASME) to incorporate reactor pressure vessel head inspections into the ASME code, adopted a new operating experience program, and enhanced the NRC's ability to detect declining plant performance by changing several NRC inspection and management programs."
Enclosure 1, pg 5, para 1, last line	This realization caused NRC to do . . .	Changed the last sentence and added additional information so that it reads: ". . . The ASP analysis of this complicated LOOP event resulted in an aggregated plant risk CCDP of 1×10^{-4}. This realization contributed to the basis for the ongoing staff efforts on the system study of electrical system and component failures to risk. In addition, the NRC staff issued Bulletin 2012-01, "Design Vulnerability in Electric Power System," and Information Notice (IN) 2012-03, "Design Vulnerability in Electric Power System" highlighting the potential significance of a single-phase open circuit condition."
Enclosure 1, pg 14, 2nd para under Section 4.7, Results	Strike out "a" in the reference to ASME/ANS RA-Sa-2009.	No change made. The reference as stated has been confirmed to be correct.

	NRR Comment	RES Response
Enclosure 2, pg 4, para 4, line 7	Replace "increase the pace of" with "improve the efficiency and therefore increase the pace of"	Made the change as suggested.
Enclosure 2, pg 6, para 2, lines 10, 11, and 12.	Why spend time to add parallelism when the runtime is so small? Waste of resources.	The main focus of this part of Enclosure 2 is to share at a high level with the Commission the Staff's efforts to develop a Web-Based version of SAPHIRE to support the needs of the Regional and HQ risk analyst. This activity is driven by User Need Request (UNR) NRR-2015-009, item 5.9. While evaluating potential approaches to developing a server-based framework for SAPHIRE, INL identified opportunities to improve SAPHIRE's ability to take advantage of the increased processing power of current computers. These improvements take advantage of the parallel processing capability of current computers and can be incorporated into efforts to maintain the current version of SAPHIRE. Having a web-based version of SAPHIRE also improves the NRC's ability to assure compliance with federal information technology requirements related to the control of information technology systems that handle proprietary or official use only information. It also provides increased assurance that risk analysts will have access to the most up-to-date models and software to conduct their analyses. Feedback from Regional and HQ users of SAPHIRE and SPAR Models indicate that while in many cases the time to conduct a PRA analysis using SAPHIRE is not excessive, more complex analyses require substantial time to perform a single run (on the order of several hours or more). Models that include external hazards such as seismic or make extensive use of "k of n" gate logic (often found in service water system models) can require significant time to run. An SDP or ASP analysis is an iterative process that for more complex operating events requires multiple runs of model changes to finalize. Often, these types of events are those for which NRC should provide a reasonably timely analysis in support of timely regulatory decision-making. As currently configured, SAPHIRE has the capability to perform limited parallel processing using several core processes in existing standalone PCs and laptops. However, substantial improvements in performance could be achieved, meeting the needs of Regional and HQ users, to take full advantage of the parallel processing available in high-speed computers that are available. Added "to reduce code runtimes for complex analyses" to the end of this sentence for clarification.

	NRR Comment	RES Response
SECY, pg 6	On page 6 of the paper where Jennifer added information about doing a pilot with Vogtle PRA, Bill wants words added to indicate how much we spend on SPAR model and SAPHIRE development and maintenance.	Resources expended on a project are not included in information papers to the Commission. RES OD agrees that this information should not to be added to the Commission Paper. Further, see RES response to the NRR comment to add information on a pilot alternative to the use of the SPAR models in the SDP. While RES does not believe that use of licensee models will provide cost savings to the agency and will pose challenges to maintaining agency independence, RES will support NRR in considering the implications of such a pilot program should it consider moving forward with the proposal. It should be noted that the Vogtle PRA currently being used by RES was provided for the specific purpose of supporting the Commission-directed Level 3 PRA project and cannot be used to support any other purpose. Therefore, NRR will need to obtain a commensurate level of PRA information from an industry volunteer to support such a pilot. Further, given the staff's current familiarity with the Vogtle PRA, RES would not recommend using Vogtle as a potential pilot.
Enclosure 2, pg 6	On page 6 of Enclosure 2 where Jennifer mentioned that RES should not work on adding parallelism to SAPHIRE since the runtime is fast enough, Bill adds that NRR funds should not be applied on this task or on developing a web-based version.	In User Need Request (UNR) NRR-2015-009, dated August 10, 2015, NRR requested that RES develop a web-based version of SAPHIRE that can be run on a centralized server and accessed using the internet. The purpose of this request was to provide users an efficient and effective way to utilize centralized high-speed computing resources and improve sharing of model results and analyses. Included within the scope of this activity is incorporating within the SAPHIRE program the capability to take advantage of the parallel computing power of high speed computers to maximize the efficiency of the processing of more complex SPAR model changes used to conduct risk analyses of challenging operating events. There may be some misunderstanding with regard to the development of dynamic PRAs that was discussed with NRR and removed from the UNR NRR-2015-009.

Tetter, Keith

From:	Weerakkody, Sunil
Sent:	Wednesday, September 30, 2015 6:45 AM
To:	Nakoski, John
Cc:	Coyne, Kevin; Tetter, Keith; Circle, Jeff; Kichline, Michelle; Giitter, Joseph; Lee, Samson
Subject:	RE: Changes made to RES SECY on ASP/SPAR Status

Thanks John. I am doing due diligence to address all comments at our level. As discussed, we expect a couple of issues to be elevated to at least Joe Giitter's level over here before getting back to Jennifer\Bill Dean.

Sunil D Weerakkody, Chief
PRA Operations & Human Factors Branch
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission

Address: Mail Stop O-10 C-15, US NRC, Washington DC 20005-0001

Tel: 301-415-2870
Black Berry (b)(6)

From: Nakoski, John
Sent: Tuesday, September 29, 2015 12:28 PM
To: Weerakkody, Sunil
Cc: Coyne, Kevin; Tetter, Keith; Circle, Jeff; Kichline, Michelle; Giitter, Joseph; Lee, Samson
Subject: RE: Changes made to RES SECY on ASP/SPAR Status

Sunil,

Thank you for the feedback. Kevin and I will be meeting with Brian Sheron and Steve West this afternoon to discuss RES' responses to NRR's comments.

If you would like to propose alternatives to the comments that we have received, of course I welcome them. I do however need to caveat my acceptance of your revised comments with the re-emphasis of the RES position that it is not appropriate for an RES status paper to inform the Commission of an NRR initiative to pilot the use of the licensee's PRA models in the SDP – that is something that NRR should do in a separate Notation Vote paper to the Commission. With regard to Project AIM 2020, as we discussed yesterday – if this is the Agency wide policy to add a statement into every SECY going to the Commission on Project AIM 2020, RES will happily add such a statement. However, as we discussed yesterday, it is not appropriate to selectively apply such a statement to Commission Papers as it inappropriate suggests to the Commission where Project AIM 2020 will recommend discontinuing an activity. Project AIM 2020 has not finalized its prioritization – let the process work as planned.

John Nakoski

From: Weerakkody, Sunil
Sent: Tuesday, September 29, 2015 12:21 PM
To: Nakoski, John

Cc: Coyne, Kevin; Tetter, Keith; Circle, Jeff; Kichline, Michelle; Giitter, Joseph; Lee, Samson
Subject: RE: Changes made to RES SECY on ASP/SPAR Status

John,

Michelle has reviewed the changes in the mark-up. Subsequently, the three of us (Jeff Circle, myself, and Michelle) met and discussed. Michele agrees with most of your changes. We found a couple of areas where we could make suggestions to enhance. We also found a couple of other places where, you (or your designee) should go back to Jennifer and ask for clarifications.

In my view, there are three issues that RES falls short of addressing NRR ET comments. I suggest that we elevate them to Joe\Rich as opposed to working them at our level:

1. Bill Dean wanted to include the resources that we spend on SPAR updates and ASP. For reasons that you mentioned, RES doesn't believe that information should be included in this SECY.
2. Jen had proposed a sentence to say that we would be looking at ASP and SPAR (in my words) under Project Aim. I don't believe the sentence that you have proposed goes far enough. (Jen's sentence may be going too far). If you want, we can send a proposal.
3. Jen provided a ½ page insert on how we plan to pilot the use of licensee's models. This has not been addressed. I agree that the words Jen has proposed not ideal. We can send a proposed bullet that may address the overall intent.

I am leaving for our division meeting. Will be back here tomorrow.

Sunil D Weerakkody, Chief
PRA Operations & Human Factors Branch
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission

Address: Mail Stop O-10 C-15, US NRC, Washington DC 20005-0001

Tel: 301-415-2870
Black Berry: (b)(6) [redacted]

From: Nakoski, John
Sent: Monday, September 28, 2015 5:09 PM
To: Weerakkody, Sunil; Circle, Jeff
Cc: Coyne, Kevin; Correia, Richard; Tetter, Keith
Subject: Changes made to RES SECY on ASP/SPAR Status

Sunil and Jeff,

Attached are the changes that we made in response to the comments we received from NRR ET. If you would like to add some context with regard to the broader agency response to Davis Besse and Byron events, please send me and Keith Tetter your sentences.

Regards,

John A. Nakoski
Chief, Performance and Reliability Branch
Division of Risk Analysis
Office of Research
301-415-2480 (w)
(b)(6) (c)

FOR: The Commissioners

FROM: Brian W. Sheron, Director
Office of Nuclear Regulatory Research

SUBJECT: STATUS OF THE ACCIDENT SEQUENCE PRECURSOR PROGRAM AND THE STANDARDIZED PLANT ANALYSIS RISK MODELS

PURPOSE:

To inform the Commission of the status, accomplishments, and results of the Accident Sequence Precursor (ASP) Program, including quantitative ASP results, and to communicate the status of the development and maintenance of the Standardized Plant Analysis Risk (SPAR) models. This paper does not address any new commitments or resource implications.

BACKGROUND:

~~Under Project AIM 2020, the staff is evaluating all NRC activities to rebaseline its efforts to establish priorities to increase efficiency and effectiveness.~~

In a memorandum to the Chairman dated April 24, 1992, the staff of the U.S. Nuclear Regulatory Commission (NRC) committed to report periodically to the Commission on the status of the ASP Program. Subsequently, in SECY-02-0041, "Status of Accident Sequence Precursor and SPAR Model Development Programs," dated March 8, 2002, the staff expanded the annual ASP status report to include: (1) an expanded evaluation of precursor data trends and insights, and (2) the development of associated probabilistic risk assessment (PRA) models (e.g., SPAR models).

CONTACT: Keith M. Tetter, RES/DRA
301-415-2407

The ASP Program systematically evaluates U.S. nuclear power plant (NPP) operating experience to identify, document, and rank the operating events most likely to lead to inadequate reactor core cooling and severe core damage (i.e., precursors).[1] The ASP Program provides a comprehensive and integrated assessment of plant risk associated with important operating events. The ASP Program provides insights into the NRC's risk-informed and performance-based regulatory programs; evaluates performance against performance indicators in the agency's Congressional Budget Justification[2] and Industry Trends Program;[3] and reports to Congress events of high safety significance in accordance with "abnormal occurrence" criteria.[4]

Under the SPAR Model Program, the staff develops and maintains independent risk-analysis tools and capabilities to support NPP-related risk-informed regulatory activities. The staff uses SPAR models for the Reactor Oversight Process (ROP) Significance Determination Process (SDP); the ASP Program; the Management Directive (MD) 8.3, "NRC Incident Investigation Program," event assessment process; and the MD 6.4, "Generic Issues Program," resolution process. In addition, the staff uses the SPAR models to risk inform NRC inspection activities, to gain risk insights in support of reactor-related rulemaking, and to support other risk assessment studies, such as system and component reliability studies.

DISCUSSION:

This section summarizes the status, accomplishments, and results of the ASP Program and SPAR Model Program since the previous status report, SECY-14-0107, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," dated October 6, 2014.

ASP Program

Program Scope. The ASP Program is one of three agency programs that assess the risk significance of events. The other two programs are the SDP and the event-response evaluation process, as defined in MD 8.3. Currently, the ASP Program provides integrated analyses of complex operating events not evaluated by the SDP or finalized by MD 8.3 evaluations. The SDP evaluates the risk significance of a single licensee performance deficiency, while risk assessments performed under MD 8.3 are used to determine, in part, the appropriate level of reactive inspection in response to an event. An SDP assessment has the benefit of information obtained from the inspection, whereas the MD 8.3 assessment is expected to be performed within a day or two after the event notification. In contrast to the other two programs, a comprehensive and integrated risk analysis under the ASP Program includes all anomalies[5] observed at the time of the event or discovered after the event.

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1 Enclosure 1 provides background on the process used by the staff to identify precursors.

2 See NUREG-1100, Volume 31, "2016 Congressional Budget Justification," issued January 2015.

3 See SECY-15-0061, "Fiscal Year 2014 Results of the Industry Trends Program for Operating Power Reactors," dated April 8, 2015.

4 See Appendix A of NUREG-0090, Volume 37, "Report to Congress on Abnormal Occurrences—Fiscal Year 2014," issued May 2015.

5 These anomalies or conditions may include unavailable and degraded plant structures, systems, and components (SSCs); human errors; and an initiating event (reactor trip). In addition, an unavailable or degraded SSC does not have to be a performance deficiency or an analyzed condition in the plant's licensed design basis.

There are similarities in the risk assessments conducted by the three programs. All programs use SPAR models, the same documented methods and guidance, and similar analysis assumptions, except where program objectives deviate from one another. To minimize overlap and improve efficiency, Ssince 2006, SDP results have been used in lieu of independent ASP analyses to the extent practical and consistent with the overall objectives of both programs, ~~if the SDP analyses considered all concurrent degraded conditions or equipment unavailabilities that existed during the time period of the condition.~~ Typically the SDP analyses are used in the ASP Program when the analysis performed addresses the major contributors to risk for the event based on a review conducted by an ASP Program risk analyst. Typically for initiating events, many of the modeling assumptions made for MD 8.3 analyses can be adopted by ASP analyses. However, some modeling assumptions are revised as detailed information about the event becomes available when inspection activities are completed. These key similarities provide opportunities for significant ASP Program efficiencies. For a potential *significant* precursor (defined below), analysts from the three programs work together to provide a timely determination of plant risk. As such, duplication between programs is minimized to the extent practical within program objectives.

Status and Results. The staff continues to review operational events from licensee event reports (LERs) and NRC inspection reports (IRs) to identify potential precursors to a reactor core damage event. Operational events that exceed the ASP thresholds, mentioned in the Background section of Enclosure 1, are considered precursors in the ASP Program. *Significant* precursors have a conditional core damage probability (CCDP)[6] or a change in core damage probability (ΔCDP)[7] greater than or equal to 1×10^{-3}. The staff has identified 16 precursor events for fiscal year (FY) 2014. The staff did not identify any *significant* precursors for FY 2014 and has not identified any potentially *significant* precursors for FY 2015 to date, although the reporting of FY 2015 events in LERs and NRC IRs are still in progress.

In addition to the identification of precursor events, the staff performs trend analyses on precursors for additional insights. Trend analyses are performed on the following precursor groups:

- all precursors
- precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4}
- precursors involving an initiating event
- precursors involving degraded conditions
- precursors involving a complete loss of offsite power (LOOP)
- precursors that occurred at boiling-water reactors (BWRs)
- precursors that occurred at pressurized-water reactors (PWRs)

For the period of FY 2005 through FY 2014, the staff found a statistically significant increasing trend in the mean occurrence rate of precursors resulting from a LOOP initiating event. This increasing trend resulted from the occurrence of 20 LOOP precursor events in the last 4 years after 7 precursor occurrences in the previous 6 years.

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6 The term CCDP is the probability of the occurrence of core damage given that an initiating event has occurred.

7 The term ΔCDP is the increase in probability of core damage (from the baseline core damage probability) due to a failure of plant equipment or an identified deficiency during the time the failure or deficiency existed.

In the FY 2012 and FY 2013 annual report, statistically significant increasing trends were identified in the mean occurrence rate of precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4}. However, with no additional precursor observed in this group in FY 2013 and FY 2014, the trend is no longer statistically significant. As reported in last year's status report (SECY-14-0107), six of the seven precursors in this group were caused by multiple electrical failures during a 3-year period. Based, in part, on the observed increases in electrical- and LOOP-related precursors over the past few years, the staff initiated a detailed study in FY 2014 to better understand the contribution of electrical system and associated component failures on risk at NPPs. Results for this study should be available in FY 2017.

The staff found no statistically significant trends for any of the other precursor groups during the FY 2005 through FY 2014 period. Enclosure 1, "Results, Trends, and Insights of the Accident Sequence Precursor Program," provides additional details on results and trends of the ASP Program.

SPAR Model Program

The SPAR models provide agency risk analysts with an independent risk assessment tool to support a variety of risk-informed agency programs, including the ROP and the ASP program. SPAR models are built with a standard modeling approach, using consistent modeling conventions, that enables staff to easily use the models across a variety of U.S. NPP designs. Unlike industry PRA models, SPAR models are run on a single software platform, the Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) computer code. The staff currently maintains and updates 75 SPAR models representing 99 commercial NPPs.[8] The scope of every SPAR model includes logic modeling covering internal initiating events at power through core damage (i.e., Level-1 PRA model). In FY 2015, the staff modified all SPAR models to take advantage of new SAPHIRE features and to improve the usability of the models. In addition to these global changes, approximately 30 models were updated to support specific SDP or ASP activities. The staff also performed more comprehensive updates to selected SPAR models to reflect recent plant modifications and to incorporate significant modeling updates. In FY 2015, the staff performed significant updates to six SPAR models to reflect changes such as the addition of logic for new station blackout generators, battery charging generators, and expansion of electrical power distribution modeling. During FY 2015, the staff continued to perform a comprehensive data update to all 75 SPAR models to reflect recent operating experience and implement other enhancements to improve the usability and functionality of the models.

In addition, the staff continued to expand SPAR model capability beyond internal events at full-power operation. For example, 22 of the SPAR models, representing 28 nuclear power reactors, include other hazard groups and are referred to as SPAR All-Hazard (SPAR-AHZ) models.[9] Currently, 18 of the SPAR-AHZ models include hazards such as fires, internal floods, and seismic events based on assessments conducted for Supplement 5, "Individual Plant Examination of External Events for Severe Accident Vulnerabilities," to Generic

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[8] The SPAR models associated with NPPs that have recently permanently shut down (Kewaunee, San Onofre Units 2 and 3, Crystal River Unit 3, and Vermont Yankee) are no longer being updated, but remain available for agency use.

[9] These models were formerly named SPAR external event (SPAR-EE) models, but have been renamed SPAR-AHZ to reflect recent improvements in external hazard modeling efforts and for consistency with the ASME PRA Standard model scope.

Letter 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities—10 CFR 50.54(f)" (dated September 8, 1995), and other readily available information. The staff also incorporated internal fire scenarios from the fire PRAs done in compliance with National Fire Protection Association (NFPA) 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," for the Shearon Harris Nuclear Power Plant, the Donald C. Cook Nuclear Power Plant, and the Virgil C. Summer Nuclear Generating Station. In addition to more detailed fire PRA modeling, the SPAR models for these NPPs include improved external hazard modeling and model validation. The staff has also leveraged the ongoing Level-3 PRA project for the Vogtle Electric Generating Plant, Units 1 and 2, to develop improved external hazard and fire modeling for the Vogtle SPAR model. In FY 2015, a new SPAR-AHZ model for the Point Beach site was created, and the SPAR-AHZ model for the Sequoyah site underwent a major revision.

In the new reactor area, the staff has developed SPAR models for the AP1000 Advanced Boiling-Water Reactor (ABWR) (for both the Toshiba and General Electric-Hitachi designs), U.S. Advanced Pressurized-Water Reactor (US-APWR), and the U.S. Evolutionary Power Reactor (U.S. EPR). The staff has expanded the capability of the AP1000 SPAR model to include hazards such as seismic, fire, flooding, and low-power shutdown events. A post-core damage severe accident logic model (i.e., Level-2 PRA model) is also being developed for the AP1000 SPAR model.

The Office of Nuclear Regulatory Research (RES) staff continues to work with the Regions, the Office of Nuclear Reactor Regulation (NRR), and the Office of New Reactors (NRO) to identify future enhancements to the SPAR models, including continuing the development of new SPAR-AHZ models. Further, NRR is considering how it can improve the efficiency and effectiveness of the SDP process. These improvements ~~that~~ may include pilot activities to assess the use of alternatives to the SPAR models ~~and SAPHIRE code~~. The use of alternatives to the SPAR models has other implications that will need to be assessed and addressed in support of any pilot activity that may be undertaken. NRR will address its plans to pilot alternatives to the SPAR model in a separate paper to the Commission.

In FY 2010, the staff completed PRA standard-based peer reviews of a representative BWR SPAR model and a representative PWR SPAR model. It performed these peer reviews in accordance with American Society of Mechanical Engineers (ASME)/ American Nuclear Society (ANS) RA-S-2008, "Standard for Level-1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," and Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities." The peer-review teams concluded that, within the constraints of the program, the SPAR model is an efficient method to offer qualitative and quantitative insights for applications, SDP evaluations, inspections, event assessments, and model evaluations. The peer review teams also noted that the SPAR model structure was robust and well developed, model fault trees were streamlined with an appropriate level of detail for the model's intended users, and the model structure and the SAPHIRE computer software are at the state of the technology. The teams also identified a number of enhancements for the SPAR models and supporting documentation. Major activities undertaken to address the high priority peer-review items include the following:

- Structuring the SPAR model documentation to more closely align with the structure of ASME/ANS PRA standard. A majority of the peer review comments were related to documentation issues.

- Incorporating improved LOOP modeling and support system initiating events modeling into the SPAR models (e.g., loss of service water or component cooling water).

- Expanding the SAPHIRE Web site to better log and track model change requests.

The staff completed these PWR and BWR SPAR Model peer-review enhancements in August 2015.

On July 14–15, 2015, RES, in collaboration with Idaho National Laboratory staff, held a 2-day public workshop on the agency's SPAR model program. Workshop discussions included the objectives of the SPAR model program; data collection and analysis; human reliability analysis; LOOP modeling; and SPAR model maintenance and quality assurance. The workshop participants included representatives from NPPs, industry contractors, international partners, and public interest groups. In addition, NRC staff from NRR, NRO, and the Regions attended. A meeting summary of the workshop can be found in Agencywide Documents Access and Management System (ADAMS) at Accession No. ML15198A191.

The staff continues to maintain and improve the SAPHIRE software to support the SPAR Model Program. SAPHIRE is a personal-computer-based software application used to develop PRA models and perform analyses with SPAR models. During FY 2015, significant SAPHIRE activities included the following:

- Oversight of the SAPHIRE software quality-assurance program, including performance of an annual audit of software quality-assurance activities, tools, and documents in accordance with NUREG/BR-0167, "Software Quality Assurance Program and Guidelines."

- Implementation of new SAPHIRE features, including the capability to easily sort model results by their contribution to different accident sequences and improvements to the reporting functions for external hazard model results.

- Evaluation of~~Research on~~ code infrastructure improvements necessary to support a multi-user Web-based platform for SAPHIRE.

Enclosure 2, "Status of the Standardized Plant Analysis Risk Models," provides a detailed status of SPAR models and related activities.

Planned ASP and SPAR Model Activities

- The staff will continue the screening, review, and analysis (preliminary and final) of potential precursors for FY 2015 and FY 2016 events.

- The staff will continue the detailed study of electrical system and component failure contribution to the risk at operating NPPs.

- The staff will continue to implement enhancements to the internal event SPAR models for full-power operations. Planned enhancements include model updates based on insights from ongoing thermal-hydraulic analyses and a comprehensive update of all SPAR models to reflect recent operating experience.

- The staff will continue quality-assurance activities for both the agency SPAR models and the SAPHIRE code. This will ensure that agency risk tools continue to be of sufficient quality for performing SDP, ASP, and MD 8.3 event assessments in support of the staff's risk-informed regulatory activities.

- The staff will continue to evaluate the need for additional SPAR model capability (beyond full-power internal events) based on experience gained from risk assessment activities and feedback from users. In addition, the staff intends to continue to develop new external hazard capabilities with new SPAR-AHZ models.

SUMMARY:

Under the ASP Program, the staff continues to evaluate the safety significance of operating events at NPPs and to provide insights into the NRC's risk-informed and performance-based regulatory programs. The staff identified no *significant* precursors in FY 2014 and in the FY 2015 events evaluated to date. The staff identified one statistically significant increasing trend involving the occurrence rate of LOOP precursor events for the period FY 2005 through FY 2014. The SPAR Model Program is continuing to develop and improve independent risk-analysis tools and capabilities to support the use of PRA in the agency's risk-informed regulatory activities.

COORDINATION:

The Office of the General Counsel reviewed this Commission paper and has no legal objection.

Brian W. Sheron, Director
Office of Nuclear Regulatory Research

Enclosures:
1. Results, Trends, and Insights of the ASP Program
2. Status of the SPAR Models

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Results, Trends, and Insights of the Accident Sequence Precursor Program

1.0 Introduction

This enclosure discusses the results of accident sequence precursor (ASP) analyses conducted by the U.S. Nuclear Regulatory Commission (NRC) staff as they relate to events that occurred during fiscal years (FYs) 2014 and 2015. Based on those results, this document also discusses the staff's analysis of historical ASP trends and the evaluation of the related insights.

2.0 Background

The NRC established the ASP Program in 1979 in response to recommendations made in NUREG/CR-0400, "Risk Assessment Review Group Report," issued September 1978 (Ref. 1).[1] The ASP Program systematically evaluates U.S. nuclear power plant (NPP) operating experience to identify, document, and rank the operational events that have a conditional core damage probability (CCDP) or an increase in core damage probability (ΔCDP) greater than or equal to 1×10^{-6}. That is, for any given operational event analyzed, the likelihood of inadequate core cooling and severe core damage was greater than or equal to one in one million.

Program Process. To identify potential precursors, the staff reviews operational events, including the impact of external events (e.g., fires, floods, and seismic events), from licensee event reports (LERs) and inspection reports (IRs) on a plant unit basis (i.e., a single event that affects a multiunit site is counted as a precursor for each unit). The staff then analyzes any identified potential precursors by calculating the probability of an event leading to a core damage state. The analyses of operational events are conducted using the NRC's Standardized Plant Analysis Risk (SPAR) models and the Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) software. The SPAR models are a plant-specific set of risk models that rely on a set of standardized modeling conventions (e.g., naming scheme, modeling approaches, and logic structure). Figure 1 illustrates the complete ASP analysis process.

Program Metrics. An operational event can be one of two types: (1) an occurrence of an initiating event, such as a reactor trip or a loss of offsite power (LOOP), with or without any subsequent equipment unavailability or degradation, or (2) a degraded plant condition characterized by the unavailability or degradation of equipment without the occurrence of an initiating event.

For the first type of event, the staff calculates a CCDP. This metric represents a conditional probability that a core damage state is reached given the occurrence of the observed initiating event (and any subsequent equipment failure or degradation). For the second type of event, the staff calculates a ΔCDP. This metric represents the increase in core damage probability for the

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[1] The NRC formed the Risk Assessment Review Group (commonly referred to as the Lewis Committee) in 1977 to perform an independent evaluation of the Reactor Safety Study (WASH-1400) that was completed 3 years earlier. That committee made a number of recommendations in 1978, including that more use be made of operational data to assess the risk from nuclear power plants. The review group's report stated, "It is important, in our view, that potentially significant (accident) sequences, and precursors, as they occur, be subjected to the kind of analysis contained in WASH-1400." The first major report of the ASP program, "Precursors to Potential Severe Core Damage Accidents: 1969–1979, A Status Report" (NUREG/CR-2497, Volume 1), was formally released in June 1982.

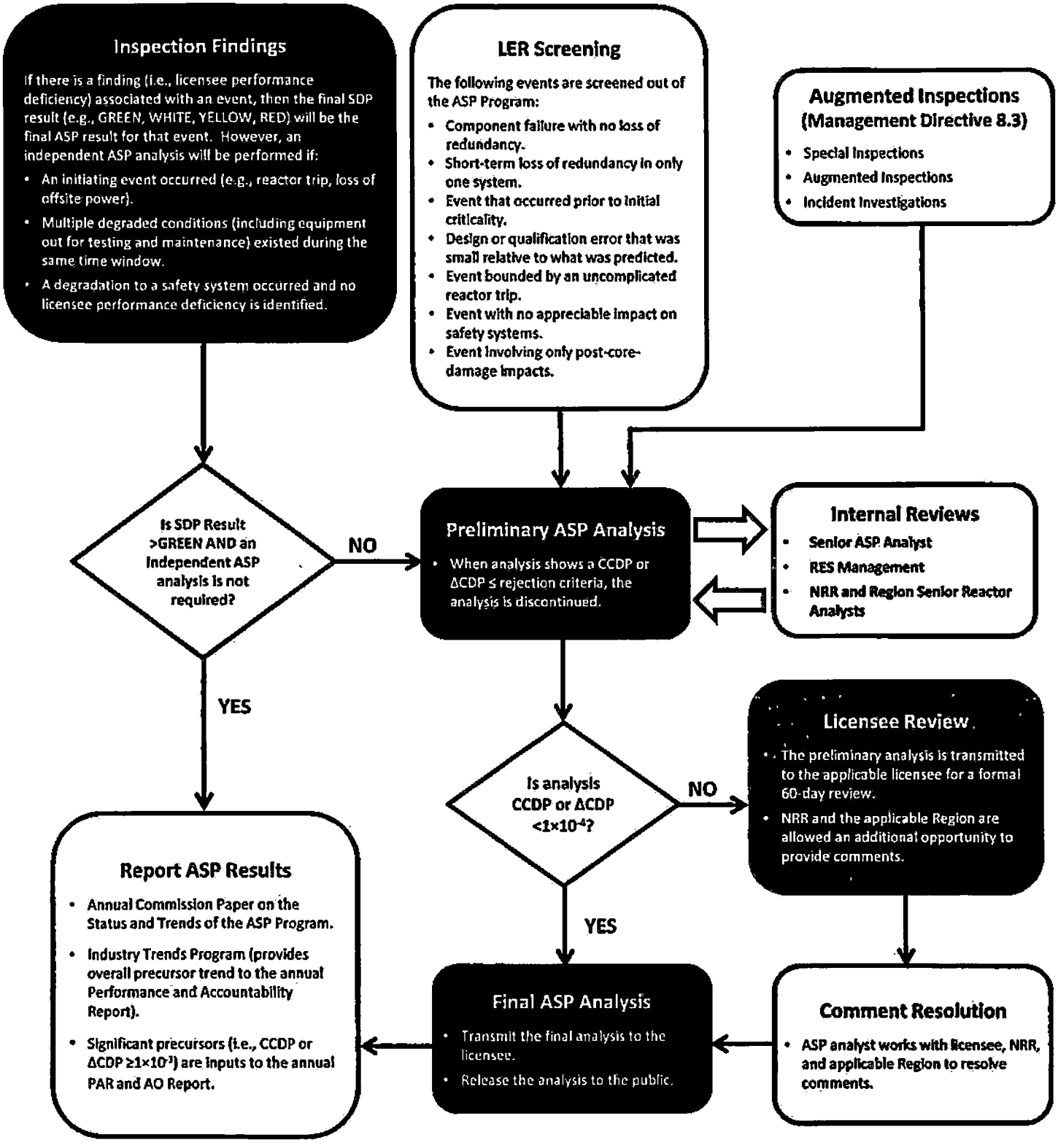

Figure 1. ASP Process Flowchart.

time period during which a component or multiple components were deemed unavailable or degraded.

Program Thresholds. The ASP Program defines an event with a CCDP or a ΔCDP greater than or equal to 1×10^{-6} to be a precursor. The ASP Program uses the plant-specific CCDP for the nonrecoverable loss of feedwater and condenser heat sink, with no degradation of safety-related equipment, as the initiating-event precursor threshold if it is greater than 1×10^{-6}. This ensures the more safety-significant events are analyzed. Since 1988, this initiating-event precursor threshold has screened out uncomplicated trips (reactor trips with no losses of safety-system equipment) from being precursors because of their relatively low risk significance. The ASP Program defines a *significant* precursor as an event with a CCDP or ΔCDP greater than or equal to 1×10^{-3}.

Program Objectives. The ASP Program has the following objectives:

- Provide a comprehensive, risk-informed view of NPP operating experience and a measure for trending core damage risk.
- Provide a partial validation of the adequacy of current probabilistic risk assessment (PRA) standards and guidance.
- Provide feedback to regulatory activities.

The NRC also uses the ASP Program results to monitor performance against performance indicators in the agency's Congressional Budget Justification (Ref. 2) and Industry Trends Program (ITP) (Ref. 3), as well as in reports to Congress on events of high safety significance in accordance with "abnormal occurrence" criteria (Ref. 4). Specially, the ASP Program provides the following inputs to programs and reports:

- Number of *significant* precursor events for the annual Congressional Budget Justification. ASP Program results are used as one of several inputs to the performance indicator "Number of malfunctions, deficiencies, events, or conditions at commercial nuclear power plants (operating or under construction) that meet or exceed abnormal occurrence (AO) criteria II.A though II.D."
- Trend of all precursor events for the ITP.
- Number of precursor events with a CCDP or ΔCDP greater than or equal to 1×10^{-5} for the ITP. ASP program results are used, along with other inputs from other programs, in the ITP, to evaluate the trend of the "significant events" industry-level indicator.
- Description of *significant* precursor events for the annual abnormal occurrence report to Congress in accordance with Criterion II.C of NUREG-0090, "Report to Congress on Abnormal Occurrences Fiscal Year 2014," Volume 37 (Ref. 4).

Program Scope. The ASP Program is one of three agency programs that assess the risk significance of events at operating NPPs. The other two programs are the Significance Determination Process (SDP) (Ref. 5) and the event-response evaluation process, as defined in Management Directive (MD) 8.3, "NRC Incident Investigation Program" (Ref. 6). The SDP evaluates the risk significance of a single licensee performance deficiency, while the risk assessments performed under MD 8.3 are used to determine, in part, the appropriate level of reactive inspection in response to an event. An SDP assessment has the benefit of information obtained from the inspection, whereas the MD 8.3 assessment is expected to be performed within a day or two after the event notification.

In contrast to the other two programs, a comprehensive and integrated risk analysis under the ASP Program includes all anomalies observed at the time of the event or discovered after the event. These anomalies may include unavailable and degraded plant structures, systems, and components (SSCs); human errors; and an initiating event (reactor trip). In addition, an unavailable or degraded SSC does not have to be a performance deficiency (e.g., SSCs out for test and maintenance) or an analyzed condition in the plant design basis. The ASP Program has time to complete an analysis of a complex issue and thus produces a more refined estimate of risk. Analyses schedules provide time so that NRC or licensee engineering evaluations can be made available for review. State-of-the-art methods can be developed or current techniques can be refined for unique conditions when necessary. In addition, the SPAR model can be modified for special considerations (e.g., seismic, internal fires, flooding).

There are similarities in the risk assessments conducted by the three programs. All programs use SPAR models, the same documented methods and guidance, and similar analysis assumptions, except where program objectives deviate from one another. ASP and SDP analyses assumptions are typically the same for single performance deficiencies. To minimize overlap and improve efficiency, ~~S~~since 2006, SDP results have been used in lieu of independent ASP analyses to the extent practical and consistent with the overall objectives of both programs~~, if the SDP analyses considered all concurrent degraded conditions or equipment unavailabilities that existed during the time period of the condition~~. Typically the SDP analyses are used in the ASP Program when the analysis performed addresses the major contributors to risk for the event based on a review conducted by an ASP Program risk analyst. Typically for initiating events, many of the modeling assumptions made for MD 8.3 analyses can be adopted by ASP analyses. However, some modeling assumptions are revised as detailed information about the event becomes available when inspection activities are completed. In addition, there are program differences on how certain modeling aspects are incorporated (e.g., SSCs out for testing or maintenance). These key similarities provide opportunities for significant ASP Program efficiencies. For a potential *significant* precursor, analysts from the three programs work together to provide a timely determination of plant risk. As such, duplication between programs is minimized to the extent practical within the program objectives.

In addition, the ASP Program provides integrated analyses of complex operating events that are not evaluated by the SDP or finalized by MD 8.3 evaluations. Two notable examples include the degraded reactor vessel head with multiple degraded conditions at Davis-Besse in FY 2003 (LERs 346/02-002, 346/02-005, and 346/03-002) and the complicated LOOP event at Byron Unit 2 in FY 2012 (LER 454/12-001).

The Davis-Besse precursor event involved (1) a potential loss-of-coolant accident (LOCA) due to reactor pressure vessel head erosion from the leakage of a circumferential cracked control rod drive mechanism nozzle, (2) the potential unavailability of sump recirculation due to screen plugging following a postulated LOCA from unqualified containment coatings and other debris (e.g., insulation) inside containment, and (3) the potential unavailability of high-pressure safety injection pumps during the recirculation phase of a postulated LOCA due to potential debris generated by certain postulated LOCAs and entrained in pumped fluid. The SDP cited three licensee performance deficiencies. Analyzed separately, the equivalent ΔCDP for the three deficiencies were 4×10^{-4}, 3×10^{-5}, and 3×10^{-6}, respectively. The ASP Program analysis integrated these deficiencies and aggregated the risk which resulted in a ΔCDP of 6×10^{-3}, identifying this as a significant precursor that was reportable to Congress. The ASP analysis result confirmed the risk significance of this event following a systematic and repeatable process that, in part, undergirded the substantial regulatory response that was undertaken.

The Byron Unit 2 precursor event resulted from a LOOP and unprotected under-voltage conditions on safety-related electrical buses for eight minutes. The loss of one of three phases (Phase "C") of 345 kilovolts offsite power to the two unit station auxiliary transformers (SATs) did not result in an automatic under-voltage protection signal, because the under-voltage protection scheme did not provide adequate protection from a single loss of Phases "A" and "C". As a result, all running safety equipment powered by the safety buses had tripped on over-current conditions. These conditions existed until operators manually opened (from the main control room) the SAT feeder breakers about eight minutes after the event had initiated. Following the opening of the SAT feeder breakers, both emergency diesel generators started and loaded supplying power to the safety buses, as designed. The MD 8.3 risk assessment of the event that was performed on the day of the event occurrence resulted in a CCDP of 7×10^{-6}. The assessment did not include the aspects of the under-voltage condition of the safety buses that was identified as the result of a special inspection. The inspection identified no performance deficiencies; therefore, no SDP assessment was required. The ASP analysis of this complicated LOOP event resulted in an aggregated plant risk CCDP of 1×10^{-4}. This realization contributed to the basis for the ongoing staff efforts on the system study of electrical system and component failures to risk.

3.0 ASP Program Status

The following subsections summarize the status and results of the ASP Program (as of September 30, 2015).

FY 2014 Analyses. The staff completed its screening and review of 501 LERs and their associated inspection findings for FY 2014. On the basis of that review, 36 events were selected and analyzed for potential precursors. Of these, the ASP analyses have identified 6 precursors (initiating events) and the SDP identified 10 precursors (degraded conditions). For 10 of the 16 precursors, the performance deficiency identified under the Reactor Oversight Process documented the risk-significant aspects of the event completely. In these cases, the SDP significance category (i.e., the "color" of the finding) is reported in the ASP Program. For the remaining events, an independent ASP analysis was performed to determine the risk significance of three LOOP initiating events, two electrical transformer failures, and a 13 kilovolts bus failure.

Table 1 presents the results of the staff's ASP analyses for FY 2014 precursors that involved initiating events. Table 2 presents the analysis results for FY 2014 precursors that involved degraded conditions.

FY 2015 Analyses. The staff performs an initial review of all events to determine if they have the potential to be *significant* precursors. Specifically, the staff reviews LERs (reported by licensees in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.73, "Licensee Event Report System") and daily event-notification reports (reported by licensees in accordance with 10 CFR 50.72, "Immediate Notification Requirements for Operating Nuclear Power Reactors") to identify potential *significant* precursors. The staff has completed the initial review of FY 2015 events and identified no potentially *significant* precursors (as of September 30, 2015). The staff will inform the Commission if a *significant* precursor is identified during the more detailed evaluations of events.

Table 1. FY 2014 Precursors Involving Initiating Events

Event Date	Plant	Description	CCDP
10/14/13	Pilgrim	LOOP and Reactor Scram. ***LER 293/13-009***	3×10^{-5}
12/9/13	Arkansas Nuclear One, Unit 2	Fire and Explosion of the Unit Auxiliary Transformer. ***LER 368/13-004***	2×10^{-6}
1/18/14	Shearon Harris	Manual Reactor Trip due to Indications of a Fire. ***LER 400/14-001***	6×10^{-6}
1/21/14	Calvert Cliffs 2	Reactor Trip due to Inadequate Protection Against Weather-Related Water Intrusion. ***LER 318/14-001***	5×10^{-6}
5/25/14	Millstone 2	Dual Unit LOOP and Reactor Scram. ***LER 336/14-006***	1×10^{-5}
5/25/14	Millstone 3	Dual Unit LOOP and Reactor Scram. ***LER 336/14-006***	2×10^{-5}

Table 2. FY 2014 Precursors Involving Degraded Conditions

Condition Duration	Plant	Description	ΔCDP/ SDP Color
39 years[5]	Fort Calhoun	Harsh Environment Due to Postulated High-Energy Line Breaks Could Lead to the Failure of Equipment Needed to Safely Shutdown the Plant. ***Enforcement Action (EA)-14-187***	WHITE[2]
31 years[5,6]	Ginna	Unanalyzed Condition for Potential Floodwater Intrusion into Vital Battery Rooms. ***EA-13-247***	WHITE
10 years[5]	Oconee 1	High Cycle Fatigue Resulted in Reactor Coolant Leak and Unit Shutdown. ***EA-14-091***	WHITE
36 years[5,6]	St. Lucie 1	Internal Reactor Auxiliary Building Flooding During Heavy Rain Due to Degraded Conduits Lacking Internal Flood Barriers. ***EA-14-131***	WHITE
40 years[5,6]	Arkansas Nuclear One, Unit 1	Inadequate External Flood Protection for Safety-Related Equipment Located Below the Design Basis Flood Elevation. ***EA-14-088***	YELLOW[3]
40 years[4,5]	Arkansas Nuclear One, Unit 2	Inadequate External Flood Protection for Safety-Related Equipment Located Below the Design Basis Flood Elevation. ***EA-14-088***	YELLOW
1 year	Millstone 3	Turbine Driven Auxiliary Feedwater Pump Operability Impacted by Incorrect Bearing. ***EA-14-092***	WHITE

2 A WHITE finding corresponds to a licensee performance deficiency of low–to–moderate safety significance and has an increase in core damage frequency in the range of greater than 10^{-6} to 10^{-5} per reactor year.

3 A YELLOW finding corresponds to a licensee performance deficiency of moderate–to–high safety significance and has an increase in core damage frequency in the range of greater than 10^{-5} to 10^{-4} per reactor year.

4 Note that although these degraded conditions lasted for many years, ASP and SDP analyses limit the exposure period to 1 year.

5 These four events were identified from the efforts undertaken by licensees and NRC inspectors as part of the Fukushima Near-Term Task Force Recommendation 2.3 walkdown inspections (Ref. 7).

Condition Duration	Plant	Description	ΔCDP/ SDP Color
23 years[5]	Oyster Creek	Technical Specification Prohibited Condition Caused by Two Electromagnetic Relief Valves Inoperable for Greater Than Allowed Outage Time. ***EA-14-178***	YELLOW
9 years[5]	Oyster Creek	Technical Specification Prohibited Condition Caused by Emergency Diesel Generator Inoperable for Greater than Allowed Outage Time. ***EA-14-186***	WHITE
109 days	Clinton	Failure of a Shutdown Cooling Water Pump Due to Damaged Bushing. ***EA-15-064***	WHITE

4.0 Trends and Insights

This section defines a statistically significant trend, defines the data period used in trending analyses, and discusses the results of trending analyses and insights for all precursors and *significant* precursors.

Statistically Significant Trend. Statistically significant is defined in terms of the "p-value." A p-value is a probability indicating whether to accept or reject the null hypothesis that no trend exists in the data.[6] A p-value less than or equal to 0.05 indicates that there is 95 percent confidence that a trend exists in the data (i.e., leading to a rejection of the null hypothesis that there is no trend).

Data Coverage. The data period for the ASP trending analyses is a rolling 10-year period, which is aligned with the rolling 10-year period used in the ITP.

4.1 Occurrence Rate of All Precursors

The NRC's ITP evaluates trends in licensee safety performance using industry-level indicators. The mean occurrence rate of all precursors identified by the ASP Program is one indicator used by the ITP to assess industry performance.[7]

Results. The mean occurrence rate of all precursors does not exhibit a statistically significant trend (p-value = 0.59) for the 10-year period from FY 2005 through FY 2014 (see Figure 2).

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6 For the purposes of this analysis, the null hypothesis is based on a constant-rate Poisson process producing the observed data set. A lower p-value indicates a lower likelihood that the observed data could be produced by this constant-rate process.

7 The occurrence rate is calculated by dividing the number of precursors by the number of reactor years.

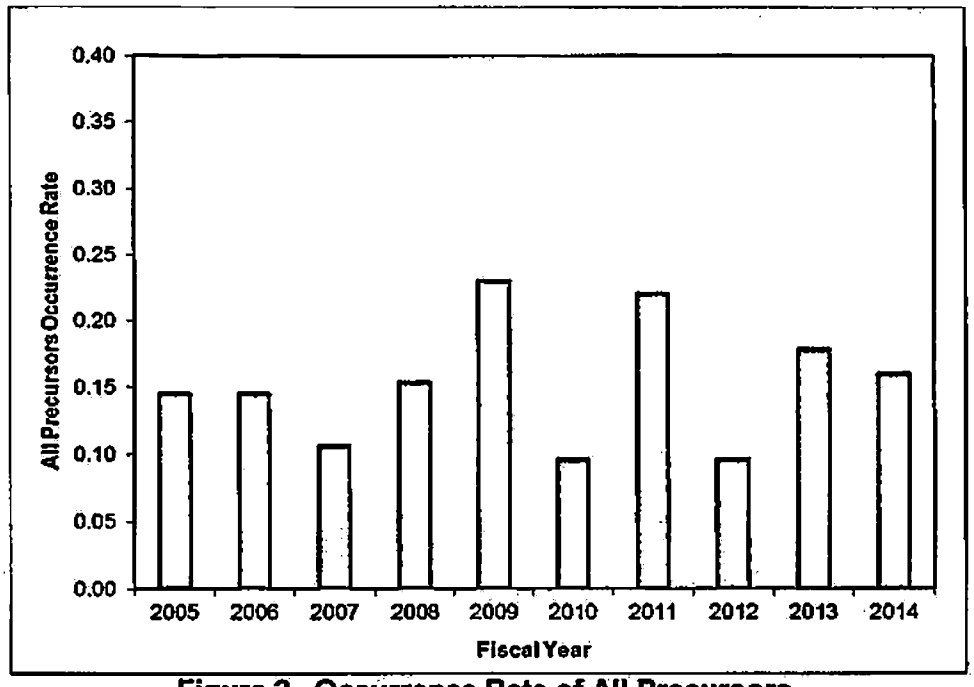

Figure 2. Occurrence Rate of All Precursors.

4.2 *Significant* Precursors

The NRC's Congressional Budget Justification (NUREG-1100, Volume 31) provides performance indicators used to measure and evaluate performance as part of the NRC's planning, budget, and performance management process. The number of *significant* precursors identified by the ASP program is one of several inputs to a performance indicator used to monitor the agency's strategic safety goal (Ref. 2).

Results. A review of the data for the 10-year period from FY 2005 through FY 2014 reveals the following insights:

- No *significant* precursors have been identified during FY 2005 through FY 2014. The staff has completed the initial review of FY 2015 events and identified no potentially *significant* precursors (as of September 30, 2015).
- The last *significant* precursor was identified in FY 2002 and involved concurrent, multiple degraded conditions at the Davis-Besse nuclear power plant.[8]

4.3 Occurrence Rate of Precursors with a CCDP or ΔCDP $\geq 1\times10^{-4}$

Precursors with a CCDP or ΔCDP $\geq 1\times10^{-4}$ are considered important in the ASP Program because they generally have a CCDP higher than the annual CDP estimated by most plant-specific PRAs.

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8 Commission Paper SECY-10-0125, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models" (Ref. 8), provides a complete list of all *significant* precursors from 1969 through 2010.

Results. A review of the data for the 10-year period from FY 2005 through FY 2014 reveals the following trend and insights:

- The staff did not identify any precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4} for FY 2013 or FY 2014.
- The mean occurrence rate of precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4} does not exhibit a statistically significant trend (p-value = 0.11; see Figure 3).

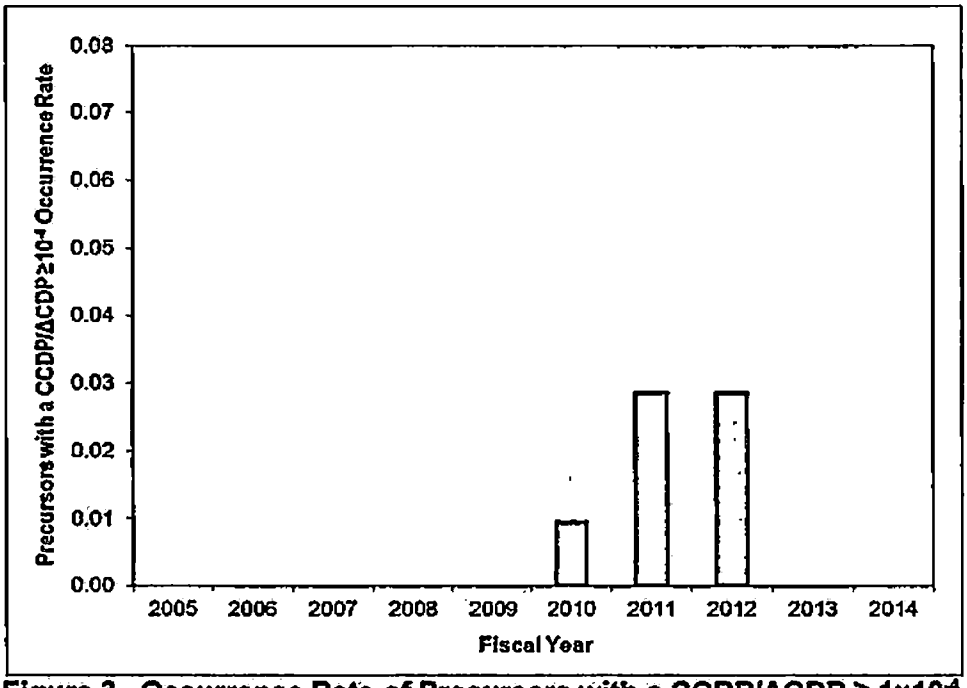

Figure 3. Occurrence Rate of Precursors with a CCDP/ΔCDP ≥ 1×10^{-4}.

- For FY 2012 and FY 2013, statistically significant increasing trends were observed in each respective 10-year period (FY 2003 through FY 2012 and FY 2004 though FY 2013, respectively). However, with no additional precursors observed in FY 2013 and FY 2014, the trend is no longer statistically significant.
- Over the past 10-year period (FY 2005 through FY 2014), a total of 7 precursors with CCDP or ΔCDP greater than or equal to 1×10^{-4} were identified: in FY 2010 (1 precursor), FY 2011 (3 precursors), and FY 2012 (3 precursors). As reported to the Commission last year, 6 of the 7 precursors involved electrical events in electrical distribution systems. See Enclosure 1 to SECY-14-0107, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," for a listing of these precursor events and a summary of insights (Ref. 9).

4.4 Precursors Involving Initiating Events and Degraded Conditions

A review of the data for the 10-year period from FY 2005 through FY 2014 reveals the following insights for precursors involving initiating events and degraded conditions.

Initiating Events

- The mean occurrence rate of precursors involving initiating events does not exhibit a statistically significant trend (p-value = 0.26) (see Figure 4).

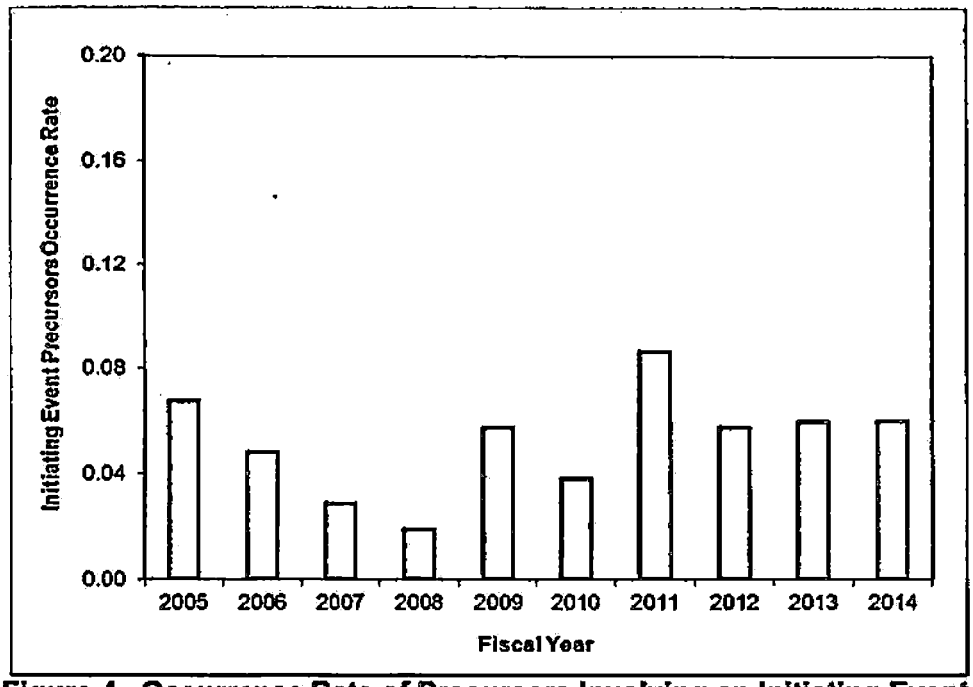

Figure 4. Occurrence Rate of Precursors Involving an Initiating Event.

- Of the 54 precursors involving initiating events, 27 precursors (50 percent) were LOOP events. While the frequency of complicated trips[9] (27 precursors) is about the same as the frequency of LOOPs (27 precursors), the CDP estimates for LOOPs are somewhat higher.

Degraded Conditions

- The mean occurrence rate of precursors involving degraded conditions does not exhibit a statistically significant trend (p-value = 0.94) (see Figure 5).
- Over the past 10 years, precursors involving degraded conditions (104 precursors) outnumbered initiating events (54 precursors) by 93 percent.
- Of the 104 precursors involving degraded conditions, 35 precursors (34 percent) involved degraded conditions existing for a decade or longer.[10] Of these 35 precursors, 15 precursors involved degraded conditions dating back to initial plant construction.

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9 A complicated trip is a reactor trip with a concurrent loss of safety-system equipment.

10 Note that although these degraded conditions lasted for many years, ASP and SDP analyses limit the exposure period to 1 year.

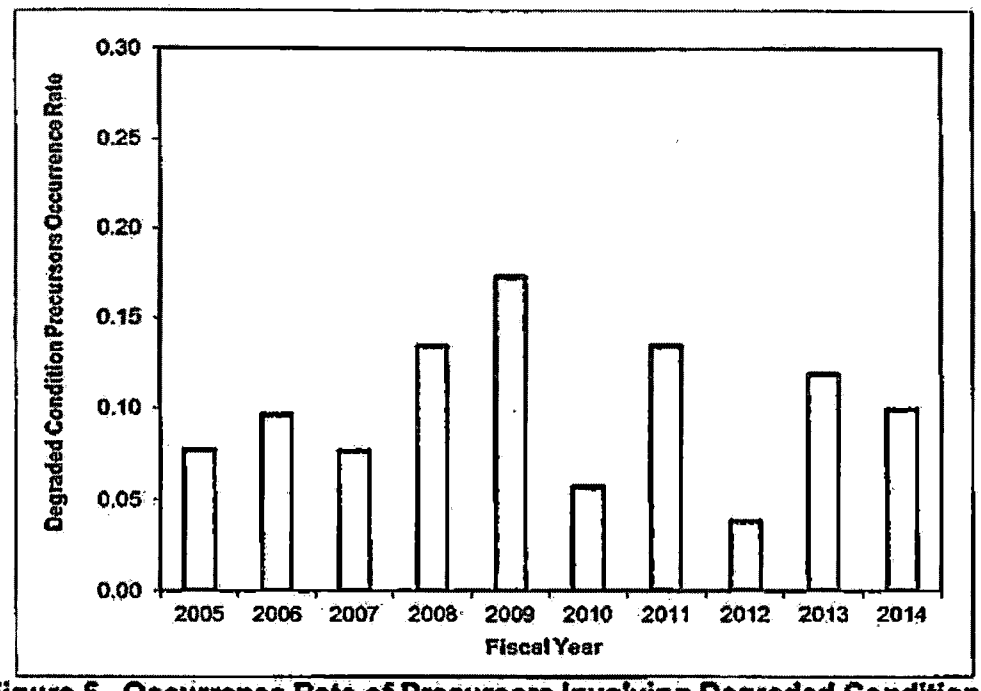

Figure 5. Occurrence Rate of Precursors Involving Degraded Conditions.

4.5 Precursors Involving a Complete Loss of Offsite Power Initiating Event

In FY 2014, 3 precursors from 2 NPP sites resulted from a complete LOOP initiating event.[11] In FY 2015, 3 complete LOOP initiating events occurred at 2 NPP sites.[12] Typically, all complete LOOP initiating events meet the precursor threshold.

Results. A review of the data for the 10-year period from FY 2005 through FY 2014 reveals the following insights:

- *Trend.* The mean occurrence rate of precursors involving LOOP precursor events exhibited a statistically significant increasing trend (p-value = 0.01; see Figure 6). The increasing trend of LOOP precursor events became significant in FY 2014 when 6 LOOP precursor events dropped out of the rolling 10-year trend period and 3 LOOP precursor events occurred in FY 2014.
- *Precursor Counts.* Of the 158 precursors that occurred during the FY 2005 through FY 2014 period, 27 precursors (17 percent) were LOOP precursor events that occurred at 19 NPP sites. Of the 27 LOOP precursor events, 20 precursors occurred during the last 4 years (FY 2011 through FY 2014).
- *Concurrent Unavailability of an Emergency Power Train.* Of the 27 LOOP precursor events, 2 (7 percent) precursors involved a concurrent unavailability of an emergency power system

[11] A LOOP initiating event involves a reactor trip and the simultaneous loss of electrical power to all unit safety buses (also referred to as emergency buses, Class 1E buses, and/or vital buses) requiring all emergency power generators to start and supply power to the safety buses. The non-safety buses may (or may not) be deenergized as a result of the LOOP initiating event. (Ref. 10)

[12] Precursor analyses of events occurring in FY 2015 are not final. Three LOOP initiating events occurred in FY 2015 and will most likely meet the ASP threshold (i.e., CCDP $\geq 1 \times 10^{-6}$). These events are not included in the trending analysis. These FY 2015 LOOP events occurred at Pilgrim on January 27, 2015 (LER 293/15-002) and Calvert Cliffs Units 1 and 2 on April 7, 2015 (LER 317/15-002).

train during the FY 2005 through FY 2014 period. One precursor involved an emergency diesel generator (EDG) failure to run due to a leak in the EDG coolant system and 1 precursor involved an EDG out of service due to maintenance. In FY 2015, a LOOP initiating event (and potential precursor) occurred involving an EDG failure to start due to a fault in the EDG startup circuity and the shutdown sequencer failure for the other EDG to automatically restart selected equipment (see Calvert Cliffs LER 317/15-002).

- *External Hazards.* Of the 27 LOOP precursor events, 12 (44 percent) precursors resulted from external hazards, including: 2 tornados (5 precursors), Hurricane Katrina (1 precursor), 3 other weather-related events (4 precursors), and the 2011 Virginia earthquake (2 precursors). All units at the 5 multi-unit NPP sites involved in these events were affected by the external events. Of these 12 LOOP precursor events, 7 (58 percent) occurred in FY 2011.[13]
- *Outside Plant Boundary.* Of the 27 LOOP precursor events, 3 (11 percent) precursors resulted from an electrical fault either in the plant switchyard or offsite power transmission line to the switchyard.
- *Multi-unit NPP Sites.* Of the 27 LOOP precursor events, 15 precursors occurred at all units at a multi-unit NPP site, 5 precursors occurred at a single unit at a multi-unit site, and 7 precursors occurred at a single-unit site.

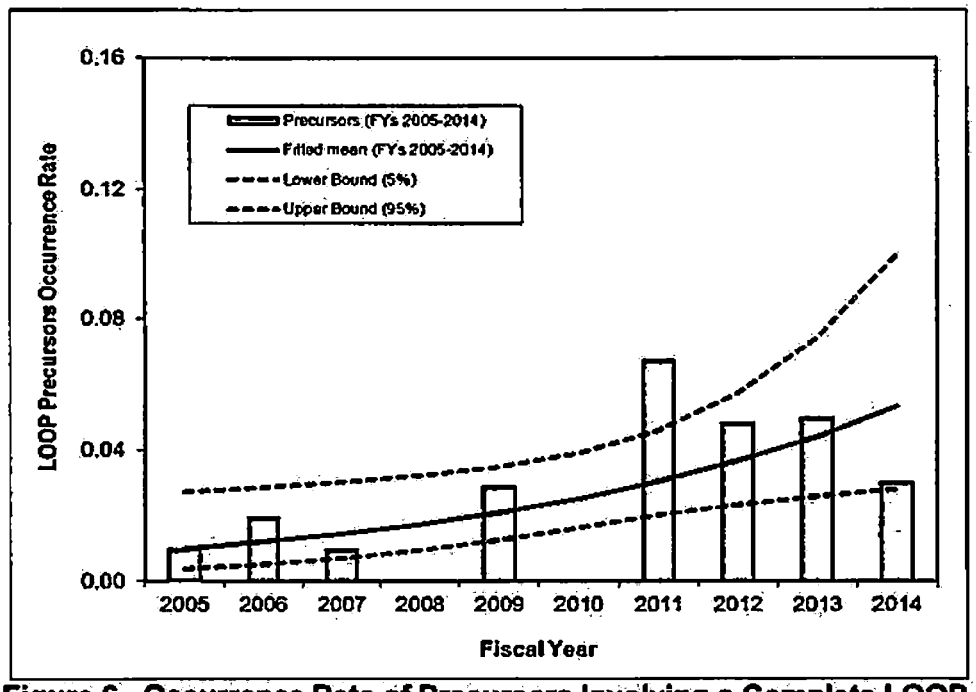

Figure 6. Occurrence Rate of Precursors Involving a Complete LOOP.

4.6 Precursors at BWRs and PWRs

A review of the data for the 10-year period from FY 2005 through FY 2014 reveals the following insights for boiling-water reactors (BWRs) and pressurized-water reactors (PWRs).

[13] These FY 2011 events were the Surry Units 1 and 2 tornado precursor events that occurred on April 16, 2011; the Browns Ferry Units 1, 2, and 3 tornado precursor events that occurred on April 27, 2011; and the North Anna Units 1 and 2 earthquake precursor events that occurred on August 23, 2011.

BWRs

- The mean occurrence rate of precursors that occurred at BWRs does not exhibit a statistically significant trend (p-value = 0.41; see Figure 7).

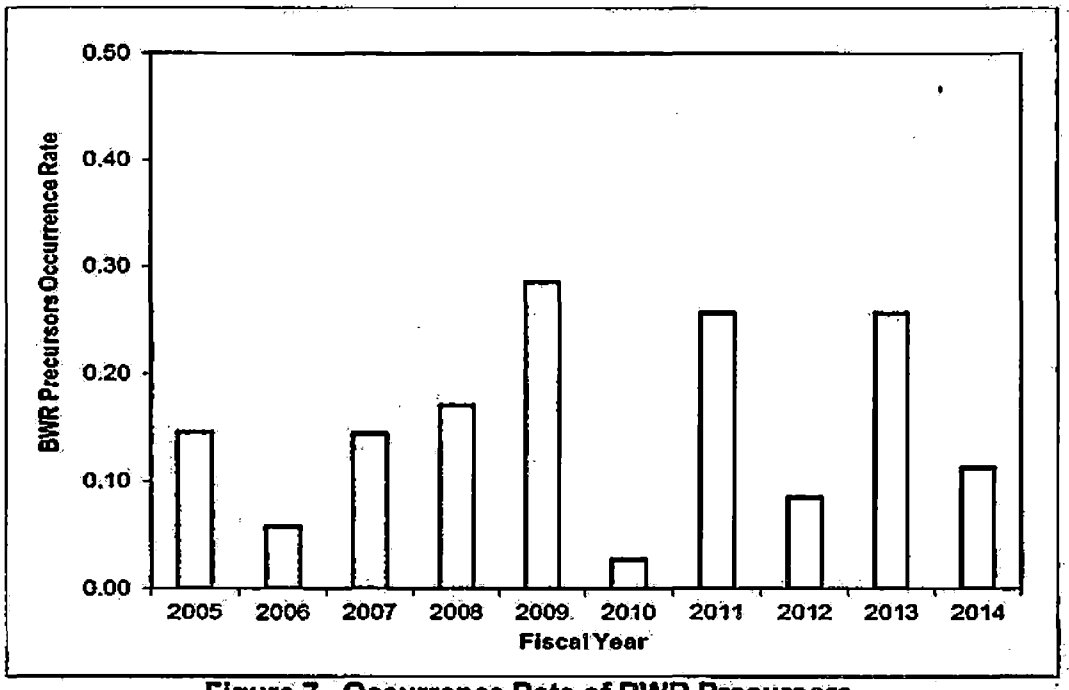

Figure 7. Occurrence Rate of BWR Precursors.

- Of the 21 precursors involving initiating events at BWRs, 11 precursors (52 percent) were complete LOOP events.
- Of the 33 precursors involving the unavailability of safety-related equipment that occurred at BWRs, most were caused by failures in the emergency power system (12 precursors or 36 percent), emergency core cooling systems (7 precursors or 21 percent), electrical distribution systems (2 precursors or 6 percent), or safety-related cooling water systems (1 precursor or 3 percent).

PWRs

- The mean occurrence rate of precursors that occurred at PWRs does not exhibit a statistically significant trend (p-value = 0.95; see Figure 8).
- Of the 33 precursors involving initiating events at PWRs, 16 precursors (48 percent) were complete LOOP events.
- Of the 71 precursors involving the unavailability of safety-related equipment that occurred at PWRs, most were caused by failures in the emergency power system (17 precursors or 24 percent), auxiliary feedwater system (10 precursors or 14 percent), electrical distribution system (10 precursors or 14 percent), safety-related cooling water systems (7 precursors or 10 percent), or emergency core cooling systems (5 precursors or 7 percent).
- Of the 5 precursors involving failures in the emergency core cooling systems, 3 precursors (60 percent) were because of conditions affecting sump recirculation during postulated loss-of-cooling accidents of varying break sizes.

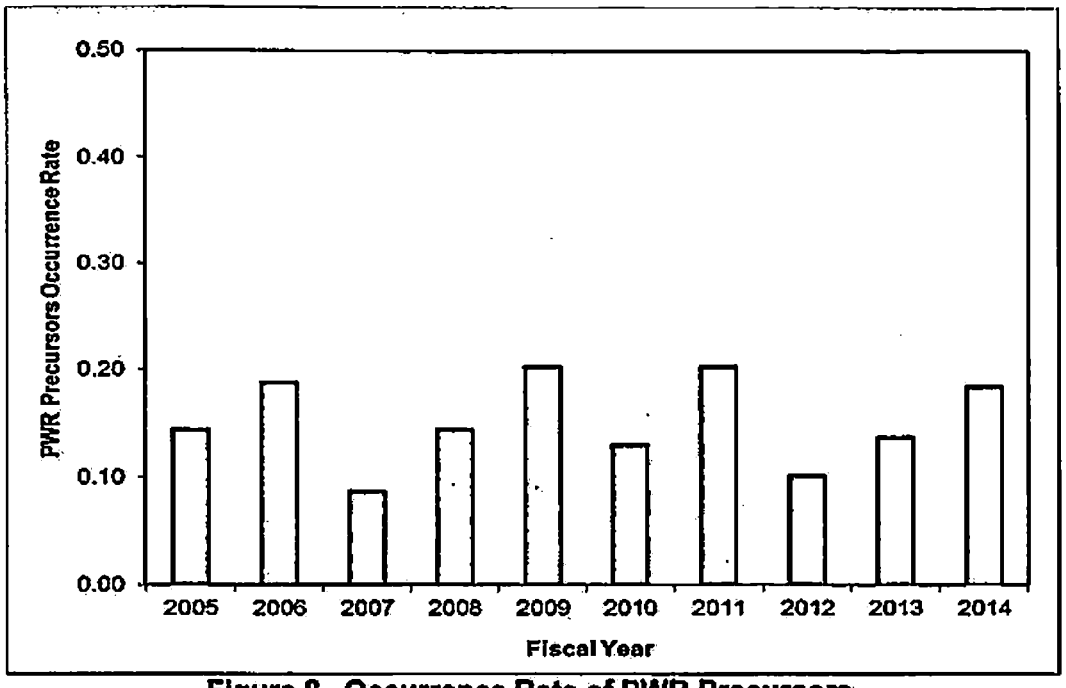

Figure 8. Occurrence Rate of PWR Precursors.

- Of the 10 precursors involving failures of the auxiliary feedwater system, random hardware failures (7 precursors or 70 percent) and design errors (2 precursors or 20 percent) were the largest failure contributors. Nine of the 10 precursors (90 percent) involved the unavailability of the turbine-driven auxiliary feedwater pump train.
- Of the 17 precursors involving failures in the emergency power system, 14 precursors (82 percent) were from hardware failures.
- Design errors contributed to 2 precursors involving the unavailability of safety-related equipment that occurred at PWRs.

4.7 Operating Experience Insights Feedback for PRA Standards and Guidance

One objective of the ASP Program is to provide insights into the adequacy of current PRA standards and guidance. ASP event analyses, both precursors and events that did not exceed the ASP Program threshold, from FY 2014 were reviewed against the PRA elements described in the American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications" (Ref. 11), as endorsed in Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities" (Ref. 12). This review sought to identify aspects of the event analyses for which the risk-significant ASME/ANS PRA Standard did not provide adequate guidance.

Results. None of the FY 2014 event analyses indicated an inadequacy in the PRA elements as described in ASME/ANS RA-Sa-2009. The staff continues to work with ASME/ANS on refining the standard to ensure that it provides sufficient guidance.

5.0 Summary

This section summarizes the ASP results, trends, and insights:

- ***Significant Precursors.*** The staff identified no *significant* precursors (i.e., CCDP or ΔCDP greater than or equal to 1×10^{-3}) in FY 2014. The staff identified no potentially *significant* precursors in FY 2015 (as of September 30, 2015).
- ***Occurrence Rate of All Precursors.*** The occurrence rate of all precursors does not exhibit a trend that is statistically significant from FY 2005 through FY 2014.
- ***Additional Trend Results.*** During the same period, a statistically significant increasing trend was observed in precursors involving LOOP precursor events. No statistically significant trend was observed in precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4}, precursors involving initiating events or degraded conditions, or precursors at BWRs or PWRs.

6.0 References

1. U. S. Nuclear Regulatory Commission, "Risk Assessment Review Group Report to the U. S. Nuclear Regulatory Commission," NUREG/CR-0400, Volume 37, September 1978, Agencywide Documents Access and Management System (ADAMS) Accession No. ML072320423.

2. U. S. Nuclear Regulatory Commission, "2016 Congressional Budget Justification," NUREG-1100, Volume 31, February 2015, ADAMS Accession No. ML15030A093.

3. U. S. Nuclear Regulatory Commission, "Industry Trends Program," Inspection Manual Chapter (IMC) 0313, May 29, 2008, ADAMS Accession No. ML102500670.

4. U. S. Nuclear Regulatory Commission, "Report to Congress on Abnormal Occurrences, Fiscal Year 2014," NUREG-0090, Volume 37, May 2015, ADAMS Accession No. ML15140A285.

5. U. S. Nuclear Regulatory Commission, "Significance Determination Process," IMC 0609, June 2. 2011, ADAMS Accession No. ML101400479.

6. U. S. Nuclear Regulatory Commission, "NRC Incident Investigation Program," Management Directive 8.3, June 25, 2014, ADAMS Accession No. ML13175A294.

7. U. S. Nuclear Regulatory Commission, "Recommendations for Enhancing Reactor Safety in the 21st Century: The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident," July 12, 2011, ADAMS Accession No. ML112510271.

8. U. S. Nuclear Regulatory Commission, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," SECY-10-0125, September 29, 2010, ADAMS Accession No. ML102100386.

9. U.S. Nuclear Regulatory Commission, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," SECY-14-0107, October 6, 2014, ADAMS Accession No. ML14230A084.

10. U. S. Nuclear Regulatory Commission, "Reevaluation of Station Blackout Risk at Nuclear Power Plants, Analysis of Loss of Offsite Power Events: 1986-2004" NUREG/CR-6890, Volume 1, December 2005, ADAMS Accession No. ML060200477.

11. American Society of Mechanical Engineers/American Nuclear Society, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," ASME/ANS RA-Sa-2009, March 2009.

12. U.S. Nuclear Regulatory Commission, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities," Regulatory Guide 1.200, Revision 2, March 2009, ADAMS Accession No. ML090410014.

Status of the Standardized Plant Analysis Risk Models

1.0 Background

The objective of the U.S. Nuclear Regulatory Commission's (NRC's) Standardized Plant Analysis Risk (SPAR) Model Program is to develop standardized risk analysis models and tools to support various regulatory activities, including the Accident Sequence Precursor (ASP) Program and the Significance Determination Process (SDP). The SPAR models have evolved from two sets of simplified event trees initially used to perform precursor analyses in the early 1980s. Today's SPAR models for internal events are far more comprehensive than their predecessors. For example, the revised SPAR models include improved loss of offsite power (LOOP) and station blackout models; an improved reactor coolant pump seal failure model; new support system initiating event models; and updated estimates of accident initiator frequencies and equipment reliability based on recent operating experience data.

The SPAR models consist of a standardized, set of plant-specific risk models that use the event-tree and fault-tree linking methodology. Although the SPAR models are plant-specific models, they rely on a set of standardized modeling conventions (e.g., standardized naming conventions, standard modeling approaches, and logic structure). They employ a standard approach for event-tree development, as well as a standard approach for initiating event frequencies, equipment performance parameters, and human performance data. These input data can be modified to be more plant- and event-specific, when needed. SPAR standardization is needed to allow agency risk analysts to efficiently use SPAR models for a wide variety of nuclear power plants (NPPs) without having to relearn modeling conventions and basic assumptions. Although the system fault trees contained in the SPAR models generally are not as detailed as those in licensee probabilistic risk assessments (PRAs), in some cases SPAR models may contain more sophisticated modeling, such as for common-cause failures, support systems, and losses of offsite power. The staff maintains 75 SPAR models representing all 99 operating commercial NPPs. The SPAR models for NPPs that have recently permanently ceased operation (Kewaunee, Crystal River, San Onofre, and Vermont Yankee) are no longer being updated but remain available for staff use. All SPAR models are developed under a comprehensive quality assurance (QA) program and have been benchmarked against licensee PRAs through either onsite QA reviews or other information provided by the licensee.

The staff initiated the Risk Assessment Standardization Project (RASP) in 2004. A primary focus of RASP was to standardize risk analyses performed in SDP, in ASP, and under Management Directive (MD) 8.3, "NRC Incident Investigation Program." Under this project, the staff initiated the following activities:

- Enhance SPAR models to be more plant-specific and improve the Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) code used to manipulate the SPAR models.
- Document consistent methods and guidelines for risk assessments of internal events during power operations; internal fires and floods; external hazards (e.g., seismic events and tornadoes); and internal events during low-power and shutdown (LPSD) operations.
- Provide on-call technical support for staff involved with licensing and inspection issues.

This effort resulted in the development of the Risk Assessment of Operational Events Handbook (commonly referred to as the RASP Handbook) and better alignment between the SDP and ASP Program event assessment processes.

2.0 SPAR Model Program Status

The SPAR Model Program continues to play an integral role in the ASP analysis of operating events. Many other agency activities, such as the SDP analyses and MD 8.3 evaluations, also involve the use of SPAR models. All SPAR models include logic modeling covering internal events at power through core damage (i.e., Level-1 PRA model). The NRC is developing new SPAR modules for assessing plant risk for internal fires, external hazards (e.g., high wind and seismic events), and for assessing post-core damage severe accident progression (i.e., Level-2 PRA modeling).

The staff has completed the following activities in model and method development since the previous status report (SECY-14-0107, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," dated October 6, 2014), as described below.

Technical Adequacy of SPAR Models. The staff implemented a QA plan covering the SPAR models in 2006. It updated the SPAR QA plan in fiscal year (FY) 2013. The main objective of this plan is to ensure that the SPAR models continue to represent the as-built, as-operated NPPs and continue to be of sufficient quality for performing event assessments of operational events in support of the staff's risk-informed activities. In addition to model development, the QA plan provides mechanisms for internal and external peer review, validation and verification, and configuration control of the SPAR models. The staff has processes in place to verify, validate, and benchmark these models according to the guidelines and standards established by the SPAR Model Program. As part of this process, the staff performs reviews of the SPAR models and results against the licensee PRA models, when applicable. The QA plan also provides a feedback process from the model users for error reporting, tracking, and resolution. The staff also has processes in place for the proper use of these models in agency programs such as the ASP Program, the SDP, and the MD 8.3 process. These processes are documented in the RASP Handbook, which serves as a desktop guidance document for agency risk analysts.

In 2010 the staff (with the cooperation of industry experts) performed a peer review of SPAR models for a representative boiling-water reactor (BWR) and a representative pressurized-water reactor (PWR) in accordance with American Society of Mechanical Engineers/American Nuclear Society RA-S-2008, "Standard for Level-1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," and Regulatory Guide (RG) 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities" ADAMS Accession No. ML090410014.

The peer review teams noted a number of strengths for the SPAR models, including:

- The SPAR model structure is robust and well developed.
- The SPAR model fault trees are streamlined with an appropriate level of detail for its intended uses.

- The SPAR model structure and the SAPHIRE software are "state of the technology."
- The SPAR models are an efficient method to develop qualitative and quantitative insights for risk-informed applications, SDP evaluations, inspections, event assessments, and model evaluations.

The peer review teams also noted a number of enhancements that could be made to the SPAR models. The staff reviewed and prioritized the peer review comments in order to identify potential improvements to the SPAR models. Enhancements that improved the usability, capabilities, and technical adequacy of the models in a cost effective manner were given high priority and the staff initiated projects to address these comments. Specific enhancements that have been completed include structuring the SPAR model documentation to more closely align with the structure of the PRA standard, incorporation of improved LOOP modeling, development of new support system initiating event models, and expanding the SAPHIRE Web site to better log and track model change requests. All high priority BWR and PWR SPAR peer review enhancements were completed by August 2015.

It should be noted that the SPAR models are generally used to categorize and prioritize operational events and conditions, including licensee non-compliance issues with existing regulations. Licensee PRA models developed to support licensing basis changes must meet the technical adequacy requirements of RG 1.200. Although the SPAR models are not maintained under a RG 1.200 program, the SPAR QA program and other process controls (such as internal and external reviews) help to ensure that SPAR-based analyses appropriately reflect the as-built, as-operated NPP.

Routine SPAR Model Updates. Existing SPAR models for operating plants need to be updated regularly as a result of any significant plant changes that may affect the risk profile of the plant. In general, the staff goal is to perform significant updates to approximately 10 to 12 SPAR models per year. As SPAR models are updated, their documentation (i.e., the model report and the plant risk information eBook summary reports) is also updated to represent the latest PRA information included in each SPAR model. Comparisons between the SPAR model baseline results and licensee model results (when voluntarily submitted by the licensee) are also performed. These comparisons include baseline core damage frequency, conditional core damage probability for each initiator type, top cut sets, and importance measures. These comparisons help ensure that SPAR models and associated risk assessments that support the SDP process are of high quality and reflect the as-built, as-operated plants. In FY 2015, the staff performed significant updates to six SPAR models to reflect changes, such as the addition of logic for new station blackout generators, battery charging generators, and broad expansion of electrical power modeling detail. Although the level of effort in FY 2015 was less than the staff goal due to resource limitations, the effort is expected to be increased again in FY 2016 to complete approximately 10 model updates per year.

In FY 2015, the staff also modified all SPAR models to take advantage of new SAPHIRE features and to improve the usability of the models. Among these new SAPHIRE features is the ability to eliminate most event tree linkage rules. SAPHIRE now automatically merges multiple overlapping rules, thus precluding the need to manually generate multiple explicit rule sets.

Automatic generation and application of convolution correction factors is another SAPHIRE enhancement that eliminates multiple manual actions each time a model is updated.

Approximately 30 SPAR models were also updated to support specific SDP or ASP activities. These more limited SPAR model updates are performed when requested by agency risk analysts. These updates are normally required to better model specific features of an operational event that are not normally captured in a base PRA or to reflect an enhanced understanding of the as-built, as-operated plant as a result of event followup activities.

During FY 2015, the staff continued to perform a comprehensive data update to all 75 SPAR models to reflect recent operating experience and implement other enhancements to improve the usability and functionality of the models. In addition to updating SPAR model parameters, this activity will improve model documentation; integrate hazard categories (i.e., internal events, external hazards, Level-2, and LPSD models) into a single report for each SPAR model report; and resolve issues associated with the SPAR logic modeling framework. Other data updates include modification of common cause events to more closely follow the guidance in the RASP Handbook. A plant-specific model convergence analysis (to assess the appropriate truncation level to run the model) and documentation of the results is also included in this task.

SPAR Models for the Analysis of All Hazards (External Events). Development of SPAR All-Hazard (SPAR-AHZ) models, which contain accident scenarios from all hazard categories (including seismic, high wind, and internal fire) applicable to a given site, has continued during FY 2015, although at a lower intensity than the previous year. The lower intensity was due to budgetary constraints and the balancing of limited staff resources to work on other projects, such as the Commission- directed site Level-3 PRA project for the Vogtle site. Currently, 22 of the 75 SPAR models, representing 28 NPPs, include internal fire and external hazard groups. Eighteen of the SPAR-AHZ models are based on assessments conducted for Supplement 5, "Individual Plant Examination of External Events for Severe Accident Vulnerabilities," to Generic Letter 88 20, "Individual Plant Examination for Severe Accident Vulnerabilities 10 CFR 50.54(f)," and other readily available information. In FY 2015, one new SPAR-AHZ model, which includes internal fire models extracted from the National Fire Protection Association (NFPA) Standard 805- compliant fire model for the Vogtle plant, has been constructed and placed in the SPAR model library for use by NRC risk analysts. SPAR-AHZ models for the Shearon Harris, D.C. Cook, and V.C. Summer NPPs had been previously completed. Because the licensee-developed NFPA 805-compliant fire PRA models contain thousands of quantified fire sequences, a significant focus of the SPAR-AHZ effort was combining similar sequences to enhance model usability while retaining the resolution contained in the licensee models.

Recently, a new SPAR-AHZ model for the Point Beach site was developed, and the SPAR-AHZ model for the Sequoyah site underwent a major upgrade. The staff is currently working on a major update to the Peach Bottom SPAR-AHZ model. Development of the Peach Bottom SPAR-AHZ model includes licensee site visits to gather information and discuss modeling assumptions and results. Currently, the Office of Nuclear Regulatory Research (RES) and the Office of Nuclear Reactor Regulation (NRR) are working together to identify ways to improve the efficiency and therefore increase the pace of SPAR-AHZ model development, given expected resource constraints in FY 2016 and beyond.

New Reactor SPAR Models. Before new plant operation, the staff may perform risk assessments to inform potential risk-informed applications for combined licenses, focus construction inspection scope, or assess the significance of construction inspection findings. Once the plants begin operation, independent assessments using SPAR models will be used by the staff for the evaluation of operational findings and events similar to the assessments performed for current operating reactors.

There are currently five new reactor internal hazard SPAR models. These include one model for the AP1000, two Advanced Boiling-Water Reactor (ABWR) models (one for the Toshiba design and one for the General Electric-Hitachi design), one model for the U.S. Advanced Pressurized-Water Reactor (US-APWR), and one model for the U.S Evolutionary Power Reactor (U.S. EPR). In addition to these internal events models, there is a seismic model for the AP1000 and a LPSD model for the Toshiba ABWR. Since FY 2013, the staff has been extending the capabilities for the AP1000 reactor design SPAR model. The AP1000 SPAR-AHZ model includes an internal flooding model (completed in FY 2013) and an internal fire model (completed in FY 2014). The staff is in the process of completing a LPSD model and developing a new severe accident model (Level-2 PRA model) for the AP1000 reactor design.

The staff plans to continue developing new reactor SPAR models, including AHZ and LPSD models, as needed, to support licensing and oversight activities.

MELCOR Thermal Hydraulic Analysis for SPAR Model Success Criteria. The staff continues to perform MELCOR analyses to investigate success criteria associated with specific Level-1 PRA sequences. In some cases, these analyses confirm the existing technical basis, and in other cases they support modifications that can be made to increase the realism of the agency's SPAR models. The latest round of activity is documented in two reports: (1) soon to be published NUREG-2187, "Confirmatory Thermal-Hydraulic Analysis to Support Specific Success Criteria in the Standardized Plant Analysis Risk Models—Byron," and (2) NUREG/CR-7177, "Compendium of Analyses To Investigate Select Level-1 Probabilistic Risk Assessment End-State Definition and Success Criteria Modeling Issues," published in May 2014 (ADAMS Accession No. ML14148A126). The results of these studies will be used to confirm specific success criteria for a suite of four-loop Westinghouse plants, which are similar to Byron, with appropriate consideration of the design and operational differences of these plants. They also will be used to support application-specific consultation on the use of the SPAR models.

This effort directly supports the agency's goal of using state-of-the-art tools that promote effectiveness and realism. The NRC is communicating the project plans and results to internal and external stakeholders through mechanisms such as the Regulatory Information Conference and the industry's Modular Accident Analysis Program Users' Group.

3.0 Additional Activities

SAPHIRE Maintenance and Improvements. In FY 2015, new features and capabilities were implemented in SAPHIRE to better support NRC regulatory activities. The new features include:

- SAPHIRE offers multiple methods for solving PRA models. Models can be assessed by solving individual accident sequences or by grouping sequences by common end states. A new capability in SAPHIRE allows users to trace the contribution of individual accident sequences regardless of the solving method that is used.
- Improvements to the reporting capabilities for external hazard model results.
- Improved tools for modelers to update and maintain the SPAR models.

All of these improvements to SAPHIRE have been performed in accordance with the SAPHIRE software QA program. A set of software QA documents has been developed for SAPHIRE. These documents cover topics such as the software development plan, configuration management, requirements tracking, and testing and acceptance. The NRC project manager performs an annual audit of the SAPHIRE software QA program. The most recent audit was completed on January 15, 2015, and no significant issues were identified. The NRC project manager confirmed that the maintenance and implementation of the SAPHIRE software QA program is consistent with the guidance contained in NUREG/BR-0167, "Software Quality Assurance Program and Guidelines," dated February 1993 (ADAMS Accession No. ML15043A791).

The SAPHIRE developers continue to explore advanced features and enhancements that may be implemented in future SAPHIRE revisions. The SAPHIRE team has developed a demonstration version of a Web-based SAPHIRE application. A Web-based SAPHIRE application is envisioned to have several advantages that are not available with a desktop application, such as improved configuration management of models and analyses, enhanced collaboration capabilities, and remote access to high-performance computing resources. After successfully demonstrating a prototype version of the application, the SAPHIRE team is developing an implementation plan to describe how a fully functional Web-based version could be completed and made available to users as a replacement to the current version of SAPHIRE. The implementation is expected to occur in a phased approach over the next several years. The work on the Web-based version has also helped the SAPHIRE team to explore new ways to use parallel computing resources to reduce code runtimes for complex analyses. These methods may even be able to benefit near-term updates to the current version of SAPHIRE. In addition to this work, the SAPHIRE team continues to remain cognizant of academic and international research activities on advanced PRA quantification techniques.

Cooperative Research for PRA. The staff has executed an addendum to the memorandum of understanding with the Electric Power Research Institute (EPRI) to conduct cooperative nuclear safety research for PRA. Several of the initiatives included in the addendum are intended to help resolve technical issues that account for the key differences between NRC SPAR models and licensee PRA models.

During FY 2015, significant efforts have been made in implementing PRA methods for support system initiating event (SSIE) analysis and treatment of LOOP in PRAs. The SSIE PRA modeling approach was developed in collaboration with EPRI and is documented in EPRI Report 1016741, "Support System Initiating Events," published December 19, 2008. These methods are being implemented in the SPAR models as one of the activities associated with addressing the peer review comments. To date, all SPAR models have been enhanced with the improved SSIE modeling methodology. Various LOOP methodology enhancements have been added to all models, with the remaining enhancements expected to be completed in conjunction with routine SPAR model updates. The staff plans to continue these cooperative efforts with EPRI and other stakeholders to address the remaining issues over the next several years.

On July 14–15, 2015, RES, in collaboration with Idaho National Laboratory staff, held a two-day public workshop on the agency's SPAR model program. Workshop discussions included the objectives of the SPAR model program; data collection and analysis; human reliability analysis; loss of offsite power modeling; and SPAR model maintenance and QA. The workshop participants included representatives from NPPs, industry contractors, international partners, and public interest groups. In addition, NRC staff from NRR, Office of New Reactors, and the Regions attended. A meeting summary of the workshop can be found in ADAMS at Accession No. ML15198A191.

4.0 Conclusion

SPAR models are one of the primary risk tools for the agency and support a wide variety of regulatory uses. The staff maintains and updates the suite of SPAR models to help ensure that agency-performed risk assessments represent the as-built, as-operated reactor plants. Recent activities have focused on the development of external hazard models, updates to model parameter estimates to reflect recent plant operating experience, and increased public outreach to promulgate information about the SPAR model program.

Tetter, Keith

From: Nakoski, John
Sent: Tuesday, September 29, 2015 3:58 PM
To: Tetter, Keith
Cc: Coyne, Kevin
Subject: Update to the sentence to add to the Paper. Use the sentences in the body of the message below instead. John EOM

Further, NRR is considering how it can improve the efficiency and effectiveness of the SDP Process. These improvements may include pilot activities to assess the use of alternatives to the SPAR Models.

John A. Nakoski
Chief, Performance and Reliability Branch
Division of Risk Analysis
Office of Research
301-415-2480 (w)
(b)(6) (c)

Coyne, Kevin

From: Coyne, Kevin
Sent: Tuesday, September 29, 2015 1:09 PM
To: Rini, Brett
Cc: Correia, Richard
Subject: RE: REPLY: SPAR Model Summary and Uses
Attachments: Key Talking Points for the SPAR Models_Rev 2.docx

Importance: High

Brett –

No problem sharing the information with NRR. However, I did have a minor typo in the previous version (used "licensing" rather than "licensee") – the attached is the corrected version. David's information is also good to include.

Kevin

From: Rini, Brett
Sent: Tuesday, September 29, 2015 11:36 AM
To: Coyne, Kevin <Kevin.Coyne@nrc.gov>
Subject: RE: REPLY: SPAR Model Summary and Uses

Thanks, Kevin.

FYI, I also have the following in the background information from Dave Aird:

- The User Need Request for Support in the Development and Enhancements of NRC Risk Analysis Tools (NRR-2015-009) was received and accepted by RES/DRA. The UNR ask RES to continue additional development and enhancements of SPAR models and to provide enhanced risk analysis methods and guidance that incorporate new research insights to enhance risk tools used by NRC senior reactor analysts (SRAs) and risk analysts.

- RES is actively working on these items:
  - Maintain and Update SPAR Models
  - Update SPAR Models for Internal Events
  - Develop SPAR Models for At-Power External Events
  - Develop and Enhance SPAR Models for Shutdown Events
  - Maintain and Enhance SAPHIRE 8 Code
  - Enhance PRA and Risk Methods
  - Develop and Update Guidance for Risk Assessments (RASP Handbook)
  - Provide Technical Support to Risk Analysts

- RES Staff will continue to interact with NRR/DRA staff and the SRAs periodically to share preliminary results and draft reports.

Let me know if you have any concerns with sharing the information in the attachment with NRR. We typically like to have one document with the background information for both offices, to ensure everyone is on the same page.

Thanks,

Brett

From: Coyne, Kevin
Sent: Tuesday, September 29, 2015 10:37 AM
To: Sheron, Brian <Brian.Sheron@nrc.gov>; Rini, Brett <Brett.Rini@nrc.gov>
Cc: West, Steven <Steven.West@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Correia, Richard <Richard.Correia@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>
Subject: RE: REPLY: SPAR Model Summary and Uses

Brian –

I've updated the info sheet on SPAR to capture this point. The fifth bullet under key talking points now reads:

- All models run on a single code platform (SAPHIRE). SAPHIRE can be updated and configured to directly support NRC risk assessment activities through coding changes and customized reporting functions. Use of licensee models would require the NRC to maintain licensees and network environmental approval for multiple commercial software codes and eliminate the ability to revise these code to support NRC-specific applications.

Let me know if you need more background or have additional questions.

Brett – the first three bullets under "key talking points" are the most significant items if you want to highlight some key points in your background info for Brian.

Kevin

From: Sheron, Brian
Sent: Thursday, September 24, 2015 7:23 AM
To: Coyne, Kevin <Kevin.Coyne@nrc.gov>
Cc: West, Steven <Steven.West@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Correia, Richard <Richard.Correia@nrc.gov>; Rini, Brett <Brett.Rini@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>
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Subject: RE: REPLY: SPAR Model Summary and Uses

Can we add that if the Regions wanted to run licensee models on an NRC machine, each of the different platforms would have to be loaded onto regional computers, and all would come under FISMA requirements.

My guess is that the only practical option if we did away with SPAR models is for NRC to require the licensees to perform the SDP with their models, and the SRAs would just review them.

From: Coyne, Kevin
Sent: Wednesday, September 23, 2015 9:57 PM
To: Sheron, Brian <Brian.Sheron@nrc.gov>

Cc: West, Steven <Steven.West@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Correia, Richard <Richard.Correia@nrc.gov>; Rini, Brett <Brett.Rini@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>
Subject: RE: REPLY: SPAR Model Summary and Uses

Brian –

Modeling almost every operational event requires some change to the PRA model – this is true for both SPAR and licensee models. The changes can range from simple data updates (such as changing a human error probability) to complex revisions of modeling logic. SRAs are able to make many of these changes to the SPAR models (sometimes in consultation with INL or RES staff) because all of the models work in a standard way – so a given change to a SPAR model has predictable and consistent results. There is no standardization across licensee models, so an SRA would have to relearn the modeling logic and conventions for each plant in order to do an SDP, NOED, or MD 8.3 analysis. And there is often a lot of logic modeling working behind the scenes that can be difficult to find and modify if you don't know what you're looking for (these are generally in the form of logic rules that do things like remove TS prohibited cutsets, adjust HRA values, and turn on and off basic events depending on the accident context). Assuming that a licensee would provide the SRAs access to their PRA model, it would take significantly more time for an SRA to competently modify the licensee model than a SPAR model. And all that assumes that (1) the licensee would even provide the model to the NRC (there is no regulatory requirement to do so) and (2) the SRA was familiar with the PRA software the licensee used (there are several codes available, and while most use the EPRI developed CAFTA code, not all do). That said, the model itself would be accessible if we had the model and the software and knowledge to run it (so there isn't an issue with a compiled vs source code version), but the real challenge is understanding the logic model and efficiently making changes. We developed a great understanding of the challenges of doing this with the Vogtle Level 3 project – initially, even running the licensee's PRA in its native software was a challenge. And although we have had access to a tremendous amount of PRA information from the site and have had several years to review the model (advantages an SRA would never have), there are still aspects of Vogtle's modeling that is impenetrable to our feeble minds (we can discuss with you in greater detail if you'd like, but something as basic as assigning unavailability values for equipment can be done in many different ways – and we are still scratching our heads over how Vogtle did this for some risk significant equipment). So, we might be able to help the SRAs, but it would be an extremely difficult process compared to what we can do with the SPAR models (and that is assuming we had the right software, the knowledge to run it, and the full set of documentation supporting the licensee PRA model).

If we did not have SPAR models, we would not have any independent capability to assess risk for ASP, generic issues, rulemaking technical bases, etc.

I've added these points to the "key talking points" - revision attached. The first bullet now reads: "SPAR program provides the NRC's only independent risk analysis capability in support of reactor oversight process (ROP) and a variety of risk-informed technical applications". And I added a final bullet that states "Given the lack of standardization in licensee PRAs (and the variety of code platforms that can be used), it would be extremely inefficient for SRAs and other agency risk analysts to use licensee models for risk assessment activities.".

Let me know if you have any other questions or would like us to set up a more detailed briefing.

Kevin

From: Correia, Richard
Sent: Wednesday, September 23, 2015 3:53 PM
To: Sheron, Brian; Rini, Brett; Coyne, Kevin
Cc: West, Steven; Appignani, Peter
Subject: RE: REPLY: SPAR Model Summary and Uses

Brian,

We'll get you answers soon.

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Sheron, Brian
Sent: Wednesday, September 23, 2015 1:57 PM
To: Rini, Brett <Brett.Rini@nrc.gov>; Correia, Richard <Richard.Correia@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>
Cc: West, Steven <Steven.West@nrc.gov>
Subject: RE: REPLY: SPAR Model Summary and Uses

Good summary. Is the following also true:

1.) If an event occurs for which the licensee's PRA model cannot accurately model the event, do we think that the licensee would let an SRA add the necessary models to their PRA (in other words, if the agency were to use a licensee's model, would the licensee likely give us a source deck or a compiled version? Even if we got a source deck, is an SRA capable of developing, programming, and incorporating a model into a licensee's code?

    If the Region or NRR came to RES with a licensee's PRA model and wanted us to add a model into a licensee's code, could we even do it?

2.) If we did not have the SPAR models, what PRA capability would we have, and could we continue to use this capability for all of the non-regional stuff we currently use it for (e.g., GIs)?

If it turns out that these two items are also a problem, can we list them in the Summary Use Table (attached)?

From: Rini, Brett
Sent: Wednesday, September 23, 2015 9:21 AM
To: Sheron, Brian <Brian.Sheron@nrc.gov>
Cc: West, Steven <Steven.West@nrc.gov>
Subject: REPLY: SPAR Model Summary and Uses

Brian,

Per your request, here's DRA's 2-pager on SPAR models and their uses.

Brett

Key Talking Points for the Standardized Plant Analysis Risk (SPAR) Model Program

- Program provides **independent** risk analysis capability for NRC in support of reactor oversight process (ROP) and a variety of risk-informed technical applications
- Plant-specific SPAR models (99 operating plants are represented by 75 SPAR models) use **standardized** modeling and naming conventions. Standardization increases analyst efficiency and accuracy and supports cross comparison across models.
- SPAR models and the SAPHIRE PRA code are **designed to support event and condition analyses** by performing "delta-risk" analyses (e.g., change in CDF from base case to performance deficiency). Licensee developed models and supporting codes lack this capability (requiring additional calculations and manual sequence/cutset result comparisons)
- The program leverages available licensee PRA information to reduce program costs, but includes validation of licensee modeling assumptions and integrates licensee model conventions into standardized SPAR modeling framework. Although SPAR models use some simplifying assumptions compared to licensee models, in several areas most pertinent to ROP applications, the SPAR models are generally more detailed (e.g., CCF, LOOP, and support system initiators)
- All models run on a single code platform (SAPHIRE). SAPHIRE can be updated and configured to directly support NRC risk assessment activities through coding changes and customized reporting functions. Use of licensee models would require the NRC to maintain licensees and network environmental approval for multiple commercial software codes and eliminate the ability to revise these code to support NRC-specific applications.
- Although licensees have made progress in developing RG 1.200 compliant PRA models, these models lack the standardization and ROP-specific features that are essential to the agency's needs for performing event and condition analyses.

SPAR Model Uses

- Significance Determination Process (Reactor Oversight) - **Regions**
- Accident Sequence Precursor Program (used as an input metric to the performance budget process) - **RES**
- Evaluation of Notices of Enforcement Discretion – **Regions, NRR** *
- MD 8.3 Incident Investigation Program Risk Evolutions (e.g., determine level of inspection response to an event) – **Regions** *
- Establish technical basis for rulemaking – **RES, NRR**
- Evaluate generic issue safety significance - **RES**
- Perform system and component studies - **RES**
- Inspection Planning (e.g., risk insights from Plant Risk Information eBooks) - **Regions**

These applications typically are performed with limited time, highlighting the importance of model standardization for SPAR

SPAR Model Annual Budget

The SPAR/SAPHIRE annual budget for **FY2015 was ~$2.2 million.** This amount is scalable depending on agency needs and available resources. Major activities include:

Base Resources (i.e., minimum requirements for the program):

- SPAR Model Configuration/Quality Control and User Support Help Desk ~$500k/year
  - Help desk handles ~ 2 calls/day from SRAs
  - Ensures model version control and maintains INL Website

- Performs model updates to support specific SDP/ASP activities (~30 models were updated to support a specific analysis in FY2015). These updates are often highly specific to the event/condition that occurred and would also need to be performed for a licensee PRA model

- SAPHIRE QA and User Support ~$300k/year
  - Maintain NUREG/BR-0167 QA program
  - User help desk Support

<u>Resources needed to Support Specific User Enhancements:</u>

- Model Updates to Reflect Significant Plant Changes (~12 models/year) - ~$250k
  - Incorporate station blackout EDGs
  - Battery charging generators
  - Significant model upgrades

- External Hazard and Fire Models - ~ $400k/year
  - Add NFPA 805 fire modeling
  - Add seismic and high wind model capabilities

- SAPHIRE Enhancements ~$300k /year
  - New reporting features and code capabilities

- Data Updates (performed every 3 years) - ~$500k (every three years)
  - Upgrade SPAR models to reflect most recent operating data
  - Update model documentation and Plant Risk Information eBooks (PRIBs)
  - General model cleanup/improvements

<u>Letter to NEI from OEDO on Use of SPAR models (2007, ML072490566)</u>

This letter addressed an NEI proposal to use licensee PRA models instead of SPAR models. A detailed review was conducted and concluded that SPAR was needed to:

- Maintain **independence** of NRC analyses. Differences between NRC and Licensee assessments is not due to the base model, but by the assumptions for each specific event or condition analysis
- Provide **standardized model framework** for efficient analyses - industry does not use a standardized modeling approach
- Avoid inefficiencies in having agency risk analysts learn the conventions of over 70 licensee developed PRAs (utilizing up to four different software platforms)

The basis for the staff conclusion remains valid today.

<u>Feedback from Regional SRAs on Potential Use of Licensee Models vice SPAR</u>

- More efficient and objective to use SPAR models for risk assessments.
- It would take a significant increase in resources to use licensee models for event and condition assessment activities due to their lack of standardization and need for SRAs to understand unique modeling conventions and new code platforms.
- Use of licensee models would cause delays in the SDP process due to need to engage in additional requests for information to understand licensee PRA modeling assumptions.
- NRC's ability to perform independent regulatory assessment activities will be eroded by not having a centralized system evaluating Generic Safety Issues, SBO/LOOP studies, etc.

Appignani, Peter

From: Sheron, Brian
Sent: Tuesday, September 29, 2015 12:34 PM
To: Coyne, Kevin; Rini, Brett
Cc: West, Steven; Appignani, Peter; Correia, Richard; Nakoski, John
Subject: RE: REPLY: SPAR Model Summary and Uses

Thanks.

From: Coyne, Kevin
Sent: Tuesday, September 29, 2015 10:37 AM
To: Sheron, Brian <Brian.Sheron@nrc.gov>; Rini, Brett <Brett.Rini@nrc.gov>
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Kevin

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Let me know if you have any other questions or would like us to set up a more detailed briefing.

Kevin

From: Correia, Richard
Sent: Wednesday, September 23, 2015 3:53 PM
To: Sheron, Brian; Rini, Brett; Coyne, Kevin
Cc: West, Steven; Appignani, Peter
Subject: RE: REPLY: SPAR Model Summary and Uses

Brian,

We'll get you answers soon.

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Sheron, Brian
Sent: Wednesday, September 23, 2015 1:57 PM
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Subject: RE: REPLY: SPAR Model Summary and Uses

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Subject: REPLY: SPAR Model Summary and Uses

Brian,

Per your request, here's DRA's 2-pager on SPAR models and their uses.

Brett

Tetter, Keith

From: Weerakkody, Sunil
Sent: Monday, September 28, 2015 3:23 PM
To: Nakoski, John
Cc: Giitter, Joseph; Correia, Richard; Circle, Jeff; Kichline, Michelle; Tetter, Keith
Subject: additional comments from Bill Dean on the ASP\SPAR SECY

John,

1. On page 6 of the paper where Jennifer added information about doing a pilot with Vogtle PRA, Bill wants words added to indicate how much we spend on SPAR model and SAPHIRE development and maintenance.

2. On page 6 of Enclosure 2 where Jennifer mentioned that RES should not work on adding parallelism to SAPHIRE since the runtime is fast enough, Bill adds that NRR funds should not be applied on this task or on developing a web-based version.

Sunil D Weerakkody, Chief
PRA Operations & Human Factors Branch
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission

Address: Mail Stop O-10 C-15, US NRC, Washington DC 20005-0001

Tel: 301-415-2870
Black Berry: (b)(6)

Coyne, Kevin

From: Correia, Richard,
Sent: Monday, September 28, 2015 3:06 PM
To: Coyne, Kevin; Nakoski, John
Subject: Re: weekly RES, NRR & NRO DD call

Th Kevin. Yes we (RES and NRO) need to discuss with NRR. We need Brian and Steve's input too.
Rich
Send by BlackBerry

From: Coyne, Kevin
Sent: Monday, September 28, 2015 03:02 PM
To: Correia, Richard; Nakoski, John
Subject: RE: weekly RES, NRR & NRO DD call

As luck would have it, John called a few minutes ago – he did not have much time this afternoon (he was on his way out to an appointment), but he was worried that there is a growing rift on the SPAR question with NRR and NRO does not understand the basis for the NRR position. I told him that we got significant comments back from NRR on the ASP/SPAR SECY related to performing a pilot to replace SPAR with Licensee models and highlighting the AIM2020 rebaselining activity. John said NRO would need to re-evaluate their concurrence on the paper if we made those changes…

Maybe a call with NRO tomorrow to determine how we get NRR in the same room as RES/NRO to have a meaningful discussion on this?

Kevin

From: Correia, Richard
Sent: Monday, September 28, 2015 1:59 PM
To: Coyne, Kevin <Kevin.Coyne@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>
Subject: Fw: weekly RES, NRR & NRO DD call

John Monninger needs to see/hear about the NRR comments on the ASP/SPAR SECY
Rich
Send by BlackBerry

From: Monninger, John
Sent: Monday, September 28, 2015 01:03 PM
To: Webber, Kimberly; Correia, Richard; Giitter, Joseph; Lee, Samson
Subject: RE: weekly RES, NRR & NRO DD call

We should probably have a meeting with all 3 offices to discuss SPAR models.

A question came up last week during the New Reactors Commission meeting on the SPAR models. We expressed our support for continued use and development of the SPAR models. I¦ ve heard comments on the side that NRR is not supportive of future SPAR efforts, but I haven¦ t heard first-hand what NRR¦ s concerns are and the basis for the concerns.

From: Webber, Kimberly

Sent: Monday, September 28, 2015 12:54 PM
To: Correia, Richard <Richard.Correia@nrc.gov>; Madden, Patrick <Patrick.Madden@nrc.gov>; Monninger, John <John.Monninger@nrc.gov>; Giitter, Joseph <Joseph.Giitter@nrc.gov>; Lee, Samson <Samson.Lee@nrc.gov>
Subject: RE: weekly RES, NRR & NRO DD call

John and I wont be able to participate today due to meeting and appointment conflicts. I dont have anything to discuss in particular. If there is anything we need to discuss, please email or call.
Thanks,
Kim

-----Original Appointment-----
From: Correia, Richard
Sent: Tuesday, May 20, 2014 8:13 AM
To: Correia, Richard; Madden, Patrick; Monninger, John; Hawkins, Kimberly
Subject: weekly RES, NRR & NRO DD call
When: Monday, September 28, 2015 4:00 PM-5:00 PM (UTC-05:00) Eastern Time (US & Canada).
Where: office

1-888-790-2553 passcode (b)(6)

Coyne, Kevin

From: Correia, Richard
Sent: Monday, September 28, 2015 1:51 PM
To: Coyne, Kevin
Subject: Re: SPAR paper

All so true Kevin. I need to get to Joe Giitter and Scott Morris about this.
Rich
Send by BlackBerry

From: Coyne, Kevin
Sent: Monday, September 28, 2015 07:23 AM
To: Correia, Richard; West, Steven; Sheron, Brian
Subject: Re: SPAR paper

Rich -

I knew that Danny Bost apparently brought it up in the context of "you already have my PRA" - which shows a lack of understanding of the legal questions involved. And I'm not sure I'd really take a brief statement during a public meeting as "volunteering" for what could be an extremely resource intensive pilot (for both the nrc and snc) and one which would place snc's pra information under intense scrutiny (which carries significant regulatory risk for their pilot applications).

If nrr is serious about pursuing this, they need to be open to objective dialogue with RES, NRO, and the Regions before engaging the industry - the way this is playing out is becoming a mess...

Kevin

Sent from an NRC Blackberry
Kevin Coyne
(b)(6)

From: Correia, Richard
Sent: Monday, September 28, 2015 07:07 AM
To: Coyne, Kevin; West, Steven; Sheron, Brian
Subject: RE: SPAR paper

Kevin,

Brian got the information from Jennifer a few weeks ago about the Vogtle PRA – SDP pilot. I've asked my counterparts in NRR for information on the who, what, when, where, how..but no response. I suspect Vogtle "volunteered" because of the new industry RISC chair, Danny Bost jumped at the notion of using licensees' PRAs vs SPAR models at the last public RISCs meeting when Bill Dean offered it.

Rich

Richard Correia, PE

Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Coyne, Kevin
Sent: Monday, September 28, 2015 6:33 AM
To: Correia, Richard <Richard.Correia@nrc.gov>; West, Steven <Steven.West@nrc.gov>; Sheron, Brian <Brian.Sheron@nrc.gov>
Subject: Re: SPAR paper

Rich -

Do you know what "Vogtle" PRA is Jennifer referring to? The only Vogtle pra we have was specifically sent to us to support the Level 3 pra project and using it for a regulatory application would be contradictory to the 2.390 withholding request we processed. Has SNC sent the NRR a seperate transmittal with their pra and supporting information (under 50.9 - unlike the one we have - and with a proper withholding request to support a regulatory application)? Absent that, I think this topic should be handled at a higher level in the paper, if at all (eg; "the staff is evaluating other means to obtain risk information to support the sdp").

And as an aside, Vogtle is the last plant I'd pick for a pilot - we have studied the plant intensively for the past 4 years and they were/are the pilot for several high level risk-informed pilot applications. I think a different plant would provide a fairer pilot test if we do indeed go down that route (and a worthwhile pilot would need to sample across the spectrum of pra's out there, and not just cherry pick one of the leaders in risk informed applications). And we have not yet decided what we would shed in order to free up the resources to conduct the pilot - and this will likely have a huge impact and the affected Region(s).

Kevin

Sent from an NRC Blackberry
Kevin Coyne
(b)(6)

From: Correia, Richard
Sent: Friday, September 25, 2015 10:03 AM
To: West, Steven; Sheron, Brian; Coyne, Kevin
Subject: RE: SPAR paper

Good point Steve.

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: West, Steven
Sent: Friday, September 25, 2015 9:48 AM
To: Correia, Richard <Richard.Correia@nrc.gov>; Sheron, Brian <Brian.Sheron@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>
Subject: Re: SPAR paper

If we are sharing the paper for review/comment we should include NRO. Glenn and John Monninger addressed the need for and the value of SPAR for new reactors at the Commission meeting yesterday. I suggest you start with John as a POC.

Steve

Steven West, Deputy Director
Office of Nuclear Regulatory Research
U.S. NRC

From: Correia, Richard
Sent: Friday, September 25, 2015 08:29 AM
To: Sheron, Brian; Coyne, Kevin
Cc: West, Steven
Subject: RE: SPAR paper

Will do.

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Sheron, Brian
Sent: Friday, September 25, 2015 8:12 AM
To: Correia, Richard <Richard.Correia@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>
Cc: West, Steven <Steven.West@nrc.gov>
Subject: FW: SPAR paper

Can you get the comments from Jennifer and see if we can or can't live with them?

From: Uhle, Jennifer
Sent: Thursday, September 24, 2015 5:38 PM
To: Sheron, Brian <Brian.Sheron@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Giitter, Joseph <Joseph.Giitter@nrc.gov>; Lee, Samson <Samson.Lee@nrc.gov>; Rosenberg, Stacey <Stacey.Rosenberg@nrc.gov>
Subject: SPAR paper

Brian, I have comments on the paper, nothing really difficult. I would like to add wording about under rebaselining doing a pilot with Vogtle PRA and also looking at ASP, SDP, MD 8.3 and figuring out the most streamlined efficient way to get what we need out of the analyses in the most efficient manner.

I have other comments, odds and ends. I plan to meet with NRR/DRA staff tomorrow and explain the comments to them and then I would expect they would talk to RES/DRA staff.

Thanks,

Jennifer

Stutzke, Martin

From: Appignani, Peter
Sent: Monday, September 28, 2015 1:29 PM
To: Stutzke, Martin
Subject: Key Talking points ..
Attachments: Key Talking Points for the SPAR Models_Rev 1.docx

Marty

Kevin put this together for Brian

Keys talking points for SPAR models

Key Talking Points for the Standardized Plant Analysis Risk (SPAR) Model Program

- SPAR program provides the NRC's only **independent** risk analysis capability in support of reactor oversight process (ROP) and a variety of risk-informed technical applications
- Plant-specific SPAR models (99 operating plants are represented by 75 SPAR models) use **standardized** modeling and naming conventions. Standardization increases analyst efficiency and accuracy and supports cross comparison across models.
- The program leverages available licensee PRA information to reduce program costs, but includes validation of licensing modeling assumptions and integrates licensing model conventions into standardized SPAR modeling framework. Although SPAR models use some simplifying assumptions compared to licensee models, in several areas most pertinent to ROP applications, the SPAR models are generally more detailed (e.g., CCF, LOOP, and support system initiators)
- SPAR models and the SAPHIRE PRA code are **designed to support event and condition analyses** by performing "delta-risk" analyses (e.g., change in CDF from base case to performance deficiency). Licensee developed models and supporting codes lack this capability (requiring additional calculations and manual sequence/cutset result comparisons)
- All models run on a single code platform (SAPHIRE). SAPHIRE can be updated and configured to directly support NRC risk assessment activities through coding changes and customized reporting functions.
- Although licensees have made progress in developing RG 1.200 compliant PRA models, these models lack the standardization and ROP-specific features that are essential to the agency's needs for performing event and condition analyses.
- Given the lack of standardization in licensee PRAs (and the variety of code platforms that can be used), it would be extremely inefficient for SRAs and other agency risk analysts to use licensee models for risk assessment activities.

SPAR Model Uses

- Significance Determination Process (Reactor Oversight) - **Regions**
- Accident Sequence Precursor Program (used as an input metric to the performance budget process) - **RES**
- Evaluation of Notices of Enforcement Discretion – **Regions, NRR** *
- MD 8.3 Incident Investigation Program Risk Evolutions (e.g., determine level of inspection response to an event) – **Regions** *
- Establish technical basis for rulemaking – **RES, NRR**
- Evaluate generic issue safety significance - **RES**
- Perform system and component studies - **RES**
- Inspection Planning (e.g., risk insights from Plant Risk Information eBooks) - **Regions**

These applications typically are performed with limited time, highlighting the importance of model standardization for SPAR

SPAR Model Annual Budget

The SPAR/SAPHIRE annual budget for **FY2015 was ~$2.2 million**. This amount is scalable depending on agency needs and available resources. Major activities include:

Base Resources (i.e., minimum requirements for the program):

- SPAR Model Configuration/Quality Control and User Support Help Desk ~$500k/year
  - Help desk handles ~ 2 calls/day from SRAs

- Ensures model version control and maintains INL Website
- Performs model updates to support specific SDP/ASP activities (~30 models were updated to support a specific analysis in FY2015). These updates are often highly specific to the event/condition that occurred and would also need to be performed for a licensee PRA model

- SAPHIRE QA and User Support ~$300k/year
  - Maintain NUREG/BR-0167 QA program
  - User help desk Support

Resources needed to Support Specific User Enhancements:

- Model Updates to Reflect Significant Plant Changes (~12 models/year) - ~$250k
  - Incorporate station blackout EDGs
  - Battery charging generators
  - Significant model upgrades

- External Hazard and Fire Models - ~ $400k/year
  - Add NFPA 805 fire modeling
  - Add seismic and high wind model capabilities

- SAPHIRE Enhancements ~$300k /year
  - New reporting features and code capabilities

- Data Updates (performed every 3 years) - ~$500k (every three years)
  - Upgrade SPAR models to reflect most recent operating data
  - Update model documentation and Plant Risk Information eBooks (PRIBs)
  - General model cleanup/improvements

Letter to NEI from OEDO on Use of SPAR models (2007, ML072490566)

This letter addressed an NEI proposal to use licensee PRA models instead of SPAR models. A detailed review was conducted and concluded that SPAR was needed to:

- Maintain **independence** of NRC analyses. Differences between NRC and Licensee assessments is not due to the base model, but by the assumptions for each specific event or condition analysis
- Provide **standardized model framework** for efficient analyses - industry does not use a standardized modeling approach
- Avoid inefficiencies in having agency risk analysts learn the conventions of over 70 licensee developed PRAs (utilizing up to four different software platforms)

The basis for the staff conclusion remains valid today.

Feedback from Regional SRAs on Potential Use of Licensee Models vice SPAR

- More efficient and objective to use SPAR models for risk assessments.
- It would take a significant increase in resources to use licensee models for event and condition assessment activities due to their lack of standardization and need for SRAs to understand unique modeling conventions and new code platforms.
- Use of licensee models would cause delays in the SDP process due to need to engage in additional requests for information to understand licensee PRA modeling assumptions.
- NRC's ability to perform independent regulatory assessment activities will be eroded by not having a centralized system evaluating Generic Safety Issues, SBO/LOOP studies, etc.

Nakoski, John

From: Nakoski, John
Sent: Tuesday, September 29, 2015 12:28 PM
To: Weerakkody, Sunil
Cc: Coyne, Kevin; Tetter, Keith; Circle, Jeff; Kichline, Michelle; Giitter, Joseph; Lee, Samson
Subject: RE: Changes made to RES SECY on ASP/SPAR Status

Sunil,
Thank you for the feedback. Kevin and I will be meeting with Brian Sheron and Steve West this afternoon to discuss RES' responses to NRR's comments.
If you would like to propose alternatives to the comments that we have received, of course I welcome them. I do however need to caveat my acceptance of your revised comments with the re-emphasis of the RES position that it is not appropriate for an RES status paper to inform the Commission of an NRR initiative to pilot the use of the licensee's PRA models in the SDP – that is something that NRR should do in a separate Notation Vote paper to the Commission. With regard to Project AIM 2020, as we discussed yesterday – if this is the Agency wide policy to add a statement into every SECY going to the Commission on Project AIM 2020, RES will happily add such a statement. However, as we discussed yesterday, it is not appropriate to selectively apply such a statement to Commission Papers as it inappropriate suggests to the Commission where Project AIM 2020 will recommend discontinuing an activity. Project AIM 2020 has not finalized its prioritization – let the process work as planned.
John Nakoski

From: Weerakkody, Sunil
Sent: Tuesday, September 29, 2015 12:21 PM
To: Nakoski, John
Cc: Coyne, Kevin; Tetter, Keith; Circle, Jeff; Kichline, Michelle; Giitter, Joseph; Lee, Samson
Subject: RE: Changes made to RES SECY on ASP/SPAR Status

John,
Michelle has reviewed the changes in the mark-up. Subsequently, the three of us (Jeff Circle, myself, and Michelle) met and discussed. Michele agrees with most of your changes. We found a couple of areas where we could make suggestions to enhance. We also found a couple of other places where, you (or your designee) should go back to Jennifer and ask for clarifications.
In my view, there are three issues that RES falls short of addressing NRR ET comments. I suggest that we elevate them to Joe\Rich as opposed to working them at our level:

1. Bill Dean wanted to include the resources that we spend on SPAR updates and ASP. For reasons that you mentioned, RES doesn't believe that information should be included in this SECY.
2. Jen had proposed a sentence to say that we would be looking at ASP and SPAR (in my words) under Project Aim. I don't believe the sentence that you have proposed goes far enough. (Jen's sentence may be going too far). If you want, we can send a proposal.
3. Jen provided a ½ page insert on how we plan to pilot the use of licensee's models. This has not been addressed. I agree that the words Jen has proposed not ideal. We can send a proposed bullet that may address the overall intent.

I am leaving for our division meeting. Will be back here tomorrow.

Sunil D Weerakkody, Chief
PRA Operations & Human Factors Branch
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Address: Mail Stop O-10 C-15, US NRC, Washington DC 20005-0001
Tel: 301-415-2870
Black Berry: (b)(6)

From: Nakoski, John
Sent: Monday, September 28, 2015 5:09 PM
To: Weerakkody, Sunil; Circle, Jeff
Cc: Coyne, Kevin; Correia, Richard; Tetter, Keith
Subject: Changes made to RES SECY on ASP/SPAR Status

Sunil and Jeff,

Attached are the changes that we made in response to the comments we received from NRR ET. If you would like to add some context with regard to the broader agency response to Davis Besse and Byron events, please send me and Keith Tetter your sentences.
Regards,

John A. Nakoski

Chief, Performance and Reliability Branch
Division of Risk Analysis
Office of Research
301-415-2480 (w)
(b)(6) (c)

Nakoski, John

From: Nakoski, John
Sent: Tuesday, September 29, 2015 8:52 AM
To: Correia, Richard; Coyne, Kevin
Subject: RE: additional comments from Bill Dean on the ASP\SPAR SECY

Will do – Kevin and I are setting up a meeting with John Monninger to go over NRR's comments. John's preliminary feedback to Kevin was supportive of our position.

John

From: Correia, Richard
Sent: Tuesday, September 29, 2015 4:42 AM
To: Coyne, Kevin; Nakoski, John
Subject: Fw: additional comments from Bill Dean on the ASP\SPAR SECY

No and no. Even if we did agree to say something about SPAR vs licensees PRA, we would have to do a FULL cost benefit analysis. Please see Brian and Steve about NRRs comments. They are way out of line.
Rich
Send by BlackBerry

From: Weerakkody, Sunil
Sent: Monday, September 28, 2015 03:23 PM
To: Nakoski, John
Cc: Giitter, Joseph; Correia, Richard; Circle, Jeff; Kichline, Michelle; Tetter, Keith
Subject: additional comments from Bill Dean on the ASP\SPAR SECY
John,

1. On page 6 of the paper where Jennifer added information about doing a pilot with Vogtle PRA, Bill wants words added to indicate how much we spend on SPAR model and SAPHIRE development and maintenance.

2. On page 6 of Enclosure 2 where Jennifer mentioned that RES should not work on adding parallelism to SAPHIRE since the runtime is fast enough, Bill adds that NRR funds should not be applied on this task or on developing a web-based version.

Sunil D Weerakkody, Chief
PRA Operations & Human Factors Branch
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission

Address: Mail Stop O-10 C-15, US NRC, Washington DC 20005-0001

Tel: 301-415-2870
Black Berry (b)(6)

Nakoski, John

From: Nakoski, John
Sent: Monday, September 28, 2015 4:59 PM
To: Coyne, Kevin; Correia, Richard (Richard.Correia@nrc.gov); Monninger, John
Subject: NRR ET comments on the ASP\SPAR SECY paper
Attachments: [Untitled].pdf; ASP_SPAR_SECY-15-XXXX Enclosure 2 - Status of the SPAR Models_NRR comments addressed.docx; ASP_SPAR SECY-15-XXXX Enclosure 1_NRR comments addressed.docx; ASP_SPAR SECY-15-XXXX_NRR comments addressed.docx

Importance: High

John,

Attached is a pdf with Jennifer Uhle's comments on the ASP/SPAR Secy. I have also attached potential changes that RES may make to the paper and the enclosures to address the comments. The short version is that we only plan to address the editorial comments and provide a sentence or two to address the comment on Project Aim 2020 and the NRR concept of a pilot for using licensee PRAs in the SDP process. When we meet tomorrow at 12:30, we can discuss this further.

Bill Dean had two additional comments:

1. On page 6 of the paper where Jennifer added information about doing a pilot with Vogtle PRA, Bill wants words added to indicate how much we spend on SPAR model and SAPHIRE development and maintenance.

2. On page 6 of Enclosure 2 where Jennifer mentioned that RES should not work on adding parallelism to SAPHIRE since the runtime is fast enough, Bill adds that NRR funds should not be applied on this task or on developing a web-based version.

I do not think we will be adding anything about the resources spend on SPAR Model and SAPHIRE development as this is something that we historically have not done in a status paper.

With regards to the comment that NRR funds should not be applied on this task or on developing a web-based version – this appears to be counter to the user need request that we received from NRR. SAPHIRE already has the capability to parallel process and this is in response to a request from Regional and NRR users of SPAR and SAPHIRE to make the processing of model runs quicker to support their needs – while some of the runs can be done in minutes, more complex model analyses can take hours, which in an iterative process can add significant delay to finalizing the analysis. This is not related to developing a dynamic PRA (which was removed from the most recent user need request from NRR). Also, the development of a web based code would provide for improved access by users that may currently be using their personal computers contrary to establish federal information policy.

Regards,

John Nakoski

From: Weerakkody, Sunil
Sent: Monday, September 28, 2015 8:26 AM
To: Nakoski, John
Cc: Circle, Jeff; Kichline, Michelle; Glitter, Joseph; Lee, Samson; Tetter, Keith; Correia, Richard; Lund, Louise
Subject: Plan to disposition NRR ET comments on the ASP\SPAR SECY paper
Importance: High

John,

I have attached a copy of NRR ET comments. (I tried to send the complete paper including the unmarked pages, but the printer kept jamming.) It is best if we meet ASAP and discuss them before your staff begins dispositioning

them. There are couple of high-level comments pertaining to the treatment of the ASP program under the re-baselining effort and use of Vogtle as a pilot to test the use of licensee's models vs SPAR.

Rich Correa has a copy of the mark-ups as well. Jennifer has sent a note Brian Sharon about the high-level comments that she has made. Will discuss details when we meet.

Please have Keith schedule a ½ hr among us (you, me, Michelle, your cognizant staff, Jeff). We really should try to meet tomorrow.

Sunil D Weerakkody, Chief
PRA Operations & Human Factors Branch
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission

Address: Mail Stop O-10 C-15, US NRC, Washington DC 20005-0001

Tel: 301-415-2870
Black Berry: (b)(6)

From: SUNIL.WEERAKKODY@NRC.GOV [mailto:SUNIL.WEERAKKODY@NRC.GOV]
Sent: Monday, September 28, 2015 7:52 AM
To: Weerakkody, Sunil
Subject: yy

FOR: The Commissioners

FROM: Brian W. Sheron, Director
Office of Nuclear Regulatory Research

SUBJECT: STATUS OF THE ACCIDENT SEQUENCE PRECURSOR PROGRAM AND THE STANDARDIZED PLANT ANALYSIS RISK MODELS

PURPOSE:

To inform the Commission of the status, accomplishments, and results of the Accident Sequence Precursor (ASP) Program, including quantitative ASP results, and to communicate the status of the development and maintenance of the Standardized Plant Analysis Risk (SPAR) models. This paper does not address any new commitments or resource implications.

BACKGROUND:

Under Project AIM 2020, the staff is evaluating all NRC activities to rebaseline its efforts to establish priorities to increase efficiency and effectiveness.

In a memorandum to the Chairman dated April 24, 1992, the staff of the U.S. Nuclear Regulatory Commission (NRC) committed to report periodically to the Commission on the status of the ASP Program. Subsequently, in SECY-02-0041, "Status of Accident Sequence Precursor and SPAR Model Development Programs," dated March 8, 2002, the staff expanded the annual ASP status report to include: (1) an expanded evaluation of precursor data trends and insights, and (2) the development of associated probabilistic risk assessment (PRA) models (e.g., SPAR models).

CONTACT: Keith M. Tetter, RES/DRA
301-415-2407

The ASP Program systematically evaluates U.S. nuclear power plant (NPP) operating experience to identify, document, and rank the operating events most likely to lead to inadequate reactor core cooling and severe core damage (i.e., precursors).[1] The ASP Program provides a comprehensive and integrated assessment of plant risk associated with important operating events. The ASP Program provides insights into the NRC's risk-informed and performance-based regulatory programs; evaluates performance against performance indicators in the agency's Congressional Budget Justification[2] and Industry Trends Program;[3] and reports to Congress events of high safety significance in accordance with "abnormal occurrence" criteria.[4]

Under the SPAR Model Program, the staff develops and maintains independent risk-analysis tools and capabilities to support NPP-related risk-informed regulatory activities. The staff uses SPAR models for the Reactor Oversight Process (ROP) Significance Determination Process (SDP); the ASP Program; the Management Directive (MD) 8.3, "NRC Incident Investigation Program," event assessment process; and the MD 6.4, "Generic Issues Program," resolution process. In addition, the staff uses the SPAR models to risk inform NRC inspection activities, to gain risk insights in support of reactor-related rulemaking, and to support other risk assessment studies, such as system and component reliability studies.

DISCUSSION:

This section summarizes the status, accomplishments, and results of the ASP Program and SPAR Model Program since the previous status report, SECY-14-0107, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," dated October 6, 2014.

ASP Program

Program Scope. The ASP Program is one of three agency programs that assess the risk significance of events. The other two programs are the SDP and the event-response evaluation process, as defined in MD 8.3. Currently, the ASP Program provides integrated analyses of complex operating events not evaluated by the SDP or finalized by MD 8.3 evaluations. The SDP evaluates the risk significance of a single licensee performance deficiency, while risk assessments performed under MD 8.3 are used to determine, in part, the appropriate level of reactive inspection in response to an event. An SDP assessment has the benefit of information obtained from the inspection, whereas the MD 8.3 assessment is expected to be performed within a day or two after the event notification. In contrast to the other two programs, a comprehensive and integrated risk analysis under the ASP Program includes all anomalies[5] observed at the time of the event or discovered after the event.

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1 Enclosure 1 provides background on the process used by the staff to identify precursors.

2 See NUREG-1100, Volume 31, "2016 Congressional Budget Justification," issued January 2015.

3 See SECY-15-0061, "Fiscal Year 2014 Results of the Industry Trends Program for Operating Power Reactors," dated April 8, 2015.

4 See Appendix A of NUREG-0090, Volume 37, "Report to Congress on Abnormal Occurrences—Fiscal Year 2014," issued May 2015.

5 These anomalies or conditions may include unavailable and degraded plant structures, systems, and components (SSCs); human errors; and an initiating event (reactor trip). In addition, an unavailable or degraded SSC does not have to be a performance deficiency or an analyzed condition in the plant's licensed design basis.

There are similarities in the risk assessments conducted by the three programs. All programs use SPAR models, the same documented methods and guidance, and similar analysis assumptions, except where program objectives deviate from one another. To minimize overlap and improve efficiency, Ssince 2006, SDP results have been used in lieu of independent ASP analyses to the extent practical and consistent with the overall objectives of both programs. If the SDP analyses considered all concurrent degraded conditions or equipment unavailabilities that existed during the time period of the condition. Typically the SDP analyses are used in the ASP Program when the analysis performed addresses the major contributors to risk for the event based on a review conducted by an ASP Program risk analyst. Typically for initiating events, many of the modeling assumptions made for MD 8.3 analyses can be adopted by ASP analyses. However, some modeling assumptions are revised as detailed information about the event becomes available when inspection activities are completed. These key similarities provide opportunities for significant ASP Program efficiencies. For a potential *significant* precursor (defined below), analysts from the three programs work together to provide a timely determination of plant risk. As such, duplication between programs is minimized to the extent practical within program objectives.

Status and Results. The staff continues to review operational events from licensee event reports (LERs) and NRC inspection reports (IRs) to identify potential precursors to a reactor core damage event. Operational events that exceed the ASP thresholds, mentioned in the Background section of Enclosure 1, are considered precursors in the ASP Program. *Significant* precursors have a conditional core damage probability (CCDP)[6] or a change in core damage probability (ΔCDP)[7] greater than or equal to 1×10^{-3}. The staff has identified 16 precursor events for fiscal year (FY) 2014. The staff did not identify any *significant* precursors for FY 2014 and has not identified any potentially *significant* precursors for FY 2015 to date, although the reporting of FY 2015 events in LERs and NRC IRs are still in progress.

In addition to the identification of precursor events, the staff performs trend analyses on precursors for additional insights. Trend analyses are performed on the following precursor groups:

- all precursors
- precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4}
- precursors involving an initiating event
- precursors involving degraded conditions
- precursors involving a complete loss of offsite power (LOOP)
- precursors that occurred at boiling-water reactors (BWRs)
- precursors that occurred at pressurized-water reactors (PWRs)

For the period of FY 2005 through FY 2014, the staff found a statistically significant increasing trend in the mean occurrence rate of precursors resulting from a LOOP initiating event. This increasing trend resulted from the occurrence of 20 LOOP precursor events in the last 4 years after 7 precursor occurrences in the previous 6 years.

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6 The term CCDP is the probability of the occurrence of core damage given that an initiating event has occurred.

7 The term ΔCDP is the increase in probability of core damage (from the baseline core damage probability) due to a failure of plant equipment or an identified deficiency during the time the failure or deficiency existed.

In the FY 2012 and FY 2013 annual report, statistically significant increasing trends were identified in the mean occurrence rate of precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4}. However, with no additional precursor observed in this group in FY 2013 and FY 2014, the trend is no longer statistically significant. As reported in last year's status report (SECY-14-0107), six of the seven precursors in this group were caused by multiple electrical failures during a 3-year period. Based, in part, on the observed increases in electrical- and LOOP-related precursors over the past few years, the staff initiated a detailed study in FY 2014 to better understand the contribution of electrical system and associated component failures on risk at NPPs. Results for this study should be available in FY 2017

The staff found no statistically significant trends for any of the other precursor groups during the FY 2005 through FY 2014 period. Enclosure 1, "Results, Trends, and Insights of the Accident Sequence Precursor Program," provides additional details on results and trends of the ASP Program.

SPAR Model Program

The SPAR models provide agency risk analysts with an independent risk assessment tool to support a variety of risk-informed agency programs, including the ROP and the ASP program. SPAR models are built with a standard modeling approach, using consistent modeling conventions, that enables staff to easily use the models across a variety of U.S. NPP designs. Unlike industry PRA models, SPAR models are run on a single software platform, the Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) computer code. The staff currently maintains and updates 75 SPAR models representing 99 commercial NPPs.[8] The scope of every SPAR model includes logic modeling covering internal initiating events at power through core damage (i.e., Level-1 PRA model). In FY 2015, the staff modified all SPAR models to take advantage of new SAPHIRE features and to improve the usability of the models. In addition to these global changes, approximately 30 models were updated to support specific SDP or ASP activities. The staff also performed more comprehensive updates to selected SPAR models to reflect recent plant modifications and to incorporate significant modeling updates. In FY 2015, the staff performed significant updates to six SPAR models to reflect changes such as the addition of logic for new station blackout generators, battery charging generators, and expansion of electrical power distribution modeling. During FY 2015, the staff continued to perform a comprehensive data update to all 75 SPAR models to reflect recent operating experience and implement other enhancements to improve the usability and functionality of the models.

In addition, the staff continued to expand SPAR model capability beyond internal events at full-power operation. For example, 22 of the SPAR models, representing 28 nuclear power reactors, include other hazard groups and are referred to as SPAR All-Hazard (SPAR-AHZ) models.[9] Currently, 18 of the SPAR-AHZ models include hazards such as fires, internal floods, and seismic events based on assessments conducted for Supplement 5, "Individual Plant Examination of External Events for Severe Accident Vulnerabilities," to Generic

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[8] The SPAR models associated with NPPs that have recently permanently shut down (Kewaunee, San Onofre Units 2 and 3, Crystal River Unit 3, and Vermont Yankee) are no longer being updated, but remain available for agency use.

[9] These models were formerly named SPAR external event (SPAR-EE) models, but have been renamed SPAR-AHZ to reflect recent improvements in external hazard modeling efforts and for consistency with the ASME PRA Standard model scope.

Letter 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities—10 CFR 50.54(f)" (dated September 8, 1995), and other readily available information. The staff also incorporated internal fire scenarios from the fire PRAs done in compliance with National Fire Protection Association (NFPA) 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," for the Shearon Harris Nuclear Power Plant, the Donald C. Cook Nuclear Power Plant, and the Virgil C. Summer Nuclear Generating Station. In addition to more detailed fire PRA modeling, the SPAR models for these NPPs include improved external hazard modeling and model validation. The staff has also leveraged the ongoing Level-3 PRA project for the Vogtle Electric Generating Plant, Units 1 and 2, to develop improved external hazard and fire modeling for the Vogtle SPAR model. In FY 2015, a new SPAR-AHZ model for the Point Beach site was created, and the SPAR-AHZ model for the Sequoyah site underwent a major revision.

In the new reactor area, the staff has developed SPAR models for the AP1000 Advanced Boiling-Water Reactor (ABWR) (for both the Toshiba and General Electric-Hitachi designs), U.S. Advanced Pressurized-Water Reactor (US-APWR), and the U.S. Evolutionary Power Reactor (U.S. EPR). The staff has expanded the capability of the AP1000 SPAR model to include hazards such as seismic, fire, flooding, and low-power shutdown events. A post-core damage severe accident logic model (i.e., Level-2 PRA model) is also being developed for the AP1000 SPAR model.

The Office of Nuclear Regulatory Research (RES) staff continues to work with the Regions, the Office of Nuclear Reactor Regulation (NRR), and the Office of New Reactors (NRO) to identify future enhancements to the SPAR models, including continuing the development of new SPAR-AHZ models. Further, NRR is considering how it can improve efficiency and effectiveness of the SDP process.

In FY 2010, the staff completed PRA standard-based peer reviews of a representative BWR SPAR model and a representative PWR SPAR model. It performed these peer reviews in accordance with American Society of Mechanical Engineers (ASME)/ American Nuclear Society (ANS) RA-S-2008, "Standard for Level-1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," and Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities." The peer-review teams concluded that, within the constraints of the program, the SPAR model is an efficient method to offer qualitative and quantitative insights for applications, SDP evaluations, inspections, event assessments, and model evaluations. The peer review teams also noted that the SPAR model structure was robust and well developed, model fault trees were streamlined with an appropriate level of detail for the model's intended users, and the model structure and the SAPHIRE computer software are at the state of the technology. The teams also identified a number of enhancements for the SPAR models and supporting documentation. Major activities undertaken to address the high priority peer-review items include the following:

- Structuring the SPAR model documentation to more closely align with the structure of ASME/ANS PRA standard. A majority of the peer review comments were related to documentation issues.

- Incorporating improved LOOP modeling and support system initiating events modeling into the SPAR models (e.g., loss of service water or component cooling water).

- Expanding the SAPHIRE Web site to better log and track model change requests.

The staff completed these PWR and BWR SPAR Model peer-review enhancements in August 2015.

On July 14–15, 2015, RES, in collaboration with Idaho National Laboratory staff, held a 2-day public workshop on the agency's SPAR model program. Workshop discussions included the objectives of the SPAR model program; data collection and analysis; human reliability analysis; LOOP modeling; and SPAR model maintenance and quality assurance. The workshop participants included representatives from NPPs, industry contractors, international partners, and public interest groups. In addition, NRC staff from NRR, NRO, and the Regions attended. A meeting summary of the workshop can be found in Agencywide Documents Access and Management System (ADAMS) at Accession No. ML15198A191.

The staff continues to maintain and improve the SAPHIRE software to support the SPAR Model Program. SAPHIRE is a personal-computer-based software application used to develop PRA models and perform analyses with SPAR models. During FY 2015, significant SAPHIRE activities included the following:

- Oversight of the SAPHIRE software quality-assurance program, including performance of an annual audit of software quality-assurance activities, tools, and documents in accordance with NUREG/BR-0167, "Software Quality Assurance Program and Guidelines."

- Implementation of new SAPHIRE features, including the capability to easily sort model results by their contribution to different accident sequences and improvements to the reporting functions for external hazard model results.

- Evaluation of Research on code infrastructure improvements necessary to support a multi-user Web-based platform for SAPHIRE.

Enclosure 2, "Status of the Standardized Plant Analysis Risk Models," provides a detailed status of SPAR models and related activities.

Planned ASP and SPAR Model Activities

- The staff will continue the screening, review, and analysis (preliminary and final) of potential precursors for FY 2015 and FY 2016 events.

- The staff will continue the detailed study of electrical system and component failure contribution to the risk at operating NPPs.

- The staff will continue to implement enhancements to the internal event SPAR models for full-power operations. Planned enhancements include model updates based on insights from ongoing thermal-hydraulic analyses and a comprehensive update of all SPAR models to reflect recent operating experience.

- The staff will continue quality-assurance activities for both the agency SPAR models and the SAPHIRE code. This will ensure that agency risk tools continue to be of sufficient quality for performing SDP, ASP, and MD 8.3 event assessments in support of the staff's risk-informed regulatory activities.

- The staff will continue to evaluate the need for additional SPAR model capability (beyond full-power internal events) based on experience gained from risk assessment activities and feedback from users. In addition, the staff intends to continue to develop new external hazard capabilities with new SPAR-AHZ models.

SUMMARY:

Under the ASP Program, the staff continues to evaluate the safety significance of operating events at NPPs and to provide insights into the NRC's risk-informed and performance-based regulatory programs. The staff identified no *significant* precursors in FY 2014 and in the FY 2015 events evaluated to date. The staff identified one statistically significant increasing trend involving the occurrence rate of LOOP precursor events for the period FY 2005 through FY 2014. The SPAR Model Program is continuing to develop and improve independent risk-analysis tools and capabilities to support the use of PRA in the agency's risk-informed regulatory activities.

COORDINATION:

The Office of the General Counsel reviewed this Commission paper and has no legal objection.

Brian W. Sheron, Director
Office of Nuclear Regulatory Research

Enclosures:
1. Results, Trends, and Insights of the ASP Program
2. Status of the SPAR Models

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1. Results, Trends, and Insights of the ASP Program
2. Status of the SPAR Models

ADAMS Accession No.: ML15187A434 WITS 199200101

OFFICE	RES/DRA/PRB	SUNSI Review	RES/DRA/PRA	RES/DRA/PRB	Tech Editor
NAME	K. Tetter	K. Tetter	K. Coyne	J. Nakoski	J. Dougherty *(via email)*
DATE	08/06/15	08/06/15	08/11/15	09/01/15	08/18/15
OFFICE	RES/DRA	NRO	NRR	OGC	RES
NAME	R. Correia	G. Tracy	B. Dean	M. Doane	B. Sheron
DATE	08/19/15	/ /15	/ /15	/ /15	/ /15

OFFICIAL RECORD COPY

Formatted: Normal, Centered, Space Before: 6 pt, Tab stops: Not at 4.61"

Nakoski, John

From: Coyne, Kevin
Sent: Monday, September 28, 2015 3:03 PM
To: Correia, Richard; Nakoski, John
Subject: RE: weekly RES, NRR & NRO DD call

As luck would have it, John called a few minutes ago – he did not have much time this afternoon (he was on his way out to an appointment), but he was worried that there is a growing rift on the SPAR question with NRR and NRO does not understand the basis for the NRR position. I told him that we got significant comments back from NRR on the ASP/SPAR SECY related to performing a pilot to replace SPAR with Licensee models and highlighting the AIM2020 rebaselining activity. John said NRO would need to re-evaluate their concurrence on the paper if we made those changes...

Maybe a call with NRO tomorrow to determine how we get NRR in the same room as RES/NRO to have a meaningful discussion on this?

Kevin

From: Correia, Richard
Sent: Monday, September 28, 2015 1:59 PM
To: Coyne, Kevin <Kevin.Coyne@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>
Subject: Fw: weekly RES, NRR & NRO DD call

John Monninger needs to see/hear about the NRR comments on the ASP/SPAR SECY
Rich
Send by BlackBerry

From: Monninger, John
Sent: Monday, September 28, 2015 01:03 PM
To: Webber, Kimberly; Correia, Richard; Giitter, Joseph; Lee, Samson
Subject: RE: weekly RES, NRR & NRO DD call

We should probably have a meeting with all 3 offices to discuss SPAR models.

A question came up last week during the New Reactors Commission meeting on the SPAR models. We expressed our support for continued use and development of the SPAR models. I ve heard comments on the side that NRR is not supportive of future SPAR efforts, but I haven t heard first-hand what NRR s concerns are and the basis for the concerns.

From: Webber, Kimberly
Sent: Monday, September 28, 2015 12:54 PM
To: Correia, Richard <Richard.Correia@nrc.gov>; Madden, Patrick <Patrick.Madden@nrc.gov>; Monninger, John <John.Monninger@nrc.gov>; Giitter, Joseph <Joseph.Giitter@nrc.gov>; Lee, Samson <Samson.Lee@nrc.gov>
Subject: RE: weekly RES, NRR & NRO DD call

John and I won t be able to participate today due to meeting and appointment conflicts. I don t have anything to discuss in particular. If there is anything we need to discuss, please email or call.
Thanks,
Kim

-----Original Appointment-----
From: Correia, Richard

Sent: Tuesday, May 20, 2014 8:13 AM
To: Correia, Richard; Madden, Patrick; Monninger, John; Hawkins, Kimberly
Subject: weekly RES, NRR & NRO DD call
When: Monday, September 28, 2015 4:00 PM-5:00 PM (UTC-05:00) Eastern Time (US & Canada).
Where: office

1-888-790-2553 passcode (b)(6)

Tetter, Keith

From: Weerakkody, Sunil
Sent: Monday, September 28, 2015 9:20 AM
To: Nakoski, John
Cc: Circle, Jeff; Kichline, Michelle; Giitter, Joseph; Lee, Samson; Tetter, Keith; Correia, Richard; Lund, Louise
Subject: RE: Plan to disposition NRR ET comments on the ASP\SPAR SECY paper

John,

I did not get any additional comments from Bill. If I do, I'll pass them to you right away. I'll wait for your scheduler.

Sunil D Weerakkody, Chief
PRA Operations & Human Factors Branch
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission

Address: Mail Stop O-10 C-15, US NRC, Washington DC 20005-0001

Tel: 301-415-2870
Black Berry: (b)(6)

From: Nakoski, John
Sent: Monday, September 28, 2015 9:16 AM
To: Weerakkody, Sunil
Cc: Circle, Jeff; Kichline, Michelle; Giitter, Joseph; Lee, Samson; Tetter, Keith; Correia, Richard; Lund, Louise
Subject: RE: Plan to disposition NRR ET comments on the ASP\SPAR SECY paper

Sunil – I am available all day today except 10-11 and 1:30-2:30. You and I can meet whenever it is convenient for you. I will set up a scheduler based on our mutual availability. I have looked over the Jennifer's comments last Friday. I understood that Bill Dean looked at this over the weekend. Did Bill provide any additional comments or feedback – the file you sent me only had the comments that Jennifer made.

John Nakoski

From: Weerakkody, Sunil
Sent: Monday, September 28, 2015 8:26 AM
To: Nakoski, John
Cc: Circle, Jeff; Kichline, Michelle; Giitter, Joseph; Lee, Samson; Tetter, Keith; Correia, Richard; Lund, Louise
Subject: Plan to disposition NRR ET comments on the ASP\SPAR SECY paper
Importance: High

John,

I have attached a copy of NRR ET comments. (I tried to send the complete paper including the unmarked pages, but the printer kept jamming.) It is best if we meet ASAP and discuss them before your staff begins

dispositioning them. There are couple of high-level comments pertaining to the treatment of the ASP program under the re-baselining effort and use of Vogtle as a pilot to test the use of licensee's models vs SPAR.

Rich Correa has a copy of the mark-ups as well. Jennifer has sent a note Brian Sharon about the high-level comments that she has made. Will discuss details when we meet.

Please have Keith schedule a ½ hr among us (you, me, Michelle, your cognizant staff, Jeff). We really should try to meet tomorrow.

Sunil D Weerakkody, Chief
PRA Operations & Human Factors Branch
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission

Address: Mail Stop O-10 C-15, US NRC, Washington DC 20005-0001

Tel: 301-415-2870
Black Berry: (b)(6)

From: SUNIL.WEERAKKODY@NRC.GOV [mailto:SUNIL.WEERAKKODY@NRC.GOV]
Sent: Monday, September 28, 2015 7:52 AM
To: Weerakkody, Sunil
Subject: yy

The ASP Program systematically evaluates U.S. nuclear power plant (NPP) operating experience to identify, document, and rank the operating events most likely to lead to inadequate reactor core cooling and severe core damage (i.e., precursors).[1] The ASP Program provides a comprehensive and integrated assessment of plant risk associated with important operating events. The ASP Program provides insights into the NRC's risk-informed and performance-based regulatory programs; monitors performance against performance indicators in the agency's Congressional Budget Justification[2] and Industry Trends Program;[3] and reports to Congress events of high safety significance in accordance with "abnormal occurrence" criteria.[4]

risk-significant?

Under the SPAR Model Program, the staff develops and maintains independent risk-analysis tools and capabilities to support NPP-related risk-informed regulatory activities. The staff uses SPAR models for the Reactor Oversight Process (ROP) Significance Determination Process (SDP); the ASP Program; the Management Directive (MD) 8.3, "NRC Incident Investigation Program," event assessment process; and the MD 6.4, "Generic Issues Program," resolution process. In addition, the staff uses the SPAR models to risk inform inspection activities, to gain risk insights in support of reactor-related rule making, and to support other risk assessment studies, such as system and component reliability studies.

how? the licensee develops their ISI, etc...

DISCUSSION:

This section summarizes the status, accomplishments, and results of the ASP Program and SPAR Model Program since the previous status report, SECY-14-0107, "Status of the Accident Sequence Precursor Program and the Standardized Plant Analysis Risk Models," dated October 6, 2014.

ASP Program

Program Scope. The ASP Program is one of three agency programs that assess the risk significance of events. The other two programs are the Significance Determination Process (SDP) and the event-response evaluation process, as defined in MD 8.3. Currently, the ASP Program provides integrated analyses of complex operating events not evaluated by the SDP or finalized by MD 8.3 evaluations. The SDP evaluates the risk significance of a single licensee performance deficiency, while risk assessments performed under MD 8.3 are used to determine, in part, the appropriate level of reactive inspection in response to an event. A SDP assessment has the benefit of information obtained from the inspection, whereas the MD 8.3 assessment is expected to be performed within a day or two after the event notification. In contrast to the other two programs, a comprehensive and integrated risk analysis under the ASP Program includes all anomalies[5] observed at the time of the event or discovered after the event.

for example simple physics - Does and what to evaluate the significance

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1 Enclosure 1 provides background on the process used by the staff to identify precursors.

2 See NUREG-1100, Volume 31, "2016 Congressional Budget Justification," issued January 2015.

3 See SECY-15-0061, "Fiscal Year 2014 Results of the Industry Trends Program for Operating Power Reactors," dated April 8, 2015.

4 See Appendix A of NUREG-0090, Volume 37, "Report to Congress on Abnormal Occurrences—Fiscal Year 2014," issued May 2015.

5 These anomalies or conditions may include unavailable and degraded plant structures, systems, and components (SSCs); human errors; and an initiating event (reactor trip). In addition, an unavailable or degraded SSC does not have to be a performance deficiency or an analyzed condition in the plant's licensed design basis.

but SDP is to do that.

There are similarities in the risk assessments conducted by the three programs. All programs use SPAR models, the same documented methods and guidance, and similar analysis assumptions, except where program objectives deviate from one another. Since 2006, SDP results have been used in lieu of independent ASP analyses, if the SDP analyses considered all concurrent degraded conditions or equipment unavailabilities that existed during the time period of the condition. Typically for initiating events, many of the modeling assumptions made for MD 8.3 analyses can be adopted by ASP analyses. However, some modeling assumptions are revised as detailed information about the event becomes available when inspection activities are completed. These key similarities provide opportunities for significant ASP Program efficiencies. For a potential *significant* precursor (defined below), analysts from the three programs work together to provide a timely determination of plant risk. As such, duplication between programs is minimized to the extent practical within program objectives.

Status and Results. The staff continues to review operational events from licensee event reports (LERs) and NRC inspection reports (IRs) to identify potential precursors to a reactor core damage event. Operational events that exceed the ASP thresholds, mentioned in the Background section of Enclosure 1, are considered precursors in the ASP Program. *Significant* precursors have a conditional core damage probability (CCDP)[6] or a change in core damage probability (ΔCDP)[7] greater than or equal to 1×10^{-3}. The staff has identified 16 precursor events for fiscal year (FY) 2014. The staff did not identify any *significant* precursors for FY 2014 and has not identified any potentially *significant* precursors for FY 2015 to date, although the reporting of FY 2015 events in LERs and NRC IRs are still in progress.

In addition to the identification of precursor events, the staff performs trend analyses on precursors for additional insights. Trend analyses are performed on the following precursor groups:

- all precursors
- precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4}
- precursors involving an initiating event
- precursors involving degraded conditions
- precursors involving a complete loss of offsite power (LOOP)
- precursors that occurred at boiling-water reactors (BWRs)
- precursors that occurred at pressurized-water reactors (PWRs)

For the period of FY 2005 through FY 2014, the staff found a statistically significant increasing trend in the mean occurrence rate of precursors resulting from a LOOP initiating event. This increasing trend resulted from the occurrence of 20 LOOP precursor events in the last 4 years after 7 precursor occurrences in the previous 6 years.

In FY 2012 and FY 2013, statistically significant increasing trends were identified in mean occurrence rate of precursors with a CCDP or ΔCDP greater than or equal to 1×10^{-4}. However, with no additional precursor observed in this group in FY 2013 and FY 2014, the trend is no longer statistically significant. As reported in last year's status report (SECY-14-0107), six of the

[6] The term CCDP is the probability of the occurrence of core damage given that an initiating event has occurred.

[7] The term ΔCDP is the increase in probability of core damage (from the baseline core damage probability) due to a failure of plant equipment or an identified deficiency during the time the failure or deficiency existed.

As part of the rebaselining work being conducted under the AIM 2020 initiative, the staff plans to evaluate the different programs and determine how →

but to ~~streamline~~ further reduce the duplication of effort and potentially modify the criteria used in the CBJ as a means of improving efficiency.

propose to the Commission

what is the result of the review? any change in the

seven precursors in this group were caused by multiple electrical failures during a 3-year period. Based, in part, on the observed increases in electrical- and LOOP-related precursors over the past few years, the staff initiated a detailed study in FY 2014 to better understand the contribution of electrical system and component failures on risk at NPPs.

The staff found no statistically significant trends for any of the other precursor groups during the FY 2005 through FY 2014 period. Enclosure 1, "Results, Trends, and Insights of the Accident Sequence Precursor Program," provides additional details on results and trends of the ASP Program.

SPAR Model Program

The SPAR models provide agency risk analysts with an independent risk assessment tool to support a variety of risk-informed agency programs, including the ROP and the ASP program. SPAR models are built with a standard modeling approach, using consistent modeling conventions, that enables staff to easily use the models across a variety of U.S. NPP designs. Unlike industry PRA models, SPAR models are run on a single software platform, the Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE) computer code. The staff currently maintains and updates the 75 SPAR models representing 99 commercial NPPs.[8] The scope of every SPAR model includes logic modeling covering internal initiating events at power through core damage (i.e., Level-1 PRA model). In FY 2015, the staff modified all SPAR models to take advantage of new SAPHIRE features and to make the models more understandable to users. In addition to these global changes, approximately 30 models were updated to support specific SDP or ASP activities. The staff also performs more comprehensive updates to selected SPAR models to reflect recent plant modifications and incorporate significant modeling updates. In FY 2015, the staff performed significant updates to six SPAR models to reflect changes such as the addition of logic for new station blackout generators, battery charging generators, and expansion of electrical power distribution modeling. During FY 2015, the staff continued to perform a comprehensive data update to all 75 SPAR models to reflect recent operating experience and implement other enhancements to improve the usability and functionality of the models.

In addition, the staff continued to expand SPAR model capability beyond internal events at full-power operation. For example, 22 of the SPAR models, representing 28 nuclear power reactors, include other hazard groups and are referred to as SPAR All-Hazard (SPAR-AHZ) models.[9] Currently, 18 of the SPAR-AHZ models include hazards such as fires, internal floods, and seismic events based on assessments conducted for Supplement 5, "Individual Plant Examination of External Events for Severe Accident Vulnerabilities," to Generic Letter 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities—10 CFR 50.54(f)" (dated September 8, 1995), and other readily available information. The staff has also completed incorporation of internal fire scenarios from the fire PRAs done in compliance with National Fire Protection Association (NFPA) 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants," for the Shearon Harris Nuclear Power Plant, the Donald C. Cook Nuclear Power Plant, and the Virgil C. Summer

[8] The SPAR models associated with NPPs that have permanently shut down (Kewaunee, San Onofre, Crystal River and Vermont Yankee) are no longer being updated, but remain available for agency use.

[9] These models were formerly named SPAR external event (SPAR-EE) models, but have been renamed SPAR-AHZ to reflect recent improvements in external hazard modeling efforts and for consistency with the ASME PRA Standard model scope.

They have not yet been updated to include the seismic

information being developed
under Fukushima
Near Term Task Force Recommendation
7.1.

analysis; LOOP modeling; and SPAR model maintenance and quality assurance. The workshop participants included representatives from NPPs, industry contractors, international partners, and public interest groups. In addition, NRC staff from NRR, NRO, and the Regions attended. A meeting summary of the workshop can be found in Agencywide Documents Access and Management System (ADAMS) at Accession No. ML15198A191.

The staff continues to maintain and improve the SAPHIRE software to support the SPAR Model Program. SAPHIRE is a personal-computer-based software application used to develop PRA models and perform analyses with SPAR models. During FY 2015, significant SAPHIRE activities included the following:

- Oversight of the SAPHIRE software quality-assurance program, including performance of an annual audit of software quality-assurance activities, tools, and documents in accordance with NUREG/BR-0167, "Software Quality Assurance Program and Guidelines."

- Implementation of new SAPHIRE features, including the capability to easily sort model results by their contribution to different accident sequences and improvements to the reporting functions for external hazard model results.

- Evaluation of ~~Research of~~ code infrastructure improvements necessary to support a multi-user server-based platform for SAPHIRE.

Enclosure 2, "Status of the Standardized Plant Analysis Risk Models," provides a detailed status of SPAR models and related activities.

Planned ASP and SPAR Model Activities

- The staff will continue the screening, review, and analysis (preliminary and final) of potential precursors for FY 2015 and FY 2016 events.

- The staff will continue the detailed study of electrical system and component failure contribution to the risk at operating NPPs.

- The staff will continue to implement enhancements to the internal event SPAR models for full-power operations. Planned enhancements include model updates based on insights from ongoing thermal-hydraulic analyses and a comprehensive update of all SPAR models to reflect recent operating experience.

- The staff will continue quality-assurance activities for both the agency SPAR models and the SAPHIRE code. This will ensure that agency risk tools continue to be of sufficient quality for performing SDP, ASP, and MD 8.3 event assessments in support of the staff's risk-informed regulatory activities.

- The staff will continue to evaluate the need for additional SPAR model capability (beyond full-power internal events) based on experience gained from risk assessment activities and feedback from users. In addition, the staff intends to continue to develop new external hazard capabilities with new SPAR-AHZ models.

also as part of the rebaselining work they conducted under the AIM 2020 initiative, the staff is planning to perform a pilot in which the staff will use »

the ~~licensee~~ PRA model for the operating Vogtle units in lieu of using the Vogtle SPAR models.

This pilot will allow the staff to determine if reliance on licensees' models could obviate the need to develop and maintain the SPAR models. This has been considered in the past, as discussed in a memorandum from ... to the EDO ... (Swirl knows the document name). Because of the efficiencies and cost savings that could be realized by relying on licensees' PRA models, as well as improvements in licensees' models, and the willingness of industry to support the NRC's use of them (as documented in the NEI letter ...), the staff believes the pilot is worthwhile at this point. The pilot will also evaluate any legal issues inherent in this approach and ~~will determine if impacted~~ any restrictions licensees will place on NRC's use. The staff ~~will~~ uses the SPAR models in a number of ways and therefore it would be necessary that the staff be able to use

ie. licensees' models in the same way as SPAR models

assessments performed under MD 8.3 are used to determine, in part, the appropriate level of reactive inspection in response to an event. A SDP assessment has the benefit of information obtained from the inspection, whereas the MD 8.3 assessment is expected to be performed within a day or two after the event notification.

In contrast to the other two programs, a comprehensive and integrated risk analysis under the ASP Program includes all anomalies observed at the time of the event or discovered after the event. These anomalies may include unavailable and degraded plant structures, systems, and components (SSCs); human errors; and an initiating event (reactor trip). In addition, an unavailable or degraded SSC does not have to be a performance deficiency (e.g., SSCs out for test and maintenance) or an analyzed condition in the plant design basis. The ASP Program has time to complete an analysis of a complex issue and thus produces a more refined estimate of risk. Analyses schedules provide time so that NRC or licensee engineering evaluations can be made available for review. State-of-the-art methods can be developed or current techniques can be refined for unique conditions when necessary. In addition, the SPAR model can be modified for special considerations (e.g., seismic, internal fires, flooding).

There are similarities in the risk assessments conducted by the three programs. All programs use SPAR models, the same documented methods and guidance, and similar analysis assumptions, except where program objectives deviate from one another. ASP and SDP analyses assumptions are typically the same for single performance deficiencies. Since 2006, SDP results have been used in lieu of independent ASP analyses, if the SDP analyses considered all concurrent degraded conditions or equipment unavailabilities that existed during the time period of the condition. Typically for initiating events, many of the modeling assumptions made for MD 8.3 analyses can be adopted by ASP analyses. However, some modeling assumptions are revised as detailed information about the event becomes available when inspection activities are completed. In addition, there are program differences on how certain modeling aspects are incorporated (e.g., SSCs out for testing or maintenance). These key similarities provide opportunities for significant ASP Program efficiencies. For a potential *significant* precursor, analysts from the three programs work together to provide a timely determination of plant risk. As such, duplication between programs is minimized to the extent practical within program objectives.

Currently, the ASP Program provides integrated analyses of complex operating events not evaluated by the SDP or finalized by MD 8.3 evaluations. Two notable examples include the degraded reactor vessel head with multiple degraded conditions at Davis-Besse in FY 2003 (LERs 346/02-002, 346/02-005, and 346/03-002) and the complicated LOOP event at Byron Unit 2 in FY 2012 (LER 454/12-001).

The Davis-Besse precursor event involved (1) a potential loss-of-coolant accident (LOCA) due to reactor pressure vessel head erosion from the leakage of a circumferential cracked control rod drive mechanism nozzle, (2) the potential unavailability of sump recirculation due to screen plugging following a postulated LOCA from unqualified containment coatings and other debris (e.g., insulation) inside containment, and (3) the potential unavailability of high-pressure safety injection pumps during the recirculation phase of a postulated LOCA due to potential debris generated by certain postulated LOCAs and entrained in pumped fluid. The SDP cited three licensee performance deficiencies. Analyzed separately, the equivalent ΔCDP for the three deficiencies were 4×10^{-4}, 3×10^{-5}, and 3×10^{-6}, respectively. The ASP Program analysis integrated these deficiencies and aggregated the risk which resulted in a ΔCDP of 6×10^{-3}. As a result of this safety significance, the NRC did . . .

only if no other legitimate way ORS, etc. . .

The Byron Unit 2 precursor event resulted from a LOOP and unprotected under-voltage conditions on safety-related electrical buses for eight minutes. The loss of one of three phases (Phase "C") of 345 kilovolts offsite power to the two unit station auxiliary transformers (SATs) did not result in an automatic under-voltage protection signal, because the under-voltage protection scheme did not provide adequate protection from a single loss of Phases "A" and "C". As a result, all running safety equipment powered by the safety buses had tripped on over-current conditions. These conditions existed until operators manually opened (from the main control room) the SAT feeder breakers about eight minutes after the event had initiated. Following the opening of the SAT feeder breakers, both emergency diesel generators started and loaded supplying power to the safety buses, as designed. The MD 8.3 risk assessment of the event that was performed on the day of the event occurrence resulted in a CCDP of 7×10^{-6}. The assessment did not include the aspects of the under-voltage condition of the safety buses that was identified as the result of a special inspection. The inspection identified no performance deficiencies; therefore, no SDP assessment was required. The ASP analysis of this complicated LOOP event resulted in an aggregated plant risk of CCDP of 1×10^{-4}. This realization caused NRC to do . . .

3.0 ASP Program Status

The following subsections summarize the status and results of the ASP Program (as of September 30, 2015).

FY 2014 Analyses. The staff completed its screening and review of 501 LERs and their associated inspection findings for FY 2014. On the basis of that review, 36 events were selected and analyzed for potential precursors. Of these, the ASP analyses have identified 6 precursors (initiating events) and the SDP identified 10 precursors (degraded conditions). For 10 of the 16 precursors, the performance deficiency identified under the Reactor Oversight Process documented the risk-significant aspects of the event completely. In these cases, the SDP significance category (i.e., the "color" of the finding) is reported in the ASP Program. For the remaining events, an independent ASP analysis was performed to determine the risk significance of three LOOP initiating events, two electrical transformer failures, and a 13 kilovolts bus failure.

Table 1 presents the results of the staff's ASP analyses for FY 2014 precursors that involved initiating events. Table 2 presents the analysis results for FY 2014 precursors that involved degraded conditions.

FY 2015 Analyses. The staff performs an initial review of all events to determine if they have the potential to be *significant* precursors. Specifically, the staff reviews LERs (reported by licensees in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 50.73, "Licensee Event Report System") and daily event-notification reports (reported by licensees in accordance with 10 CFR 50.72, "Immediate Notification Requirements for Operating Nuclear Power Reactors") to identify potential *significant* precursors. The staff has completed the initial review of FY 2015 events and identified no potentially *significant* precursors (as of September 30, 2015). The staff will inform the Commission if a *significant* precursor is identified during the more detailed evaluations of events.

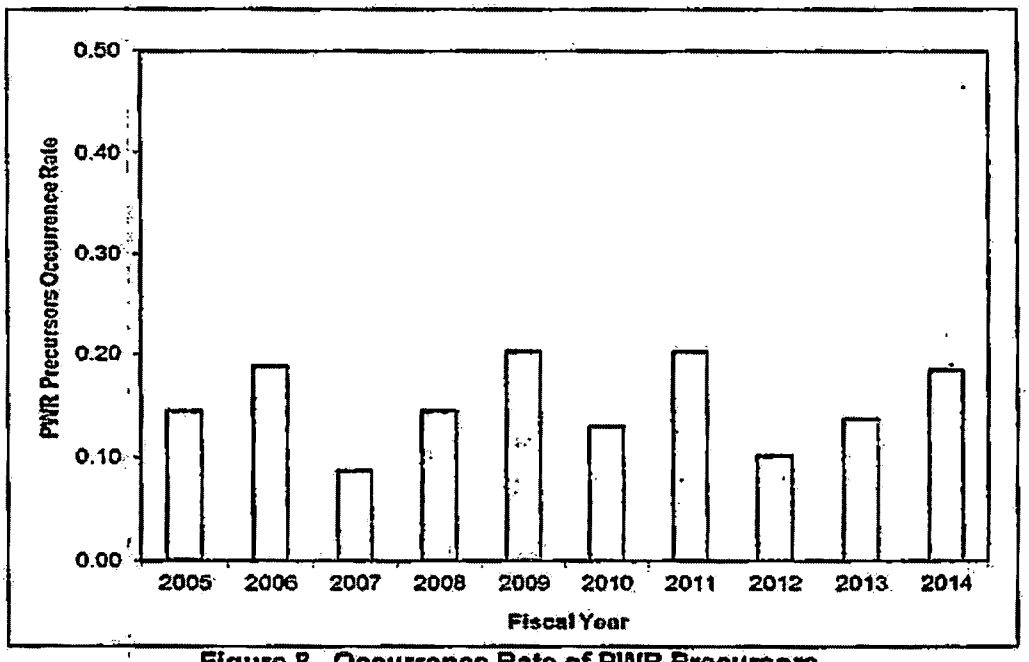

Figure 8. Occurrence Rate of PWR Precursors.

- Of the 10 precursors involving failures of the auxiliary feedwater system, random hardware failures (7 precursors or 70 percent) and design errors (2 precursors or 20 percent) were the largest failure contributors. Nine of the 10 precursors (90 percent) involved the unavailability of the turbine-driven auxiliary feedwater pump train.
- Of the 17 precursors involving failures in the emergency power system, 14 precursors (82 percent) were from hardware failures.
- Design errors contributed 2 precursors involving the unavailability of safety-related equipment that occurred at PWRs.

4.7 Operating Experience Insights Feedback for PRA Standards and Guidance

One objective of the ASP Program is to provide insights into the current state of practice in risk assessment. ASP event analyses, both precursors and events that did not exceed the ASP Program threshold, from FY 2014 were reviewed against the approaches to PRA described in the American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008 Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications" (Ref. 11), as endorsed in Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities" (Ref. 12). This review sought to identify aspects of the event analyses for which the risk-significant ASME/ANS PRA Standard did not provide guidance.

Results. None of the FY 2014 event analyses indicated an inadequacy in the state of PRA practice as described in ASME/ANS RA-Sa-2009. The staff continues to work with ASME/ANS on refining the standard to ensure that it provides sufficient guidance to assess the risk significance of external events, including external flooding.

Approximately 30 SPAR models were also updated to support specific SDP or ASP activities. These more limited SPAR model updates are performed when requested by agency risk analysts. These updates are normally required to better model specific features of an operational event that are not normally captured in a base PRA or to reflect an enhanced understanding of the as-built, as-operated plant as a result of event followup activities.

During FY 2015, the staff continued to perform a comprehensive data update to all 75 SPAR models to reflect recent operating experience and implement other enhancements to improve the usability and functionality of the models. In addition to updating SPAR model parameters, this comprehensive update will also update model documentation; provide an integrated (i.e., internal events, external hazards, Level-2, and LPSD models) report; and resolve structural modeling issues. Other data updates include modification of common cause events to more closely follow the guidance in the RASP Handbook. A plant-specific model convergence analysis (to assess the appropriate truncation level to run the model) and documentation of the results is also included in this task.

SPAR Models for the Analysis of All Hazards (External Events). Development of SPAR All-Hazard (SPAR-AHZ) models—which contain accident scenarios from all hazard categories (including seismic, high wind, and internal fire) applicable to a given site—has continued during FY 2015, although at a lower intensity than the previous year because of budgetary constraints and balancing limited staff resources to work on other projects, such as the Commission-directed site Level-3 PRA project for the Vogtle site. Currently, 22 of the 75 SPAR models, representing 28 NPPs, include internal fire and external hazard groups. Eighteen of the SPAR-AHZ models are based on assessments conducted for Supplement 5, "Individual Plant Examination of External Events for Severe Accident Vulnerabilities," to Generic Letter 88 20, "Individual Plant Examination for Severe Accident Vulnerabilities 10 CFR 50.54(f)," and other readily available information. In FY 2015, one new SPAR-AHZ model, which includes internal fire models extracted from the National Fire Protection Association (NFPA) Standard 805-compliant fire model for the Vogtle plant, has been constructed and placed in the SPAR model library for use by NRC risk analysts. SPAR-AHZ models for the Shearon Harris, D.C. Cook, and V.C. Summer NPPs had been previously completed. Because the licensee-developed NFPA 805-compliant fire PRA models contain thousands of quantified fire sequences, a significant focus of the SPAR-AHZ effort was combining similar sequences to enhance model usability while maintaining the ability to retain the resolution contained in the licensee models.

Recently, a new SPAR-AHZ model for the Point Beach site has been developed, and the SPAR-AHZ model for the Sequoyah site has undergone a major upgrade. The staff is currently working on a major update to the Peach Bottom SPAR-AHZ model. Development of the Peach Bottom SPAR-AHZ model includes licensee site visits to gather information and discuss modeling assumptions and results. Currently, the Office of Nuclear Regulatory Research (RES) and the Office of Nuclear Reactor Regulation (NRR) are working together to identify ways to increase the pace of SPAR-AHZ model development, given expected resource constraints in FY 2016 and beyond.

New Reactor SPAR Models. Before new plant operation, the staff may perform risk assessments to inform potential risk-informed applications for combined licenses, focus construction inspection scope, or assess the significance of construction inspection findings. Once the plants begin operation, independent assessments using SPAR models will be used by

improve the efficiency and therefore increase pace of

the staff for the evaluation of operational findings and events similar to the assessments performed for current operating reactors.

There are currently five new reactor internal hazard SPAR models. These include one model for the AP1000, two Advanced Boiling-Water Reactor (ABWR) models (one for the Toshiba design and one for the General Electric-Hitachi design), one model for the U.S. Advanced Pressurized-Water Reactor (US-APWR), and one model for the U.S Evolutionary Power Reactor (U.S. EPR). In addition to these internal events models, there is a seismic model for the AP1000 and a LPSD model for the Toshiba ABWR. Since FY 2013, the staff has been extending the capabilities for the AP1000 reactor design SPAR model. The AP1000 SPAR-AHZ model includes an internal flooding model (completed in FY 2013) and an internal fire model (completed in FY 2014). The staff is in the process of completing a LPSD model and developing a new severe accident model (Level-2 PRA model) for the AP1000 reactor design.

The staff plans to continue developing new reactor SPAR models, including AHZ and LPSD models, as needed, to support licensing and oversight activities.

MELCOR Thermal Hydraulic Analysis for SPAR Model Success Criteria. The staff continues to perform MELCOR analyses to investigate success criteria associated with specific Level-1 PRA sequences. In some cases, these analyses confirm the existing technical basis, and in other cases they support modifications that can be made to increase the realism of the agency's SPAR models. The latest round of activity is documented in two reports: (1) soon to be published NUREG-2187, "Confirmatory Thermal-Hydraulic Analysis to Support Specific Success Criteria in the Standardized Plant Analysis Risk Models—Byron," and (2) NUREG/CR-7177, "Compendium of Analyses To Investigate Select Level-1 Probabilistic Risk Assessment End-State Definition and Success Criteria Modeling Issues," published in May 2014 (ADAMS Accession No. ML14148A126). The results of these studies will be used to confirm specific success criteria for a suite of four-loop Westinghouse plants, which are similar to Byron, with appropriate consideration of the design and operational differences of these plants. They also will be used to support application-specific consultation on the use of the SPAR models.

This effort directly supports the agency's goal of using state-of-the-art tools that promote effectiveness and realism. The NRC is communicating the project plans and results to internal and external stakeholders through mechanisms such as the Regulatory Information Conference and the industry's Modular Accident Analysis Program Users' Group.

3.0 Additional Activities

SAPHIRE Maintenance and Improvements. In FY 2015, new features and capabilities have been implemented in SAPHIRE to better support NRC regulatory activities. The new features include:

- SAPHIRE offers multiple methods for solving PRA models. Models can be assessed by solving individual accident sequences or by grouping sequences by common end states. A new capability in SAPHIRE allows users to trace the contribution of individual accident sequences regardless of the solving method that is used.
- Improvements to the reporting capabilities for external hazard model results.

- Improved tools for modelers to update and maintain the SPAR models.

All of these improvements to SAPHIRE have been performed in accordance with the SAPHIRE software QA program. A set of software QA documents has been developed for SAPHIRE. These documents cover topics such as the software development plan, configuration management, requirements tracking, and testing and acceptance. The NRC project manager performs an annual audit of the SAPHIRE software QA program. The most recent audit was completed on January 15, 2015, and no significant issues were identified. The NRC project manager confirmed that the maintenance and implementation of the SAPHIRE software QA program is consistent with the guidance contained in NUREG/BR-0167, "Software Quality Assurance Program and Guidelines," dated February 1993 (ADAMS Accession No. ML15043A791).

The SAPHIRE developers continue to explore advanced features and enhancements that may be implemented in future SAPHIRE revisions. The SAPHIRE team has developed a demonstration version of a Web-based SAPHIRE application. A Web-based SAPHIRE application is envisioned to have several advantages that are not available with a desktop application, such as improved configuration management of models and analyses, enhanced collaboration capabilities, and remote access to high-performance computing resources. After successfully demonstrating a prototype version of the application, the SAPHIRE team is developing an implementation plan to describe how a fully functional Web-based version could be completed and made available to users as a replacement to the current version of SAPHIRE. The implementation is expected to occur in a phased approach over the next several years. The work on the Web-based version has also helped the SAPHIRE team to explore new ways to use parallel computing resources. These methods may even be able to benefit near-term updates to the current version of SAPHIRE. In addition to this work, the SAPHIRE team continues to remain cognizant of academic and international research activities on advanced PRA quantification techniques.

Cooperative Research for PRA. The staff has executed an addendum to the memorandum of understanding with the Electric Power Research Institute (EPRI) to conduct cooperative nuclear safety research for PRA. Several of the initiatives included in the addendum are intended to help resolve technical issues that account for the key differences between NRC SPAR models and licensee PRA models.

During FY 2015, significant efforts have been made in implementing PRA methods for support system initiating event (SSIE) analysis and treatment of LOOP in PRAs. The SSIE PRA modeling approach was developed in collaboration with EPRI and is documented in EPRI Report 1016741, "Support System Initiating Events," published December 19, 2008. These methods are being implemented in the SPAR models as one of the activities associated with addressing the peer review comments. To date, all SPAR models have been enhanced with the improved SSIE modeling methodology. Various LOOP methodology enhancements have been added to all models, with the remaining enhancements expected to be completed in conjunction with routine SPAR model updates. The staff plans to continue these cooperative efforts with EPRI and other stakeholders to address the remaining issues over the next several years.

Nakoski, John

From: Nakoski, John
Sent: Friday, September 25, 2015 5:31 PM
To: Correia, Richard (Richard.Correia@nrc.gov); Coyne, Kevin
Cc: Tetter, Keith
Subject: ASP/SPAR SECY and NRR's comments

Rich and Kevin,

I spoke with Bill Dean, Jennifer Uhle, and Samson Lee. I have a copy of Jennifer's comments. Bill Dean told me he will be looking at the paper over the weekend (he has Jennifer's comments too).

I have looked at Jennifer's comments. Some I am ok with. Some are not appropriate for a status paper. The two major pushbacks I have are:

1. NRR should not use this RES ASP/SPAR Program status update SECY to inform the Commission of NRR's plan to pilot the use of licensee PRA models and their results for the Significance Determination Process. I believe this would make the paper a Notation Vote, since this is a policy issue for the Commission to weigh in on before the staff expends resources on it. Further, the pilot activity is not something that I support as I believe it is fundamentally counter to the NRC's principles of good regulation. It is not consistent with "Independent" – as it relies exclusively on the licensee's PRA models, methods, and results to provide risk insights into NRC Reactor Oversight Program and its Enforcement Program. It is not an "Efficient" use of NRC resources as I think it would take considerably more resources to restore some measure of independence by developing the internal or contracted support to understand the licensee PRA models and methods. Further, if the NRC wanted to do its own analysis of performance deficiencies the licensee's software and models would need to be loaded into NRC Government-owned computers that would create additional burden and cost to assure it is maintain compliant with Federal information technology requirements. I am not sure that it would have "Reliability" as well since the methods and models would be outside of our control. Further, it would give the appearance that the processes are not "Open" to the public since the licensees are not directly accountable to the public whereas the NRC is. We could add a sentence noting that NRR is considering options to improving the effectiveness of the SDP that may warrant conforming changes in how the SPAR models are used. But I would stop there.

2. There is a push in the comments to introduce the notation that the NRC will be looking at improving the efficiency and effectiveness under Project AIM 2020 into this status paper. I do not think it is appropriate to do so unless there is a policy decision that every Commission Paper going forward includes the same caveat – that the programs, processes, and procedures described in this paper are being evaluated within the context of Project AIM 2020 to improve the efficient and effective implementation of NRC's statutory safety mandate. Doing otherwise would tell the Commission that the ASP Program and the SPAR Models have already been put on the chopping block to delete – something that RES does not support – and that I think would be bad public policy in that it would create the appearance or actually cause a decline in the NRC's focus on those activities that contribute the most to risk. We can add a sentence or two in the paper to not that RES and NRR continue to look at ways to enhance the efficiency and effectiveness of the ASP Program and the SDP – but I would not tie it to Project Aim.

I think the rest of Jennifer's comments can be addressed with minor changes to the text, or by educating her on how some of our regulatory processes work. Or we could just adopt the NRR approach of just telling them, we took your editorial comments and disregarded the rest. ☺ (No, really, I don't think we should do that).

I look forward to getting Bill's comments early next week. Have a great weekend.

Best regards,

John A. Nakoski
Chief, Performance and Reliability Branch

Division of Risk Analysis
Office of Research
301-415-2480 (w)
(b)(6) (c)

Nakoski, John

From: Correia, Richard
Sent: Friday, September 25, 2015 1:00 PM
To: Nakoski, John
Cc: Sheron, Brian; West, Steven
Subject: FW: ASP/SPAR paper

John,

See Sam Lee on Jennifer's comments on the ASP paper

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Uhle, Jennifer
Sent: Friday, September 25, 2015 12:40 PM
To: Correia, Richard <Richard.Correia@nrc.gov>
Subject: RE: ASP/SPAR paper

Rich, I discussed my comments with Sam Lee and he can meet with your staff on my behalf today.

From: Correia, Richard
Sent: Friday, September 25, 2015 9:01 AM
To: Uhle, Jennifer <Jennifer.Uhle@nrc.gov>
Subject: RE: ASP/SPAR paper

Great and thanks Jennifer. I'll send someone over to get them.

Best

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Uhle, Jennifer
Sent: Friday, September 25, 2015 8:47 AM
To: Correia, Richard <Richard.Correia@nrc.gov>
Subject: Re: ASP/SPAR paper

Hi Rich. YeS you will get them today.

From: Correia, Richard
Sent: Friday, September 25, 2015 08:31 AM
To: Uhle, Jennifer
Subject: ASP/SPAR paper

Hi Jennifer..long time no see.

Would you be willing to share your comments with us on the ASP/SPAR SECY today so we can start revising? The paper is due soon and we want to give Brian & Steve enough time for their review.

Best

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Uhle, Jennifer
Sent: Thursday, September 24, 2015 5:38 PM
To: Sheron, Brian <Brian.Sheron@nrc.gov>; Weerakkody, Sunil <Sunil.Weerakkody@nrc.gov>; Giitter, Joseph <Joseph.Giitter@nrc.gov>; Lee, Samson <Samson.Lee@nrc.gov>; Rosenberg, Stacey <Stacey.Rosenberg@nrc.gov>
Subject: SPAR paper

Brian, I have comments on the paper, nothing really difficult. I would like to add wording about under rebaselining doing a pilot with Vogtle PRA and also looking at ASP, SDP, MD 8.3 and figuring out the most streamlined efficient way to get what we need out of the analyses in the most efficient manner.

I have other comments, odds and ends. I plan to meet with NRR/DRA staff tomorrow and explain the comments to them and then I would expect they would talk to RES/DRA staff.

Thanks,

Jennifer

Stutzke, Martin

From: Correia, Richard
Sent: Friday, September 25, 2015 12:45 PM
To: Appignani, Peter; Siu, Nathan; Stutzke, Martin; Coyne, Kevin; Nakoski, John
Subject: RE: SPAR vs Licensee models outline, latest version

Thanks Pete

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Appignani, Peter
Sent: Friday, September 25, 2015 11:23 AM
To: Correia, Richard <Richard.Correia@nrc.gov>; Siu, Nathan <Nathan.Siu@nrc.gov>; Stutzke, Martin <Martin.Stutzke@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>
Subject: RE: SPAR vs Licensee models outline, latest version

Rich

As we discussed yesterday, I incorporated Nathan's comments, attached.

Pete

From: Correia, Richard
Sent: Thursday, September 24, 2015 12:46 PM
To: Siu, Nathan <Nathan.Siu@nrc.gov>; Stutzke, Martin <Martin.Stutzke@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>
Cc: Appignani, Peter <Peter.Appignani@nrc.gov>
Subject: RE: SPAR vs Licensee models outline, latest version

Thanks Nathan. Great insights and recommendations. We're a "bit" defensive given we are under attack to do away with SPAR (and thus SAPHIRE).

I'll ask Pete to revise the write up as appropriate considering Nathan's comments. We need to get something to Brian fairly short term for his 30 Sept meeting with Bill Dean and allow Brian time to read, question and absorb the info. Kevin has been sending pieces and responding to questions but it's better to have it all in one document.

Thx

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Siu, Nathan
Sent: Wednesday, September 23, 2015 4:20 PM
To: Correia, Richard <Richard.Correia@nrc.gov>; Stutzke, Martin <Martin.Stutzke@nrc.gov>
Cc: Appignani, Peter <Peter.Appignani@nrc.gov>
Subject: RE: SPAR vs Licensee models outline, latest version

Rich,

Looks good. (I was a little confused at first by the first section, but eventually realized it was a summary.)

One tone thing – it appears to be an advocacy paper. Would it play better with the principal audience if it were an options paper (with pros and cons)? Of course there's a possibility of facts being cherry picked to support a pre-determined position.

A few other comments:

- I'd have to see the writeup for Section 3.3. It isn't clear to me why eliminating the SPAR models would violate the spirit of the PRA Policy Statement. We could use licensee models (although there are lots of good reasons why this wouldn't be as good).
- The discussion in Section 4 may have to be nuanced (i.e., talk in terms of a reduced degree of independence, rather than complete loss). For example, if NRC staff/contractors are independently manipulating a licensee's model, OGC might decide this is sufficiently independent. I don't know of specific analogous (non-PRA) situations within the agency, but I imagine there might be some.
- It may be OK because the paper will have a number of different audiences, but Section 5.2 might be getting a little too detailed. I think the emphasis should be on why standardization is a good thing (vs. what things are standardized). I recognize some of this is covered in Section 6. If technical information is important, it can be retained but perhaps would be better suited for an appendix.
- Section 6.1.2. See above point about pros and cons. I've heard there are some good features in the other tools that we might not have.
- I suspect one of the implications for Section 6.3.1.1 is that we'll need more trained staff because it may be too hard for a small number of folks to remember all the plant-specific modeling nuances. I guess this will be covered under Section 8.2.5.
- Section 7. Would loss of SPAR (and therefore SAPHIRE? – not sure there would be sufficient justification absent SPAR) inhibit our ability to develop tailored models when new situations arise? (I recall the Grand Gulf LPSD analysis required changes in SAPHIRE to accommodate the model.)
- Section 7.7. I presume the Vogtle SPAR model was useful to the Level 3 project. I think the SPAR models also provided important input to SOARCA.
- Section 8.2. There would likely be startup costs every time we want to do a new analysis of the sort discussed in Section 7.7. We'd have to pick the plant(s), the project staff would have to get trained up on the model(s), etc.

One last thing. For an audience of decision makers, it may be useful to create an overall paper structure (or at least add a discussion) that directly addresses the principles of good regulation: independence, openness, efficiency, clarity, and reliability. I think that in the SPAR vs. licensee model discussion, something useful can be said about each of these principles. Interestingly, the list of principles doesn't include effectiveness. Perhaps that's a higher principle?

Nathan

From: Correia, Richard
Sent: Wednesday, September 23, 2015 2:57 PM
To: Siu, Nathan <Nathan.Siu@nrc.gov>; Stutzke, Martin <Martin.Stutzke@nrc.gov>
Cc: Appignani, Peter <Peter.Appignani@nrc.gov>
Subject: FW: SPAR vs Licensee models outline, latest version

Nathan, Marty,

FYI...any comments?

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Appignani, Peter
Sent: Tuesday, September 15, 2015 4:19 PM
To: Correia, Richard <Richard.Correia@nrc.gov>; Rivera, Tammie <Tammie.Rivera@nrc.gov>
Subject: SPAR vs Licensee models outline, latest version

Rich, Tammie

The latest version of the outline

Pete

Principles of Good Regulation

Independence:	Nothing but the highest possible standards of ethical performance and professionalism should influence regulation. However, independence does not imply isolation. All available facts and opinions must be sought openly from licensees and other interested members of the public. The many and possibly conflicting public interests involved must be considered. Final decisions must be based on objective, unbiased assessments of all information, and must be documented with reasons explicitly stated.
Openness:	Nuclear regulation is the public's business, and it must be transacted publicly and candidly. The public must be informed about and have the opportunity to participate in the regulatory processes as required by law. Open channels of communication must be maintained with Congress, other government agencies, licensees, and the public, as well as with the international nuclear community.
Efficiency:	The American taxpayer, the rate-paying consumer, and licensees are all entitled to the best possible management and administration of regulatory activities. The highest technical and managerial competence is required, and must be a constant agency goal. NRC must establish means to evaluate and continually upgrade its regulatory capabilities. Regulatory activities should be consistent with the degree of risk reduction they achieve. Where several effective alternatives are available, the option which minimizes the use of resources should be adopted. Regulatory decisions should be made without undue delay.
Clarity:	Regulations should be coherent, logical, and practical. There should be a clear nexus between regulations and agency goals and objectives whether explicitly or implicitly stated. Agency positions should be readily understood and easily applied.
Reliability:	Regulations should be based on the best available knowledge from research and operational experience. Systems interactions, technological uncertainties, and the diversity of licensees and regulatory activities must all be taken into account so that risks are maintained at an acceptably low level. Once established, regulation should be perceived to be reliable and not unjustifiably in a state of transition. Regulatory actions should always be fully consistent with written regulations and should be promptly, fairly, and decisively administered so as to lend stability to the nuclear operational and planning processes.

Considerations for using other than the Standardized Plant Analysis Risk (SPAR) models Outline

1. **Summary of Key Considerations for using licensees' PRA Models**
   - 1.1. Regulatory Processes
   - 1.2. PRA Policy Statement
   - 1.3. Model Quality
   - 1.4. Maintain independence of NRC
   - 1.5. Standardization of modeling and assessment techniques
   - 1.6. Use by the NRC staff of licensees' PRA models
   - 1.7. Effect on other NRC Programs
   - 1.8. Costs

2. **Regulatory Processes**
   - 2.1. Reactor Oversight Process (ROP)
     - 2.1.1. ROP is an NRC process
   - 2.2. Significance Determination Process (SDP)
     - 2.2.1. Today's SDP outcomes using NRC versus licensee PRA
       - 2.2.1.1. The PRA models are often in close agreement.
       - 2.2.1.2. Differences in SDP outcomes between the NRC and the licensee are driven by factors other than the baseline PRA model
         - 2.2.1.2.1. Engineering assumptions
         - 2.2.1.2.2. Modeling assumptions
         - 2.2.1.2.3. Human reliability assumptions
         - 2.2.1.2.4. Other ...
       - 2.2.1.3. These issues are also applicable to the other regulatory processes and other risk-informed licensing related activities
   - 2.3. MD 8.3 - NRC Incident Investigation Program
   - 2.4. Notice of Enforcement Discretion (NOEDs)
   - 2.5. Technical basis for rulemaking
   - 2.6. Generic issues
   - 2.7. Other risk-informed licensing related activities

3. **PRA Policy Statement**
   - 3.1. The PRA Policy Statement encouraged the NRC to increase the use and application of PRA to the greatest extent practical.
   - 3.2. SPAR models are one of the key incarnations of that effort.

Considerations for using other than the Standardized Plant Analysis Risk (SPAR) models Outline

3.3. Eliminating SPAR models would violate the spirit of that policy because it could undermine confidence in PRA-based findings.

4. **Model Quality**

4.1. SPAR models have been peer reviewed by industry led peer review teams[1]

4.1.1. SPAR models were determined to be adequate for their intended application

4.1.2. Confidence on the part of staff and industry that the current generation of SPAR models accurately portray the plants that they model.

5. **Maintain Independence of NRC**

5.1. ROP provides for an independent regulatory assessment of licensee performance

5.1.1. Staff may lose ability to verify - "trust but verify"

5.1.2. Licensee's initially indicate an event as low safety significance in LERs that are later established as a greater than Green finding

5.2. Conflict of interest issues

5.2.1. Since the ROP is an NRC process, how will the appropriate level of independence be established if the licensee's PRA is used?

5.2.1.1. Does the independent manipulation of the licensee's model by NRC staff/contractors establish an appropriate level of independence?

5.2.2. OGC may need to endorse use of licensee PRA

5.2.3. OGC may need to endorse allowing the licensee to perform the assessment

5.3. Public confidence

5.3.1. Use of licensee PRA and/or allowing the licensee to perform the assessment could erode public confidence

5.3.2. In effect, the licensee is communicating events and degraded plant conditions to the public and other stakeholders if they perform the analysis.

6. **Standardization of modeling and assessment techniques**

6.1. Standardization provides for:

6.1.1. Efficiency

6.1.2. Consistency

6.1.3. Automation

6.2. Efficiency of standardization

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[1] One typical BWR and one typical PWR SPAR model was peer reviewed since they are standardized. Recently completed a multi-year peer review resolution activity to address peer review findings across all SPAR models.

6.2.1. Modeling assumptions

6.2.2. Modeling conventions

6.2.3. Naming schemes (basic events, fault trees, event tress, etc.)

6.2.4. Post processing rule construction

6.2.5. Reporting functions (built into SAPHIRE)

6.2.6. Consistency in event tree/fault tree construction

6.2.7. Single Software platform

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6.3.1. Uniformity of assessments (RASP Handbooks)

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6.3.1.2. Uniform because SPAR models are standardized

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6.4.1.1. SAPHIRE was developed and modified specifically to support the regulatory processes

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6.5. Experience indicates the use of NRC developed standardized models supports the principles of good regulation: independence, openness, efficiency, clarity, and reliability.

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7.1. Additional logistical and resource requirements

7.1.1. Seventy (70) plus licensee PRAs

7.1.1.1. No standardization

7.1.2. Four (4) different commercial software platforms

7.1.2.1. CAFTA (EPRI)

7.1.2.2. WinNUPRA (Scientech)

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7.3.2. Availability of PRA models and supporting documentation

7.3.2.1. Will all of the licensees formally submit their PRA to NRC?

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Coyne, Kevin

From: Coyne, Kevin
Sent: Thursday, September 24, 2015 2:14 PM
To: Coyne, Kevin
Subject: Re: SPAR vs Licensee models outline, latest version

Rich, Nathan-

I'm not sure I agree that - at this stage - this needs to be a neutral pro/con discussion. The fact is that the agency has already expended significant resources on this question, answered it, and yet we keep revisiting it because a mis-informed senior manager thinks it represents a significant cost savings to the agency. I think we are in an advocacy role because - speaking as someone who lived and sent my kids to school within a 10 mile epz - the nrc needs to be an independent regulator and having our own risk tools is a key piece to maintaining this independence. As John Craig once remarked, sometimes people need to be told when they're wrong (and I'm paraphrasing the exact quote...).

I personnally believe conducting a pilot study for use of licensee models is a miss use of our extremely limited resources - and it will be unlikely to sway the opinions on either side. We have yet (as subject matter experts) to engage nrr in a briefing on this topic - which seems like a necessary prerequisite to developing an outline of a document whose purpose has not been fully vetted. In my opinion, the lack of engagement by nrr on this does not meet our organizational values as a regulator and yet we continue to air this as if it is a neutral question to be decided by an arbitration panel. And I would want to hear the views from ogc before we spend much more time on this topic. But if nrr wants a pilot activity, then per our own office instructions we would need a user need because it will clearly exceed the 300 hour threshold (even more so when considering the time we've already sunk into the issue).

As an aside, I'm not sure that the summary will resonate with Brian - the level of detail is quite variable and it is difficult for someone not elbow deep in the issue to figure out what the outline/summary is trying to convey - I get lost in Pete's summary and I have been responsible for the program for 7 years... I think the summary has the potential to generate more confusion than it resolve - So, I've put more effort into developing talking points and shorter summary information for the front office he is more likely to be able to digest quickly.

Kevin

Sent from an NRC Blackberry
Kevin Coyne
(b)(6)

From: Correia, Richard
Sent: Thursday, September 24, 2015 12:46 PM
To: Siu, Nathan; Stutzke, Martin; Coyne, Kevin
Cc: Appignani, Peter
Subject: RE: SPAR vs Licensee models outline, latest version

Thanks Nathan. Great insights and recommendations. We're a "bit" defensive given we are under attack to do away with SPAR (and thus SAPHIRE).

I'll ask Pete to revise the write up as appropriate considering Nathan's comments. We need to get something to Brian fairly short term for his 30 Sept meeting with Bill Dean and allow Brian time to read, question and absorb the info. Kevin has been sending pieces and responding to questions but it's better to have it all in one document.

Thx

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Siu, Nathan
Sent: Wednesday, September 23, 2015 4:20 PM
To: Correia, Richard <Richard.Correia@nrc.gov>; Stutzke, Martin <Martin.Stutzke@nrc.gov>
Cc: Appignani, Peter <Peter.Appignani@nrc.gov>
Subject: RE: SPAR vs Licensee models outline, latest version

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One tone thing – it appears to be an advocacy paper. Would it play better with the principal audience if it were an options paper (with pros and cons)? Of course there's a possibility of facts being cherry picked to support a pre-determined position.

A few other comments:

- I'd have to see the writeup for Section 3.3. It isn't clear to me why eliminating the SPAR models would violate the spirit of the PRA Policy Statement. We could use licensee models (although there are lots of good reasons why this wouldn't be as good).
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- It may be OK because the paper will have a number of different audiences, but Section 5.2 might be getting a little too detailed. I think the emphasis should be on why standardization is a good thing (vs. what things are standardized). I recognize some of this is covered in Section 6. If technical information is important, it can be retained but perhaps would be better suited for an appendix.
- Section 6.1.2. See above point about pros and cons. I've heard there are some good features in the other tools that we might not have.
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One last thing. For an audience of decision makers, it may be useful to create an overall paper structure (or at least add a discussion) that directly addresses the principles of good regulation: independence, openness, efficiency, clarity, and reliability. I think that in the SPAR vs. licensee model discussion, something useful can be said about each of these principles. Interestingly, the list of principles doesn't include effectiveness. Perhaps that's a higher principle?

Nathan

From: Correia, Richard
Sent: Wednesday, September 23, 2015 2:57 PM
To: Siu, Nathan <Nathan.Siu@nrc.gov>; Stutzke, Martin <Martin.Stutzke@nrc.gov>
Cc: Appignani, Peter <Peter.Appignani@nrc.gov>
Subject: FW: SPAR vs Licensee models outline, latest version

Nathan, Marty,

FYI...any comments?

Rich

Richard Correia, PE
Director,
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Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Appignani, Peter
Sent: Tuesday, September 15, 2015 4:19 PM
To: Correia, Richard <Richard.Correia@nrc.gov>; Rivera, Tammie <Tammie.Rivera@nrc.gov>
Subject: SPAR vs Licensee models outline, latest version

Rich, Tammie

The latest version of the outline

Pete

Dennis, Suzanne

From:	Appignani, Peter
Sent:	Thursday, September 24, 2015 11:41 AM
To:	Alferink, Steven; Ferrante, Fernando; Gonzalez, Michelle; Helton, Donald; Hudson, Daniel; Kuritzky, Alan; Leschek, Walter; Li, Ming; Ning, Lauren (Killian); Sancaktar, Selim; Wessels, Steven; Wood, Jeffery; Ireland, JoAnn
Subject:	NEI Letter - Industry Recommendations for NRC Project AIM 2020 Prioritization and Re-baselining Initiatives
Attachments:	Industry Recommendations for NRC Project AIM 2020 Prioritization and Re-baselining Initiatives.pdf

I thought I had sent to everyone in the Branch, obviously I did not.

Pete

Appignani, Peter

From: Appignani, Peter
Sent: Friday, September 25, 2015 11:23 AM
To: Correia, Richard; Siu, Nathan; Stutzke, Martin; Coyne, Kevin
Subject: RE: SPAR vs Licensee models outline, latest version
Attachments: Outline Considerations for using other than the Standardized Plant Analysis Risk rev 2.docx

Rich

As we discussed yesterday, I incorporated Nathan's comments, attached.

Pete

From: Correia, Richard
Sent: Thursday, September 24, 2015 12:46 PM
To: Siu, Nathan <Nathan.Siu@nrc.gov>; Stutzke, Martin <Martin.Stutzke@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>
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Pete

Considerations for using other than the Standardized Plant Analysis Risk (SPAR) models Outline

1. **Summary of Key Considerations for using licensees' PRA Models**
   - 1.1. Regulatory Processes
   - 1.2. PRA Policy Statement
   - 1.3. Model Quality
   - 1.4. Maintain independence of NRC
   - 1.5. Standardization of modeling and assessment techniques
   - 1.6. Use by the NRC staff of licensees' PRA models
   - 1.7. Effect on other NRC Programs
   - 1.8. Costs

2. **Regulatory Processes**
   - 2.1. Reactor Oversight Process (ROP)
     - 2.1.1. ROP is an NRC process
   - 2.2. Significance Determination Process (SDP)
     - 2.2.1. Today's SDP outcomes using NRC versus licensee PRA
       - 2.2.1.1. The PRA models are often in close agreement.
       - 2.2.1.2. Differences in SDP outcomes between the NRC and the licensee are driven by factors other than the baseline PRA model
         - 2.2.1.2.1. Engineering assumptions
         - 2.2.1.2.2. Modeling assumptions
         - 2.2.1.2.3. Human reliability assumptions
         - 2.2.1.2.4. Other ...
       - 2.2.1.3. These issues are also applicable to the other regulatory processes and other risk-informed licensing related activities
   - 2.3. MD 8.3 - NRC Incident Investigation Program
   - 2.4. Notice of Enforcement Discretion (NOEDs)
   - 2.5. Technical basis for rulemaking
   - 2.6. Generic issues
   - 2.7. Other risk-informed licensing related activities

3. **PRA Policy Statement**
   - 3.1. The PRA Policy Statement encouraged the NRC to increase the use and application of PRA to the greatest extent practical.
   - 3.2. SPAR models are one of the key incarnations of that effort.

3.3. Eliminating SPAR models would violate the spirit of that policy because it could undermine confidence in PRA-based findings.

4. **Model Quality**

4.1. SPAR models have been peer reviewed by industry led peer review teams[1]

4.1.1. SPAR models were determined to be adequate for their intended application

4.1.2. Confidence on the part of staff and industry that the current generation of SPAR models accurately portray the plants that they model.

5. **Maintain independence of NRC**

5.1. ROP provides for an independent regulatory assessment of licensee performance

5.1.1. Staff may lose ability to verify - "trust but verify"

5.1.2. Licensee's initially indicate an event as low safety significance in LERs that are later established as a greater than Green finding

5.2. Conflict of interest issues

5.2.1. Since the ROP is an NRC process, how will the appropriate level of independence be established if the licensee's PRA is used?

5.2.1.1. Does the independent manipulation of the licensee's model by NRC staff/contractors establish an appropriate level of independence?

5.2.2. OGC may need to endorse use of licensee PRA

5.2.3. OGC may need to endorse allowing the licensee to perform the assessment

5.3. Public confidence

5.3.1. Use of licensee PRA and/or allowing the licensee to perform the assessment could erode public confidence

5.3.2. In effect, the licensee is communicating events and degraded plant conditions to the public and other stakeholders if they perform the analysis.

6. **Standardization of modeling and assessment techniques**

6.1. Standardization provides for:

6.1.1. Efficiency

6.1.2. Consistency

6.1.3. Automation

6.2. Efficiency of standardization

---

[1] One typical BWR and one typical PWR SPAR model was peer reviewed since they are standardized. Recently completed a multi-year peer review resolution activity to address peer review findings across all SPAR models.

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Coyne, Kevin

From: Correia, Richard
Sent: Thursday, September 24, 2015 7:38 AM
To: Appignani, Peter
Cc: Coyne, Kevin
Subject: RE: REPLY: SPAR Model Summary and Uses

Thanks Pete.

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Appignani, Peter
Sent: Wednesday, September 23, 2015 7:21 PM
To: Correia, Richard <Richard.Correia@nrc.gov>
Cc: Coyne, Kevin <Kevin.Coyne@nrc.gov>
Subject: Re: REPLY: SPAR Model Summary and Uses

Rich

My short responses to Brian's question. We should discuss this further.

1. There is no regulatory requirement for the licensee's to give their PRA to the NRC. If they did, I do not believe the SRAs nor INL is familiar enough with the commercial software to make changes to the models, at least not very efficiently.

2. Without the SPAR models we would have no PRA capability – completely dependent on the licensees. The following non-regional capability would be lost:

- Technical basis for rulemaking
- Generic issues
- Other risk-informed licensing related activities
- Accident Sequence Precursor (ASP) program
- Abnormal occurrence report to Congress
- Industry trends/operating experience programs
- New Reactors (PRA & licensing)
- Inspection programs
- Inspection resources
- Use of SPAR models to support system and component studies

From: Rini, Brett
Sent: Wednesday, September 23, 2015 9:21 AM
To: Sheron, Brian <Brian.Sheron@nrc.gov>
Cc: West, Steven <Steven.West@nrc.gov>
Subject: REPLY: SPAR Model Summary and Uses

Brian,

Per your request, here's DRA's 2-pager on SPAR models and their uses.

Brett

Appignani, Peter

From: Sheron, Brian
Sent: Thursday, September 24, 2015 7:23 AM
To: Coyne, Kevin
Cc: West, Steven; Appignani, Peter; Correia, Richard; Rini, Brett; Nakoski, John
Subject: RE: REPLY: SPAR Model Summary and Uses

Your last bullet sort of captures this thought. Perhaps we could expand on it a little.

From: Sheron, Brian
Sent: Thursday, September 24, 2015 7:21 AM
To: Coyne, Kevin <Kevin.Coyne@nrc.gov>
Cc: West, Steven <Steven.West@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Correia, Richard <Richard.Correia@nrc.gov>; Rini, Brett <Brett.Rini@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>
Subject: RE: REPLY: SPAR Model Summary and Uses

Can we add that if the Regions wanted to run licensee models on an NRC machine, each of the different platforms would have to be loaded onto regional computers, and all would come under FISMA requirements.

My guess is that the only practical option if we did away with SPAR models is for NRC to require the licensees to perform the SDP with their models, and the SRAs would just review them.

From: Coyne, Kevin
Sent: Wednesday, September 23, 2015 9:57 PM
To: Sheron, Brian <Brian.Sheron@nrc.gov>
Cc: West, Steven <Steven.West@nrc.gov>; Appignani, Peter <Peter.Appignani@nrc.gov>; Correia, Richard <Richard.Correia@nrc.gov>; Rini, Brett <Brett.Rini@nrc.gov>; Nakoski, John <John.Nakoski@nrc.gov>
Subject: RE: REPLY: SPAR Model Summary and Uses

Brian –

Modeling almost every operational event requires some change to the PRA model – this is true for both SPAR and licensee models. The changes can range from simple data updates (such as changing a human error probability) to complex revisions of modeling logic. SRAs are able to make many of these changes to the SPAR models (sometimes in consultation with INL or RES staff) because all of the models work in a standard way – so a given change to a SPAR model has predictable and consistent results. There is no standardization across licensee models, so an SRA would have to relearn the modeling logic and conventions for each plant in order to do an SDP, NOED, or MD 8.3 analysis. And there is often a lot of logic modeling working behind the scenes that can be difficult to find and modify if you don't know what you're looking for (these are generally in the form of logic rules that do things like remove TS prohibited cutsets, adjust HRA values, and turn on and off basic events depending on the accident context). Assuming that a licensee would provide the SRAs access to their PRA model, it would take significantly more time for an SRA to competently modify the licensee model than a SPAR model. And all that assumes that (1) the licensee would even provide the model to the NRC (there is no regulatory requirement to do so) and (2) the SRA was familiar with the PRA software the licensee used (there are several codes available, and while most use the EPRI developed CAFTA code, not all do). That said, the model itself would be accessible if we had the model and the software and knowledge to run it (so there isn't an issue with a compiled vs source code version), but the real challenge is understanding the logic model and efficiently making changes. We developed a great understanding of the challenges of doing this with the Vogtle Level 3 project – initially, even running the licensee's PRA in its native software was a challenge. And although we have had access to a tremendous amount of PRA information from the site and

have had several years to review the model (advantages an SRA would never have), there are still aspects of Vogtle's modeling that is impenetrable to our feeble minds (we can discuss with you in greater detail if you'd like, but something as basic as assigning unavailability values for equipment can be done in many different ways – and we are still scratching our heads over how Vogtle did this for some risk significant equipment). So, we might be able to help the SRAs, but it would be an extremely difficult process compared to what we can do with the SPAR models (and that is assuming we had the right software, the knowledge to run it, and the full set of documentation supporting the licensee PRA model).

If we did not have SPAR models, we would not have any independent capability to assess risk for ASP, generic issues, rulemaking technical bases, etc.

I've added these points to the "key talking points" - revision attached. The first bullet now reads: "SPAR program provides the NRC's only independent risk analysis capability in support of reactor oversight process (ROP) and a variety of risk-informed technical applications". And I added a final bullet that states "Given the lack of standardization in licensee PRAs (and the variety of code platforms that can be used), it would be extremely inefficient for SRAs and other agency risk analysts to use licensee models for risk assessment activities.".

Let me know if you have any other questions or would like us to set up a more detailed briefing.

Kevin

From: Correia, Richard
Sent: Wednesday, September 23, 2015 3:53 PM
To: Sheron, Brian; Rini, Brett; Coyne, Kevin
Cc: West, Steven; Appignani, Peter
Subject: RE: REPLY: SPAR Model Summary and Uses

Brian,

We'll get you answers soon.

Rich

Richard Correia, PE
Director,
Division of Risk Analysis
Office of Nuclear Regulatory Research
US NRC

richard.correia@nrc.gov

From: Sheron, Brian
Sent: Wednesday, September 23, 2015 1:57 PM
To: Rini, Brett <Brett.Rini@nrc.gov>; Correia, Richard <Richard.Correia@nrc.gov>; Coyne, Kevin <Kevin.Coyne@nrc.gov>
Cc: West, Steven <Steven.West@nrc.gov>
Subject: RE: REPLY: SPAR Model Summary and Uses

Good summary. Is the following also true:

1.) If an event occurs for which the licensee's PRA model cannot accurately model the event, do we think that the licensee would let an SRA add the necessary models to their PRA (in other words, if the agency were to use a licensee's model, would the licensee likely give us a source deck or a compiled version? Even if we got a source deck, is an SRA capable of developing, programming, and incorporating a model into a licensee's code?

    If the Region or NRR came to RES with a licensee's PRA model and wanted us to add a model into a licensee's code, could we even do it?

2.) If we did not have the SPAR models, what PRA capability would we have, and could we continue to use this capability for all of the non-regional stuff we currently use it for (e.g., GIs)?

If it turns out that these two items are also a problem, can we list them in the Summary Use Table (attached)?

From: Rini, Brett
Sent: Wednesday, September 23, 2015 9:21 AM
To: Sheron, Brian <Brian.Sheron@nrc.gov>
Cc: West, Steven <Steven.West@nrc.gov>
Subject: REPLY: SPAR Model Summary and Uses

Brian,

Per your request, here's DRA's 2-pager on SPAR models and their uses.

Brett

Key Talking Points for the Standardized Plant Analysis Risk (SPAR) Model Program

- SPAR program provides the NRC's only **independent** risk analysis capability in support of reactor oversight process (ROP) and a variety of risk-informed technical applications
- Plant-specific SPAR models (99 operating plants are represented by 75 SPAR models) use **standardized** modeling and naming conventions. Standardization increases analyst efficiency and accuracy and supports cross comparison across models.
- The program leverages available licensee PRA information to reduce program costs, but includes validation of licensing modeling assumptions and integrates licensing model conventions into standardized SPAR modeling framework. Although SPAR models use some simplifying assumptions compared to licensee models, in several areas most pertinent to ROP applications, the SPAR models are generally more detailed (e.g., CCF, LOOP, and support system initiators)
- SPAR models and the SAPHIRE PRA code are **designed to support event and condition analyses** by performing "delta-risk" analyses (e.g., change in CDF from base case to performance deficiency). Licensee developed models and supporting codes lack this capability (requiring additional calculations and manual sequence/cutset result comparisons)
- All models run on a single code platform (SAPHIRE). SAPHIRE can be updated and configured to directly support NRC risk assessment activities through coding changes and customized reporting functions.
- Although licensees have made progress in developing RG 1.200 compliant PRA models, these models lack the standardization and ROP-specific features that are essential to the agency's needs for performing event and condition analyses.
- Given the lack of standardization in licensee PRAs (and the variety of code platforms that can be used), it would be extremely inefficient for SRAs and other agency risk analysts to use licensee models for risk assessment activities.

SPAR Model Uses

- Significance Determination Process (Reactor Oversight) - **Regions**
- Accident Sequence Precursor Program (used as an input metric to the performance budget process) - **RES**
- Evaluation of Notices of Enforcement Discretion – **Regions, NRR** *
- MD 8.3 Incident Investigation Program Risk Evolutions (e.g., determine level of inspection response to an event) – **Regions** *
- Establish technical basis for rulemaking – **RES, NRR**
- Evaluate generic issue safety significance - **RES**
- Perform system and component studies - **RES**
- Inspection Planning (e.g., risk insights from Plant Risk Information eBooks) - **Regions**

These applications typically are performed with limited time, highlighting the importance of model standardization for SPAR

SPAR Model Annual Budget

The SPAR/SAPHIRE annual budget for **FY2015 was ~$2.2 million**. This amount is scalable depending on agency needs and available resources. Major activities include:

Base Resources (i.e., minimum requirements for the program):

- SPAR Model Configuration/Quality Control and User Support Help Desk ~$500k/year
  - Help desk handles ~ 2 calls/day from SRAs

- Ensures model version control and maintains INL Website
- Performs model updates to support specific SDP/ASP activities (~30 models were updated to support a specific analysis in FY2015). These updates are often highly specific to the event/condition that occurred and would also need to be performed for a licensee PRA model

- SAPHIRE QA and User Support ~$300k/year
  - Maintain NUREG/BR-0167 QA program
  - User help desk Support

Resources needed to Support Specific User Enhancements:

- Model Updates to Reflect Significant Plant Changes (~12 models/year) - ~$250k
  - Incorporate station blackout EDGs
  - Battery charging generators
  - Significant model upgrades

- External Hazard and Fire Models - ~ $400k/year
  - Add NFPA 805 fire modeling
  - Add seismic and high wind model capabilities

- SAPHIRE Enhancements ~$300k /year
  - New reporting features and code capabilities

- Data Updates (performed every 3 years) - ~$500k (every three years)
  - Upgrade SPAR models to reflect most recent operating data
  - Update model documentation and Plant Risk Information eBooks (PRIBs)
  - General model cleanup/improvements

Letter to NEI from OEDO on Use of SPAR models (2007, ML072490566)

This letter addressed an NEI proposal to use licensee PRA models instead of SPAR models. A detailed review was conducted and concluded that SPAR was needed to:

- Maintain **independence** of NRC analyses. Differences between NRC and Licensee assessments is not due to the base model, but by the assumptions for each specific event or condition analysis
- Provide **standardized model framework** for efficient analyses - industry does not use a standardized modeling approach
- Avoid inefficiencies in having agency risk analysts learn the conventions of over 70 licensee developed PRAs (utilizing up to four different software platforms)

The basis for the staff conclusion remains valid today.

Feedback from Regional SRAs on Potential Use of Licensee Models vice SPAR

- More efficient and objective to use SPAR models for risk assessments.
- It would take a significant increase in resources to use licensee models for event and condition assessment activities due to their lack of standardization and need for SRAs to understand unique modeling conventions and new code platforms.
- Use of licensee models would cause delays in the SDP process due to need to engage in additional requests for information to understand licensee PRA modeling assumptions.
- NRC's ability to perform independent regulatory assessment activities will be eroded by not having a centralized system evaluating Generic Safety Issues, SBO/LOOP studies, etc.

Appignani, Peter

From: Appignani, Peter
Sent: Tuesday, September 22, 2015 9:03 AM
To: Stutzke, Martin (Martin.Stutzke@nrc.gov)
Subject: FW: SPAR Vs Lic PRA
Attachments: SAPHIRE-SPAR Model inter-relationship paper.docx; Outline Considerations for using other than the Standardized Plant Analysis Risk rev 1.docx

Marty

If you have any suggestions ...

Pete

Appignani, Peter

From:	Appignani, Peter
Sent:	Monday, September 21, 2015 2:02 PM
To:	Gonzalez, Michelle (Michelle.Gonzalez@nrc.gov)
Subject:	SPAR Vs Lic PRA
Attachments:	SAPHIRE-SPAR Model inter-relationship paper.docx; Outline Considerations for using other than the Standardized Plant Analysis Risk rev 1.docx

SAPHIRE/SPAR Model inter-relationship

The U.S. Nuclear Regulatory Commission (NRC) maintains a set of risk models, called standardized plant analysis risk (SPAR) models, for the operating U.S. commercial nuclear power plants. SPAR models are used by the NRC on a day-to-day basis to support risk-informed decision-making activities such as the accident sequence precursor (ASP) and significance determination process (SDP) programs. The primary objective of the ASP Program is to identify, document, and rank operating events most likely to lead to inadequate core cooling and core damage. The main purpose of the SDP is to determine the safety significance of inspection findings.

In addition to supporting the ASP and SDP analyses, SPAR models confirm licensee risk analyses submitted in support of license amendment requests and other related activities. The SPAR models utilize the software tool Systems Analysis Programs for Hands-on Integrated Reliability Evaluation (SAPHIRE), developed by the Idaho National Laboratory (INL) for the NRC. SAPHIRE is a state-of-the-art probabilistic risk analysis (PRA) tool used to evaluate event tree/fault tree logic. The software provides multiple risk metrics to help the analyst make risk informed decisions. There are many features that are built into SAPHIRE to help the different analysts (e.g., Senior Reactor Analysts, Resident Inspectors). The following features of the software will be discussed along with how the software and the SPAR models have been integrated together to help the NRC analysts perform their tasks more efficiently.

SAPHIRE has evolved over the years to meet the needs of the NRC analyst to help them better perform their tasks when utilizing the SPAR models. These features were built directly into SAPHIRE to eliminate the analyst performing offline calculations and then placing those calculated probabilities back into the SPAR model. Some of these important features are discussed below.

Common Cause Failure (CCF) modeling:

CCF modeling requires the use of a mathematical model to determine the failure probability of multiple redundant components. The calculation of this probability has been built directly into the SAPHIRE software tool, which eliminates the analyst from offline calculations (i.e., use of calculator, Excel) and then manually adding this probability into the software. The manual method can induce different types of input errors.

The most important part of having these CCF models directly built into SAPHIRE is the automatic adjustments that SAPHIRE performs during analyses. SAPHIRE makes the correct adjustment conditional on the deficiency identified and eliminates any manual manipulation. More information about this process will be discussed in the SDP and ECA module parts.

Human Reliability Analysis (HRA) modeling:

The HRA modeling that is built into SAPHIRE provides the analyst with different cues and performance shaping factors to help perform an HRA analysis. This built in worksheet provides the analyst shaping factors to generate a baseline (i.e., nominal) operator failure probability and then the flexibility to adjust this probability conditioned on the event being analyzed.

Level 2 Modeling:

SAPHIRE has been updated to provide the analyst with the ability to integrate the Level 1 core damage PRA with the Level 2 plant damage state PRA. This new feature provides the analyst with a transparent means to take the Level 1 sequences and then changing the PRA to a new phase, which represents the

Level 2 part of the PRA. This process streamlines the integration of Level 1 sequences with the Level 2 sequences. The advantage of this feature is the Level 1 cut sets that make up the different Level 2 plant damage states are available for review. This will allow a better uncertainty evaluation of the Level 2 results.

SAPHIRE also has the capability to assign LERF factors to sequences based on rules related to initiator or equipment availability or can be assigned explicitly for each sequence.

Power related modules:

A module built into SAPHIRE is the ability to calculate the non-recovery of offsite power given a loss of offsite power (LOOP) and/or station blackout (SBO). This module calculates the non-recovery probability based on the time until core damage and the type of LOOP that occurred. These recovery factors can be automatically updated given a change in the parameters based on the different potential events that are evaluated. This automatic update eliminates manual calculations using other software programs, which makes the analysis streamline and efficient.

A new module has been incorporated into SAPHIRE that calculates an adjustment factor that takes into account the time at which core damage can occur. This new module is developed to move the static event tree/fault tree process into a more correct dynamic evaluation. This module convolves the failure rates of the operating components with the non-recovery events to determine the true core damage frequency and then divides this by the static core damage frequency. The result is an adjustment that should be applied to the certain time related cut sets to obtain the correct sequence frequency.

SDP Module

The SDP module was originally developed to help the Senior Reactor Analysts evaluate at-power potential deficiencies that were observed. However, given the ease of use of this module and flexibility and detail of the SPAR models, this SDP module and SPAR models are available to all Resident Inspectors to help them perform their tasks.

The SDP module is designed to help guide the analysts through setting up potential deficiencies to determine their risk significance. Once a deficiency has been set up using the interface, SAPHIRE/SDP will evaluate the potential deficiency and provide the risk measures. The risk measures are conditional core damage frequency (probability) and the delta core damage frequency. The following will show some user interfaces that help the analyst set up the event being analyzed. The interfaces streamline the process of setting up the evaluation, which in turn makes the analysis part more efficient.

The first interface provides a button for the user to select, which system contained the deficiency. The SPAR models integrate the required fields that the SDP interface uses to parse the components into the correct system. Figure 1 is a subset of systems in a typical SPAR model. The analyst selects the system of interest and all of the components that are modeled for that system are listed. From the list the analyst, then selects the component of interest to evaluate the deficiency.

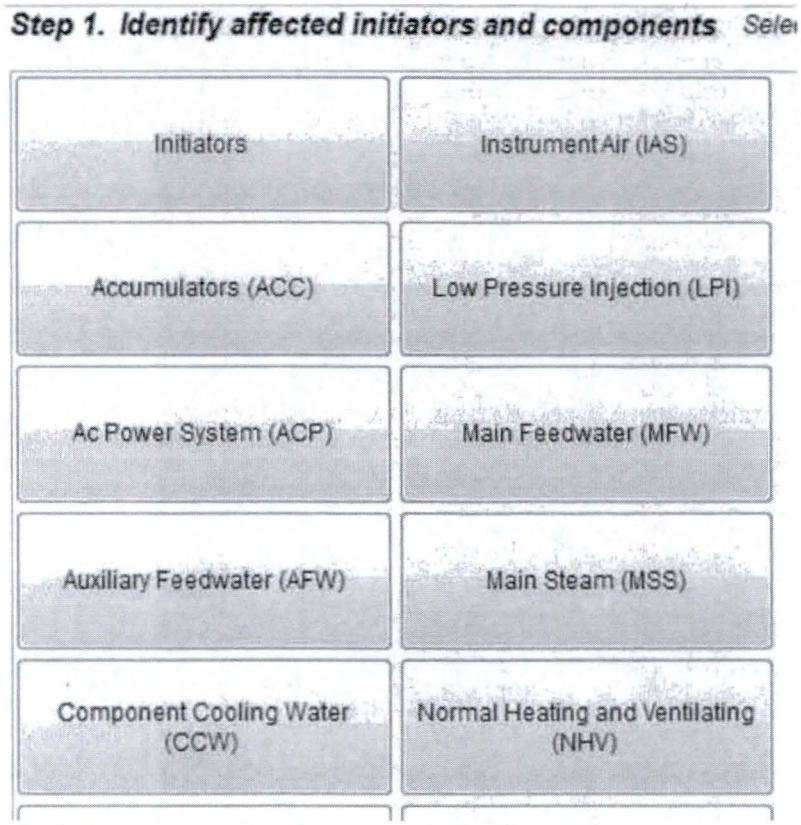


Figure 1. Systems related to a typical SPAR model.

Once the component has been identified and is placed in a failed state, the SDP module becomes an efficient tool for evaluating model. The analysis interface provides many options to help the analyst correctly evaluate the deficiency. Figure 2 shows the calculation interface.

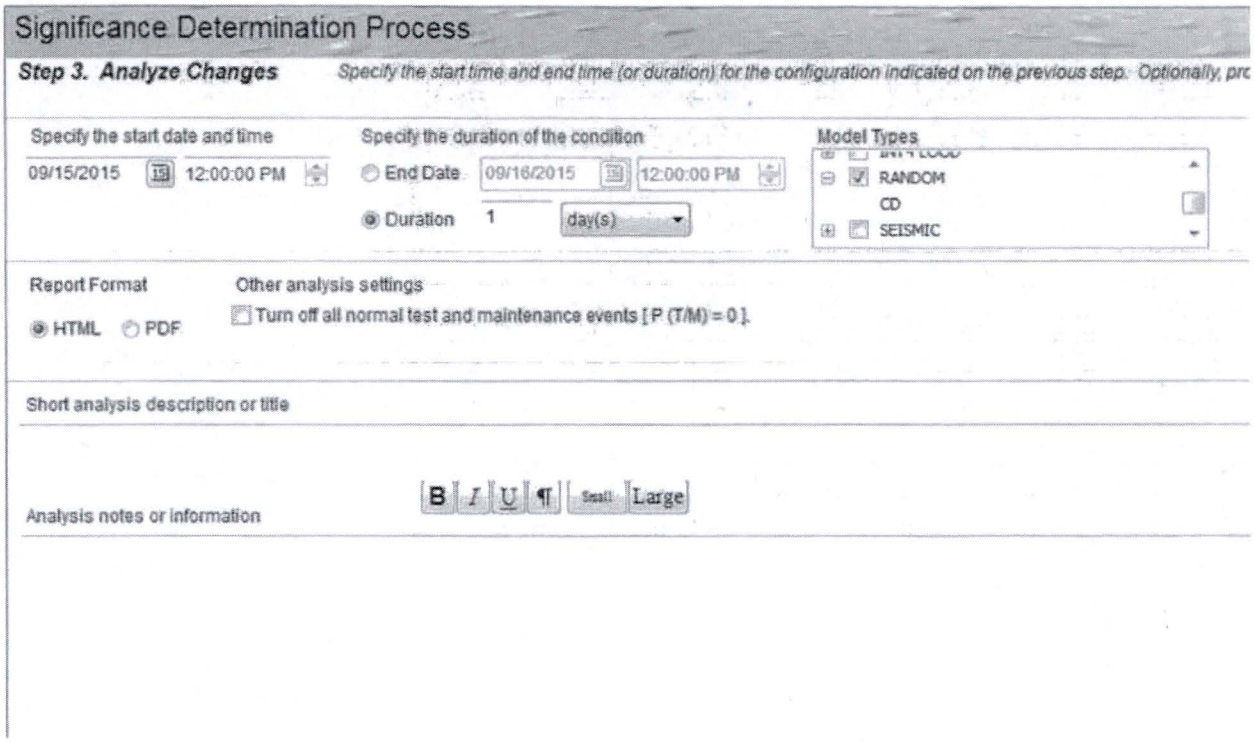


Figure 2. Calculation interface.

This interface tells SAPHIRE how to evaluate the deficiency. The first part allows for duration of the deficiency to be incorporated. This duration can be designated by selecting the duration time (i.e., hours, days, weeks, or months) or the actual dates can be input. The duration is important, because this becomes part of the final result. The interface automatically converts the units and performs the correct evaluation. Otherwise, the analyst would have to perform this calculation by hand.

Another feature is the built-in option to set all test and maintenance failure modes to a probability of 0.0. If the analysis is similar to configuration risk management operation to verify the utility PRA result, the analyst could identify the component that is being removed for testing of maintenance and then set all other maintenance related components to 0.0. The result from this should provide insights about the current configuration of the plant.

The last part of this interface is the ability to type in notes about the evaluation. These notes will become a record with the evaluation for later reference purposes.

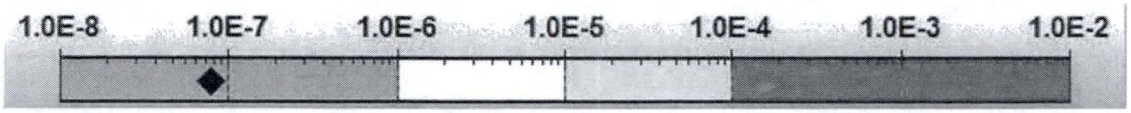
The interfaces are designed to streamline the process for setting up the evaluation. The real benefit of the SDP module in SAPHIRE is when the logic is being solved to provide the risk metrics. The SDP module performs many auto-adjustments to the different calculation models. The SDP module will automatically re-calculate the CCF probability conditional on the failure that was observed. As part of the CCF adjustment, if the component has multiple failure modes (i.e., fails to run, fails to start) the SDP module will correctly adjust the non-observed failure mode. This provides the correct resultant cut sets.

Another adjustment that is performed during the evaluation is the correct application of post-processing rules. The SDP module will solve the logic twice to make sure the post-processing rules get applied to correctly recover components and/or remove invalid cut sets. This process will first solve the logic model for the minimal cut sets by setting the failed component to a probability of 1.0. By setting the component to a probability, ensures that it remains in the resultant cut sets. This group of cut sets will have the post-

processing rules applied to them to ensure correct recovery and removal of invalid cut sets. This new group of cut sets are re-evaluated given the failed component is set to a guaranteed failure of TRUE. This two step process is an enhanced feature of the SDP module to ensure correct resultant cut sets and eliminates the analyst from performing these steps individually and potentially having to manually manipulate the cut sets.

The results from the SDP module provide the analyst all of the risk metrics need to make a risk informed decision. Figure 3 shows the bar chart developed for a quick view of the importance of the deficiency (delta CDF in relationship to the SDP colors) and the calculated CCDP and CDP. The CCDP is the conditional core damage probability of event and the CDP is the core damage probability given nominal random failure of all components.

Increase in Yearly Core Damage Frequency



I. Summary **Condition: Green: 7.9E-08/yr**

The given condition duration is 1 day.

I. Assessment Summary

Duration:	1 day	**Project:**	SPAR MODEL
CCDP:	1.2E-7	**Model Version:**	8.21
CDP:	3.8E-8	**Model Date:**	02/28/2009
Increase:	7.9E-8 /year	**Saphire Version:**	Saphire 8.1.2.25
Color:	Green		

Figure 3. Result of the SDP evaluation.

Figure 4 shows a graph of the change in delta CDF as a function of duration. This plot shows that if the condition lasted for roughly 12 days, it would trigger a white type finding and if the condition lasted for 4 months it would trigger a yellow finding. This plot gives some insights on how long the condition could be in before triggering one of the next significant colors.

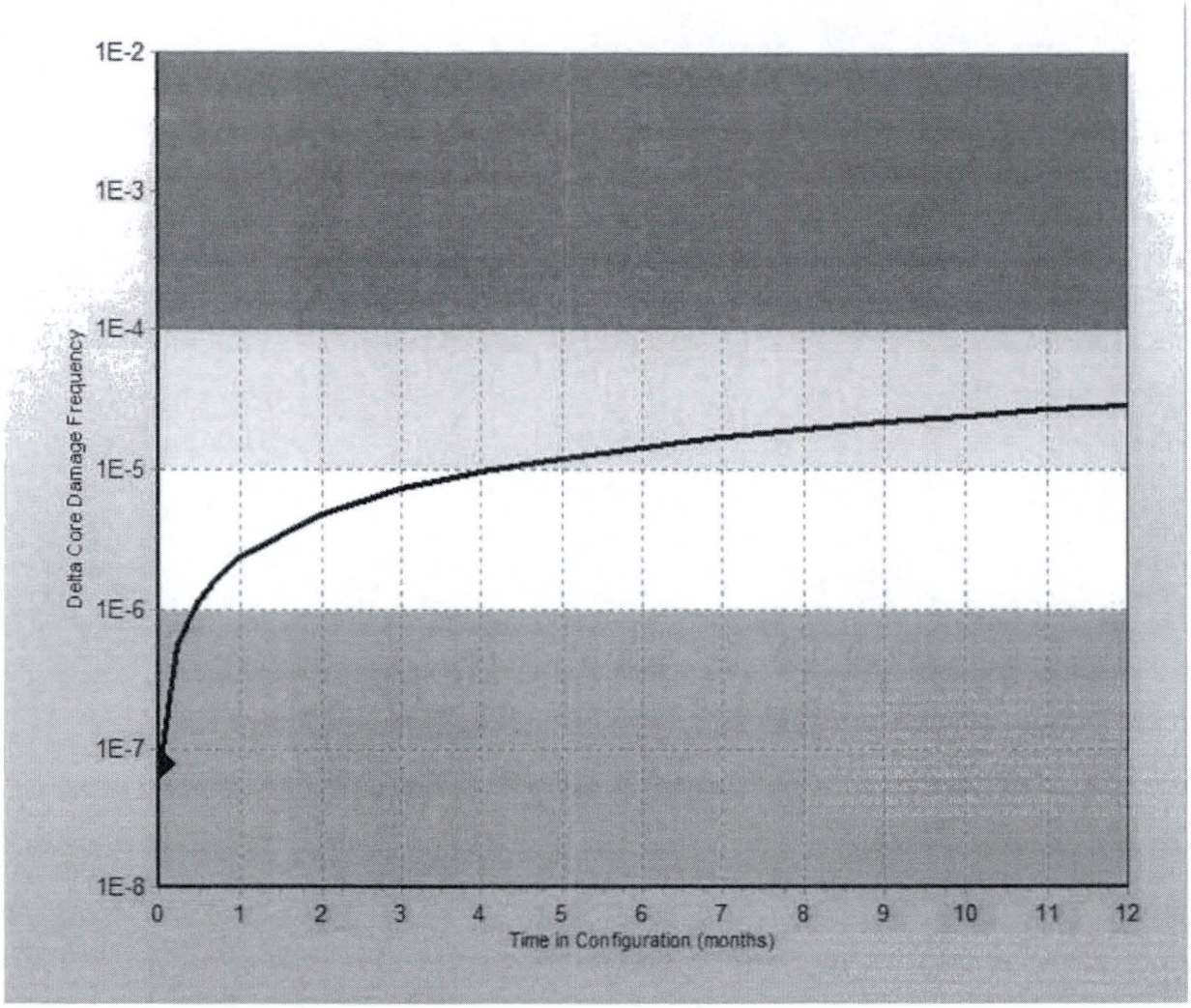


Figure 4. Change in Delta CDF as a function of time.

Events Condition Analysis Module

The ECA module is a different module built into the SAPHIRE software in order to help the Senior Reactor Analysts and other NRC staff to perform event evaluations. This module allows for both condition type assessments (condition found for some duration prior to being fixed) and an initiating event assessment (condition where one of the initiating events occurred). The interface helps the analyst set up which type of evaluation is necessary. The first interface has the analyst select the type of evaluation being performed as shown in Figure 5.

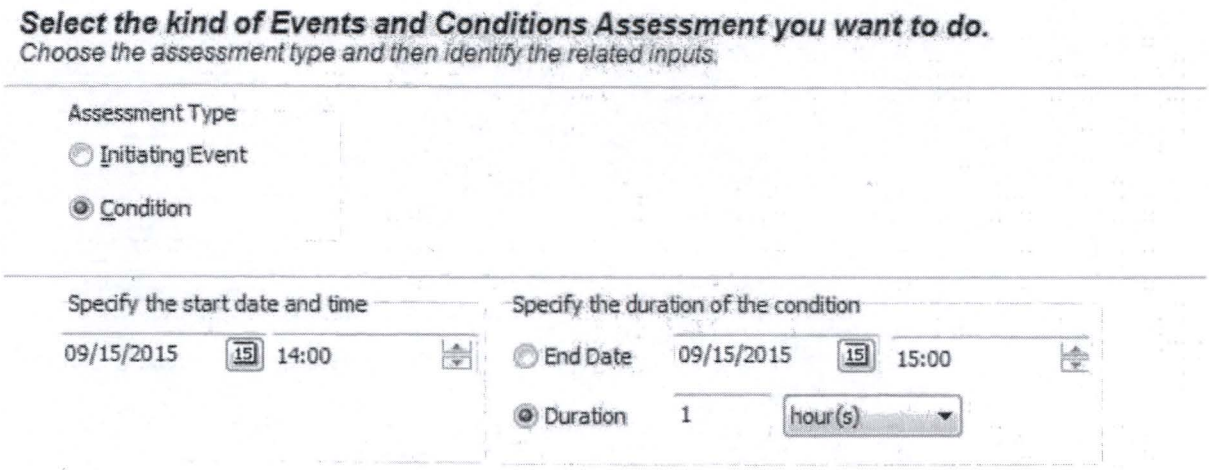


Figure 5. ECA condition assessment interface.

The duration portion is the same as discussed above for the SDP module. Once the specific condition assessment is selected, the interface streamlines the next questions on what component needs to be evaluated as above. The difference here is all of the component basic events are listed, which gives more flexibility to the analyst on selecting the components and make different changes.

After the component of interest has been selected and its correct change has been made, the next interface is the calculation options. This interface is shown in Figure 6. The ECA calculation interface is similar to the SDP calculation interface as the analyst can set all test and maintenance components to 0.0 prior to evaluation. The evaluation is a multiple pass operation as discussed above. The differences between these two calculation interfaces are the ability to change the truncation for the specific calculation and perform an uncertainty analysis on the evaluation. The uncertainty evaluation will provide additional risk insights on the importance of the deficiency being evaluated.

The automatic adjustments discussed above are also performed when using the ECA module. Those are CCF adjustments and post-processing rules for multiple pass operation.

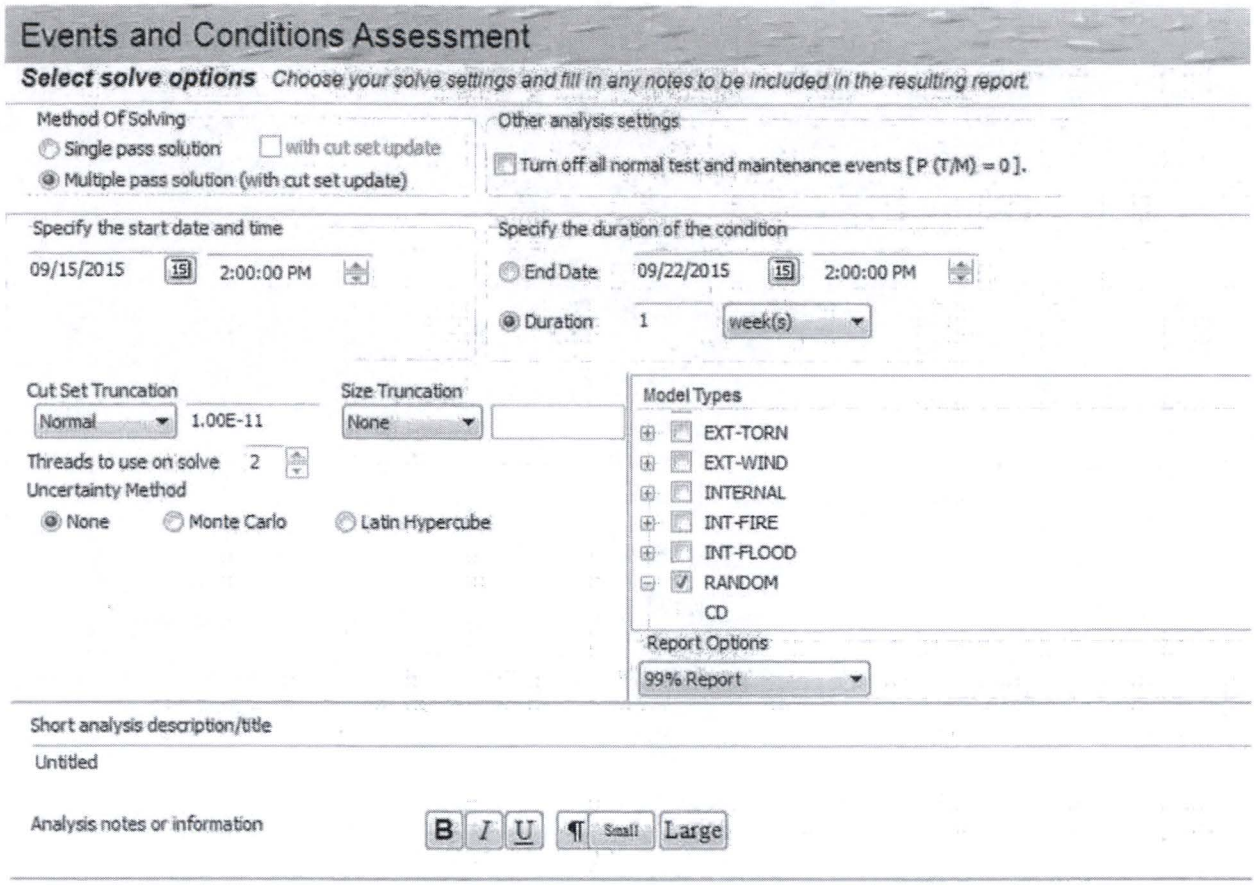


Figure 6. Calculation interface.

Other SPAR/SAPHIRE features facilitating rapid and efficient evaluation of risk impacts

- **Full suite of automated reports on a variety of topics**
- **Model documentation and supporting P&IDs accessible directly from SAPHIRE**
- **Auto generation of the Plant Risk Information e-Book (PRIB). This summary document provides a quick and handy reference to the risk importances of all systems and equipment included in the SPAR model.**
- **A set of documentation reduced to only key information necessary to support SDP/ECA analyses.**
- **A feature (Change Sets) that allows rapid and temporary modifications to specific model data . This feature is beneficial when attemping multiple 'what if' type analyses.**
- **Integrated Model type/Phase type applications. A single basic event can be developed in a way that allows it to be susceptible to multiple Model types (e.g., Random failures, Seismic failures) and Phase type (e.g., level 1 and level 2). This gives the analyst the ability to assign different failure probabilities for each Model type and Phase type and then solve the logic and store the results in these different areas.**
-

Conclusion:

The modules and the advanced features discussed above for the SAPHIRE software tool were developed as an integral part of the SPAR models to help all NRC staff perform their job in a streamline and efficient means. SAPHIRE and the two modules provide many risk metrics from the SPAR model that can be used to help make risk informed decisions.