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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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SUBCOMMITTEE ON RELIABILITY AND PROBABILISTIC

RISK ASSESSMENT

+ + + + +

WEDNESDAY, MAY 11, 2011

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ROCKVILLE, MARYLAND

The Subcommittee convened at the Nuclear
Regulatory Commission, Two White Flint North, Room
T2B1, 11545 Rockville Pike, at 1:00 p.m., Dr. Dennis
Bley, Acting Chairman, presiding.

SUBCOMMITTEE MEMBERS PRESENT:

DENNIS C. BLEY, Acting Chair

SAID ABDEL-KHALIK

J. SAM ARMIJO

MICHAEL CORRADINI

HAROLD B. RAY

JOY REMPE

MICHAEL T. RYAN

WILLIAM J. SHACK

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NRC STAFF PRESENT:

JOHN LAI, Designated Federal Official

RICHARD CORREIA

DANIEL HUDSON

MARTY STUTZKE

DOUG COE

A.J. JAIGOBIND

ALSO PRESENT:

BIFF BRADLEY

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TABLE OF CONTENTS

OPENING REMARKS 4

Dennis C. Bley, Acting Chair

INTRODUCTION 5

Richard Correia

BACKGROUND, PERSPECTIVES ON FUTURE USES 6

AND OPTIONS FOR PROCEEDING WITH FUTURE

LEVEL 3 PRAs

Daniel Hudson

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

1:00 p.m.

1
2
3 ACTING CHAIR BLEY: The meeting will now
4 come to order. This is a meeting of the Reliability
5 and PRA Subcommittee. I am Dennis Bley. I am sitting
6 in for John Stetkar who could not be here today. He's
7 the Chairman of the Subcommittee.

8 The ACRS members in attendance are Bill
9 Shack, Mike Ryan, Sam Armijo, Harold Ray and Mike
10 Corradini and Joy Rempe are here and on their way in.
11 And our consultant Tom Kress is also present. John
12 Lai of the ACRS staff is the designated Federal
13 officer for this meeting.

14 The purpose of the meeting is for staff to
15 brief the Subcommittee on the development of Level 3
16 PRA options. You will hear presentations from the
17 staff.

18 There is a phone bridge line. To preclude
19 interruptions of the meeting, the phone will be placed
20 in the listen-in mode during the presentations and
21 committee discussions.

22 We have received no written comments or
23 requests to make oral statements from members of the
24 public regarding today's meeting. The entire meeting
25 will be open to public attendance. The Subcommittee

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1 will gather information, analyze relevant issues and
2 fact and formulate proposed positions and actions as
3 appropriate for deliberation by the full committee.

4 The rules for participation in today's
5 meeting have been announced as part of the notice of
6 this meeting previously published in the Federal
7 Register. A transcript of the meeting is being kept
8 and will be made available as stated in the Federal
9 Register notice. Therefore, we request that all
10 participants in this meeting use the microphone
11 located throughout the meeting room when addressing
12 the Subcommittee.

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

16 We will not proceed with the meeting and
17 I call upon Richard Correia RES to begin.

18 MR. CORREIA: Good afternoon and thank
19 you. I am the relatively new director of the Division
20 of Risk Analysis and Research. This afternoon as you
21 said we're here to describe to you our current
22 thinking on options for future Level 3 PRA. Dan
23 Hudson will be presenting. Marty Stutzke will be
24 supporting the discussions. Doug Coe, our Deputy
25 Director, will be here to answer any of the questions.

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1 We look forward to the discussion. Thank
2 you.

3 MEMBER CORRADINI: How relatively new?

4 MR. CORREIA: Six weeks.

5 MEMBER CORRADINI: That's pretty new.
6 Congratulations.

7 MR. CORREIA: Thank you.

8 All right. Dan, you're up.

9 MR. HUDSON: Thank you very much and as
10 Rich said my name is Dan Hudson. I'm the Technical
11 Assistant in the Office of Nuclear Regulatory Research
12 Division of Risk Analysis. I work directly for Rich
13 and Doug Coe over there. And I've also been serving
14 as the Project Manager for this Level 3 PRA
15 initiative.

16 It's a pleasure to be here again after
17 meeting with you all back in November.

18 I only have one presentation today. I'm
19 it. Marty is here obviously to provide support with
20 his extensive expertise.

21 MR. STUTZKE: Defense in depth.

22 MEMBER CORRADINI: Only for beyond design
23 basis.

24 MEMBER SHACK: Same with the accident
25 pressure.

1 MR. HUDSON: Sos, what you see before you
2 on Slide 2 is just an outline of the topics that we're
3 going to cover throughout this single presentation.
4 Somewhere in here at your discretion I imagine we'll
5 take a break.

6 ACTING CHAIR BLEY: Somewhere around 3:00.
7 Whenever it fits your presentation.

8 MR. HUDSON: Now, throughout our various
9 interactions with internal and external stakeholders
10 the resounding message that we got was we need to be
11 more clear about what it is that we're trying to
12 achieve with this initiative. So, we figured we'd put
13 that up front and the idea is we'll talk about it now
14 and we'll most likely come back to Slide 3 at various
15 points throughout the discussion today to refer to
16 what it is that we're trying to achieve exactly.

17 So, our overall vision here is to extend
18 the scope of the NUREG-1150 PRAs and to incorporate
19 advanced that have been since that time frame.

20 MEMBER RAY: What is that time frame,
21 please?

22 MR. HUDSON: The NUREG-1150 PRAs were
23 conducted in the late 1980s and the document itself
24 was published in 1990. So, it's been about 20 years
25 since then and as you can imagine a lot of advanced

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1 have been made since then.

2 MEMBER RAY: No question.

3 MR. HUDSON: Another vision that we have
4 is to achieve analytical consistency to enable a
5 meaningful comparison and relative ranking of risk
6 contributors. What we're talking about here is
7 obviously there are a variety of initiators to
8 consider and the approach up until now has been to,
9 you know, focus on the internal events. Initially,
10 we've developed pretty solid capability in that area.
11 And then we've gradually progressed into considering
12 the external initiators and now we're talking about
13 looking at other site risk contributors including
14 spent fuel. So, the idea here is to achieve some
15 consistency in terms of the screening analysis,
16 modeling assumptions, level of detail so that we can
17 allow for a meaningful comparison and a relative
18 ranking to the overall risk associated with their
19 power plant site.

20 And the bottom line here. We're doing all
21 of this to achieve the third bullet. We want to
22 extract new and improved risk incites to better focus
23 our critical resources on those items that are most
24 important to safety.

25 MEMBER CORRADINI: I'm sorry. So, would

1 one of the incites that you get is you may need more
2 experimentation to actually validate some of what
3 you're computing?

4 MR. HUDSON: Absolutely. I think that is
5 definitely one of the incites that we may get. You
6 know, one of the things that we're well aware of is
7 that there's always going to be some uncertainty
8 associated with the results of a PRA. And, you know,
9 we intend to use those incites, you know. We're going
10 to characterize the uncertainty and we intend to
11 better understand what the key sources of uncertainty
12 and that can better inform later research to try to
13 reduce those uncertainties or validate.

14 MEMBER CORRADINI: I guess there reason I
15 should frame it this way. So, it's in your mission to
16 be actively looking for that rather than it just
17 happens to stumped upon.

18 MR. HUDSON: Absolutely.

19 MEMBER CORRADINI: Okay.

20 ACTING CHAIR BLEY: Dan, I peeked at your
21 last slide and I see you have one bullet saying, we're
22 going to have to think a little bit about Fukushima.
23 I don't know if you've had much time to talk about it
24 and I know we don't know everything as yet, but as you
25 go through today, if you hit areas where you're

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1 discussions have flagged that it might be important to
2 dig deeper because of what's happened there, please
3 raise those points as we go along.

4 MR. HUDSON: Sure. I'm sure you saw in
5 your reading of the paper and its enclosure that we've
6 made reference to the Fukushima event and, in fact,
7 one of the comments that we received through our
8 interactions with stakeholders was that, you know,
9 maybe we need to be careful about our reference to
10 that event because we don't want to get ahead of
11 ourselves here. As you're well aware, we have a task
12 force that's looking into the event and there are
13 still a lot of lessons to be learned. That said, we
14 recognize that, clearly there are some things that we
15 need to be considering as a result of that event. So,
16 we'll certainly try to touch on those when we come
17 upon them.

18 MEMBER ARMIJO: You mentioned spent fuel
19 as site risk contributors. Has that not been
20 addressed in previous --

21 MR. HUDSON: It's certainly been addressed
22 and you'll see on some of the other slides. There
23 have been some studies done in the past, mainly a
24 decommissioning risk study and pilot study for dry
25 cask storage PRA. But in terms of a comprehensive

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1 risk study where you are directly comparing the risk
2 attributable to the reactor cores on the site versus
3 the spent fuel, that really hasn't been done to this
4 level.

5 Any other questions?

6 CONSULTANT KRESS: Are you including
7 shutdown conditions?

8 MR. HUDSON: We'll talk about the
9 different options we developed and one of those
10 options is obviously a site level 3 PRA study and our
11 vision is to include low power shutdown conditions.

12 CONSULTANT KRESS: You intend to apply
13 this to LWRs?

14 MR. HUDSON: Well, in terms of the various
15 options that we considered, what you see before you
16 are three options. Throughout this Scoping Study, the
17 staff has considered a number of different options,
18 some of which took a look at the possibility of
19 examining a new or advanced reactor designs. But what
20 you see before you are the ones that the staff
21 determined were the most feasible from a cost benefit
22 perspective. So, we've taken a look at that but the
23 staff has decided upon at this point is we're going to
24 get the most bang for our buck by taking a look at a
25 Light Water Reactor and operating Light Water

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1 Reactors.

2 CONSULTANT KRESS: Would that include
3 Small Modular Light Water Reactors?

4 MR. HUDSON: No, we're taking a look at
5 the plants that are currently operating for this
6 study.

7 Objectives for our interaction with you
8 today are listed on this slide and primarily we want
9 to talk with you about the approach and our basis for
10 developing the options that you've already seen. And
11 we certainly welcome any feedback that you have for
12 us. And then ultimately what we're striving for is to
13 obtain your support for our recommended option that
14 we're going to be providing to the Commission.

15 I have some background slides included in
16 the presentation. We'll get through these relatively
17 quickly but they were included for the benefit of some
18 of the potential members of the audience that might
19 not be as well versed in PRA and risk-informed
20 regulation.

21 So, what is PRA? It's quite simply a
22 structured analytical process that provides both
23 qualitative insights and quantitative estimates of
24 risk. It does this by answering the three questions
25 that are commonly referred to as the rick triple.

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1 What can go wrong? It answers this by identifying
2 potential initiative event scenarios that can
3 challenge system operations. How likely is it that it
4 will happen? And answers that question by estimating
5 the likelihood of event sequences that lead to adverse
6 events. And then finally what are the consequences if
7 this does happen? And it answers that by estimating
8 the consequences associated with the accident
9 sequences.

10 The scope of nuclear power plant PRAs can
11 vary depending on their intended application or use
12 and the scope is ultimately defined by the extent to
13 which various options for the factors that are
14 highlighted in this table are modeled and analyzed in
15 the PRA. So, this is included just to give you an
16 idea of, you know, what the full scope might entail.

17 Nuclear power plant PRAs can estimate risk
18 metrics at three different end states or level of risk
19 characterization. It does this by using sequential
20 analyses in which the output from one level serves as
21 a conditional input to the next.

22 This has actually been a point of
23 confusion as we discovered during our public meeting.
24 Some people there weren't sure exactly what was meant
25 by a Level 3 PRA. You can get the impression by even

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1 looking at something like this that when you talk
2 about a Level 3 PRA, all you're talking about is the
3 consequence analysis. So, it became clear to us that
4 we need to be more specific about what a Level 3 PRA
5 entails. And ultimately we're starting from the
6 initiating event and then in the case of a Level 3
7 PRA, we're taking it all the way out to the off site
8 consequences.

9 Realistically, you can pick any, you know,
10 point throughout a sequence as an arbitrary end state
11 and analyze to it, but, you know, historically in the
12 nuclear industry we've, you know, selected these
13 levels where Level 1 PRA ends at the onset of core
14 damage. Level 2 PRA ends at the release of
15 radioactivity to the environment. And then, finally,
16 Level 3 PRA ends at the off site consequences.

17 What's important here and why we're
18 considering doing a Level 3 PRA is that if we really
19 want to understand the relative contribution of
20 various site risk contributors to public risk, not to
21 core damage or to radioactivity release, we have to do
22 a Level 3 PRA. And related to this is that, you know,
23 up until now we haven't really identified an analog to
24 core damage frequency or large early release frequency
25 for some of these other site risk contributors like

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1 spent fuel that we can make a direct comparison. And
2 so to make that comparison we need to do a Level 3
3 PRA.

4 ACTING CHAIR BLEY: I guess the spent fuel
5 doesn't quite fit in your picture.

6 MR. HUDSON: Right. Yes. What you see
7 here. This is somewhat deceiving in that all you're
8 looking at is a Level 3 PRA for a reactor and doesn't
9 include, you know, the spent fuel.

10 ACTING CHAIR BLEY: Has there been any
11 pressures from any sources to look at any end state
12 short of core damage with things involving the
13 reactor?

14 MR. HUDSON: You know, we haven't heard
15 anything up until now about that. There hasn't been
16 any question about stopping before core damage to take
17 a look at, you know --

18 ACTING CHAIR BLEY: Well, your white paper
19 mentions that as one of the expansions of the PRA
20 technology.

21 MR. HUDSON: Are you referring to our
22 discussion related to the future reactor designs and
23 the technology-neutral frame work?

24 ACTING CHAIR BLEY: I have to find it.

25 MR. HUDSON: Okay. He'll be there in a

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1 second but go ahead.

2 MEMBER CORRADINI: Can I go back to
3 Dennis' question so --

4 MR. HUDSON: Sure.

5 MEMBER CORRADINI: I'm just trying to go
6 back with WASH-1400 for Surry. They did do spent fuel
7 accidents so I thought.

8 ACTING CHAIR BLEY: I don't remember that.

9 MEMBER CORRADINI: I didn't understand
10 your question to him relative to this because if I
11 look at onset of spent fuel damage, everything else
12 would then map into that. I'm just trying to think
13 historically have they done that analysis? And I
14 thought they had.

15 ACTING CHAIR BLEY: For spent fuel?

16 MEMBER CORRADINI: Yes.

17 ACTING CHAIR BLEY: There have been
18 several spent fuel PRAs done and staff did a kind of
19 bounding calculation for a Commission paper. Some
20 other --

21 MEMBER CORRADINI: The bounding
22 calculation was the Brookhaven report, right?

23 ACTING CHAIR BLEY: Well, Brookhaven did
24 their own study. And then there have been some out in
25 industry, but it's not been a standard part PRA.

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1 There are isolated examples.

2 I was also asking about things like if you
3 just pump reactor coolant out for awhile in the lower
4 doses. The things that show up in the licensing
5 basis. I wondered if anybody was asking about those
6 or should they be?

7 MEMBER SHACK: Well, the sentence I had in
8 mind was, for example. The screening of event
9 sequences did not lead to core damage results in a
10 potential loss of useful incites, particularly when
11 comparing and contrasting PRA results with
12 deterministic DBA approaches which is sort of --

13 ACTING CHAIR BLEY: Exactly there. And
14 some of the stuff they were talking on the non-OWR,
15 Small Modular Reactors developing a new methodology
16 kind of making the technology neutral frame work also
17 --

18 MR. HUDSON: That's right.

19 ACTING CHAIR BLEY: -- had opened that
20 area.

21 MEMBER CORRADINI: Okay. Now I get your
22 point.

23 MEMBER CORRADINI: And so maybe this is
24 the point to ask the question, but you don't have to
25 answer it here. Which is, okay. So, where is PRA --

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1 Level 3 PRAs not useful? Where is the limit that you
2 don't venture because the uncertainty is large enough
3 you might as well not go there because the answer is
4 here and the uncertainty of the answer is there? Is
5 that part of this is to decide where it's not
6 appropriate?

7 MR. HUDSON: I think that could certainly
8 be an incite that we gain by doing the study.

9 MEMBER CORRADINI: Because if you stick
10 with current Light Water Reactors not SMRs, I would
11 think we're all probably going to say, yes, totally
12 appropriate. But I'm trying to decide, because the
13 SMR is the first thing that pops in my head that
14 somebody would say, well, let's go do one. And my
15 thought is, well, fine. As long as you show me the
16 failure rates of some of the unusual components you're
17 starting to use and I don't know what the answer to
18 that is. And if the whole result depends on that, how
19 useful is the PRA?

20 MR. HUDSON: Right.

21 MR. STUTZKE: One of the things that we
22 will do in this is a complete propagation of
23 uncertainty from the initiator out to the
24 consequences. At least that's what's envisioned here
25 to ge ta feel for --

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1 MR. HUDSON: Okay.

2 MR. STUTZKE: -- what it is.

3 MEMBER CORRADINI: Within the context of
4 the current LWR?

5 MR. STUTZKE: Right.

6 MEMBER CORRADINI: Okay.

7 MR. STUTZKE: One of the other things I
8 would point is as you well know, we use risk
9 surrogates now like court hammered frequency in larger
10 release frequency and some of the reasons why those
11 are done is because of concerns about uncertainty in
12 the Level 3 space. Okay.

13 ACTING CHAIR BLEY: Of you're going to
14 take that on.

15 MR. STUTZKE: Yes. And, in fact, you
16 know, this might even come up with new risk
17 surrogates.

18 CONSULTANT KRESS: Those surrogates also
19 give you a way to characterize design without having
20 a site.

21 MR. STUTZKE: Yes.

22 CONSULTANT KRESS: But in order to get the
23 appropriate surrogate, you kind of have to look at a
24 bunch of sites.

25 MR. STUTZKE: I agree.

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1 CONSULTANT KRESS: You intend to maybe
2 recalibrate those surrogates like LERF and LRF --
3 well, CDF you don't have to, but LERF and LRF?

4 MR. STUTZKE: Yes. That's all on the
5 table. Whether it would actually be done as part of
6 the study or we would be building a tool. --

7 CONSULTANT KRESS: But you'd have the
8 ability to do it.

9 MR. STUTZKE: That's the intention. We'd
10 look at a broad range of Level 3 types of result and
11 not just fixate on Level 3 types of results and not
12 fixate on early fatality risk or --

13 CONSULTANT KRESS: Yes, my impression is
14 that LERF as a --

15 MR. STUTZKE: I know where you're going on
16 this.

17 CONSULTANT KRESS: The factor is Level 10
18 if you're looking at early fatalities.

19 MR. STUTZKE: Yes.

20 CONSULTANT KRESS: Depending on the site,
21 of course.

22 MR. HUDSON: Okay. All right.

23 Slide 8 is, again, it's a background slide
24 meant to provide some of the historical perspective
25 that sheds some light on the evolution of PRA and

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1 risk-informed regulation.

2 The intent of the first bullet is to
3 illustrate that the NRC and the Atomic Energy
4 Commission before the NRC had set a precedent for
5 periodically sponsoring studies to obtain updated
6 estimates of risk as the PRA technology had evolved
7 and as we acquired more operating experience with the
8 nuclear power plants.

9 MR. COE: Have you gone back and read WASH
10 740?

11 MR. HUDSON: I've taken a look at some of
12 the specific sections of WASH-740.

13 MR. COE: Including a risk -- as something
14 that looked at risk is a bit of a stretch.

15 MEMBER CORRADINI: Well, it was a bounding
16 calculation.

17 MR. HUDSON: That's --

18 ACTING CHAIR BLEY: It was an extreme
19 calculation and an estimate of no where for the
20 likelihood of it happening.

21 MEMBER CORRADINI: It led to Price-
22 Anderson.

23 ACTING CHAIR BLEY: And eventually it led
24 to WASH-1400.

25 MEMBER CORRADINI: But testimony from the

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1 Edison Electric Institute shows that it led for sure
2 to Price-Anderson.

3 MR. HUDSON: I'm sorry. I was used
4 certainly to inform the deliberation of the Price-
5 Anderson Act. It was a conservative study. And an
6 important distinction here. It's lumped under this
7 category of studies estimating risk, but really WASH
8 740 was a consequence study that examined three
9 different scenarios. And we really didn't transition
10 into the use of PRA technology until the Reactor
11 Safety Study or WASH 1400 which was motivated by an
12 update to the Price-Anderson Act.

13 MEMBER CORRADINI: And I was going to say,
14 Dennis is probably right. Probably the 25-year --
15 this 25-year comparison would be the '82 sighting
16 study. That's probably the close analogue to the 57.

17 ACTING CHAIR BLEY: Yes, perhaps. Yes.

18 MR. HUDSON: So, WASH 740 wasn't a risk
19 study, although I think they did have some discussion
20 in there about the probability of the reactor accident
21 somewhere in the neighborhood of 1 in 100,000 to 1 in
22 a billion.

23 ACTING CHAIR BLEY: I remember the 1 in a
24 million being in there but --

25 MR. HUDSON: I didn't put that in, I'm

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1 sorry. But what's important here is WASH 1400 and
2 NUREG 1150 were Level 3 PRA studies and as you can see
3 NUREG 1150 was motivated by obviously the Three Mile
4 Island accident. And a significant criticism of the
5 WASH 1400 study in that it didn't appropriately treat
6 or discuss the potential uncertainties associated but
7 the estimates that were obtained there.

8 So, again, as the PRA technology evolved
9 and we gained more operating experience and in the
10 wake of Three Mile Island, the NRC initiated a follow-
11 on study to update WASH 1400. And you can envision
12 now after 20 years has passed since the publication of
13 NUREG 1150 where again, you know, taking a look at the
14 possibility of updating that study because there have
15 been significant advances.

16 A Safety Goal Policy Statement was issued
17 in 1986 by the Commission to address one of those
18 long-standing questions. We had some previous PRA
19 studies that obtained some estimates of risk, but
20 there was this lingering question about what do we do
21 with those figures? How safe is safe enough? And
22 when do we need to take action? So, that policy
23 statement was issued to determine what level of risk
24 was acceptable to the public for nuclear power plant
25 operations. And so as you know, the Commission

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1 identified two qualitative safety goals that were
2 supported by two quantitative health objectives
3 related to prompt fatality risk and latent cancer
4 fatality risk.

5 CONSULTANT KRESS: Is there a need for an
6 additional one you think? You knew I was going to say
7 that. Another safety goal of societal risk in view of
8 the Fukushima stuff. Looks like it's all society
9 risk, not individual.

10 MR. STUTZKE: It may well be. You know,
11 we have some efforts afoot now to do some things in
12 spent fuel outside of risk study like that. And one
13 of the things that's come up is the realization that
14 the risk may well be a land contamination issue.

15 CONSULTANT KRESS: Things like that.

16 MR. STUTZKE: Not really a public health
17 risk. Well, that's a different metric and you don't
18 know how to think about it too well.

19 CONSULTANT KRESS: Well, when you put it
20 all in dollars. That's the other metric in common
21 with those societal risk. But we're glad you're
22 thinking about it.

23 ACTING CHAIR BLEY: Dan, there's a little
24 bit of revisionist history that --

25 MEMBER CORRADINI: A little?

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1 ACTING CHAIR BLEY: Well, 1150 wasn't done
2 because of the issue of uncertainty. 1150 came out of
3 another project. Did you know the ASEP project or
4 talked to anybody who was involved in that?

5 MR. HUDSON: I'm not directly familiar
6 with it.

7 MEMBER CORRADINI: There was a couple of
8 projects. The Containment Loads Working Group on Level
9 2 and Level 3 side was going on early in the '80s too.

10 ACTING CHAIR BLEY: And that fed it, but
11 this one was actually a review meeting on ASEP that
12 out of which came 1150. And ASEP had tried to break
13 the plant up into a lot of little pieces. You know,
14 this hunk of Auxiliary Feedwater System. And then
15 they thought out of all these pieces you could put
16 together a PRA for any plant. And after years of
17 fighting it and running into the problem that cooling
18 water systems and electric power were unique. And
19 that overwhelmed everything else and you couldn't get
20 away with that. Somebody said, well, what can we do?
21 And why not do a nuclear PRA and it came from and then
22 they brought in the consequence stuff as well.

23 MEMBER CORRADINI: And the fact that they
24 at the time --

25 ACTING CHAIR BLEY: They addressed --

1 MEMBER CORRADINI: Containments because
2 this was essentially the first time you look at --
3 yes. Pick one of each of the source.

4 So, we were saying -- I haven't reach your
5 SECY paper in detail so I assume that the summary here
6 doesn't reflect -- because we want to make sure the
7 Commissions are properly historically tutored.

8 MR. HUDSON: What you'll see in terms of
9 the main body of the SECY paper, there's only a
10 paragraph that has this historical perspective and
11 doesn't really provide a lot of the detail in terms of
12 what led to what. The enclosure on the other hand
13 that come with it is intended to provide some of that
14 historical perspective. So, if that is in any way
15 inaccurate, we'll need to update that.

16 ACTING CHAIR BLEY: I was trying to
17 remember who was on staff back then. The people who
18 managed it have all retired. And the people who
19 started it I think are all retired. But Mary Drouin
20 was working under contract to Sandia to manage some of
21 the work that was done in 1150. And probably
22 remembers that history pretty well and she was
23 involved in that ASEP as well. So, there aren't many
24 others who were here and are still here, I think.

25 MR. HUDSON: Okay.

1 ACTING CHAIR BLEY: She wasn't here at the
2 time.

3 MEMBER CORRADINI: About the only one that
4 I can think of on the industry side that would
5 probably give you, I think, don't know about fair, but
6 I would say a pretty broad picture is Ian Wall at
7 EPRI.

8 ACTING CHAIR BLEY: He wasn't much
9 involved in the 1150.

10 MR. HUDSON: Raj Sehgal was the other one
11 that --

12 ACTING CHAIR BLEY: But I do think if you
13 are going to provide, I mean, this is a side note. If
14 you're going to provide the Commission with a
15 background, I think you want to make sure the
16 background accurately reflects those that were
17 involved in it and drove it.

18 MEMBER CORRADINI: I'm trying to think who
19 left but Mary and I don't know anybody.

20 ACTING CHAIR BLEY: And she wasn't here on
21 stuff. You know, Joe Murphy was kind of the -- Bill
22 Murphy was probably the key one.

23 The key guy here and there were several
24 others but I think they're all retired.

25 MEMBER CORRADINI: Mark Cunningham would

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1 know but I think Joe was the key --

2 MR. HUDSON: Mark wasn't as heavily
3 involved as I recall except. He was managing some of
4 it so, yes, Mark is a good one to fill in some
5 history.

6 MR. HUDSON: Mark is retired now but I
7 think he's working on the task force.

8 ACTING CHAIR BLEY: Yes. Well, he's not
9 here anymore, but he is sort of here. I'm sorry, Dan.
10 I agree with Mike. I think getting that story as
11 straight as you can is probably useful.

12 MR. HUDSON: I appreciate that insight.
13 Obviously, the documents that I've read didn't provide
14 that perspective and so --

15 MEMBER CORRADINI: And just to make Tom's
16 point and I'm sorry to actually support Tom on this.
17 The '57 study did -- tried to essentially estimate the
18 societal risk.

19 ACTING CHAIR BLEY: Well --

20 MEMBER CORRADINI: In a very crude way.

21 ACTING CHAIR BLEY: It did a couple of
22 things. Whoever said it was a consequence study is
23 right.

24 MEMBER CORRADINI: It was.

25 ACTING CHAIR BLEY: It put together some

1 mutually exclusive impossible scenarios and I'd have
2 to go back and look at the details. But part of it
3 was where the core was. There were assumptions about
4 where it was and contradicting each other. So, it was
5 a real bounding consequence study. And then there was
6 a sentence or two that hinted at how likely it was but
7 we didn't know how to really come to grips with that.

8 MEMBER CORRADINI: And I'm trying to
9 remember if the citing study in '82 from Sandia also
10 do societal risk and internal land contamination?

11 CONSULTANT KRESS: I don't remember.

12 ACTING CHAIR BLEY: I can't remember for
13 sure.

14 CONSULTANT KRESS: I don't think so.

15 MEMBER CORRADINI: But I knew it was in
16 their purview but I think when Aldrich finished I
17 think it wasn't in the final Sand report as far as I
18 remember.

19 CONSULTANT KRESS: That part is, if you're
20 going to use something like MACCS, the capability is
21 already there. They already calculate these things.
22 And it's not that much of a step to include it I don't
23 think.

24 MR. STUTZKE: No, I agree. We'll turn
25 them on and see what we get.

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1 ACTING CHAIR BLEY: It's hard to say.
2 You've got so much you'll never get finished.

3 MR. HUDSON: That's quite all right.
4 That's why we have four hours, I think allotted for
5 today.

6 MEMBER CORRADINI: Don, you should push
7 this though.

8 CONSULTANT KRESS: If you are looking for
9 names on NUREG 1150, when I was part of that, I was
10 working for Mel Silverberg and Mike Jankowski who are
11 both retired and gone from --

12 MEMBER CORRADINI: The only other person
13 that pops in my head that I think is still back on
14 staff is Rick Sherry. Rick was intimately involved in
15 the Containment Wells Working Group part of it.

16 ACTING CHAIR BLEY: Is he still here?

17 MEMBER CORRADINI: I saw him upstairs once
18 when research was upstairs a few months ago.

19 ACTING CHAIR BLEY: Yes, he was a key guy
20 in getting that started, yes. That's right.

21 MEMBER SHACK: Yes, the Strip report 2723
22 is Estimates of Financial Consequences of Nuclear
23 Power Accidents. 1982.

24 CONSULTANT KRESS: That is the societal
25 reign. And that's --

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1 MEMBER SHACK: Right. Within that fall is
2 the sighting study, but this was the one that turned
3 the siding study into bucks.

4 MR. HUDSON: Okay. We mentioned the
5 safety goal policy statement on here because most of
6 the current PRAs out there are Level 1, Level 2 --
7 limited Level 2 PRAs and if we want to make a direct
8 comparison to these quantitative health objectives, we
9 need to do a Level 3 PRA that estimates the, you know,
10 prompt fatality risk and latent cancer fatality risk
11 metrics.

12 Generic Letter 88-20, this is what was
13 issued by the NRC and prompted the individual plant
14 examination program. It's significant in that it
15 directly contributed to the development of PRA
16 expertise and capability throughout the industry and
17 provided some good incites into the plant-specific
18 vulnerabilities that existed. And a lot of the work
19 that we've done today in terms of the SPAR models and
20 especially the SPAR models that have addressed the
21 external initiators are based on some of the work that
22 was done during the IPE program.

23 ACTING CHAIR BLEY: By the way they kept
24 the acronym but they changed what the letters stood
25 for on the -- they started this integrated land

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1 examination.

2 MR. HUDSON: Is that right?

3 ACTING CHAIR BLEY: Yes.

4 MR. HUDSON: So, as a result of the
5 evolution of PRA and the confidence that the NRC had
6 in the industry's capability in terms of using PRA
7 results and risk insights, the Commission issued in
8 1995 the PRA Policy Statement which effectively
9 introduced what we now know as the risk-informed
10 regulatory framework. Some of the major statements
11 that are included there are summarized on the slide.

12 Now, we talked a little bit already today
13 about the use of CDF and LERF and as you know, Reg
14 Guide 1.174 is where we implemented the use of
15 subsidiary numerical objectives based on CDF and LERF
16 service surrogates for their safety goal quantitative
17 health objectives. So, it's quite a significant role
18 in how we conduct risk-informed regulation today.

19 Now, Slide 3 we talked about what it is
20 we're trying to achieve. We've already alluded to
21 this throughout our discussion today but why are we
22 pursuing this? And the first thing I'll talk about is
23 as with any PRA, the NUREG 1150 PRAs had a number of
24 limitations associated with their skill. Those PRAs
25 did not evaluate accidents involving multiple units,

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1 spent fuel. Although the NUREG 1150 study didn't
2 examine accidents occurring in low-power shutdown
3 conditions, there was a follow-on study for the Surry
4 and Grand Gulf plants that examined both power
5 shutdown risk. And as you probably know, the NUREG
6 1150 PRAs were primarily taking a look at internal
7 initiated events although they did examine the fire
8 and seismic initiators for a few of the plants that
9 were analyzed.

10 MEMBER CORRADINI: Which two are those?
11 Was it Surry and Peach Bottom?

12 MR. HUDSON: Surry and Peach Bottom, yes.

13 MEMBER CORRADINI: Okay.

14 MR. STUTZKE: But even then when they did
15 the Level 3 calculations for like seismic kits and
16 contractor report, but it's not in the main Reg 1150.

17 ACTING CHAIR BLEY: Oh, I didn't remember
18 that.

19 MEMBER CORRADINI: So, it's when they did
20 the seismic they essentially just changed the plant
21 damage date and then looked at the evolution of the
22 accident. Is that basically --

23 MR. STUTZKE: Yes. In fact, Chapter 1 of
24 1150 has a page of explanation why the seismic Level
25 3 is not there. And the issue was, you know, when you

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1 look at things like safety goals and it says percent
2 of something. Percent of what? What would it be?
3 All accident fatalities or only those created by the
4 seismic event and issues like that. And I certainly
5 won't comment on that.

6 ACTING CHAIR BLEY: So are you just
7 ignoring that as you move forward?

8 MR. STUTZKE: I just want to calculate
9 what the answer is and --

10 ACTING CHAIR BLEY: Thanks.

11 MR. STUTZKE: And let the bigger minds
12 decide whether it's relevant.

13 MR. HUDSON: Now, in addition to some of
14 the limitations associated with the NUREG 1150 PRAs,
15 we've talked about the fact that in the 20 years that
16 have passed since the study was completed and
17 published, there have been a number of advances that
18 we should be considering.

19 First would be some of the modifications
20 that have been made to enhance the safety and security
21 of nuclear power plants. This came in the say of
22 implementing risk-informed regulations such as the
23 Station Blackout Rule, the Maintenance Rule. More
24 recently we're talking about NFPA 805 transition.

25 In addition to that, we've conducted, you

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1 know, years of research that has expanded our
2 understanding of severe accident phenomenology and
3 you've seen the evolution of PRA methods, models,
4 tools and data that has occurred as we've also
5 acquired more operating experience.

6 Finally, more recently as you might be
7 aware and Marty's intimately familiar with this is the
8 issue associated with Generic Issue 199. And the
9 updated seismic hazard estimates that we've obtained.

10 So, based on all these considerations,
11 during a February 2010 Commission briefing on the
12 research program performance and future plans, the
13 staff communicated to the Commission that we believe
14 that the time is right for proceeding with new Level
15 3 PRA activities. And in response to that Commission
16 briefing, the Commission issued the Staff Requirements
17 Memorandum that you see here. And in that SRM the
18 Commission expressed conditional support for new Level
19 3 PRA activities and directed us to continue our
20 internal coordination efforts and to engage external
21 stakeholders in formulating a plan and scope for
22 future actions. And ultimately directed us to provide
23 the Commission with various options for proceeding
24 which include cost and perspectives on future uses for
25 Level 3 PRAs.

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1 In response to this Commission tasking and
2 to optimize cost benefit considerations by focusing
3 NRC resources, the staff developed the approach that
4 you see on this slide. We began with a Scoping Study
5 in April of 2010. And the Scoping Study will conclude
6 upon the submission of a notation vote SECY paper in
7 the July time frame to the Commission.

8 After the Scoping Study, pending
9 Commission direction after they review the notation
10 vote SECY paper, we would intend to proceed with
11 whatever option is ultimately selected in the SECY
12 paper. And then finally once at the completion of
13 that option, whichever one it is, there will be some
14 follow-on activities as directed.

15 Based on our Commission tasking, the staff
16 identified a number of objectives for the Scoping
17 Study that you see on the slide before you. The first
18 was to identify potential future uses for Level 3
19 PRAs. The second was to develop various options for
20 proceeding. And in developing those options, we
21 wanted to consider the possible scope of the analysis,
22 PRA technology that could be used, site selection
23 attributes are considerations and resource estimates.

24 After we developed those options, we
25 wanted to determine the feasibility of the developed

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1 options and as I mentioned earlier, what you see in
2 the paper now are the ones that were determined to be
3 the most feasible.

4 We also wanted to if possible identify a
5 staff recommendation for proceeding. Obviously, one
6 option would be to just develop the options, put them
7 in the paper and let the Commission decide. But if
8 internally among the staff we were able to come to
9 some agreement upon which option we recommend for
10 proceeding, we would do that.

11 And then finally, we wanted to engage
12 external stakeholders to obtain their views on the
13 developed options and our approach and to ultimately
14 obtain their support for the direction that we were
15 heading in.

16 Throughout the Scoping Study we've
17 participated in a variety of internal coordination and
18 external stakeholder engagement activities. During
19 the internal coordination activities, there have been
20 a variety of brainstorming workshops, coordination
21 meetings where we interfaced with some of the program
22 offices to better understand the implications of this
23 effort on the work that we're doing now. And then
24 finally some alignment meetings that will continue to
25 occur between now and ultimately the submission of the

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1 paper.

2 MEMBER CORRADINI: What an alignment?

3 MR. HUDSON: An alignment meeting it's a
4 meeting to insure that we're in agreement on what the
5 key message is and the direction that we're heading
6 into this.

7 MEMBER CORRADINI: Is this a polite way of
8 saying you formed the outline of the SECY paper and
9 the report and you keep on revisiting it to make sure
10 everybody's on board?

11 MR. HUDSON: Everybody's on board with the
12 key messages that we're putting together. Yes.

13 It's not necessarily meant to mean that
14 we're achieving consensus because there is possibility
15 for some different views. And if there are, those
16 would be, you know, documented.

17 MR. STUTZKE: It's really an effort to try
18 to expedite the consensus once we formally issue the
19 paper.

20 MEMBER CORRADINI: Since I'm not familiar
21 with the staff's approach, this is a typical internal
22 coordination activity approach?

23 MR. HUDSON: It is. And it's been more
24 formalized I think within the past year. There was a
25 Lean Six Sigma effort that was done to try to make the

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1 SECY paper development process more efficient. So,
2 this was really implemented to try to expedite and
3 have a more efficient concurrence process when we send
4 the paper out to the program offices for their review
5 and to make sure that they sign off on the paper.
6 This is intended to make that process more efficient.

7 MEMBER CORRADINI: But, I'm sorry to dwell
8 on this, but it's a process I'm trying to understand.

9 So, this is basically to make sure all
10 those that are contributing to the report are on the
11 same page. And if they're not on the same page,
12 document why they aren't on the same page. And then
13 it goes through concurrence and that's a different
14 process than the workshop meeting?

15 MR. HUDSON: It's a different process but
16 related. The intent of this alignment phase is to
17 make the concurrence process more efficient.

18 MEMBER CORRADINI: Okay. Fine.

19 MR. HUDSON: And just to be clear, when
20 you're holding an alignment meeting it's not
21 necessarily with people that are just directly
22 contributing to the paper. We want to include the
23 people that aren't necessarily directly contributing
24 to it, but because they're going to be impacted in
25 some way by the work that we're proposing, the

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1 resources that are tied to that, we want to insure
2 that they review the paper and are in basic agreement
3 with the approach that we're using and what we intend
4 to use it for.

5 MEMBER CORRADINI: I would ask more but
6 that's fine.

7 MR. HUDSON: In the form of external
8 stakeholder engagement activities, we've obviously
9 interacted with the ACRS. Back in the November time
10 frame was our first meeting. This is our follow up of
11 the Subcommittee and we'll be meeting with the full
12 Committee during the June 8 through 10 meeting
13 session.

14 We've also engaged with external
15 stakeholders by way of poster presentations and
16 presentations during technical sessions at the
17 Regulatory Information Conference. It was done both
18 in 2010 and in 2011. And more recently on April 11th,
19 we held a Category 2 public meeting at the Church
20 Street Building with a variety of stakeholders. We
21 specifically invited NEI, the Union of Concerned
22 Scientists and EPRI to participate. But we also had
23 representatives from various industry and research
24 organizations.

25 MEMBER SHACK: Is there a transcript of

1 that meeting? I couldn't find one.

2 MR. HUDSON: There's not a transcript but
3 there is going to be a meeting summary that will be
4 posted within 30 working days of the meeting so it's
5 going to be coming up here within the next, you know,
6 week or two.

7 MEMBER CORRADINI: And what is a Category
8 2 meeting? I don't think I understand what that is.

9 MR. HUDSON: So, we have three different
10 categories of public meetings. And the distinction
11 between them is really based on the expected level of
12 participation of the public.

13 In a Category Meeting that's primarily
14 related to licensing regulatory type issues with one
15 of the licensees. There's not a whole lot of public
16 participation there.

17 MEMBER CORRADINI: Meaning that they can
18 attend, listen, but they don't speak?

19 MR. HUDSON: Exactly.

20 MEMBER CORRADINI: Okay.

21 MR. HUDSON: In a Category 2 Public
22 Meeting there is going to be more public
23 participation but it's in an more structured setting.
24 You anticipate that they're going to be able to
25 provide some feedback there, but it's going to be at

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1 specific points in time. It's not kind of an open
2 discussion where we're really trying to have a free
3 exchange of ideas which is more the intent of a
4 Category 3 type meeting which would be like a workshop
5 type setting where we're really trying to have an open
6 sharing of ideas of the public.

7 MEMBER CORRADINI: So, in a Category 2
8 Meeting at the end of each morning or afternoon
9 session you would have a public forum or a set of
10 allowable public comments?

11 MR. HUDSON: That could be done. Or in
12 the case of this one, we just had specific points
13 throughout a presentation where we would invite
14 comment or questions.

15 MEMBER CORRADINI: Fine. Fine.

16 ACTING CHAIR BLEY: In the meeting you had
17 with the invited participants, did you get any
18 surprises? Were people pretty much in agreement with
19 where you're headed or what kind of things did you
20 hear?

21 MR. HUDSON: I don't think we were
22 necessarily surprised by any of the feedback that we
23 got.

24 ACTING CHAIR BLEY: Marty wouldn't be
25 surprised by anything, right? Maybe I phrased that

1 wrong.

2 MR. STUTZKE: I've been doing this too
3 long.

4 MEMBER CORRADINI: It takes too much to
5 shock you, is that you're point?

6 MR. STUTZKE: Well, I would say people in
7 general were in good agreement, even Dr. Lyman from
8 the Union of Concerned Scientists because, you know,
9 as you understand the scope we're proposing here, we
10 haven't really left out a great deal, you know. It's
11 all there and that's hard to disagree with. What you
12 disagree on is how are you going to do it in the time
13 frame that you propose to do it or what technical
14 methodologies are you going to use and those sorts of
15 things.

16 MEMBER CORRADINI: Was that brought up in
17 the public comment parts?

18 MR. HUDSON: That feedback was certainly
19 provided in there. Just as a note, I did provide a
20 few slides towards the end here where we try to
21 summarize some of the comments that we received from
22 stakeholders.

23 MEMBER REMPE: But before you leave us,
24 you mentioned the types of organizations. Can you
25 even go a little bit further and cite some of the

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1 organizations that attended?

2 MR. HUDSON: I talked about NEI, EPRI and
3 UCS that were there. I think we had an AREVA
4 representative.

5 MR. STUTZKE: Westinghouse.

6 MR. HUDSON: I'm sorry?

7 MR. STUTZKE: Westinghouse.

8 MR. HUDSON: Westinghouse, that's right.
9 We had some media that were there.

10 MEMBER REMPE: Okay. Utilities, National
11 Labs, anything like that?

12 MR. HUDSON: I don't think we had any
13 National Lab participants there. I think -- I don't
14 even recall specific utilities that were represented
15 there either.

16 With the meeting summary that's going to
17 be posted within the next couple of weeks, you'll get
18 to see the different organizations that were
19 represented there.

20 Again, one of the objectives of the
21 Scoping Study was to develop different perspectives on
22 future uses for Level 3 PRAs. In doing so, a natural
23 starting point for us was to evaluate the different
24 ways in which the results and incites from the NUREG
25 1150 PRAs were used. And in that way we developed the

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1 high-level potential future uses that you see on this
2 slide. Use future Level 3 PRAs for supporting
3 potential regulatory decision-making such as assessing
4 the policy and decision-making implications associated
5 with using CDF and LERF as surrogate risk metrics.
6 Another one would be to update regulatory requirements
7 and guidance that was developed using the NUREG 1150
8 results. And a solid example of that that we've seen
9 brought up in our interactions with various
10 stakeholders is the regulatory analysis guidelines and
11 how it might be a good time to update those.

12 We also envision the future Level 3 PRAs
13 providing support for specific risk-informed
14 regulatory applications such as focusing the NRC's
15 inspection program or developing the technical basis
16 for risk-informing emergency preparedness.

17 MEMBER CORRADINI: Maybe this is the wrong
18 place to ask this question but is there a
19 technological analogue in other industries that you
20 can compare it to? In other words, if I went to the
21 chemical industry, the aeronautical industry, any sort
22 of industry that they do whether the regulatory agency
23 that watches over them worries about it or not, they
24 do an equivalent PRA or hazard analysis that looks at
25 essentially the consequences thereof for the, we'll

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1 say the low probability/high consequence events?

2 Where I'm going with this is, I'm kind of
3 curious if they have societal -- they have metrics,
4 they have surrogates that one can learn about or use
5 or are we just -- is this energy just different and
6 nobody else cares to even look at this?

7 MR. HUDSON: That's a good question worth
8 looking into, I think. I know that EPA is using
9 public risk assessment techniques to inform their
10 regulatory activities. In fact, I think they have a
11 lot of risk-based regulations, not just risk informed.
12 So, I think you're right in that we could have some
13 valuable lessons to learn there.

14 MEMBER CORRADINI: I mean, I really don't
15 know of any. Before I asked the question, I started
16 thinking where could I see these? And I don't know of
17 any.

18 ACTING CHAIR BLEY: Before -- oh, I'm
19 sorry.

20 MR. COE: And this is Doug Coe at the
21 Office of Research. The best example is NASA. We
22 have a very close working relationship with NASA and
23 we share a lot of technology, including some of the
24 PRA tools that we've developed they utilize in terms
25 of creating their own models for assessing the risk of

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1 shuttle launches.

2 MEMBER CORRADINI: So, there's nothing in
3 the commercial industry that exists?

4 ACTING CHAIR BLEY: That is not true.

5 MEMBER CORRADINI: Or nothing is public.

6 ACTING CHAIR BLEY: In the chemical
7 industry there's a number of organizations who do this
8 routinely. Much of that is proprietary and they don't
9 let it out of their company. But there's quite a bit
10 of it going on.

11 The Army's chemical weapons program,
12 chemical weapons destruction program been doing PRA
13 for 15 years or more.

14 MEMBER CORRADINI: Ten or fifty?

15 ACTING CHAIR BLEY: Fifteen. Fifteen,
16 since they've been trying to close down those
17 facilities.

18 MEMBER CORRADINI: Stuff out of Utah, Doug

19 --

20 ACTING CHAIR BLEY: That's one of the six
21 sites, yes.

22 MEMBER CORRADINI: Well, the reason I'm
23 asking is, since Dr. Kress is not going to give up on
24 this societal risk and you mentioned looking at other
25 surrogates, it strikes me that it would be useful to

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1 start asking the question. What are other surrogates
2 that from an analogue standpoint, from an analogy
3 standpoint are out there and how do they map into the
4 things you're currently using or you could use? And
5 if you have to go to industries where you have to sign
6 proprietary agreements, Non-Disclosure Agreements so
7 you can look at this, to use some idea, I think it
8 would be very valuable because it just strikes me that
9 this industry is not singular in this. It's got to be
10 out there and you need to look at it as best you can.

11 I'm assuming you're well versed in what
12 other countries are using in the nuclear field in
13 terms of their surrogates?

14 MR. STUTZKE: Yes, most countries pick up
15 what we already use CDF.

16 MEMBER CORRADINI: But there is nothing
17 else that's out there.

18 MR. STUTZKE: For full Level 3's.

19 MEMBER CORRADINI: For example, if I asked
20 Dr. Kress' question, is any other country looking at
21 land contamination or dollars of damage.

22 CONSULTANT KRESS: Yes, they do.

23 MEMBER CORRADINI: Are there other
24 countries that do that?

25 CONSULTANT KRESS: It's because of copied

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1 our codes using the same models.

2 MEMBER CORRADINI: But they're asking
3 those questions and looking at the results of that.

4 MR. COE: We have been in dialogue with
5 France recently regarding their interest in cost
6 benefit evaluations that are analogous to our
7 regulatory analysis guidelines for backfitting. And
8 so there's some interest on their part in learning
9 from us and we're interested in what they're doing.

10 MEMBER CORRADINI: Well, the only reason
11 I asked. I mean, I was thinking of France because
12 there was a statement by Commissioner -- I can't
13 remember. I guess it's High Commissioner Bigot about
14 risk following the accident and he still maintained
15 based on apparently some sort of risk, cost benefit
16 analysis they've done relative to other fuel sources
17 and a question of fuel switching even within France
18 going forward. So, I was thinking that somebody is
19 thinking about this in an international vein. So,
20 okay.

21 MR. HUDSON: Thank you.

22 Some other potential future uses are as
23 you see in the third bullet there, to provide a
24 technical basis for supporting the resolution of
25 issues associated with future reactor designs. An

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1 example of this might be the multi-unit sighting
2 issue. Just like the NUREG 1150 PRAs we would
3 envision future Level 3 PRAs being used to prioritize
4 safety research programs to either reduce risk or to
5 reduce key sources of uncertainty.

6 And finally, we would envision using 21st
7 century technology to document the results and
8 assumptions that are associated with the new PRA
9 models to support knowledge management.

10 ACTING CHAIR BLEY: Your third bullet
11 makes me bring out that NRAs been here telling us
12 about what they're planning to do in terms of
13 methodology development for looking at some of the new
14 designs in a fairly long-term way. Are you
15 interacting closely with them in that area?

16 MR. HUDSON: We've certainly had
17 discussions with them about this. I think because of
18 the time frame that we're dealing with, there's not an
19 immediate interest in using the, you know, potential
20 Level 3 PRA that we're talking about in Option 3 here
21 for some of those applications. Now, we include this
22 as a bullet in here because what the Commission wanted
23 was perspectives on future uses for future Level 3
24 PRAs in general and not necessarily one that we might
25 be doing as a result of this initiative.

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1 MEMBER CORRADINI: Unless you are going to
2 come back -- are you going to come back to the future
3 reactor designs later then I'll just wait?

4 MR. HUDSON: I don't think we're going to
5 be talking much about that again.

6 MEMBER CORRADINI: So, just let me ask the
7 question this way. So, if you were to do -- how would
8 I frame this? With the new reactor designs, and let's
9 just take the SMRs, the Smaller Light Water Reactors
10 and then you could go on to the Gas-Cooled Reactor.
11 And then you would go on to eventually a Faster Burner
12 Reactor. You couldn't do the detailed Level 3 that
13 you're doing here. You'd have to do something
14 equivalent to almost a WASH-1400-like analysis.

15 So, what if you were to say I wanted to
16 turn back time to 1972 and redo WASH-1400 in a
17 simplified Level 3, would it be a useful exercise to
18 say, I would now re-benchmark how I would simplify the
19 Level 3 PRA in a fashion where I don't have all the
20 codes. I don't have all the stuff but I still have to
21 do it in some simplified manner and then take that
22 model to move it forward for the small modular
23 reactor, the gas-cooled reactor and the beyond.

24 And the reason I'm asking that question
25 is, when I see this presented relative to the SMRs and

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1 the NGNP, I hear that they're going to take the
2 current technology and apply it. In my mind, at least
3 maybe I'm the only one, I don't see that's possible
4 because all the details aren't there. Rather, I'm
5 almost back in 1972 space and I would expect I would
6 take the methodology here, simplify it and then take
7 the simplified approach and apply it rather than the
8 complex approach because I'm not sure what the
9 complexity buys you in these advanced designs, since
10 I don't know the design. I don't know the failure
11 rates. I don't know any of this stuff to the extent
12 that -- do you understand what I'm asking?

13 MR. HUDSON: I do and the very issues that
14 you're bringing up is why we're not proposing to do a
15 Level 3 PRA right now with one of those designs.

16 MEMBER CORRADINI: But eventually somebody
17 is going to ask to do some part of it and I'm thinking
18 to use your experience going back in time as a method
19 of benchmarking it.

20 In other words, I'll pick an example. The
21 example is MELCOR. MELCOR now is fairly complicated.
22 Are you really doing to use a complicated MELCOR
23 analysis to look at NGNP when eventually somebody is
24 going to do it somewhere? I can almost venture a
25 guess when you don't even understand the details of

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1 it. Rather than to simplify it to the point that you
2 might have simplified back in WASH-1400 space and then
3 take it forward? My point is, the modeling of these
4 systems requires some thoughtfulness to it rather than
5 just taking what you got now and changing the
6 materials and changing this and that and then hitting
7 the go button, if you see where I'm going?

8 MR. HUDSON: Yes.

9 MEMBER CORRADINI: Okay. All right.

10 That's my worry because I hear this said to us for the
11 future reactor designs, whether it be the whole Level
12 3 or pieces that fit into a Level 3.

13 ACTING CHAIR BLEY: I am a little nervous
14 about the way you're talking.

15 MEMBER CORRADINI: Somebody noticed. That
16 was my intent.

17 ACTING CHAIR BLEY: I'm probably, you
18 know, going back to where we were was a state with
19 less knowledge than they have now. And starting with
20 the knowledge we currently have and on some of the
21 designs you don't have all the details and then being
22 a simplified methodology that's looking at things we
23 can do kind of makes sense.

24 MEMBER CORRADINI: But then how would you
25 test that invented simplified methodology. The only

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1 way to test it would be to go back and re-analyze in
2 a WASH-14 -- it seems to me you'd have to almost look
3 at what you've done before in a simplified fashion and
4 see -- in other words. You want to simplify,
5 simplify, simplify on something that you have a
6 benchmark. I'm back to the benchmarking part of this
7 which bothers me. If I launch off into a new design,
8 how do I benchmark what I just launched off into? How
9 do I know it's even close to right unless I do some
10 sort of simplified analysis and I can compare, so
11 that's the part that I'm getting at is the
12 benchmarking of it.

13 ACTING CHAIR BLEY: I think we got to go
14 on here, but I think that's worthy of some real
15 thought.

16 Go ahead.

17 MR. HUDSON: Okay. So through our Scoping
18 Study activities, the staff ultimately developed three
19 different options for proceeding as you likely saw in
20 the paper. They're summarized here and we'll be
21 talking about each of them in more detail in the
22 following slides.

23 The first option was to put it quite
24 simply to maintain the status quo and what that means
25 is we want to continue the evolutionary development of

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1 risk tools to improve upon our existing capability on
2 a resource-available basis.

3 Now, to be clear in the slides that you're
4 going to see where we talk about advantages and
5 disadvantages, what we're really talking about are the
6 relative advantages and disadvantages with looking at
7 the options. They're not absolute. They're relative
8 to one another.

9 The advantages with maintaining the status
10 quo are essentially budget related. It's consistent
11 with the current fiscal climate. Now, these are tight
12 years where we're all identifying ways in which we can
13 be more efficient with our use of resources or make
14 some cuts if necessary. So, this approach is
15 consistent with that.

16 It focuses resources on our existing
17 mission-critical work rather than taking a look at
18 bringing on some additional work. By doing a Level 3
19 PRA, we can focus our resources on the work that's
20 been identified through program office user needs.

21 Disadvantages are obviously that insights
22 that might be obtained from a new site-level PRA which
23 is really where we're trying to head would not be
24 realized.

25 And ultimately even though right now it

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1 may seem like it's a cost-effective way to just
2 maintain the status quo, it can ultimately result in
3 an inconsistent and potentially more costly treatment
4 of issues because we're developing analytical tools
5 and reacting on an ad hoc basis rather than developing
6 a tool box capability that can be used up front.

7 The second option is keeping the endstate
8 of ultimately performing a new site-level 3 PRA in
9 mind, we want to conduct near-term research that is
10 focused on addressing gaps that we know exist in
11 existing PRA technology to insure that, you know, when
12 we do ultimately reach that point where we want to
13 conduct a new site-level PRA, that PRA is going to be
14 of sufficient quality to support a wide variety of
15 regulatory applications.

16 Some of the research areas that we've
17 identified that, you know, might be included in this
18 option and that we want to investigate further include
19 the consequential or linked multiple initiating event
20 modeling and at the beginning you had asked if we
21 would touch on the Fukushima event. Well, this is
22 clearly related to the Fukushima event. And our
23 current models take a look at initiating an event
24 scenario and take it through to either core damager or
25 LERF, whatever we're trying to measure. But they

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1 don't really consider the possibility of a close in
2 time or linked second initiator that hits the plant
3 while it's responding to the first one.

4 Another issue that we've mentioned is the
5 multi-unit modeling. Right now in our models we don't
6 really account for some of the dependencies that can
7 exist among multiple units at the site in the way of
8 shared support systems.

9 MEMBER REMPE: Are there structures that
10 are connected to the U.S. plants like there's been
11 some discussion hydrogen from three into four through
12 a tunnel. Is that something that exists in the U.S.
13 and that needs to be included too?

14 MR. STUTZKE: Particularly among some of
15 the earlier designs like Oconee is just one big
16 building when you think about it. But when we talk
17 about the multi-unit modeling, you know, there's the
18 so-called common cause of maching events. The big
19 earthquake that gets all the reactors in trouble at
20 one time.

21 There are potentials for cascading
22 sequences so one plant goes down for some reason and
23 the grid might be fragile and now the other plants
24 have a loss of grid. And it's exacerbated by some
25 plants. For example at Browns Ferry they have almost

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1 interlaced electrical systems. So, some of the buses
2 are powered by --

3 ACTING CHAIR BLEY: Cooling systems.

4 MR. STUTZKE: -- water systems. And
5 Cooling Service Water and so you get a tremendous
6 logic modeling issues that haven't been treated well.
7 So, that's sort of what we want to go after here.

8 MR. HUDSON: Other issues that we think
9 are worthy of investigation are the modeling
10 essentially with human reliability in host core damage
11 scenarios and in external events. The SAMGs and
12 EDMGs, you know, they fundamentally differ from the
13 way that we look at human reliability leading up to
14 post-core damage. There's different decision-making
15 paradigm and there's a trade off that's taking place
16 in those spaces where the decision makers are often
17 choosing between the lesser of two evils. You know,
18 so defining success and failure in those cases can be
19 quite challenging and maybe that's not even the right
20 way to look at it. So, some work needs to be done in
21 that area.

22 Spent fuel, we talked about how some work
23 has been done in that area. There's been some pilot
24 studies. There's been some bounding analyses done in
25 the past but if we really want to bring the technology

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1 up so that we can have a meaningful comparison between
2 spent fuel risk and reactor risk, there's some work to
3 be done there.

4 And, finally, we talked about wanting to be able
5 to propagate THE uncertainty all the way through to
6 the consequences so that we can really, you know,
7 understand where the key sources of uncertainty are
8 and where, you know, there may be additional work in
9 the future.

10 ACTING CHAIR BLEY: Back in the late '70s
11 and throughout the '80s, we'd finished WASH 1400 here
12 and then we had a whole series of PRAs done by the
13 labs and by utilities. And we've moved ahead in this
14 country and started doing a lot of them. We didn't
15 know how to do things but we evolved very quickly.

16 Over in Europe, they took kind of other
17 approach. I remember especially the Germans wanted to
18 get all the pieces right before they did a PRA because
19 it wouldn't be any good. I think they were a good 10
20 years behind us b y following that approach. And it's
21 just -- until you try to put it all together, you
22 don't see the trouble spots it seems to me.

23 MR. STUTZKE: I would agree. Schedule
24 pressure is a real motivating force for innovation.
25 And I think we've all worked on PRAs and suddenly you

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1 needed to cook up some new method to treat an issue
2 that popped up. It's hard to know that you've got
3 your hands around the whole thing here like that.

4 If I could, I'll elaborate a little bit on
5 the spent fuel PRA technology because in my view, I
6 mean, we're talking about the transport from the fuel,
7 from the reactor vessel, into the pool, storing it in
8 the pool for awhile, transporting it to the dry cask
9 and sitting it on the drink, storing it in the dry
10 cask. Those manipulation activities, transportation
11 are really different than what we normally look at in
12 PRA space.

13 When you have certain random phenomena but
14 the fact is you've got a through put. It's very
15 similar. Dennis had mentioned before the chemical
16 weapon demilitarization program that I was involved in
17 for awhile. I did land mine analysis for awhile, you
18 know, and you've got an assembly line of so many
19 things coming through. Well, that frequency is not
20 the frequency of a Poisson process. And so you've got
21 issues of how do you actually model these sorts of
22 things? But I think we've got a lot of good ideas
23 here and things that we can use. But it is something
24 different than we've done before.

25 ACTING CHAIR BLEY: Just two thoughts come

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1 to mind. One is I know NMS sponsored some work
2 through RES to develop human factors models for the
3 depository. And I don't know if the Army's willing to
4 share stuff, but there was several different
5 approaches to the process system--

6 MR. STUTZKE: Yes.

7 ACTING CHAIR BLEY: -- HRA applied during
8 that process and we could learn from all of those I
9 think.

10 MR. STUTZKE: I think so.

11 ACTING CHAIR BLEY: And you're right.
12 Very different kind of things. If you interrupt the
13 process for awhile because of a problem, you clean up
14 the problem. You go back and right there is a real
15 spot for things to go wrong. In fact, peopled had
16 been through one part of the process and threw it into
17 the next and it blew up. Things like that. So,
18 there's different kinds of things in the process
19 approach. Anyway, the more you can get on that, the
20 better. But you'd be doing all of these anyway if you
21 go ahead with Option 3, is that correct?

22 MR. HUDSON: That's right. We'll show
23 that as we move forward.

24 MEMBER SHACK: And more at a reduced
25 minimum.

1 MR. HUDSON: In terms of relative
2 advantages and disadvantages associated with this
3 option, we're still focusing any additional resources
4 that we're asking for on research that's ultimately
5 going to be needed for Level 3 PRAs. So, that's an
6 advantage.

7 The other thing is that even if we
8 ultimately never do a site-level PRA, we'll be
9 contributing to enhancing PRA capability by conducting
10 this research.

11 Obvious disadvantages are that, you know,
12 if we don't do a Level 3 PRA now and we put it off to
13 do this research, it's going to take us a longer prior
14 of time to obtain those insights. And importantly
15 this could result in the loss of critical momentum and
16 duplication of effort, you know, the effort that we've
17 put into the Scoping Study to develop options, to
18 engage in stakeholders if we end up putting the PRA
19 off, and ultimately have to come back to it, and
20 potentially do another Scoping Study to prepare for
21 that.

22 Moving on to Option 3, this is probably
23 the one that we're most interested in talking about.
24 This is the full scope comprehensive Site-level 3 PRA.
25 So, potential objectives associated with this study

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1 would be, you know, again getting back to Slide 3
2 where we talked about what it is that we're trying to
3 achieve. One objective would be to extract new and
4 improved risk insights and that would be in the way of
5 expanding the scope and incorporating some of the
6 technical advances that have been made since the NUREG
7 1150 study.

8 We also want to enhance our PRA
9 capability, expertise and documentation by building
10 upon some of our existing analytical tools and by
11 engaging our staff in the participation of the study
12 to develop in-house expertise.

13 And ultimately we talked about improving
14 documentation for PRA knowledge management reasons and
15 to make this a useful product moving forward.

16 A third potential objective would be to
17 evaluate the cost associated with developing Level 3
18 PRA models. This will be of particular interest to
19 the industry. We're moving in a direction where we
20 want the industry to develop Level 3 PRA models. They
21 are obviously going to be keenly interested in how
22 much it cost for us to do so and what the potential
23 benefits are associated with it.

24 Finally, we want to use this study to
25 evaluate the need for and scope of potential follow-on

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1 activities. You know, at the end of this we want to
2 take stock of where we are and what is our new PRA
3 capability, how do we envision potentially using these
4 tools and what other questions are out there that need
5 to be answered. You know, a lot of that is going to
6 be hinged upon what sorts of insights we can gain from
7 this potential study and how they can be applied.

8 The potential scope of the study is
9 illustrated on this slide and you might notice that
10 this differs a little bit from the concept that we
11 conveyed in the paper. And what you probably say in
12 the paper was, hey. We were taking a look at all of
13 the site radiological sources. All initiators, so we
14 toned it down a little bit now to focus on the reactor
15 cores and the spent fuel.

16 Originally, we talked about these other
17 site radiological sources such as fresh fuel,
18 radiological waste. We're really trying to focus it
19 a little bit more to get to the issues that are of
20 most concern right now.

21 You can see on the slide there the
22 specific site risk contributors or potential site risk
23 contributors that have been excluded at this point.
24 The fresh fuel, the radiological waste and initiating
25 event hazards that are initiated by deliberate

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1 malevolent acts such as sabotage or terrorism. And
2 that's consistent with the approach that has been
3 taken in the past.

4 MEMBER CORRADINI: I am looking at your
5 slides going forward. Are you going to address how
6 you're considering doing the various stages? I mean,
7 in particular, I'm thinking about Level 2. Is that
8 going to be later, otherwise I'll just wait and ask
9 the question?

10 MR. HUDSON: Your question is related to
11 our specific technical approach for Level 2?

12 MEMBER CORRADINI: Yes.

13 MR. HUDSON: That's one of the things
14 that--

15 MEMBER CORRADINI: Beyond the scope of
16 this?

17 MR. HUDSON: That's a message that I
18 wanted to convey here. The intent here and the intent
19 of the paper is to really at a high level make the
20 case for why we think we need Level 3 PRAs.

21 MEMBER CORRADINI: I'll just wait. That's
22 fine. Thank you.

23 MR. HUDSON: Okay.

24 And to put things in perspective here, you
25 can see in the blue-shaded box there the approximate

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1 scope of NUREG 1150. It was limited to single-unit
2 reactor accidents occurring at power primarily due to
3 internal initiators with some limited treatment of the
4 external initiators as I talked about earlier.

5 This really gives you a feel for the
6 expanded scope that we're trying to achieve.

7 ACTING CHAIR BLEY: The full -- the Level
8 3 isn't showing up on here too because that's also.

9 MEMBER CORRADINI: So, let me ask a
10 different question. So what if a fuel vendor came in
11 with a different design, would you be able to look --
12 of a current reactor, different fuel design, would you
13 be able to look at the impact of that?

14 MR. STUTZKE: In principle, yes.

15 MEMBER CORRADINI: So, if somebody came in
16 with stainless steel clad, field clad, would you do
17 that?

18 MR. STUTZKE: It would shut down.
19 Well, assume they had originally so that they -- if
20 they have the right reactivity ---

21 MEMBER RAY: I ran a plant with stainless
22 steel clay. Don't laugh about it.

23 MEMBER ARMIJO: No, I actually tested
24 quite a bit but extremely uneconomical.

25 MEMBER RAY: Well, that's somebody else's

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1 problem. I'm asking the question because in the cents
2 per kilowatt hour on a meter is nothing. Trust me.

3 MEMBER CORRADINI: So, the reason I'm
4 asking the question is already proposals to require if
5 not strongly consider that. And I'm trying to
6 understand technically does it make a difference? Can
7 you do that?

8 MR. HUDSON: You're trying to understand
9 if as a result of this --

10 MEMBER CORRADINI: If tomorrow Surry had
11 stainless steel cladding with the appropriate
12 enrichment to make all -- and at least make it stay
13 critical for a year.

14 MEMBER ARMIJO: Well, you come up to a
15 hydrogen generation. I assume it's a zircaloy clad
16 and just turn off the hydrogen.

17 MEMBER CORRADINI: Well, you'll get -- my
18 point is, you'll get hydrogen generation. Those that
19 are proposing this are thinking that goes away. It
20 doesn't go away.

21 MEMBER CORRADINI: But the feedback
22 effect, what I'm asking is, can you handle such design
23 changes in this as a what if?

24 MR. HUDSON: I think that ultimately gets
25 in the capability of MELCOR, right, in how much you

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1 can --

2 MEMBER REMPE: Change your MELCOR model.

3 MEMBER CORRADINI: That's right. That
4 goes back to my simplified analysis approach because
5 I think in WASH 1400 that could from a simplified
6 analysis, one could easily handle it. But anyway I
7 wanted to ask. What sorts of things before I run off
8 and pay somebody to do more development of a
9 complicated code, I can just see the differential
10 effect. You see my question?

11 MR. HUDSON: I do.

12 MEMBER CORRADINI: Okay.

13 MEMBER REMPE: If you didn't go all the
14 way back to WASH 1400, to 1150, you'd change your XSOR
15 model and you'd have an expert say, well, I think the
16 release is a higher or lower fraction and so that's an
17 example of a simplified model versus a more detailed.
18 Right?

19 MEMBER CORRADINI: Or just simply change
20 out the one and only correlation in all of MELCOR that
21 gives you the Arrhenius law. Okay. I was trying to
22 think of other example, but that's the one that's
23 prominent in my mind since that's already come in
24 front of Congress in suggestions by individuals.

25 MR. STUTZKE: Well, we hadn't thought

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1 about this in terms you can find a delta risk from
2 using MOX fuel.

3 MR. DUBE: A quick answer to Mike
4 Corradini's question. I'm Don Dube, Office of New
5 Reactors.

6 You may recall Connecticut Yankee which I
7 was involved in doing the IPE on had stainless steel
8 cladding.

9 MEMBER CORRADINI: I do remember that.

10 MR. DUBE: And the delta between stainless
11 steel cladding and ZOR cladding is overwhelmed by the
12 uncertainty of Level 1, Level 2 and Level 3. So,
13 you're looking at a delta that's --

14 MEMBER CORRADINI: Imperceptible.

15 MR. DUBE: Correct.

16 MEMBER ARMIJO: Delta what?

17 MR. DUBE: The delta in terms of hydrogen
18 production in terms --

19 MEMBER ARMIJO: Really.

20 MR. DUBE: Level 2 phenomena and off site
21 consequences.

22 MEMBER CORRADINI: The only reason I'm
23 asking that is a practical reason is that I've already
24 seen testimony by some -- like UCS individuals that
25 are suggesting this and I think you have to be ready

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1 for analysis to answer those questions. That's all.

2

3 MEMBER ARMIJO: Good to know.

4 MR. HUDSON: And to your point that you
5 were making. You're right. We're not illustrating on
6 this graphic that it's going out to Level 3, but the
7 intent here is to illustrate the scope of the
8 radiological sources and initiating event hazards that
9 would be included in this in the interplanography
10 states. But, yes, the implicit assumption here is
11 that we're taking it out to Level 3.

12 Some of the PRA technology that we
13 envision using for the --

14 ACTING CHAIR BLEY: And from what Marty
15 said earlier, you plan to take it out to site response
16 using the emergency response guidelines. I'm sorry,
17 the SAMGs?

18 MR. STUTZKE: Yes. All of the --

19 MR. HUDSON: That's right.

20 ACTING CHAIR BLEY: Okay.

21 MR. STUTZKE: As you know, that's one of
22 the burning questions from the SOARCA project. How
23 much credit do you want to give people for these
24 things.

25 MR. STUTZKE: Seems a good thing to look

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1 at very closely.

2 ACTING CHAIR BLEY: I would agree.

3 MR. STUTZKE: Because I think it's got
4 implications. Until I really thought about it, I
5 thought SAMgs were something where I could tack onto
6 a Level 2. I think they got to be meshed into the
7 Level 1. It's going to be some big -- I don't know
8 exactly where the breakdown is now.

9 ACTING CHAIR BLEY: Yes, could affect it.

10 MR. STUTZKE: I've got Susan Cooper
11 thinking about it. She's not very happy with me. I
12 needle her every chance I get.

13 MR. HUDSON: Okay. When thinking about
14 the PRA technology that we would be using as part of
15 this effort, and consistent with our objective to
16 improve upon our existing capability, we were looking
17 at starting with our SPAR models as the baseline PRA.
18 Now, these are used by the agency to support a variety
19 of risk informed applications specifically in the
20 event evaluation area. We have a number of them. We
21 have 78 different models that exist. Some of them
22 have an integrated capability where external events
23 are included or low-power shutdown conditions are also
24 included. So, that's what we would be looking at as
25 our baseline. We would obviously be using the

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1 Licensee's PRA as well to provide some information.

2 ACTING CHAIR BLEY: And you would need
3 some agreement with the Licensee to really dig deeper
4 and get information you don't already have.

5 MR. HUDSON: That's right.

6 ACTING CHAIR BLEY: Okay.

7 MR. HUDSON: And we'll talk a little bit
8 about that here as we move forward too with the site
9 selection issues.

10 ACTING CHAIR BLEY: I'm just curious.
11 Have you -- so, you definitely need one licensee to
12 support this. Back in the fire PRA work and HRA work,
13 you had an agreement with EPRI to develop that
14 methodology jointly which had some advantages and
15 perhaps some disadvantages by the time it was done.
16 Is there any thought of going that way with this or is
17 this going to be an NRC project?

18 MR. HUDSON: There's certainly been some
19 discussion about the possibility of an MOU with that
20 brief to support the suffered. And after we attended
21 the public meeting and we talked to Stuart Lewis
22 there. But there have been no decisions made.

23 MR. STUTZKE: I think it's a little
24 premature until we get a Commission go-ahead to get a
25 big industry buy-in. One of the reasons why we're

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1 interested in the MOU, you know, if this was an NRC
2 project, we're restricted by a conflict of interest
3 thing and it greatly limits our ability to get
4 technical expertise. Whereas, from an MOU, then EPRI
5 could provide us -- we have to be real careful there.

6 ACTING CHAIR BLEY: It would be nice to
7 see a real thorough enumeration of advantages and
8 disadvantages and maybe leaning back to some of the
9 other areas where you've worked with and worked
10 separately from industry on this. I mean, having your
11 own pieces and some nice things from independence and
12 from separate thinking and all of that. On the other
13 hand, the information availability in life in
14 important. But eventually, I think we'd like to see
15 that before you're too far along. I bet the
16 Commission would too.

17 MR. HUDSON: Okay. For the development
18 and quantification of logic models we've been looking
19 at using the SAPHIRE code. Version 8 is the most
20 recent release of that. MELCOR would envision -- we
21 would envision using MELCOR, MELMACCS and the MACCS2
22 code for the accident progression and consequence
23 analysis piece. And the SOARCA Project, one of the
24 things that we envision using there is it demonstrated
25 the capabilities of MELCOR and MACCS interns of having

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1 integrated accident progression and accident
2 consequence analysis. So, we'd want to leverage that
3 capability moving forward.

4 ACTING CHAIR BLEY: Is somewhere in here
5 you're planning to talk about it because at one point
6 we'd heard that there was going to be a joint letter
7 of Level 3 and SOARCA? Then we heard there's not. In
8 the paper there's a parenthesis that said interface
9 with SOARCA will be here.

10 MR. HUDSON: Right.

11 ACTING CHAIR BLEY: Where does that stand?

12 MR. HUDSON: Okay. We first started
13 talking about that back at the November meeting.
14 Leading up to that meeting we started having some
15 internal discussions about the possibility of sending
16 up a combined paper where rather than having these two
17 separate sets of recommendations going before the
18 Commission, it would be better and the Commission
19 would be better informed if they had a combined
20 recommendation coming from the staff on whether and
21 how to proceed with those two projects.

22 MEMBER CORRADINI: Super consensus. Did
23 you have another alignment meeting, I'm sorry?

24 MR. HUDSON: There were a number of
25 alignment meetings associated with that.

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1 MEMBER CORRADINI: That was not
2 appropriate, I'm sorry.

3 MR. HUDSON: But to answer your question,
4 as you may be aware, for a variety of reasons, the
5 schedule associated with the SOARCA project has been
6 in flux and has changed and so rather than having a
7 common end date in the June time frame, now we were
8 looking at different times for completing this Scoping
9 Study and for the SOARCA project to come to
10 completion. So, there were a couple of possibilities
11 there. We could either still try to maintain this
12 drive for an integrated paper with a single
13 recommendation coming before the Commission, but that
14 would require delaying the completion of the Level 3
15 PRA Scoping Study. And to be timely, a decision was
16 made to separate the two. We're going to provide our
17 recommendations now for our current thinking for a
18 Level 3 PRA. The cost benefit justification for that
19 and, you know, a separate set of recommendations
20 regarding whether or how to proceed with the follow-on
21 SOARCA-type analysis will be coming at a different
22 time. So, we're trying to come to some agreement
23 about the specific language that we're going to be
24 using in the paper to talk about the relationship
25 between the two projects because clearly there are

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1 questions surrounding that. And so it needs to be
2 addressed. And our current thinking is to just talk
3 about the fact that the staff recognizes they're
4 different potential benefits associated with these
5 different approaches.

6 We're going to talk about Level 3 PRA here
7 and a separate discussion --

8 ACTING CHAIR BLEY: How dependent on
9 SOARCA is this project?

10 MR. HUDSON: I wouldn't say that there is
11 a dependency on it. I mean, we do intend to
12 capitalize on some of the insights that have been
13 gained.

14 ACTING CHAIR BLEY: Have to be done or the
15 insights there for -- we haven't heard from them in
16 several years and are here so we're a little
17 uninformed.

18 MEMBER CORRADINI: I was trying to ask
19 politely. What will you have to do because SOARCA did
20 it? That's the question I guess what I ask is, there
21 are key calculations. They spent millions of dollars,
22 I think. What did they do that you do not have to do
23 so it's sitting there already pre-done that you can
24 just plus in. Has that been analyzed?

25 MR. HUDSON: Well, I think in some ways

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1 the site selection is going to play a role in that.

2 MEMBER CORRADINI: I'm sorry?

3 MR. HUDSON: I think site selection is
4 going to play a strong role in determining to what
5 extent we can use that information --

6 MR. STUTZKE: Yes, I mean, certainly we
7 have their tools. We have MELCOR and MACCS and
8 there's a great body of expertise in how to run those
9 codes and, you know, efficiently and get the answers
10 out.

11 If we were to select Surry or Peach Bottom
12 for our project, you know, then you've already got
13 this input decks that's developed and we would take
14 advantage of those sorts of things.

15 You know, as far as specific SOARCA
16 calculations, the MELCOR work that's been done
17 realized, you know, that's a very small number of
18 scenarios out of a very large spectrum of the PRA.
19 It's not like you would be reproducing those
20 calculations. You would be calculating new scenarios.

21 MEMBER CORRADINI: But those that are
22 there are useable if that happens to be the sample
23 plan.

24 MR. STUTZKE: Exactly. They're useful.

25 MR. COE: If I could add just one thing.

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1 This is Doug Coe again. SOARCA starts with a PRA so
2 you have to have a PRA to examine what sequences
3 you're going to simulate using the MELCOR tools. So,
4 we are going to take maximum advantage of the tools
5 that have been developed. The state-of-the art MELCOR
6 MACCS tools that have been developed. And as we
7 generate insights from the sequences that we identify,
8 the insights that we draw from the work that we do in
9 this, these tools may become very valuable to us to
10 further simulate in greater detail the consequences of
11 those particular sequences to either confirm or refute
12 what we think are the consequences coming out of our
13 Level 3 study. So, these are inextricably connected
14 but they're very different ways of looking at things.
15 And so we have to constantly remind our audience that
16 they're really different analysis techniques, but
17 they're very useful when combined together.

18 MEMBER CORRADINI: If I might just make
19 sure I understand.

20 Isn't the -- this was where my Level 2
21 questions was coming from. Isn't this Level 2? Isn't
22 what Level 2 has become is essentially running a
23 series, a planned series of MELCOR calculations or am
24 I missing something?

25 MR. STUTZKE: Well, I mean, there are so-

1 called dynamic PRAs when one actually simulates and
2 then uses a probabilistic model to inject the failures
3 into the code calculation.

4 MEMBER CORRADINI: But that would have to
5 be somehow normalized to some set of deterministic
6 calculations so you know when you do your branching
7 --

8 MR. STUTZKE: Right.

9 MEMBER CORRADINI: -- what you're
10 branching to, right?

11 MR. STUTZKE: Right. I mean it's a brute
12 force Monte Carlo report. It's not perhaps overly
13 simplistic but you just run the code, a lot of large
14 numbers at times.

15 MEMBER CORRADINI: Right. That's why I
16 guess I was --

17 MR. STUTZKE: And this profile --

18 MEMBER CORRADINI: In my mind, that's what
19 I was thinking about with a whole different set of
20 damage states that you would --

21 MR. STUTZKE: Right.

22 MEMBER CORRADINI: -- or initial condition
23 states that you would run through.

24 MR. STUTZKE: But one of the premises of
25 this project was, you know -- one of the things I

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1 guess we've been wrestling with is how far to push the
2 state of the art in this project? Okay. And what we
3 envisioned was, you know, a PRA that would be done to
4 the state of practice right now which would be an
5 event tree sort of structure in the Level 2 that would
6 be quantified with MELCOR-type --

7 MEMBER CORRADINI: You wouldn't run -- if
8 this is taking you too far off track, I just want to
9 make sure. So, you wouldn't run --

10 MR. STUTZKE: No.

11 MEMBER CORRADINI: -- essentially a series
12 of Monte Carlo calculations with MELCOR with various
13 initial states, you would simply do a few and that
14 would inform you to an event tree analysis.

15 MR. STUTZKE: Right now the thinking is,
16 we would define point damage states and the issue is,
17 well, do you want 10 or do you want 1,000.

18 MEMBER CORRADINI: Okay.

19 MR. STUTZKE: That sort of things, but
20 it's still a binning type of approach is what we have
21 envisioned.

22 MEMBER CORRADINI: Okay. All right.

23 Thank you. That helps. Thank you very much.

24 MR. STUTZKE: Particularly when you begin
25 to super impose multi-unit scenarios on top of that

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1 and the external events on top of that, you know,
2 rapidly give in to something that's not computable.

3 MEMBER CORRADINI: But you would still
4 have to have -- one last thing. You would still have
5 to have though a collection of deterministic
6 calculations to develop -- to inform all those
7 branches?

8 MR. STUTZKE: Absolutely.

9 MEMBER CORRADINI: Okay. And that's where
10 your point is that there's only a few there given what
11 they did in SOARCA?

12 MR. STUTZKE: Right.

13 MEMBER CORRADINI: Okay. Thank you.

14 MR. HUDSON: Yes, the SOARCA discussion
15 was actually a nice segue into the next slide here
16 where we talk about some of the sight selection
17 considerations. If you recall, one of the objectives
18 of our Scoping Study was not to select the specific
19 site. We wanted to identify some sight selection
20 considerations because, you know, I think we talked
21 about this before in this meeting and we're going to
22 have to engage with industry to identify somebody that
23 is willing and motivated to participate in this so
24 they share information with us.

25 So, what we've done is we've identified a

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1 number of areas that we think should be considered
2 when we start looking at different sights and these
3 considerations are based on both the scope of the
4 study and also the availability of information that
5 could result in some cost savings moving forward.

6 So, the first one is obvious. If we're
7 wanting to evaluate the multi-unit effects on risk, we
8 need to be looking at the multi-unit sites.

9 The next one I talked earlier about how we
10 want to use SPAR models as our starting point and to
11 build upon them to enhance our PRA capability. Well,
12 one thing we may want to consider for cost-savings
13 reasons would be to take a look at some of the more --
14 some of the SPAR models that have better capabilities
15 that have already taken a look at the external
16 initiating event -- initiators that may already have
17 the low-power shutdown operating state built into it.

18 And finally we have, I don't know if
19 you're aware of it or not but we do have three SPAR
20 models that were developed as part of a feasibility
21 study to enhance the Level 2 PRA capability associated
22 with them. So, all of those things, we want to keep
23 in mind as we're moving forward and looking at a
24 potential sight.

25 The third bullets, availability of MELCOR

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1 input decks. We've just been talking to that, the two
2 sites that participated in the SOARCA projects
3 available so there may be some cost savings associated
4 with that.

5 Sites that either have already started the
6 process or preparing for the process of transitioning
7 into NFPA 805 implementation will have detailed cable
8 raceway databases and circuit analysis developed. So,
9 that can obviously result in some savings in terms of
10 money and time if we're to develop a quality fire PRA.

11 And then the last three things that have
12 been identified here really get to, you know, the
13 potential insights that can be gained. We might want
14 to consider sites that have specific external hazards
15 and specific spent fuel storage configurations or
16 whether or not they have ISFSIs on site to inform the
17 insights that we can gain from the study.

18 ACTING CHAIR BLEY: Now WASH-1400 looked
19 at two sites. 1150 looked at three or was it four?

20 MEMBER REMPE: Five.

21 ACTING CHAIR BLEY: Five sites. You're
22 looking at one or you're looking at more?

23 MR. HUDSON: This would be one site. This
24 initial study would just be a single site. And
25 obviously there's going to be some limitation to the

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1 insights that can be gained and the applicability of
2 those insights to the broader industry. But, again,
3 one of our objectives would be to evaluate the need
4 for follow-on studies.

5 ACTING CHAIR BLEY: Are there any
6 considerations. I don't see any up here except for
7 multi-unit -- any considerations about the design of
8 the site that would make a difference in your
9 selection criteria? I mean, you mentioned Surry.
10 Surry is a very unique site in a number of ways. And
11 is that a problem or does that matter?

12 MR. HUDSON: I mean, it's a legitimate
13 consideration if we're trying to obtain some more
14 general insights, you might want to look at a design
15 that is more representative.

16 MEMBER CORRADINI: What's unique about it
17 then?

18 ACTING CHAIR BLEY: Well, the containment
19 is unique and the --

20 MEMBER CORRADINI: Because of the
21 subatmospheric?

22 ACTING CHAIR BLEY: Yes, and there's some
23 of the cooling water systems are unique, very unusual.

24 MR. STUTZKE: Yes, my response to that is
25 you want to pick on e that is more vanilla flavored,

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1 you know.

2 ACTING CHAIR BLEY: That's what I was
3 wondering.

4 MR. STUTZKE: You know, make it a large
5 DWR, something like that and it's part of the
6 criteria. The other thing, we actually have a back-up
7 slide that we tried to sort sites out according to
8 these criteria. Slide 35.

9 MEMBER CORRADINI: Oh, you showed us this
10 one before. I got confused. And it's

11 MR. STUTZKE: Oh, and it's confusing me
12 too.

13 MEMBER CORRADINI: Oh, my God.

14 MR. HUDSON: That's why it's a back-up
15 slide.

16 MR. STUTZKE: But it's trying to short out
17 and the message here is there's no ideal site with
18 respect to what we already know.

19 MEMBER CORRADINI: Is that the middle
20 purple region that says none?

21 MR. STUTZKE: Yes. It says EE shutdown in
22 Level 2. We don't have a SPAR model at the same plant
23 that has external events and shutdown and -- we've got
24 bits and pieces of it.

25 ACTING CHAIR BLEY: So, there is no -- no

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1 one gives you everything.

2 MR. STUTZKE: The reason why I want Dan to
3 flip back here is that you will notice the color
4 coding based on whether or not there's license renewal
5 or combined operating license going on there. You
6 want to pick a site that, you know, when you get done
7 analyzing it, you'd kind of like the sight to be there
8 for awhile.

9 MEMBER CORRADINI: I like this figure. I
10 don't understand it, but I like it.

11 MR. STUTZKE: Yes, you know, he's trying
12 to sort things out as to who we would approached and
13 things like that. But, you know, for example, the
14 specific external hazard choice, he's right in the
15 middle is Turkey Point that got a combined license
16 request and license renewal was done. They have a
17 P805 or whatever. That implies you're going to do a
18 hurricane risk assessment, but you're not going to do,
19 hopefully, ice storms, you know, things like that.
20 Probably aircraft crash would be good one at Turkey
21 Point.

22 MEMBER CORRADINI: From the standpoint, I
23 think Bill asked the question about looking for a
24 volunteer. Is it -- is it just logical that the
25 potential for Peach Bottom and Surry to be likely

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1 volunteers as they've historically been in that mode?

2 MR. STUTZKE: One would hope so.

3 MEMBER CORRADINI: They seem to appear as
4 a pair.

5 MR. STUTZKE: Yes, I mean, they've always
6 been very supportive and the staff's gracious of that
7 but they may, you know, decide they need to do other
8 things.

9 MEMBER CORRADINI: And that's going to
10 involve a lot of their efforts, I assume?

11 MR. STUTZKE: Definitely.

12 MEMBER CORRADINI: Okay.

13 MR. STUTZKE: I mean, one of the
14 advantages, I mean, if I recall right, Peach Bottom
15 and Surry were picked because of their proximity to
16 the Washington area among other reasons so it's easy
17 to go on site and get the information, although --

18 ACTING CHAIR BLEY: Well, Surry, I think
19 back WASH-1400 times, have other reasons.

20 MR. STUTZKE: Yes, there were other
21 reasons like that.

22 ACTING CHAIR BLEY: Cooperative.

23 MR. COE: If I could add just one thing,
24 we did broach this subject with NEI and EPRI at the
25 public meeting that we had about a month ago and I

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1 mean there's interest, but in a general sense, but
2 they need to see more details as to what level of
3 effort that they would be signing up for. And this
4 paper is currently not public yet and so I think that
5 they're waiting to hear more details about what our
6 plans are before they can really have a constructive
7 dialogue for this.

8 MR. HUDSON: Yes, okay.

9 I think that's where we were. Moving on,
10 Slide 24 put together a graphic here to try to
11 illustrate at a high level our plans for proceeding.
12 If we ultimately receive Commission direction to
13 proceed with the study, this is the approach that we
14 would take. You see the time line up top. We'd be
15 looking at completing the study ideally in a three-
16 year time frame.

17 Phase 1 would be the getting started phase
18 in terms of contract placement, you know, the site
19 selection that we've just been talking about.

20 Phase 2 really equates to Option 2 in the
21 paper as well. We talked if we were to do the study
22 what we'd need to also conduct research to fill in
23 those gaps in parallel with proceeding with the study
24 and that's illustrated here on this slide.

25 So, then the idea here is with Phase 3 to

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1 start off doing the internal vents Level 3 PRA
2 including at power and low power shutdown conditions
3 and taking a look at both the reactor core and the
4 spent fuel on site. Then as that is in progress, we'd
5 be in the information collection phase for the
6 external events PRA which would be completed in Phase
7 4b there. So, the idea here is internal events Level
8 3 PRA first followed by the external events Level 3
9 PRA.

10 If you recall from our November meeting,
11 we were sitting here before you trying to figure out
12 what the right approach was here. Do we start off
13 with the approach that we've ultimately identified or
14 do we first do internal and external events in Level
15 1 space and then proceed to Level 2 and Level 3. This
16 is ultimately the approach that we believe would be
17 effective.

18 ACTING CHAIR BLEY: I'm having a little
19 trouble. Stay on that one a second.

20 So, the level -- where is Level 2 in this?
21 That's what I'm having trouble -- the purple is the
22 Level 1.

23 MR. HUDSON: Purple is actually, it's
24 Level 3. It's an internal events Level 3 PRA.

25 ACTING CHAIR BLEY: Oh, it's the internal

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1 events, Level 3. Okay. So, you'll have the whole
2 Level 3 done in a year and a half from the start date?

3 MR. HUDSON: Taking a look at the internal
4 initiators.

5 MR. STUTZKE: Because the bulk of the
6 effort here is Level 2/Level 3. The Level 1 models
7 pretty well exist.

8 ACTING CHAIR BLEY: So, the intent is,
9 yes, you won't have to do a Model Level 1 work?

10 MR. STUTZKE: That's correct. Of course,
11 remember what's embedded in here is all the plant
12 operating states is implied in here.

13 ACTING CHAIR BLEY: Now, on that last
14 chart, did you have the -- done some form of shutdown
15 PRA?

16 MR. STUTZKE: Yes.

17 MR. HUDSON: The SPAR model.

18 MR. STUTZKE: Spar model shutdown work.

19 ACTING CHAIR BLEY: Okay. That was on
20 there. Okay.

21 MEMBER SHACK: How consistent are your
22 PRAs with the external standards?

23 MR. STUTZKE: We have had peer reviews of
24 two of the SPAR models and they compared pretty well.
25 I mean, there were documentation issues but, you know,

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1 their capability, Category 1 type of PRAs for the most
2 part.

3 We know we have to do things to the SPAR
4 models to get them up to snuff here. For example,
5 they don't really model instrumentation and control to
6 any great level of detail.

7 But what I think is that we have a lot of
8 the building blocks to build these for shutdown and
9 low-power modes. We have an electric power model. We
10 have a cooling water model. I mean, it's not that
11 much -- we understand how the systems work. We have
12 that documentation for most of the plants.

13 ACTING CHAIR BLEY: I guess what really
14 scares me on this is page 35. This looks to me like
15 a very optimistic schedule if you had the ideal plant
16 to start with. And as page 35 says, there is no ideal
17 plant so whichever plant you get is going to have a
18 lot of filling in to do to make it up to the ideal
19 before you start on anything new. And that first year
20 and a half just looks just frighteningly optimistic to
21 me.

22 And having watched the labs running the
23 PRAs for 1150, I just -- it just seems incredibly
24 optimistic. If you could walk in with that ideal
25 plant that was going to support you completely and a

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1 team that knew the PRA inside and out to start with
2 that was already existing, it's still a fair amount of
3 work, but --

4 MEMBER CORRADINI: Is your question more
5 like is this -- if it was Surry or Peach Bottom, this
6 is a reasonable schedule? If it was something else,
7 this is not a reasonable schedule? Is that what
8 you're basically --

9 ACTING CHAIR BLEY: No, what I'm saying.

10 MEMBER SHACK: Even if it was.

11 ACTING CHAIR BLEY: Even if it was, anyone
12 of those is missing some of these key boxes back here.
13 What's missing is the 805 implementation, there's not
14 a chance they're going to get all through this in that
15 length of time. That's probably the biggest slowdown
16 I would think of any of them.

17 MR. STUTZKE: Yes, the fire cable.

18 ACTING CHAIR BLEY: Bringing that up to
19 snuff with all the short circuit analysis and all that
20 stuff is a big job no matter how you do it, it's a big
21 job.

22 MR. HUDSON: And that's why you see the
23 information collection phase for the external events
24 Level 3 PRA starting at the same time as the internal
25 events. Have a 15-month information collection phase

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1 for external events.

2 MR. COE: If I may just add. I mean, it's
3 a good point you make and it's been made before and
4 we've been carefully considering resource impact and
5 ability to meet the schedule. One thing that we
6 continue to have to refer back to is the original
7 technical objective. And if we can create a model
8 that has all of these components in it, each of the
9 components that we have to develop may not be
10 necessarily the optimum or the finished product maybe
11 that we would like to end up with in the end. But it
12 will be good enough for us to compose the entire model
13 in a comprehensive way and extract useful risk
14 insights. And then at the end of that product -- with
15 that product we all recognize that we'll continue to
16 evolve forward in improving each of the modules that
17 continue to need and warrant improvement.

18 ACTING CHAIR BLEY: I'd like to see some
19 acknowledgement of that in your schedule. I'm not
20 finding who has to decide that. It looks pretty --

21 MR. COE: We may not meet a --

22 ACTING CHAIR BLEY: It's been more than 18
23 months since the SOARCA guys came to talk to us. It
24 just seems very optimistic. I hear what you're
25 saying.

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1 MR. HUDSON: And we understand your point
2 and it's a very good one.

3 MEMBER SHACK: You know, you're not going
4 to meet this schedule and have the state-of-the art
5 1150 approach. I mean, 1150 pushed the state of the
6 art.

7 ACTING CHAIR BLEY: Pushed the state of
8 the art.

9 MEMBER SHACK: If you're going to get
10 anywhere close to this schedule, you're going to be
11 coming in with a different approach, let's say.

12 MR. HUDSON: Right. That was something
13 that Marty mentioned earlier, you know. We made a
14 decision early on that we're not really intending to
15 push the state of the art here in any specific
16 technical element. We're trying to just --

17 MEMBER SHACK: In a bigger picture, I kind
18 of worry about, you know, I look back and, you know,
19 what's the real regulatory impact of this and I can
20 sort of see it in terms of SAMGs and emergency
21 preparedness. Then I go back and I look at well, you
22 know. You've got seismic on your plate. It would
23 seem to me that recent events have sort of said we
24 ought to look at external flooding and SBOs and SAMGs
25 again and, you know, I'm going to take resources from

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1 one to the other. It just seems to me that there's a
2 plate full of other things to be doing as much as this
3 is appealing. As much as the ACS is asked for over
4 the years.

5 MEMBER CORRADINI: And your point is that
6 this is although interesting, your concern it's not
7 going to address some of these particular points?

8 MEMBER SHACK: Yes, I think, you know, if
9 I had -- if I had to allocate resources that were
10 directly going to impact safety, not my understanding
11 perhaps, you know, at least I could make the argument
12 with myself that maybe, you know, it goes to relooking
13 at issues associated with the new seismic hazards or
14 relook at external flooding or relook at SBOs or
15 relook at SAMGs. And, you know, this really comes
16 down to resources when you're -- when it's all said
17 and done and if you're going to do one you probably
18 have to, you know, take the resources from the other.

19 MEMBER CORRADINI: I'm assuming what
20 you're saying was, if nothing can go.

21 MEMBER RAY: Well, to pick up on what Bill
22 is saying, I've been pondering this for some time.

23 Let's look back to either associate 1150
24 with SBO rule. Correct? That's what I wrote down
25 here. How did that -- can anybody describe exactly

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1 how that happened? I mean, that was a consequence of
2 doing work at that time that translated into
3 regulatory action as opposed to just insights to guide
4 the agency's work moving forward. Right? It actually
5 translated into a new requirement. You characterized
6 it, I don't know, as a modification. Anyway, whatever
7 it was.

8 How did that happen? Marty, you probably
9 remember that well enough.

10 MR. STUTZKE: Only because the movement
11 was already afoot on an SBO rule while 1150 was being
12 constructed to some extent.

13 MEMBER RAY: Okay. So, it didn't pop out
14 of 1150?

15 MR. STUTZKE: No, you can't say, you know,
16 cause and effect.

17 ACTING CHAIR BLEY: It kind of popped out
18 of that ASAP I mentioned that preceded 1150 and Pat
19 Baranowski, I think, from the analysis led that work.

20 MEMBER RAY: Well, I'm trying to follow up
21 on what Bill is saying here which is if you have a
22 resource allocation problem and you have had
23 experience in using this technology to have an impact
24 on safety as opposed to just enhancing your insight
25 and understanding of things, is that an example? And

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1 I hear, well, not entirely. It wasn't something that
2 the work of 1150 caused to happen by itself. Am I
3 putting words in your mouth or tell me how you would
4 say it.

5 MR. STUTZKE: No, I think you pretty well
6 said it well.

7 MEMBER RAY: Because I think it's that
8 sort of thing that we're talking about here when you
9 ask the question. Do you just want to increase the
10 rigor and comprehensiveness of an integrated analysis
11 which is a worthy objective because you never know
12 what it might reveal? Or are you concerned about
13 things and you want to try and use the available
14 resources to try and come to some closure about them?
15 That's what I think you were saying and it was the
16 same thing I was thinking about.

17 MR. STUTZKE: I mean, to a large extent
18 we've been overtaken by events.

19 MEMBER RAY: Right.

20 MR. STUTZKE: You know, I mean, we started
21 this well before Fukushima and we're obligated to
22 respond to the Commission, you know, and say this is
23 our best shot.

24 MEMBER RAY: But, Marty, given that we all
25 were taken by events, is there anything -- I think

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1 this what maybe Dennis was thinking about in the very
2 beginning. Is there anything that would make it more
3 targeted what you're talking about doing here to
4 things that are on people's minds now as maybe SBO was
5 before?

6 MR. STUTZKE: Certainly the spent fuel
7 risk.

8 MEMBER RAY: Yes.

9 MR. STUTZKE: That would be a good piece
10 to do like that.

11 MEMBER RAY: Well, I think of flooding, of
12 course. Flooding on a multi-unit site is to me
13 something that my God if we haven't figured how to
14 analyze that, we'd better get onto it.

15 ACTING CHAIR BLEY: Just one last thing
16 from me on this.

17 I have no idea when zero is up here, do I?

18 MR. HUDSON: It was intentionally left
19 that way because obviously we're submitting our paper
20 in July --

21 ACTING CHAIR BLEY: I understand. Start.
22 I'm just thinking about, we're going to learn a lot
23 from Fukushima as time goes on but it's going to be
24 awhile. It's probably going to be a year before we
25 really digest a lot of that. Maybe that aligns here

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1 but it would be a shame to charge through much work
2 here and then find out, oh, my gosh. We should have
3 done it differently from that. But it will probably
4 stretch out. You'll have time to account for that.

5 MR. HUDSON: I think that caution was
6 expressed at the public meeting too by some of the
7 participants.

8 ACTING CHAIR BLEY: Nevertheless, getting
9 started with the things that are in 2 and 3 and even
10 4 make a lot of sense. I just suspect it's going to
11 take you longer. 4b maybe not. Maybe that will come
12 together nicely but it's the other ones that seem to
13 me to have a lot of going on in parallel. But look
14 for these guys you pick and how much fill in work
15 there's got to be.

16 Who do you envision doing most of the
17 work? Will it be people here, at the labs, a real
18 mix?

19 MR. HUDSON: We originally had a slide
20 that addressed that question, but decided to leave it
21 out now because it's really -- it really represented
22 some of our current thinking and hadn't really been
23 vetted at this point.

24 ACTING CHAIR BLEY: Okay.

25 MR. HUDSON: But I think we envision a mix

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1 of staff and contractor resources and having a team
2 that's dedicated to this project. And then having
3 sort of a matrix of people where you have a mix of
4 contractors and staff that are assigned specific
5 tasks.

6 MR. STUTZKE: Well, we have to be very
7 sensitive where lab contractors are pretty well full
8 up anyway like this, you know. In other words, we
9 keep, for example, INL gainfully employed just
10 maintaining our SPAR models and our Sapphire software
11 like this. And so they would have to staff u perhaps.
12 Of course, they would love us for a reason to do that.
13 The same thing, you know, with Sandia, with MELCOR and
14 MACCS capability select out are full. So, yes, it's
15 going to be a real challenge but at the same time, you
16 know, we thought about we have dedicated team here,
17 but that takes away from the FTE we have available for
18 our core safety missions. And the Commission needs to
19 decide how much of that is appropriate.

20 MEMBER REMPE: I trust that at the last
21 Subcommittee meeting that you talked about having
22 independence versus collaboration and that's why I was
23 asking who all came to your last meeting. Did anyone
24 that came said, you know, you're right. Haven't this
25 size of a PRA in a long time and it would be great

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1 staff graining? And I would that would be something
2 the industry as well as a lot of other organizations
3 would say, this could be an opportunity. Did anyone
4 step up to the plate and say, maybe we should think
5 about this as a collaborative effort and maybe donate
6 some staff or something like to help or anything?

7 MEMBER CORRADINI: The D word. Done in.

8 MEMBER REMPE: Dedicate some people
9 because of special development type of thing.

10 MR. STUTZKE: Nobody has done that yet.

11 MEMBER REMPE: And has that been brought
12 up to other organizations?

13 MR. STUTZKE: No. But that is a good
14 idea. Part of what we have when we've tried to
15 schedule this thing out is if you want to have an
16 aggressive schedule, you need the best analysts you
17 have available and then you are in some respects
18 short-changing your staff development capability --

19 MEMBER REMPE: Right.

20 MR. STUTZKE: -- like that. We'd always
21 envisioned that this would be a great opportunity for
22 rotational assignments from the NRR staff, the NRO
23 staff to come in and learn how to do these sorts of
24 things. You're asking all the right questions about
25 how to expedite this. As far as getting things done

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1 collaboratively with industry, I mean, we already
2 indicated, yes, we'd be interested in an MOU with
3 industry to get that done. At the same time, you
4 know, we firmly intend this is going to be our
5 product.

6 MEMBER REMPE: Again, it seems like
7 something could be worked out that, yes, it could be
8 --

9 MR. STUTZKE: Right.

10 MEMBER REMPE: -- your product but it's an
11 opportunity.

12 MR. STUTZKE: Yes.

13 MEMBER REMPE: I don't know. I would
14 think so. It would be worth exploring at least.

15 MR. COE: We would like to have the
16 industry view it that way as an opportunity.

17 MEMBER REMPE: Has anyone said, I mean,
18 had discussions or you just haven't brought it up?

19 MR. COE: Again, no. A general sense of
20 interest at the last public meeting but need to see
21 more detail before anyone is willing to really
22 collaborate and know what they're signing up for,
23 level of resource, level of effort.

24 MR. STUTZKE: I don't see Mr. Bradley
25 raising his hand.

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1 ACTING CHAIR BLEY: Dan, what do you
2 think?

3 MR. BRADLEY: I'll just mention we have
4 three provisional possible plants that might be
5 interest.

6 MEMBER CORRADINI: Boy, those are a lot of
7 qualified --

8 MR. BRADLEY: I mean, overall. And they
9 don't meet all the criteria, but we do have some
10 initial interest. As Dan said, we need better
11 definition of what this would involve for the plants.

12 MR. STUTZKE: Sure.

13 MR. BRADLEY: Okay. Thanks.

14 Dan, do you want to go through the pluses
15 and minuses or is this a good place for a break?

16 MR. COE: Just before the break, if we are
17 going to break, I would like to just return very
18 briefly to the points made by Dr. Shack and Mr. Ray
19 because the question of whether or not these effort
20 should focus on specific areas of interest or specific
21 questions that we might have a near-term desire to
22 answer was one that the staff has considered and, in
23 fact, an earlier draft of this paper had another
24 option in it that included a more focused look at a
25 specific question without actually naming that

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1 specific issue. And it was intended that, you know,
2 that provide an option to the Commission to tell us
3 exactly what question they would like us to focus on.
4 And that option was removed and in part because the
5 real purpose of this initiative is to really get your
6 arms around the entire picture. And if you focus on
7 one area, you lose -- obviously, you lose the insights
8 of the whole picture.

9 And, secondly, there was an understanding,
10 I guess, a recognition that if the Commission really
11 wanted us to look at something, they were going to
12 tell us no matter what we had in the paper.

13 So, if the committee would care to advise
14 us or recommend or provide it's insight to us
15 regarding whether -- there is greater good perhaps in
16 focusing on a specific area versus attempting to look
17 at the more comprehensive picture of rick at a site.
18 We would be very interested in the committee's views
19 on that. And I believe that the Commission would
20 also.

21 ACTING CHAIR BLEY: Thank you.

22 MR. HUDSON: Break?

23 ACTING CHAIR BLEY: Okay. Given that, we
24 will recess for 15 minutes. See you back here at
25 quarter after.

1 (Whereupon, off the record from 3:00 p.m.
2 to 3:15 p.m.)

3 ACTING CHAIR BLEY: We are back in
4 session.

5 Dan?

6 MR. HUDSON: Okay. Thank you. I think
7 we've talked about everything on this slide so we'll
8 move on to the next slide. We only have a few more to
9 go actually.

10 Okay. In terms of the relative advantages
11 and disadvantages associated with Option 3, we're
12 going to go back to the third slide where we talked
13 about an overall vision.

14 We ultimately want to obtain new and
15 improved risk insights. We want to be able to focus
16 our resources on those things that are most important
17 to safety -- to public health and safety. And to
18 arrive at those insights in the most timely manner,
19 Option 3 is the one that gets us there.

20 Another advantage is like Option 2 where
21 we're enhancing our visibility, this takes it steps
22 further. In Option 2 we're conducting some research
23 to fill in some gaps. This develops a new Level 3 PRA
24 model, provides us with some new insights. We've
25 developed some expertise by going through the process

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1 and we have a tool that we can use moving forward.

2 And, finally, I talked about the
3 efficiency use of resources. You know, we've
4 dedicated a lot of time and energy over the past year
5 during the Scoping Study to think about where we want
6 to go to engage with stakeholders and we don't want to
7 have to repeat that effort in the future by delaying
8 a Level 3 PRA.

9 The most obvious disadvantage that we've
10 already been alluding to is the resource issue. It's
11 going to take a lot of staff and contractor resources
12 to get this done. It's more than we have budgeted.
13 So, we're going to ultimately make a decision at the
14 agency what's important as we're moving forward and
15 where are we going to focus those resources.

16 ACTING CHAIR BLEY: Can I ask you one
17 question. We have a NUREG on uncertainty treatment in
18 PRA. I don't think it goes up to Level 3, does it?

19 MR. HUDSON: It doesn't. It talks
20 specifically in the beginning about the scope of that
21 NUREG and the limitations associated with it. It's
22 primarily --

23 ACTING CHAIR BLEY: Is that one of the big
24 items in your green or red box, whatever that was?

25 MR. HUDSON: That's why you see it in

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1 Option 2 or in the case of that graphic it's Phase 2

2 --

3 ACTING CHAIR BLEY: Yes, Phase 2.

4 MR. HUDSON: -- research. It's because
5 NUREG 1855 is limited to the internal events at Power
6 Level 1 PRA. Now, although they do talk in that NUREG
7 about how the principles that are discussed, some of
8 these methods would apply to the uncertainty analysis
9 in Level 2 and Level 3 PRAs. So, there's something to
10 work with there but it doesn't specifically address
11 all the issues.

12 ACTING CHAIR BLEY: And I see in Phase 2
13 you also have and you mentioned it, the post-core
14 damage and external events, HRM.

15 MR. HUDSON: Yes.

16 ACTING CHAIR BLEY: The new methodology
17 work that's been going on, have you had much
18 discussion about whether you think that will be an
19 approach that will work in this area as well or is
20 that something that --

21 MR. STUTZKE: You're referring to the SRM
22 problem?

23 ACTING CHAIR BLEY: I am.

24 MR. STUTZKE: Yes, we had an off-site
25 retreat. I hate that word.

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1 MR. HUDSON: Not the retreat that you want
2 to take.

3 MR. STUTZKE: Anyway, the cognizant branch
4 chief was saying, well, you know, the timing on the
5 SRM project. Have to be careful. SRM, SMR.

6 ACTING CHAIR BLEY: Yes.

7 MR. STUTZKE: Anyway, the HRA work seems
8 to be about the time frame when we would get this
9 thing kicked off. And so naturally one would expect
10 that you would use this unified HRA approach throughout
11 this.

12 MR. HUDSON: The idea there is that, you
13 know, they're developing a method on principles that
14 can be applied to other domains and do their vision
15 for that is that we would be able to use what's
16 developed to inform the HRA methods and post-core
17 damage space.

18 ACTING CHAIR BLEY: Okay. Great. Thank
19 you.

20 MR. HUDSON: So, the next slide
21 essentially captures. It's an excerpt from the paper
22 itself. The staff recommendation. We ultimately
23 believe that the time is right for moving forward with
24 a Level 3 PRA study. We want to obtain these new risk
25 insights, want to better understand what the important

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1 contributors to risk are and we want to apply this
2 understanding to future regulatory decision making.
3 We want to demonstrate the ability to do this and move
4 forward.

5 The next three slides summarize some of
6 the stakeholder comments that we've received
7 throughout our interactions. The first one is limited
8 to the internal stakeholders and then the next two are
9 for external stakeholders and they're broken up into
10 comments related to the scope and then comments
11 related to perspective on future uses.

12 So, I stated at the outset that one of the
13 things we needed to do here was to make our objectives
14 more clear. What is it that we're trying to achieve
15 and that's what we tried to do here today.

16 The next thing is, as I mentioned earlier,
17 was we received some feedback to remove references to
18 the Fukushima event because we don't want to get ahead
19 of ourselves. You know, we want to see where things
20 go and not make that a focus of this paper.

21 The third bullet is getting into some of
22 the weeds --

23 ACTING CHAIR BLEY: Let me ask you about
24 that.

25 Can we remove it completely or at least

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1 acknowledge that following it may have an impact on
2 being your work is complete as it needs to be to
3 address issues that might come out of that that will
4 evolve during the process of this PRA?

5 MR. HUDSON: It's a good question. We
6 haven't necessarily arrived at a conclusion in terms
7 of how we're hoping to address all these comments that
8 we've received. What we intend to do is after this
9 meeting we're going to get together, take a look at
10 all the comments we received, including the ones that
11 we receive here today and then make a decision about
12 how we're going to address those in the paper.

13 ACTING CHAIR BLEY: Okay. Good. That's
14 good to hear because I mean, it's clearly too soon to
15 draw conclusions.

16 MR. HUDSON: Right.

17 ACTING CHAIR BLEY: But it's not too soon
18 to recognize the need to understand that event and
19 include its lessons in this work.

20 CONSULTANT KRESS: Are internal
21 stakeholders strictly NRC people?

22 MR. HUDSON: That's right.

23 CONSULTANT KRESS: Okay.

24 MR. HUDSON: The next had to do with the
25 way some of the information was organized in the

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1 paper. When talking about why we were thinking about
2 doing a new Level 3 PRA, one of the sections was
3 potential enhancements that occur in PRAs and
4 identified a couple of areas that could be improved
5 and thought that might serve as a basis for doing a
6 new Level 3 PRA. But there was some overlap between
7 that section and then the separate section that we had
8 on perspective on future uses. So, the feedback we
9 received was to combine the information there in the
10 perspectives for future uses for Level 3 PRA section.

11 Mentioned earlier too that we wanted to --
12 the feedback we received was to emphasize the revision
13 of the regulatory analysis guidelines as a potential
14 use. That's consistently come up in our discussions
15 when we start talking about potential future uses.

16 MEMBER SHACK: I guess that's the response
17 to my comment is that everything I say is really --
18 gets off into backfit and regulatory analysis space.

19 MR. STUTZKE: Exactly. I mean the reason
20 why this one is in here, our regulatory analysis
21 handbook. I think it's NUREG/BR-0184, okay, has
22 conversion factors to come up with population dose
23 that's based on NUREG 1150. So, one would compute a
24 backfit that would have a certain delta core damage
25 frequency and then you multiply it by the magic

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1 conversion factor. And now I've got delta person room
2 so I can then multiply it by the value of statistical
3 life and get it converted to dollars like that.

4 When you look at what is in the handbook
5 and you compare them to what you see in SAMA reviews,
6 I mean, they're SAMAs generally are much higher like
7 that which indicates you need to be able to review --
8 to revise these things.

9 We also have effort I think just initiated
10 to look at the value of statistical life again.

11 ACTING CHAIR BLEY: I'm sorry, I couldn't
12 hear.

13 MR. STUTZKE: The value of statistical
14 life. The \$2,000 per person rem. We're in the
15 process of re-examining.

16 MEMBER RYAN: How hard is the dosimetry
17 that backs those numbers up? Is it ICRP-2? Is it --

18 MR. STUTZKE: I wouldn't know the precise
19 standard. I mean, that was last done in the end of
20 '99.

21 MEMBER RYAN: So, it's fairly -- okay.
22 That's fine. That's enough.

23 MEMBER CORRADINI: I don't even appreciate
24 the question you're asking, Mike.

25 MEMBER RYAN: Well, I mean, the dosimetry

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1 methods, because the NUREG was relatively old, I was
2 asking was it based on old method of calculating dose
3 or the new methods.

4 MEMBER CORRADINI: Not the dollar number?

5 MEMBER RYAN: No, dose itself, thank you.
6 But I think 99 tells me it's new enough. Thank you.

7 ACTING CHAIR BLEY: Yes, Marty, I guess I
8 haven't looked at the reg analysis handbook. Would
9 you say that number again?

10 MR. STUTZKE: The handbook is NUREG/BR-
11 0184. And the guidelines themselves, the NUREG/BR-
12 0058.

13 ACTING CHAIR BLEY: Thanks.

14 MR. HUDSON: Sure. Other feedback we
15 received was that we should use terminology in the
16 paper and in the enclosure that is consistent with the
17 consensus PRA standards. And this was specifically
18 related to the scoping issues when we start talking
19 about initiating event hazards and hazard groups and
20 radiological sources versus hazards and those things
21 where in the consensus PRA standard, they've arrived
22 at an agreed-upon definition for these things. So, we
23 should be consistent with that.

24 CONSULTANT KRESS: That's the ANS
25 standards?

1 MR. HUDSON: Yes. The ANS standard.

2 ACTING CHAIR BLEY: And NUREG on PRA
3 quality, is it 1200?

4 MR. HUDSON: Are you thinking of
5 Regulatory Guide 1.200?

6 ACTING CHAIR BLEY: Yes, I guess that's
7 what I'm thinking of.

8 Is it consistent because that's got a
9 whole set of language.

10 MR. STUTZKE: Oh, absolutely.

11 ACTING CHAIR BLEY: Okay.

12 MR. HUDSON: It's absolutely consistent.

13 MR. STUTZKE: No, this is a carryover
14 because when I learned PRA, internal fires were
15 external events.

16 ACTING CHAIR BLEY: Yes, me too.

17 MR. STUTZKE: They are not in the
18 standard. They are now -- in groups.

19 ACTING CHAIR BLEY: Okay.

20 MR. HUDSON: The next bullet, we talked
21 about earlier how we originally had a fourth option in
22 the paper that was limited in scope specifically to
23 address some of the questions that might arise from
24 the Fukushima event. That's since been removed
25 because it created some confusion even in the public

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1 meeting and appeared to be inconsistent with an
2 overall vision in terms of obtaining new risk insights
3 based on the overall picture.

4 I've also been asked to be a little more
5 clear about some of the issues related to the adequacy
6 of CDF and LERF and to be more clear about what is
7 meant by integrated. We found that that word
8 "integrated" created a lot of confusion. What did it
9 mean? What did it mean in terms of the logic models?
10 What did it mean in terms of looking at all of the
11 different site risk contributors? So, we've since
12 started talking more about and use this thing from
13 earlier today. We started getting back to the use of
14 more comprehensive instead of integrated to try to
15 avoid some of that confusion.

16 CONSULTANT KRESS: I must have missed it
17 in the information I have. Where would I find these
18 issues related to adequacy of CDF and LERF?

19 MR. HUDSON: You'll see it more clearly in
20 the enclosure that was submitted with the paper.

21 MEMBER REMPE: The draft --

22 MR. HUDSON: It is just summarized at a
23 high level in the SECY paper itself. But there was a
24 42-page enclosure that came with the paper in there.

25 CONSULTANT KRESS: I don't think I got

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1 that but --

2 MR. HUDSON: You said you did not get
3 that?

4 CONSULTANT KRESS: I don't think so.

5 MR. HUDSON: Okay. That's where you'll
6 find some of those issues that I'm talking about.

7 MR. LAI: I can resend to you again.

8 CONSULTANT KRESS: Thank you, John.

9 MR. HUDSON: And some of those issues I
10 identified in there were based on issues that were
11 previously identified in a NUREG/CR. I think it was
12 sponsored by the ACRS where it took a close look at
13 some of the issues with the current use of PRAs and
14 risk-informed decision making. I think it was
15 NUREG/CR-6813.

16 MEMBER SHACK: Carl Fleming.

17 MR. HUDSON: Carl Fleming was involved.

18 MEMBER SHACK: Tom and I are the only ones
19 left.

20 MR. HUDSON: Moving on to the external
21 stakeholder comments.

22 Again, I talked about this in the
23 beginning when I was describing Level 1 Level 2 and
24 Level 3 PRA. We needed to be more clear about what
25 was meant by that. When we say we're doing a Level 3

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1 PRA, we're not just talking about doing a consequence
2 analysis.

3 Again, we talked about how at the public
4 meeting UCS was supportive of this notion of the full
5 scope Level 3 PRA. They felt it was needed to fully
6 understand where the risk exists and they wanted us to
7 be cautious about the use of screening analysis and
8 making decisions about what would not be included in
9 the study.

10 It was also brought up again when we start
11 talking about the potential scope of a study of this
12 magnitude and all the different things that can be
13 considered. We need to be careful about the different
14 possible scenarios that we can come up with and try to
15 investigate. We cannot consider all the possible
16 different combinations. We're going to need to make
17 some decisions about what the most credible and
18 important ones are.

19 ACTING CHAIR BLEY: Since you read that
20 last one and I'm going to read you one of the comments
21 that John Stetkar sent to me when he couldn't be here.
22 I've hit most of the points he raised. But --

23 MEMBER CORRADINI: So, you've had
24 questions fed to you?

25 ACTING CHAIR BLEY: I didn't do it.

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1 MR. HUDSON: It's your staff.

2 MEMBER CORRADINI: Clearly he is --

3 ACTING CHAIR BLEY: He's John. But he
4 noticed in the background characteristics of NPP PRA
5 models, the statement that because of the unique
6 methods and data used, a significantly higher level of
7 conservative bias can exist in PRAs for internal
8 fires, external events, seismic, high wind and others
9 and low-power shutdown conditions. And he points out
10 that experience has repeatedly shown us that these
11 types of blanket statements about conservative bias
12 are essentially always wrong. So, he urges care in
13 that area.

14 MR. HUDSON: So, he had some issues with
15 the specific statement that he found related to the
16 conservative bias that can be introduced?

17 ACTING CHAIR BLEY: Well, every time
18 that's been claimed in the past, when you go do a
19 detailed analysis you find, yes, there was some
20 conservative bias and there was also some optimism and
21 sometimes it turns out that overall it wasn't even
22 conservative at all. So, just be really careful about
23 that.

24 MR. HUDSON: I'll take a look at that.

25 ACTING CHAIR BLEY: And those blanket

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1 claims are especially the troublesome thing that, you
2 know, raising them as things to look at within the
3 context that there might be competing effects that
4 aren't obvious on the surface seems to be important
5 and I certainly agree with him.

6 MR. HUDSON: Okay.

7 ACTING CHAIR BLEY: We've seen that happen
8 often.

9 MR. HUDSON: Thank you.

10 ACTING CHAIR BLEY: Especially, when you
11 try to take an existing model and apply it to new
12 areas and you don't think hard enough about what might
13 not have been in that existing in all this.

14 MR. HUDSON: Okay. The next one we've
15 talked about in this meeting today. We need to be
16 realistic about the time and resource constraints when
17 we start looking at the scope of this. So, the
18 feedback we received at the public meeting was not
19 inconsistent with the feedback we received today or,
20 you know, we may be optimistic with the schedule that
21 we've come up with.

22 We were told at the public meeting that
23 the uncertainty analysis is going to be an important
24 part of the study and a potentially important
25 contribution of this work. We were able to expand

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1 upon the guidance that has been provided in NUREG-1855
2 as we talked about earlier.

3 And then the last one with regard to scope
4 is that we need to be careful and considerate of the
5 challenges associated with responding to the Fukushima
6 event. And this was something that was touched on a
7 little bit earlier before the break. Obviously, we're
8 going to continue to learn some lessons from that
9 event. There may be some actions that are taken in
10 response to that event and the specific feedback we
11 received there was that the plants may continue to
12 evolve over time throughout this study in response to
13 that event. So, we need to be considerate of some of
14 those challenges.

15 And, lastly, we received some comments on
16 the potential uses. Again, revision of the
17 regulatory analysis guidelines came back. A general
18 comment was just like NUREG-1150, you know, some of
19 these future Level 3 PRAs can provide the underpinning
20 or foundation for our regulatory process as we move
21 forward so that we can potentially address some of the
22 issues - -the long-standing issues associated with the
23 definition of LRF. I think that was talked about
24 earlier today.

25 Pilot testing the PRA standards came up.

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1 Again, one of the issues here is the timing first of
2 all, you know. We don't have standards for all of the
3 different technical elements or analyses just yet so
4 there's a timing issue and another issue that was
5 raised was well, how do you test this PRA against the
6 standard? And, you know, when you talk about meeting
7 a standard, that's typically in the context of a very
8 specific application and you're taking a look at
9 specific supporting requirements to see if the PRA
10 meets the supporting requirements for that capability
11 category. So, there are some challenges there when
12 you start talking about well, how do you benchmark
13 this PRA against the standard?

14 Other applications that were brought up
15 were the evaluation of EPZs and to inform specific
16 issues associated with the Fukushima event.

17 We've already talked about the next one
18 with regard to the treatment of uncertainties beyond
19 the scope of NUREG-1855.

20 And then finally we could use this to
21 potentially resolve some of the open issues that we
22 have of PRA technology and some of the specific areas
23 that we've been talking about today with regard to the
24 modeling of SAMGs and EDGMs could be one of those
25 areas.

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1 And that's all we have for our
2 presentation. We invite any additional questions or
3 comments that you have.

4 ACTING CHAIR BLEY: Thanks very much.
5 Maybe we shouldn't have taken a break.

6 MR. HUDSON: i was wondering about it. I
7 wasn't sure exactly how much longer we might talk
8 about some of those other issues.

9 ACTING CHAIR BLEY: It wasn't clear.

10 Anything from the members, any questions?
11 Issues?

12 MEMBER RAY: No, I mean, I expressed my
13 comment earlier that I would have which is the
14 application and the benefits from the enterprise or
15 just what I'm trying to focus on and whether there's
16 a different strategy that would produce those benefits
17 sooner, but I don't really have any comment, Dennis,
18 to offer as to whether I think that that's the case or
19 not. It's just an open question.

20 ACTING CHAIR BLEY: Okay. Thanks, Harold.
21 Let's take that as a beginning of going around the
22 table. Is there anything else you want to add for a
23 final wrap up?

24 MEMBER RAY: No, that was it.

25 ACTING CHAIR BLEY: Okay. Sam?

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1 MEMBER ARMIJO: Yes, I thought it was a
2 very good presentation. I'm far from even being a
3 novice at this area, but if Fukushima hadn't happened,
4 I think this would be a very good program. But since
5 it did happen, I'm not sure that this is the best way
6 to spend your resources. I think the -- where I think
7 we missed the boat is, is an appreciation of the
8 magnitude of the threat scenarios that our plants
9 around the world should face. Huge earthquakes, huge
10 flooding events, in combination and something that we
11 really haven't addressed. And also the duration of a
12 station blackout. It's extensive, far beyond at least
13 I understand we've thought about and analyzed.

14 So, I kind of like the Option 4 that we
15 didn't hear about, except that you were kind enough to
16 tell us that there was such an Option 4 that was kind
17 of thinking along those lines. And it may be the
18 Commissioners when they look at your proposals may
19 want to tilt you back into that approach. But this is
20 not a criticism of the work.

21 If everything -- Fukushima hadn't
22 happened, I don't think I'd have any criticism of this
23 work. But it did happen, and I'm troubled that we
24 missed the magnitude of the threat. We were just too
25 sure of ourselves.

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1 ACTING CHAIR BLEY: Mike? Mike Corradini,
2 yes. I'm going to go down there.

3 MEMBER CORRADINI: Oh, you're going to go
4 here?

5 ACTING CHAIR BLEY: Yes, at that one.

6 MEMBER CORRADINI: Okay.

7 ACTING CHAIR BLEY: Just catching up.

8 MEMBER CORRADINI: I don't have anything
9 additional. I asked enough questions which I am sure
10 they wrote down.

11 But I do think though that my only comment
12 really is that I think Bill's asked a lot of very
13 practical things that one has to consider if there was
14 essentially a zero growth model. That is, if you guys
15 are stuck with what you have in terms of resources,
16 you're going to have to make some hard -- management
17 is going to have to make -- somebody is going to have
18 to make some hard decisions. It would just seem to me
19 that this long-term has to be done. If you don't do
20 it now, it's have to eventually be done. So, I would
21 think -- I guess I encourage you to get as much
22 industry buy-in as you can. So persuasion would be my
23 biggest through relative to the industry because I
24 really do think even if they may not see it, I think
25 kit will benefit them to participate and the

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1 laboratories to participate, donate, dedicate, you
2 pick the word, to do this going forward because I
3 really do think this has some benefit.

4 You guys had your own method of justifying
5 relative to time windows. It just think you have to
6 take a fresh look at this at some sort of periodic
7 basis, even though you're not advancing the state of
8 the art. You're using the state of the art to look
9 and see what's happened. So, I think the staff is
10 going to have to be persuasive both within and
11 without.

12 You would like to have the mike or is it
13 Joy?

14 ACTING CHAIR BLEY: Joy?

15 MEMBER REMPE: I think I'm in concurrence
16 with what Dr. Corradini said that I get to do this in
17 a realistic fashion that there's a lot of entities
18 that could benefit from it. And so I would try and
19 get whatever concurrence and support you have with
20 part of what you submit to the Commission, even though
21 it will be with a lot of caveats as we heard from the
22 industry representative today.

23 ACTING CHAIR BLEY: Bill.

24 MEMBER SHACK: You know, I think I've made
25 my comments. I think I agree with Mike that I

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1 wouldn't put Option 4 back in. I'd go up with guns
2 blazing. If the Commission wants you to work on other
3 things, they'll tell you about it. Or, you know, find
4 the resources to do it all.

5 ACTING CHAIR BLEY: Other Mike.

6 MEMBER RYAN: Other mike.

7 I'm kind of with Sam that, you know,
8 Fukushima has happened and I'm going to guess there's
9 going to be things you want to do or would like to
10 address to issues that probably we haven't heard about
11 yet because it's still even now fairly early in
12 Fukushima's evolution. So, I would try and figure out
13 some mechanism to capture issues or analyses, ideas or
14 whatever it is that you think would be helpful later
15 on as Fukushima evolves so that you don't lose that in
16 the context of, you know, the work you've been doing
17 and seeing if you can collect that up in some way
18 that, you know, it's not lost and you can inform what
19 you might be doing later on. But I'd make that a
20 formal process in what you're doing. That's not a
21 huge amount of resources but a formal capture of
22 questions you might want to pursue relative to
23 Fukushima's evolution as it comes out might not be a
24 bad thing to collect formally.

25 ACTING CHAIR BLEY: Okay. Thank you.

1 Tom.

2 CONSULTANT KRESS: You know, I am
3 certainly glad to see this effort because in my mind
4 the Regulatory Commission is the Nation's guardian
5 with respect to risk. We advance. And, you know, it
6 seems ridiculous to me that we don't have a Level 3
7 capability and the ability to do more sales with your
8 own people. I mean, that seems to me like the essence
9 of NRC's job. So, I would fully support as I always
10 have getting this capability.

11 I guess I disagree on the Fukushima
12 comments because in the first place it's going to be
13 three or four years before you have enough information
14 to do anything. And by then you can have your scope
15 already outlined. So, I wouldn't associate this too
16 much with Fukushima because it looks like the reason
17 you started it. I know you started it before, but you
18 get that kind of like it's a just a knee-jerk reaction
19 and I would avoid that.

20 The other thing we mentioned come up is
21 scope and resources and time. I think this is
22 important that you do and if you can manage to get the
23 resources, I would just spread out the time. That's
24 what you usually do and, you know, you can use
25 resources come up each year so I don't see a real

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1 hurry. I mean, it can go on for years and years
2 without this, I thin kit's important to get it done
3 and if you can't get the resources together, I would
4 look at spreading out my time.

5 Let's see if I have any other comments.

6 Yes, I liked the comment somebody made.
7 I think it was you, Dan, that one of the things you
8 were going to need for additional experiments were
9 needed to validate these things. Even if I like the
10 thought that the intent includes societal risk, of
11 course, I have to say that since that's my bag. So,
12 that's basically my comments.

13 ACTING CHAIR BLEY: Thank you. I don't
14 have many more to add but I like all the comments I've
15 heard from the committee about giving you some ideas
16 to think about ways to hold to moving ahead and trying
17 to get support in any way you can to keep it moving.
18 And to me that's important.

19 Tom's point that it's really untenable not
20 to have this capability, I fully agree with and, you
21 know, Fukushima is going to teach us stuff but we
22 don't know yet how well that plant had considered the
23 possibility of external events and the uncertain in
24 them. And so we don't know if, you know, if we'd done
25 an external events PRA there and tried to consider

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1 uncertainty fully if we would have worried about this
2 event or not just yet. But I think being thorough and
3 the treatment of uncertainty, especially with respect
4 to the external event, gives you a way to deal with
5 these however they turn out. And over the next couple
6 of years we'll probably learn more about what we ought
7 to be doing in that area and I think you've got time
8 to incorporate that.

9 I'd like to thank you a really helpful
10 presentation and discussion. And you're coming back
11 in June --

12 MR. HUDSON: That's right.

13 ACTING CHAIR BLEY: For full committee.
14 I suppose the letter may have changes by then.

15 MR. HUDSON: It will and I think, you
16 know, we've talked with John Lai about the time frame
17 for submitting the paper for the full committee
18 meeting and I think we were looking at the 25th or the
19 26th for the submission of the materials maybe.

20 MR. LAI: A couple of weeks.

21 MR. HUDSON: A couple of weeks. So, we do
22 have some time to get back and to revise the paper as
23 needed to address comments. Again, we're not
24 necessarily going to be reactionary to everything that
25 we've received, but we're going to give careful

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1 consideration to all the comments that we've received
2 and come up with a strategy for how we're going to
3 resolve those comments. So, there will be some
4 revision to it. And you will be receiving the
5 revised papers prior to the full committee meeting.

6 ACTING CHAIR BLEY: Okay. And I think
7 with just a little pruning, you can probably get
8 through almost the same presentation at the full
9 committee. You have to prune it just a little I think
10 when you get there. And Hugh Boffle will be there.

11 MEMBER CORRADINI: We will just tell him
12 that he should get -- John -- he should get Dennis'
13 answers to John's question.

14 ACTING CHAIR BLEY: That's right.

15 Sorry, I lost track. I've been working
16 with John too long.

17 I think focusing on any changes will be
18 real important and -- well, I guess by then you have
19 to have something about this interaction with SOARCA
20 because you got a gaping hole there in the piece right
21 now about that. And we'll be interested in hearing
22 about that too. But look forward to that meeting and
23 thanks again.

24 Oh, I should ask, is there anyone in the
25 audience who wants to make a comment. And I suppose

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1 we should open the bridge line and see if there's
2 anyone on there.

3 John, can you tell us you're doing that?

4 John, could you go check? I'm sorry, I
5 should have asked you.

6 MR. JAIGOBIND: The bridge line is open.

7 ACTING CHAIR BLEY: The bridge line is
8 open. If there is anybody listening on the bridge
9 line who would like to make a comment, this is your
10 opportunity. Please speak up.

11 Hearing none, this meeting is adjourned
12 everyone.

13 (Whereupon, the above matter was concluded
14 at 3:48 p.m.)

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U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Options for Proceeding with Future Level 3 Probabilistic Risk Assessment Activities

Dan Hudson, Project Manager

Office of Nuclear Regulatory Research

May 11, 2011

Agenda

- Introduction
- Background
- Scoping Study
- Perspectives on Future Uses for Level 3 PRAs
- Options for Proceeding with Future Level 3 PRA Activities
- Staff's Recommendation
- Summary of Stakeholder Comments

What Are We Trying to Achieve?

Overall Vision

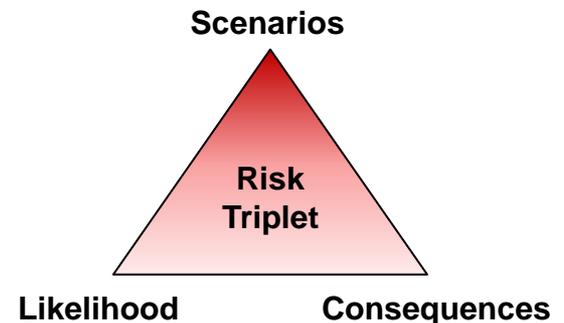
- Expand scope of NUREG-1150 analyses and incorporate advances since NUREG-1150
- Achieve analytical consistency to enable a meaningful comparison and relative ranking of site risk contributors.
- Extract new and improved risk insights to focus critical resources on issues most important to safety.

Presentation Objectives

- To discuss the NRC staff's approach and basis for the developed options for proceeding with future Level 3 PRA activities.
- To obtain feedback from ACRS members on the NRC staff's approach and developed options.
- To obtain ACRS support for the NRC staff's recommended option.

Probabilistic Risk Assessment (PRA)

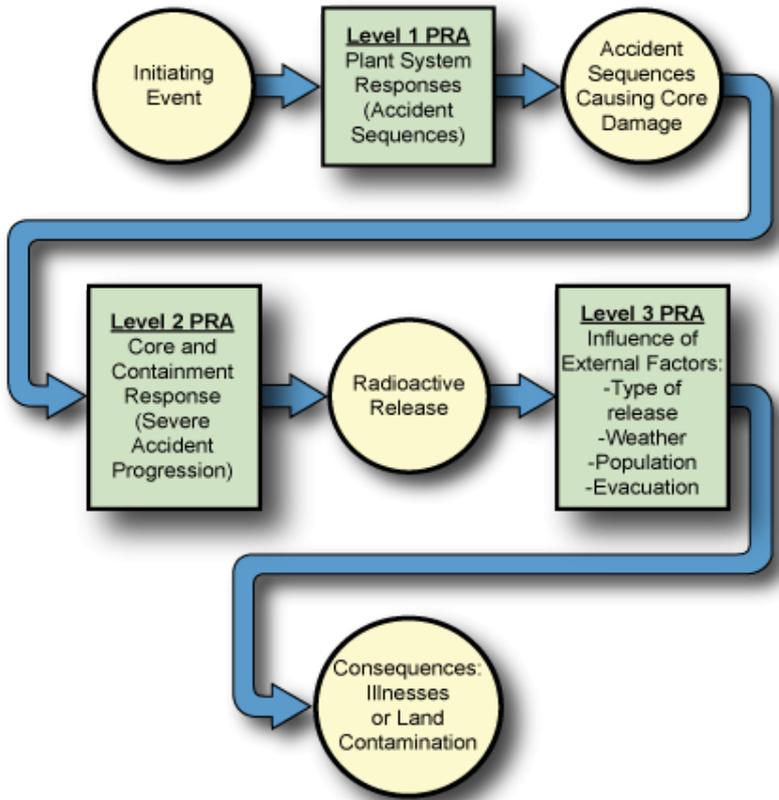
- A structured, analytical process that provides both *qualitative insights* and *quantitative estimates of risk* by:
 - Identifying potential initiating event scenarios that can challenge system operations;
 - Estimating the likelihood of event sequences that lead to an adverse event; and
 - Estimating the consequences associated with these “accident sequences.”



Scope of Nuclear Power Plant PRAs

Factor	Scoping Options for Commercial Nuclear Power Plant PRAs
Radiological sources	Reactor core(s) Spent nuclear fuel (spent fuel pool and dry cask storage) Other radioactive sources (e.g., fresh fuel and radiological wastes)
Population exposed to hazards	Onsite population Offsite population
Initiating event hazard groups	Internal hazards <ul style="list-style-type: none"> • Internal events (transients, loss-of-coolant accidents) • Internal floods • Internal fires
	External hazards <ul style="list-style-type: none"> • Seismic events (earthquakes) • High winds • Other external hazards
Plant operating states	At-Power Low-Power/Shutdown (LPSD)
End state/Level of risk characterization	Level 1 PRA: Initiating event to onset of core damage or safe state Level 2 PRA: Initiating event to radioactive material release Level 3 PRA: Initiating event to offsite radiological consequences

Significance of Level 3 PRAs



PRA End States

Level 1 PRA – Onset of core damage
 Level 2 PRA – Radioactivity release
 Level 3 PRA – Offsite consequences

Key Message:
 To quantitatively estimate the risk to the public from all radiological sources and hazards, a Level 3 PRA is needed.

Historical Perspective

- **Prior studies estimating risk to public**
 - WASH-740 (March 1957)
 - WASH-1400 (October 1975)
 - NUREG-1150 (December 1990)
 - Present day

18 years (WASH-740 to WASH-1400)
15 years (WASH-1400 to NUREG-1150)
20 years (WASH-740 to Present day)
- **Safety Goal Policy Statement (August 1986)**
 - Two qualitative safety goals
 - Two quantitative health objectives (QHOs)
- **Generic Letter 88-20 (November 1988)**
 - Initiated Individual Plant Examination (IPE) Program
 - Supplement 4: IPE of External Events (IPEEE) Program

Historical Perspective

- **PRA Policy Statement (August 1995)**
 - Increase use of PRA technology in all regulatory matters
 - Reduce unnecessary conservatism in regulatory requirements
 - PRAs should be as realistic as practicable
 - Safety goals and subsidiary numerical objectives are to be used with appropriate consideration of uncertainties
- **Regulatory Guide (RG) 1.174 (1998)**
 - Approved use of core damage frequency (CDF) and large early-release frequency (LERF) subsidiary numerical objectives that serve as surrogates for safety goal QHOs

Basis for New Site Level 3 PRA Initiative

- **Scope limitations of NUREG-1150**
 - Did not evaluate accidents involving:
 - Multiple units
 - Spent fuel
 - LPSD plant operating states
 - Other external events
- **Advances since NUREG-1150**
 - Modifications to enhance nuclear power plant safety and security
 - Improved understanding of severe accident phenomenology and advances in PRA methods, models, tools, and data
 - Updated seismic hazard data

Commission Tasking

- **Staff requirements memorandum M100218**
 - Issued in response to February 2010 Commission Briefing on Research Programs, Performance, and Future Plans
 - Expressed conditional support for new Level 3 PRA activities
 - Directed the staff to:
 - Continue internal coordination efforts and engage external stakeholders in formulating a plan and scope for future actions
 - Provide the Commission with various options for proceeding which include costs and perspectives on future uses for Level 3 PRAs

NRC Staff's Approach

- **Scoping Study**
 - April 2010 to present
- **Proposed Option for Proceeding**
 - Notation vote SECY paper to be submitted to the Commission by July 7, 2011
- **Follow-on Activities**
 - As directed

Scoping Study Objectives

- **Identify potential future uses for Level 3 PRAs**
- **Develop options for proceeding**
 - Scope of the analysis
 - PRA technology to be used
 - Site selection attributes
 - Resource estimates
- **Determine feasibility of developed options**
- **Identify staff's recommendation for proceeding**
- **Obtain external stakeholder views and support**

Scoping Study Activities

- **Internal Coordination Activities**
 - Workshops
 - Coordination meetings
 - Alignment meetings
- **External Stakeholder Engagement Activities**
 - ACRS interactions
 - Regulatory Information Conference (RIC) presentations
 - Category 2 public meeting

Perspectives on Future Uses

- Support potential future regulatory decision making
- Support specific risk-informed regulatory applications
- Provide technical basis to support resolution of issues associated with future reactor designs
- Prioritization of safety research programs
- Support PRA knowledge management

Staff-Developed Options for Proceeding

Option 1: Maintain Status Quo – Continue Evolutionary Development of Risk Tools

Option 2: Conduct Focused Research to Address Identified Gaps Before Performing Future Level 3 PRAs

Option 3: Full-Scope Comprehensive Site Level 3 PRA Study – Operating Nuclear Power Plant Site

Option 1: Maintain Status Quo

Potential Objectives

- Continue ongoing and planned research to develop and improve upon existing analytical tools on a resource-available basis.

Advantages

- Consistent with current fiscal climate
- Focuses resources on existing mission critical work

Disadvantages

- Insights from a new site Level 3 PRA would not be realized
- Can result in inconsistent and potentially more costly treatment of emerging issues by developing the necessary analytical tools on an ad-hoc basis

Option 2: Research to Address Gaps

Potential Objectives

- Conduct near-term focused research to address gaps in existing PRA technology to ensure future site Level 3 PRAs are of sufficient quality to support a wide variety of regulatory applications.

Scope (example research areas)

- Consequential (linked) multiple initiating event modeling
- Multi-unit modeling
- Post-core damage and external events human reliability analysis
- Spent fuel PRA technology
- Level 2/3 PRA uncertainty analysis

Option 2: Research to Address Gaps

Advantages

- Focuses additional resources on needed research
- Enhances PRA capability

Disadvantages

- Insights from a new site Level 3 PRA would be delayed
- Potential loss of critical momentum and duplication of scoping study effort if a future Level 3 PRA study is planned

Option 3: Full-Scope Site Level 3 PRA

Potential Objectives

- Extract new and improved risk insights
- Enhance PRA capability, expertise, and documentation
- Evaluate cost associated with developing Level 3 PRA models
- Evaluate need for and scope of follow-on activities

Option 3: Full-Scope Site Level 3 PRA

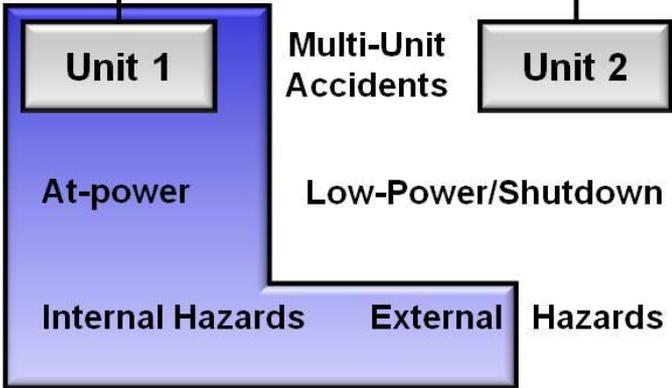
PRA Scope

Nuclear Site
Accident Risk

Reactor Cores

Spent Fuel

Spent fuel handling
 Spent fuel pool storage
 Dry cask storage



Radiological sources excluded:
 - Fresh fuel
 - Radiological waste

Initiating event hazards excluded:
 - Deliberate malevolent acts
 (terrorism, sabotage)

*Approximate Scope of
 NUREG-1150*

Option 3: Full-Scope Site Level 3 PRA

PRA Technology

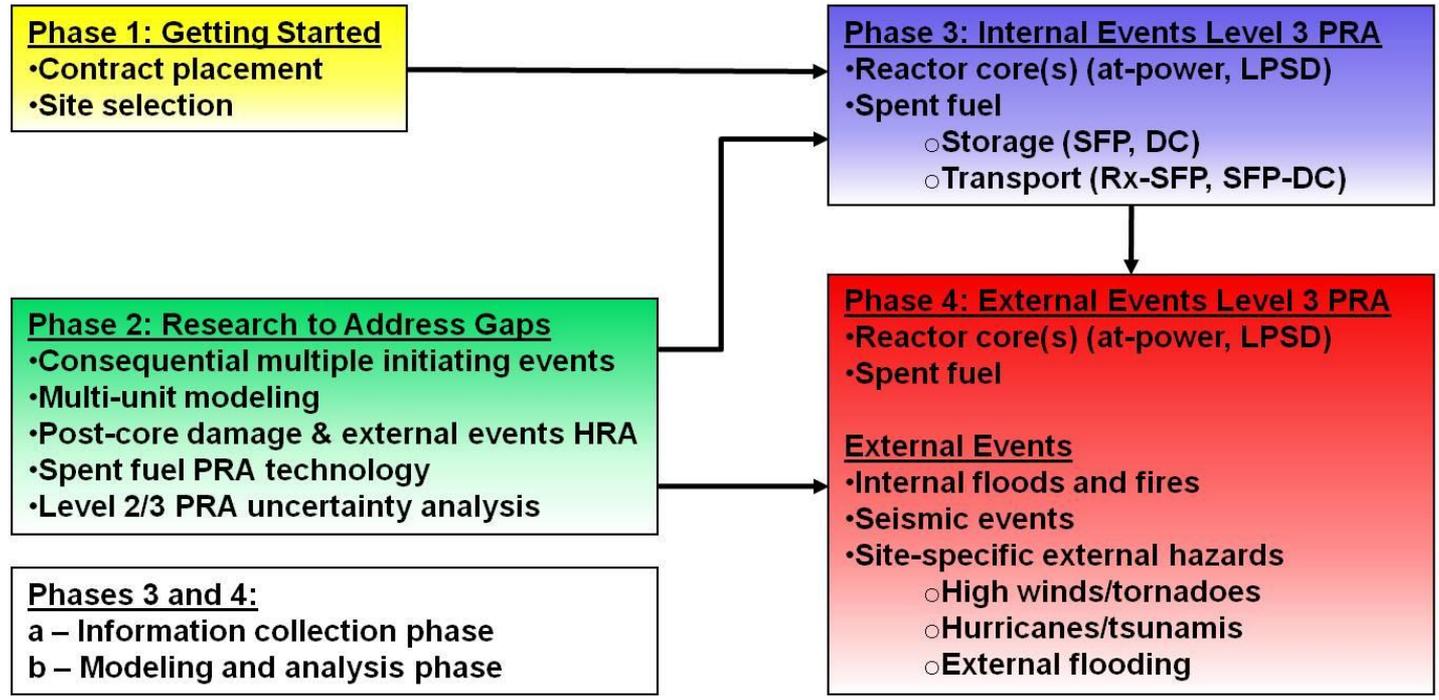
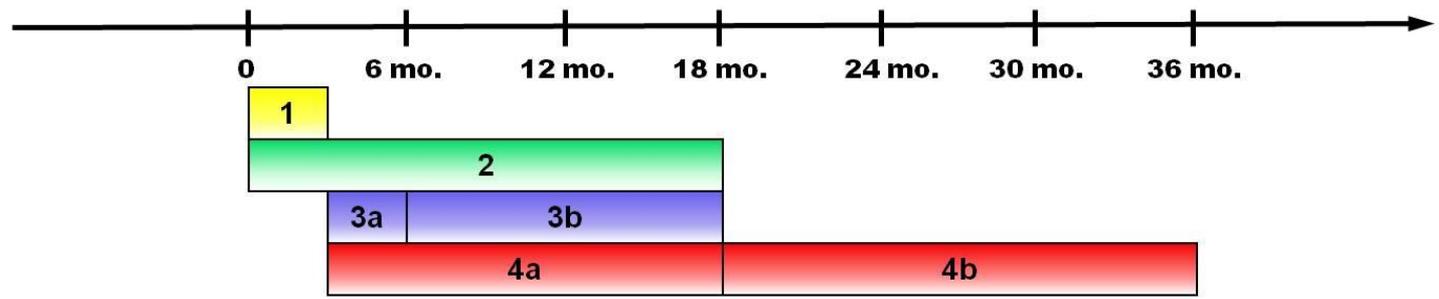
- Standardized Plant Analysis Risk (SPAR) Models
- Systems Analysis Programs for Hands-on Integrated Reliability Evaluations (SAPHIRE), Version 8
- MELCOR Severe Accident Analysis Code
- MELCOR Accident Consequence Code System, Version 2 (MACCS2)

Option 3: Full-Scope Site Level 3 PRA

Site Selection Considerations

- Multi-unit
- SPAR model capability
- Availability of MELCOR input decks
- National Fire Protection Association (NFPA) Standard 805 transition
- Site-specific external hazards
- Spent fuel pool storage Configuration
- Independent Spent Fuel Storage Installations (ISFSIs)

Option 3: Full-Scope Site Level 3 PRA



Option 3: Full-Scope Site Level 3 PRA

Advantages

- Provides new and improved risk insights to better focus critical resources on issues most important to safety
- Enhances PRA capability
- More efficient use of resources by capitalizing on scoping study efforts and momentum; prevents duplication of scoping study effort if a site Level 3 PRA study is planned in the future.

Disadvantages

- Resource-intensive, requiring more staff and contractor resources than currently budgeted

Staff's Recommendation

Option 3: Full-Scope Site Level 3 PRA

The staff believes it would be prudent and timely to demonstrate its ability to conduct a new and more comprehensive site Level 3 PRA study to assess the risk to the public from all radiological sources and hazards associated with commercial nuclear power plant sites; to better understand the important contributors to risk; and to apply this understanding to regulatory decision making.

Summary of Stakeholder Comments

Internal Stakeholders

- Objectives need to be more clear and visible.
- Remove references to severe nuclear accident at Fukushima.
- Combine “potential enhancements to current use of PRAs in risk-informed regulatory decision making” with “perspectives on future uses for Level 3 PRAs.”
- Emphasize revision of regulatory analysis guidelines as a potential use.
- Use terminology that is consistent with consensus PRA standards.
- Remove limited scope option (previously Option 4) because it is confusing and inconsistent with overall vision.
- Be more clear about issues related to the adequacy of CDF and LERF.
- Be more clear about what is meant by “integrated.”

Summary of Stakeholder Comments

External Stakeholders – Scope

- Be more clear about the distinction between Level 1 PRA, Level 2 PRA, and Level 3 PRA.
- A full-scope Level 3 PRA is needed to truly understand where the risk exists. Be careful about screening analyses.
- Cannot consider all possible combinations of initiating events; need to focus on most credible/important.
- Need to be realistic about time and resource constraints when considering scope.
- Uncertainty analysis will be an important part of the study. How are we limited by our current state of knowledge?
- Need to consider challenges associated with response to severe nuclear accident at Fukushima.

Summary of Stakeholder Comments

External Stakeholders – Potential Uses

- Inform revision of regulatory analysis guidelines
- Similar to NUREG-1150, provide underpinning for regulatory process
- Address issues associated with definition of LRF
- Pilot test PRA standards
- Potential applications
 - Evaluation of emergency planning zones
 - Inform issues associated with severe nuclear accident at Fukushima
- Development of guidance on treatment of uncertainties for areas beyond the scope of NUREG-1855.
- Resolution of open issues with PRA technology



Questions and Comments

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Acronyms and Abbreviations

ACRS	Advisory Committee on Reactor Safeguards
CDF	core damage frequency
COL	combined operating license
DC	dry cask
DRA	NRC Division of Risk Analysis
EE	external event
HRA	human reliability analysis
IPE	individual plant examination
IPEEE	individual plant examination of external events
ISFSI	independent spent fuel storage installation
L2	Level 2
LERF	large early-release frequency
LPSD	low-power/shutdown
LR	license renewal

Acronyms and Abbreviations

LRF	large release frequency
MACCS2	MELCOR Accident Consequence Code System, Version 2
MELCOR	severe accident analysis code (not an acronym)
NFPA	National Fire Protection Association
NRC	U.S. Nuclear Regulatory Commission
PRA	probabilistic risk assessment
QHO	quantitative health objective
RES	NRC Office of Nuclear Regulatory Research
RIC	Regulatory Information Conference
SAPHIRE	Systems Analysis Programs for Hands-on Integrated Reliability Evaluations
SECY	NRC Office of the Secretary of the Commission
SFP	spent fuel pool
SPAR	standardized plant analysis risk



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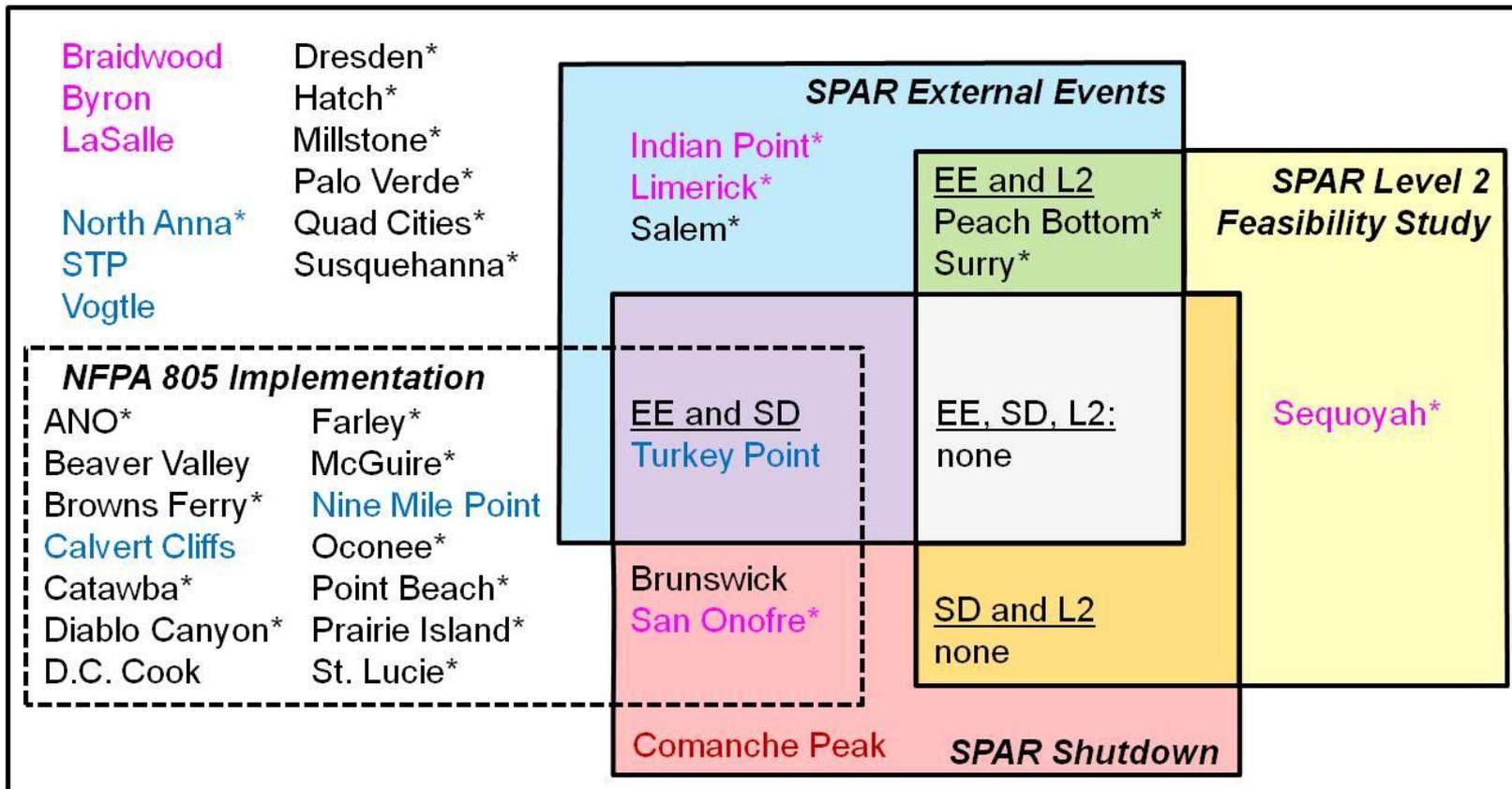
UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment

Backup Slides

Option 3: Full-Scope Site Level 3 PRA

Site Selection Considerations



Legend: No LR or COL LR only COL only LR and COL *ISFSI