Official Transcript of Proceedings ACRST-3316

NUCLEAR REGULATORY COMMISSION

ORIGINAL

Title: Advisory Committee on Reactor Safeguards 523rd Meeting

PROCESS USING ADAMS
TEMPLATE: ACRS/ACNW-005

SISP REVIEW COMPLETE

Docket Number: (not applicable)

Location: Rockville, Maryland

Date: Wednesday, June 1, 2005

Work Order No.: NRC-423 Pages 1-358

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

TR04

DISCLAIMER

UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

June 1, 2005

The contents of this transcript of the proceeding of the United States Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, taken on June 1, 2005, as reported herein, is a record of the discussions recorded at the meeting held on the above date.

This transcript has not been reviewed, corrected and edited and it may contain inaccuracies.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

\+ + + + +

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

\+ + + + +

523rd MEETING

\+ + + + +

WEDNESDAY

JUNE 1, 2005

\+ + + + +

ROCKVILLE, MARYLAND

\+ + + + +

The Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., Graham B. Wallis, Chairman, presiding.

MEMBERS PRESENT:

GRAHAM B. WALLIS	Chairman
WILLIAM J. SHACK	Vice Chairman
GEORGE E. APOSTOLAKIS	Member
MARIO V. BONACA	Member
RICHARD S. DENNING	Member
THOMAS S. KRESS	Member

MEMBERS PRESENT (CONTINUED):

DANA A. POWERS	Member
VICTOR H. RANSOM	Member
STEPHEN L. ROSEN	Member
JOHN D. SIEBER	Member-At-Large

ACRS STAFF PRESENT:

JOHN T. LARKINS	Executive Director
ASHOK C. THADANI	Deputy Executive Director
RALPH CARUSO	
SAM DURAISWAMY	
JENNY M. GALLO	
CAYATANO SANTOS	
MICHAEL L. SCOTT	
MICHAEL SNODDERLY	

NRC STAFF PRESENT:

MARY DROUIN	RES
HOSSEIN HAMZEHEE	RES
J. S. HYSLOP	RES
JOHN LANE	RES
PATRICK LOUDEN	Region III
DAVID MATTHEWS	NRR
MARTY STUTZKE	NRR

ALSO PRESENT:

DOUGLAS COOPER	Nuclear Management Company
ALAN KOLACZKOWSKI	SAIC, via teleconference
GERALDO MARTINEZ	Brookhaven National Laboratory
BIJAN NAJAFI	SAIC/EPRI
STEVEN P. NOWLEN	Sandia National Laboratory
JIM SCHWEITZER	Nuclear Management Company
BOB YOUNGBLOOD	ISL

A-G-E-N-D-A

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

(8:30 a.m.)

CHAIRMAN WALLIS: Good morning. The meeting will now come to order.

This is the first day of the 523rd meeting of the Advisory Committee on Reactor Safeguards. During today's meeting, the Committee will consider the following:

Interim review of the license renewal application for the Point Beach Nuclear Plant, Units 1 and 2, draft Commission paper on policy issues related to new plant licensing, fire risk requantification and probabilistic risk analysis methodology for nuclear power plants, draft Commission paper on proposed alternatives to the existing single-failure criterion, and the preparation of ACRS reports.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act.

Dr. John T. Larkins is the Designated Federal Official for the initial portion of the meeting.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's sessions.

A transcript of portions of the meeting is being kept and it is requested that the speakers use one of the microphones, identify themselves, and speak with sufficient clarity and volume so that they can be readily heard.

I will begin with some items of current interest. John Lamb joined the ACRS staff as a Senior Staff Engineer on May 16th. John joined the NRC in June 2000 as a Licensing Project Manager in the Office of Nuclear Reactor Regulation, Division of Licensing Project Management.

His assignments included being the Lead Project Manager for Generic Safety Issue 191, Assessment of Debris Accumulation on Pressurized Water Reactor Sump Performance and also being the backup Lead Project Manager for power uprates, both areas of considerable current interest to the Committee.

John just completed a rotational assignment as a Lead Project Manager for Grid Reliability in NRR's Division of Engineering.

Before joining the NRC, John worked for 15 years for Consolidated Edison Company of New York, with 12 years at Indian Point Unit 2.

He received a bachelor of science degree in mechanical engineering from Villanova University and a master of science degree from the State University of New York at Buffalo.

This is the last time that Steve Rosen will join us as a member of the ACRS. Please show your appreciation of his contributions to the Committee and of the pleasure we've had in having him as a colleague over the last four years. Thank you, Steve.

(Applause.)

CHAIRMAN WALLIS: I should have also asked you to welcome John Lamb in the same sort of way.

(Applause.)

CHAIRMAN WALLIS: There are several SRMs in the items of interest which has been handed out for you today. This room got very crowded yesterday when we were discussing Point Beach. And the meeting in here is being piped next door. If anyone is feeling overcrowded here, you can step next door and see what is going on.

It's also being transmitted over Channel 48 in White Flint 1 and 2. So members please note that you will be on television today. So act accordingly.

(Laughter.)

CHAIRMAN WALLIS: Without more ado, I'd like to move on with the real business. And I'd invite Dr. Bonaca to lead us through the first item.

MEMBER BONACA: Yes, good morning.

Yesterday we met as a Subcommittee on License Renewal to review the application and SER, interim SER with open items for Point Beach. We reviewed the SER as we normally do. We noted a number of open items. We also noted that there are some scoping issues still to be fully resolved which is only telling us that maybe the SER could have been held back for a month or two and probably all of these issues would have been dealt with.

There was not anything noticeable about this application, you know, different from the others. The main difference is for the first time we saw a vessel for Unit 2 that would not be able to meet the screening criteria for PTS at the end of 20 years of extended life.

And the licensee has opted to choose an approach where they will manage fluence which will allow them to go not much more than eight years into license renewal. By that time they'll have some options that they can choose to reach 20 years of extended life.

This is an accepted approach by the NRC. We had no specific comment at this stage regarding this issue.

The reason for bringing this application to the full Committee at this stage is tied to the current performance of Point Beach. As you know, Point Beach is now in the column 4 of the ROP Action Matrix with an open Confirmatory Action Letter that identifies several weaknesses of significance in current performance.

Now this Committee has consistently been supportive of the rule. And the rule does not take into consideration current performance. We don't intend to change that rule at this stage. I mean we don't have a recommendation to do that. We will recognize the current performance is not a condition of the rule.

We're only concerned about those aspects of current performance that may effect one, the proper establishment of commitments of the rule, okay. Take, for example in this case, human performance. I mean human performance is one of the crosscutting issues identified that gives us some concern regarding, you know, the extent to which inspections done by the NRC gives the confidence that these commitments have been properly implemented.

The other concern, of course, is with Corrective Action Program. Corrective Action Program is the foundation to license renewal. Every program of license renewal runs through Correct Action Program either to identify the aging mechanism that you have to deal with or aging effect and also to correct it. So, therefore, it's really the cornerstone of license renewal.

And this plant, the first plant will go into license renewal in five years. So we may certainly hope that the Corrective Action Program will be improved by that time. But certainly it would have been nicer to see it already improved. And so we wanted to hear from the staff yesterday about, you know, where did they stand right now with this program.

Again, we're not trying to make them part of license renewal. But to get the confidence that these elements which are so important to licensee renewal will be effective and will be effectively implemented.

With that, we received a presentation from Region III which was quite effective. So we asked Region III to come back today and give the whole

Committee an overview of those issues we discussed yesterday. And that's what will happen.

Before that, however, we have a brief presentation from Mr. Cooper of Nuclear Management Company that manages a number of these units and that will take probably about ten minutes.

And before that, I believe Mr. Matthews of NRR is going to make some statements, too. So I will turn the meeting to Mr. Matthews.

And then we'll have the other people on the agenda.

MR. MATTHEWS: Thank you, Dr. Bonaca.

I'm David Matthews. I'm the Director of the Regulatory Improvement Programs in the Office of Nuclear Reactor Regulation. One of those programs is the license renewal program in addition to the rulemaking and advance reactor activities that NRR has responsibility over.

These will be very brief remarks. I just want to acknowledge and thank you for your consideration of the distinction that does exist in the regulations with regard to aging management programs, time-limited aging analysis as being the principle focus of license renewal.

I do understand the statement and the

concern with regard to -- I guess I'd put it in the category of possible anxiety prompted by the Corrective Action Program deficiencies that have been identified. And their relationship to any of a number of programs as we continue forward also into the period of extended operation.

So I mean we have an immediate concern over the next five to ten years relative to continued operation of the two units. And we see how those same concerns would be an issue that the Committee would want to be reassured on.

But as you understand, the licensing review of aging management, time-limited aging analysis is the focus of license renewal. And that's the basis upon which the SER is written.

To the extent that the Committee at some juncture, you know, is going to propose or suggest based on your collegial view that maybe there be a consideration with regard to operating programs, that would constitute the need for a rule change. And we'd have to, you know, you raise it and we'd have to address it in front of the Commission.

So I think with that, I'll conclude any comments with regard to what I view the separation of license renewal and operating history. And I'm pleased that the staff was able to provide some reassurance for you yesterday. And we're prepared to address those issues again today for the benefit of the full Committee.

And with that, I think I'd like to turn it over, I think, to Mr. Cooper.

MEMBER BONACA: That's right. Thank you.

MR. COOPER: Good morning. Now where do you prefer me to be at?

MEMBER BONACA: Any location at the table. And please speak in the microphone.

MR. COOPER: Yes, sir.

First of all, thank you for allowing me to make a few brief comments. My name is Douglas Cooper. I'm a Senior Vice President of Group Operations for Nuclear Management Company. I'm responsible for Point Beach, Palisades, and Kewanee Nuclear Plants.

Yesterday afternoon when I spoke to the Chairman, he asked me to talk about performance at Point Beach, specifically relative to where performance is. And to talk about Corrective Action Programs and human performance. And I think that's appropriate.

I remember a report issued by the IAEA on safety culture. And in that report, they say something to the effect of except for what can legitimately be characterized as acts of God, performance at all nuclear power plants originate in some form of human error or human performance. And we subscribe to that. And that's what our improvement program is based upon.

So today what I'll talk about very briefly, what have we done specifically to improve performance and Point Beach? And if we have made progress. And why do I feel confident that performance will continue to improve?

I was assigned at Point Beach -- or I picked that up as one of my plants in the fall of 1994. And that was just when the 950003 Inspection was becoming final. And I don't need to go into these in great detail. But in that report, it categorized our findings in terms of five broad areas where we needed to improve.

Point Beach had an Excellence Plan in place but what that inspection, in addition to some of our own internal evaluations which were ongoing, told us was that we needed to do more. And so we took that Excellence Plan and we actually overhauled it. We did much more than enhance it.

First of all, it needed to be resource-loaded. It needed to include more routine monitoring and updating as things changed. And I'll tell you based upon our assessments, there were four broad objectives that had to occur -- or actually three broad objectives that had to occur. And I'll show you how those lay out later.

But first of all, we had to ensure that we had the right team in place. So the first task was to select and retain the right people.

The next thing was to communicate what performance looked like. What was the right picture of performance? And then we had to put the items in place to routinely enforce that picture of performance.

And then thirdly, we had to routine -- continuously monitor and verify the effectiveness of the programs that were in place.

Now I'll speak to corrective action. What I will tell you was the Corrective Action Program was not the problem. The thing that we had to address was individual behaviors and how we utilize the Corrective Action Program.

What we have here is what we call the Picture of Excellence. And this is a structure which has been put in place and, I believe, ingrained at

Point Beach to allow us to monitor performance and to enforce this picture.

What this tells us, we use it to communicate first of all what are the right behaviors. What does it look like when individuals are performing the way we expect? That's one thing that is incorporated in here.

Secondly, it includes routine performance indicators. What does it look like in objective terms when it is done correctly? If you look at the top, what we call the pillars, which is there on up, we have attributes and behaviors, and we've done training for every person on site. There are specific performance indicators. For instance, under Organizational Excellence, there are specific performance indicators for the Corrective Action Program. What do they look like?

MEMBER POWERS: Can I ask you a question?

MR. COOPER: Yes, sir.

MEMBER POWERS: Everything has got "excellent" up here. What would be missing if it was pretty darned good instead of excellent? What takes you from pretty good to excellent in this list of things here?

MR. COOPER: As far as behaviors, I would tell you nothing. From pretty good to excellent would be there are specific measures of performance in all of these. So it is a matter of how high the bar. So we have the right performance indicators. But it's what --

MEMBER POWERS: Well, I have to have something quantitative in order to understand what excellence is here.

MR. COOPER: Excellence is in terms of our performance as measured against our peers.

MEMBER APOSTOLAKIS: Are you going to show us some of the performance indicators?

MR. COOPER: No. Based upon the ten -- I could do that at a later date. But I have ten minutes. And so I didn't bring the specific performance indicators.

MEMBER APOSTOLAKIS: I'd like to see those. Who is the engineer? Okay. Thank you.

MR. COOPER: Yes.

So we have organizational. These performance indicators are measured at the organizational level. Also embodied in these performance indicators we look at are the CAL indicators. And for the CAL, we have specific measures of performance which in large part are taken from the performance indicators we already had in place. And we routinely monitor those.

If you go over under Equipment Excellence, there are things such as corrective maintenance backlogs, elective maintenance backlog. We have specific measures of equipment performance that feed directly -- if done well, they feed directly into the NRC performance indicators. So they're graduated and one supports the other.

CHAIRMAN WALLIS: Do you have many measures of improvement in performance over the last oh, whatever you want to say -- years, months, or something? Presumably there are measures of these things. Is there a trend that you could tell us about?

MR. COOPER: Yes. Overall, we have seen improvement in most trends. Some of the -- I can give you some specific examples. Corrective maintenance, Jim, I need your help. When we started a year ago at the beginning -- or at the beginning of '94, our corrective maintenance backlog was in the neighborhood of over 100.

MR. SCHWEITZER: Correct.

MR. COOPER: But we're currently at about 13 for both units. Elective maintenance was at the tune of over 500 if I --

MR. SCHWEITZER: Close to 600.

MR. COOPER: -- 600 and now we're in the neighborhood of 250.

MR. SCHWEITZER: Under 250.

MR. COOPER: Under 250.

MEMBER SIEBER: And how did you do that? Add more staff? Work overtime? Or eliminate --

MR. COOPER: We did not add more staff.

MEMBER SIEBER: -- eliminate items from your list.

MR. COOPER: We did not eliminate items. What we actually did was it was a combination of a number of things. First of all, we set out specific performance standards for the staff. One thing that we will talk about specifically, we worked very hard on communicating what the right level of performance is, down to the individual.

We communicate and provide feedback to the individual level and groups. But five days a week at noon every day, we provide in general -- specifically how the organization performed in our six elements of individual excellence. And then routinely we provide -- so we provided a clear picture of right looks like. We monitored how we were doing. And we fed back to the individuals.

We did add -- we worked additional overtime to at least get the backlog -- trimmed it down. But right now we maintain that backlog with, by and large, no overtime.

So it really goes back to -- what I would say one thing that is different is we focus performance at the individual level. We've communicated how individual performance feeds organizational performance and excellence above.

You might ask why do we talk about excellence as opposed to just getting it good. What we found, based on industry experience, is if you set the bar at just get me good enough, that's where the staff starts relaxing. You have to go toward excellence, understanding -- and we understood that the first thing we had to do was transition through good enough.

MEMBER BONACA: How is, you know, you correctly said before that human performance is the key to everything. You can lay down a program and the program has all the elements. But then humans are the people.

MR. COOPER: Right.

MEMBER BONACA: Now this is an old site.

And I'm sure you have a lot of old-timers there.

MR. COOPER: Yes.

MEMBER BONACA: Are they accepting the changes you are making in procedures? In more detailed prescriptive ways to do business? Or do you find there is a problem there?

MR. COOPER: I would say they are responding. And across the site, there are different levels of -- I will say -- you know we get response from almost everyone. As far as buy-in, it's varying.

But what I can tell you is I'll talk about one specific element on how we're taking performance to the individual level. Every day every work group stands down at lunchtime. And we talk about how did the organization perform on these critical elements relative to industrial safety, in terms of radiological dose performance, in terms of nuclear events, basically errors.

We talk about how do we meet commitments relative not just to meeting the schedule but what we told others we would do. And what did we tell each other we would do. So we -- and then we talk about training and rework. What resulted in rework?

MEMBER POWERS: Can I ask you a question?

MR. COOPER: Yes, sir.

MEMBER POWERS: You said you do this every day at noon. You stand down all the workers. That means there's nobody in the Control Room operating the plant?

MR. COOPER: They're in the Control Room. Yes, sir. What we do is the Control Room is in place but they review these parameters during generally over their turnovers. Jim, that's correct at the beginning of the staff?

MR. SCHWEITZER: That's right. They would review them during each turnover. They do not have a specific stand down during the day where they stop monitoring.

MEMBER POWERS: So every worker doesn't stand down at noon is what you're saying?

MR. COOPER: That's correct. That's a good question. I should have been a lot clearer on that.

But part of that discussion is how did we do and what do we need to do over the next 24 hours to ensure that the thumbs are all up? We measure it in terms of thumbs up or thumbs down. We try to keep it as easy as we can so it is a very real conversation, supervisor to individual.

Now what I will tell you, back to your

point, Mr. Chairman, I've sat in a number of these. Some of the conversations are very good. Others are toward the minimum. But there is -- in every one, there is a dialogue on what is our performance and what do we need to do to go forward.

That is what has produced a lot of progress, specifically if you talk about human error performance. When we started this picture rollout at the beginning of '94, I don't remember exactly what we were between site resets but it was 30 days or less. Our current average is over 121 days between clock resets.

MEMBER APOSTOLAKIS: I'm a little confused now. Dr. Bonaca said earlier -- I'm sorry I missed the supplemental meeting, Dr. Bonaca said that the plant is now in the fourth column of the action matrix.

MR. COOPER: That is correct.

MEMBER APOSTOLAKIS: How can that be after all this excellence being implemented since 1994?

MR. COOPER: Because it takes time. First of all, and I certainly would, if there is anyone from the NRC that would like to talk about the regulatory oversight process, it takes a while to get off. You don't get off of it from one day to the next.

MEMBER APOSTOLAKIS: Off what?

MR. COOPER: Off from Column 4 into Column 1.

MEMBER APOSTOLAKIS: But how did you ever get into Column 4? I mean with all this stuff since 1994.

MR. COOPER: This was not in place prior to going to Column 4. This is new since the beginning of 2004.

MEMBER APOSTOLAKIS: Oh, 2004.

MR. COOPER: Yes.

MEMBER APOSTOLAKIS: I thought you said 1994.

MR. COOPER: If I said that, I misspoke.

MEMBER APOSTOLAKIS: Oh 2004. Okay.

MR. COOPER: 2004. Oh, no. This is what we've done to improve and to sustain.

MEMBER APOSTOLAKIS: All right.

MR. COOPER: If I said 1994, I --

MEMBER APOSTOLAKIS: That's what I heard.

MR. COOPER: So I know the time is limited. I'll stay here as long as you'd like me to stay. But what I would say is this structure provides first of all what are clear expectations in terms of behavior. What are clear expectations in terms of objective measures of performance?

And then routine monitoring of the Excellence Plan. At least monthly, the senior staff sits down and discusses what do we need to focus on, what do we need to change, what do we need to do differently.

Next slide. The next thing that was done between the -- as we enhanced the Excellence Plan, we -- candidly we had a plan that was probably that thick. It was thick. And it was beyond the comprehension of the general worker to say what am I doing? How does it contribute to achieving success?

So part of this Excellence Plan we established "Six for Success" and we looked out over the next 18 months. And we said these are critical things -- now there's other things -- but what are six things that the workforce can relate to that they know we have to be successful in?

And then we looked at the Excellence Plan and said what things have to be in place to support that? And we began with dry fuel storage in the fall of 2004, the spring refueling outage, of clearly meeting our commitments to the Confirmatory Action Letter, the fall outage, we have an operations training accreditation at the beginning of 2006, and then the INPO evaluation in 2006.

So we keep this before the workforce. We talk about daily performance. And is what we're doing today meeting -- contributing to success? Now what I can tell you is dry fuel storage was completed the last part of November of 2005. And it was error free. It was on schedule. And it was quite successful.

MEMBER KRESS: Is your spent fuel pool filled up?

MR. COOPER: It's -- Jim? It's not totally full.

MR. SCHWEITZER: No. We have enough room in the spent fuel pool to allow for a full core offload. And we have a campaign to continue to load casks as necessary.

PARTICIPANT: You need to use a microphone.

MR. SCHWEITZER: We have enough room in our spent fuel pool right now for a full core offload and we have a continuing campaign to continue to load casks to maintain that.

MR. COOPER: So what I've attempted to do is to lay out what we put in place to improve performance and what we have in place to sustain performance.

The other things I would -- yes, sir?

MEMBER KRESS: What is the goal less than one -- is that half of a radiological event? Or a fraction of a radiological event?

MR. COOPER: None.

MEMBER KRESS: That should be none?

MR. COOPER: That's correct.

MEMBER KRESS: It just seems strange to put a goal like that -- less than one.

MR. COOPER: Yes, I'll take that coaching. Thanks a lot.

CHAIRMAN WALLIS: That's just to give you something to ask about.

MEMBER KRESS: Oh, I see, I see.

(Laughter.)

MEMBER KRESS: That's what that was for.

MR. COOPER: So we talked about what we have in place. I'd like to -- in case I missed the point, the first thing we knew we had to do for this Excellence Plan we had to select and retain the right people. I will tell you from -- I came on board in the fall of 2004.

Between then and now, of approximately 23 to 24 senior management positions, 70 to 75 percent of those people are new in position. And that is a mix of bringing in outside folks from outside the NRC fleet, moving some people from within the fleet to Point Beach, and then selecting and moving people from within Point Beach to different jobs. Jim Schweitzer is an example of a Point Beach person that was moved into a new position.

And we're continuing to evaluate do we have the right people in position. For instance, we're going down through the supervisor level. We're evaluating every person on site for do we have the right basic skill set to continue improvement and providing the help or moving if appropriate.

The next thing was to communicate and enforce the right picture. And then thirdly was to verify that we have the right implementation of the right processes in place. And then engaging the workforce.

Now let's talk about basically what we've seen as results. These are the outage goals. And what we've seen to date relative to outage performance. And what I can tell you, the change between last spring's outage and this spring's outage -- we still have a ways to go but it is remarkable, particularly -- or, it's good in terms of what we've done in human performance. And human performance actually drives the actual results we've actually seen.

The results to date, I don't need to read them all to you. I would highlight a couple. We had our emergency preparedness exercise, which was conducted in December of 2004. That was clearly communicated to us from the NRC that we had to be successful in that venture and we were.

Human performance, we talked about the clock resets are currently -- we're at 121 days. It's an average between site clock resets. That's a significant improvement.

In the Confirmatory Action Letter, and this has been an issue that we worked hard on, there are 143 separate tasks that have to be accomplished to fulfil the CAL. We're currently at 134 and on track. We have met 60 of the 65 performance measures. That's how effective are the actions. And we're on track with the remaining five. And you can read the rest.

The last board I would say is not only do we just look at performance indicators, but we routinely assess our own performance and utilize the performance of outside agencies and organizations to improve our performance. And all of the outside looks have shown progress.

MEMBER SIEBER: When do you expect to complete all of the items and meet all of the parameters in your Confirmatory Action Letter?

MR. COOPER: By the end of this year. We're on track to have most of them done by June of this year. A couple of them have been -- the calculation reviews, we have extended into 2006. But other than that --

MEMBER SIEBER: These are engineering calculations?

MR. COOPER: That's correct.

MEMBER SIEBER: Okay. Who is doing that? Your engineers? Or have you hired somebody?

MR. COOPER: We're actually utilizing an outside vendor with oversight from our own engineers. We're accountability for performance but the bulk of the work is being done by an outside vendor.

MEMBER SIEBER: Have you captured most of the or all of the engineering records that pertain to the design and construction of your plant?

MR. COOPER: I believe yes but I'm going to ask Jim Schweitzer who is our Engineering Director to answer that question.

MR. SCHWEITZER: This is Jim Schweitzer from Point Beach. The question was have we captured all of our design information. For the calculations, we have gone back and reviewed and we pulled all of our safety-related and calculations that support safety-related calcs. There were about 1,400. And we have done a complete review of those and identified everything that we need to revise.

We also have DBDs, design-basis documents, in place. And we are going through another review at this time to do a validation of those. And we're going through them based on risk significance. We've completed aux feedwater, which is the most risk-significant. We're just in the process of completing service water and fire protection. And then we'll continue on through the rest of them.

MEMBER SIEBER: One final question. When you did this review, particularly of calcs, did you find any errors?

MR. COOPER: Jim?

MR. SCHWEITZER: Yes, we did find some errors. And all of those errors as we found them would be entered into our Corrective Action Program and there were a number of them that we had to operability determinations on to demonstrate that even with the error in the calc, that the equipment would be able to perform its function.

And we may still be in some of that discovery as we step through and do the detailed revisions. There are about 200 calculations that we're doing a revision to or either incorporating other calcs into it and redoing the calc completely.

MR. COOPER: And we do have the right administrative controls in place so that we don't go and use an unvalidated calc. Correct Jim?

MR. SCHWEITZER: That's right. For all the calcs that have any type of problem, they are on administrative hold so that if someone picks them up, we can tell them what the problem is and we'll figure out how we will address it. But all the calcs with any issues are on administrative hold.

MEMBER ROSEN: You said you had design-basis documents in place?

MR. SCHWEITZER: Yes, we do have design-basis --

MEMBER ROSEN: Does that mean that they're new or that they were in existence and have been revised? Which?

MR. SCHWEITZER: Design-basis documents were generated in the 1980s. We have done one revision to them. And we're doing another -- just another validation at this time, again to go back and look and make sure that we've incorporated all the latest design items. And also trying to streamline them to be a little bit more user friendly than they have been in the past.

MEMBER BONACA: To what extent does this review effect the license renewal team? I mean are they aware of the changes, the modifications, some of the errors found? I'm trying to understand what linkage there is there.

MR. SCHWEITZER: Anything that we would find -- like I said we go through our Corrective Action Process, that would be -- I think the license renewal group does take a look at most of the items that hit into the Correction Action Process. And we're linked fairly closely also. So they would be aware of any significant errors or issues that we would come across.

MR. COOPER: It's the expectation as anything is entered into the Corrective Action Program, we evaluate for extent of condition and impact on current operations and future. That's an expectation.

MEMBER BONACA: Okay.

MR. COOPER: Last slide. These are the comments that we've taken from the public meetings with the NRC and the most recent Agency Action Review Meeting. I would summarize these by saying progress has been noted in all five areas. We do have some challenges in the area of the calculation project because of the volume of that. And it's going to take careful project management but we are accountable and committed to make sure we're successful on that.

But there has been progress noted both from outside evaluators and including the NRC in most recent public meetings.

So that's the extent of my comments. And thank you for the opportunity.

MEMBER BONACA: I thank you for the presentation.

I wonder are there questions from the Members? If not, we can move to the Region's presentation. I thank you again.

MEMBER SIEBER: I think if they are successful with this, that will be a pretty major achievement. It's one of the situations where if you're not successful or you fail or don't finish, you're probably in as much trouble as you were in had you not even started.

MR. COOPER: Well, I agree with you. There are a number of sources that tell you once you get religion and start going towards it, if you fall back, you're worse than had you never started.

MEMBER SIEBER: That's right. That's right.

MR. COOPER: And I will tell you it's my job to make sure we don't fall back. And there's a team of managers that every day are making sure we don't fall back.

MEMBER SIEBER: All right. Thank you.

MR. COOPER: Yes, sir. Thank you.

MR. LOUDEN: Good morning everyone. My name is Pat Louden. I'm a Branch Chief in the Division of Reactor Projects in the Region III Office in Lisle, Illinois. I'm the Branch Chief for the region that oversees the inspection activities at Point Beach.

And my presentation today is to provide an overview, a short background of the red findings and the placement of Point Beach into Column 4 of the Action Matrix. And I'll also go over activities that we've conducted in the region as far as inspection activities. And also with what the assessment results have been, particularly I will address the two specific areas of human performance and the Corrective Action Program.

MEMBER BONACA: Great.

MR. LOUDEN: Okay. Next slide. During a PRA upgrade in 2001, the licensee identified a potential common mode failure mechanism for the aux feedwater system during certain transients. This issue was identified by their PRA staff and was communicated to the NRC.

We responded by conducting a special inspection which reviewed the circumstances surrounding the issues associated with the aux feedwater system.

The particular item involved the minimum recirculation valve, an air-operated valve that would fail close. And the particular transients that we were concerned with were those with the loss of instrument error combined with the need for operators to throttle back on feeding the steam generators and, therefore, being more dependent on recirc flow.

MEMBER APOSTOLAKIS: How did the PRA team find this? I mean they were doing the PRA and they asked questions?

MR. LOUDEN: That was a licensee effort. And I think they would best answer what their team was doing and how they identified that problem. It was licensee identified.

MEMBER APOSTOLAKIS: Okay.

MR. SCHWEITZER: Jim Schweitzer from Point Beach. What we were doing was a PRA update. And what it was was including operator actions, operator-critical actions. So it was looking at the timed actions.

And because the aux feedwater one, we were relying on the fact that the operators would have to take actions to assure that we maintained minimum flow through the aux feedwater pump, it came up high on the risk assessment. So it was an upgrade, adding actual operator actions.

MEMBER APOSTOLAKIS: And how did you find the problem? I mean, you know, usually people add the operator actions and they give a number and everybody is happy. But you went beyond that. So that's where I'm missing something.

MR. SCHWEITZER: It did go a little beyond. It went to start looking at what were the critical actions and how -- and if they were not performed correctly, what would be the problem. What we really identified here is that some of these actions were not procedurally driven so that changed the factor that was applied for it.

MEMBER APOSTOLAKIS: Oh, okay. Okay. So

it was not just a matter of probabilities? They had to take initiatives and do things that were not in the procedures.

MR. SCHWEITZER: That's right. It was evaluating the probability of performing the correct human performance action.

MEMBER APOSTOLAKIS: Okay.

MR. SCHWEITZER: And there's different levels based on whether it's proceduralized, whether it's trained, whether --

MEMBER APOSTOLAKIS: And you decided to change the procedures?

MR. SCHWEITZER: We did change the procedures after that, correct.

MEMBER APOSTOLAKIS: And that's why you informed the NRC?

MR. SCHWEITZER: Well, we informed the NRC at the time because we identified that it was a significant issue associated with the PRA.

MEMBER APOSTOLAKIS: See, that's what I don't understand. What is it that makes it a significant issue?

MR. SCHWEITZER: The calculated core damage frequency was high enough to put us in --

MEMBER APOSTOLAKIS: How high was it?

MR. SCHWEITZER: I don't remember the exact number.

MEMBER APOSTOLAKIS: Was it ten to the minus three?

MEMBER BONACA: Well, let me just say that, you know, this -- by throttling back, I mean there was an issue with the loss of air. And that effected the auxiliary feedwater system.

I understand it effected to PORVs, therefore effecting the possibility of bleed and feed. So there was a cascading effect in many parts. I don't know what the results of the CDF would be.

MEMBER APOSTOLAKIS: But my question, Mario, is at which point did the licensee decide wait, this is important. We'd better let the regulators know about it.

MEMBER BONACA: Well, I think internally, they discussed it for about a month.

MEMBER APOSTOLAKIS: And why?

MEMBER BONACA: Because when you have an operator action to throttle and the question is will he throttle correctly, will he succeed, not succeed --

MEMBER APOSTOLAKIS: This is not unusual. I mean I've seen many --

MEMBER BONACA: Of course it's not

unusual.

MEMBER APOSTOLAKIS: -- in a lot of PRAs they have that problem.

MEMBER BONACA: The reason why I think also it is important to put it in perspective, I think this issue -- there were many opportunities to identify it since 1981.

MEMBER APOSTOLAKIS: I understand.

MEMBER BONACA: There were bulletins of the NRC specifically addressing the issue of air --

MR. LOUDEN: That's correct. Our inspection that we conducted --

MEMBER BONACA: -- requesting the licensees to review, in fact, the possibilities that these kinds of things would happen. And that's why, I believe, the NRC found that this was a severe event because the opportunities had been there for a long time.

MEMBER APOSTOLAKIS: Is that the event that put you in the fourth column?

MR. LOUDEN: It's one of those.

MEMBER APOSTOLAKIS: And would someone remind us what the fourth column is? I mean we keep referring to it as the fourth column.

MEMBER SIEBER: Multiple degraded

cornerstones.

MEMBER APOSTOLAKIS: Degraded cornerstones.

MEMBER BONACA: Multiple degraded cornerstones.

MEMBER SIEBER: Multiple degraded cornerstones.

MEMBER APOSTOLAKIS: So which cornerstone was degraded here?

MR. LOUDEN: Well, I mean mitigating systems would have been --

MEMBER SIEBER: A mitigating system is a big one.

MEMBER APOSTOLAKIS: Mitigating system.

MR. LOUDEN: The aux feedwater.

MEMBER SIEBER: And you had an emergency plan cornerstone in there, too, someplace.

MR. LOUDEN: The particular item -- this issue it came out red because to qualify to get into Column 4, you can have multiple or repetitive degraded cornerstones from various cornerstones or you can have one red finding.

MEMBER SIEBER: Yes.

MR. LOUDEN: And the one red finding category under aux feedwater is what placed the plant in Column 4 on the Action Matrix.

MEMBER BONACA: I think for the benefit of the membership also, later on they made modifications to the orifices in the auxiliary feedwater system and the NRC had an inspection and found problems with that. So there was a compounding effect of inadequate corrective actions because the issue wasn't solved. And you had no auxiliary feedwater --

MEMBER APOSTOLAKIS: But the core damage frequency itself did not play any role in this, did it?

MEMBER BONACA: Well, I mean I'm sure that the number they calculated must have been pretty high.

MEMBER APOSTOLAKIS: But that's not why they put them in the fourth column. It was the systems.

MEMBER BONACA: Well, I would expect a significant determination would be --

MEMBER APOSTOLAKIS: Is that -- the CDF took you to the red?

MR. LOUDEN: Part of what we did during our process -- evaluating in the significance determination process is that we went into the various phases, Phase 2 and Phase 3 of the PRA analyses to see where the CDF placed this relative to color. And I don't have the exact number myself but I do know that it was above the criteria that would qualify for a red.

MEMBER BONACA: My understanding is that also the aux feed was effected, the main feed was effected. Bleed and feed was effected. So you can draw your conclusions.

MEMBER SIEBER: Yes. And even without the PRA, a system review, which a lot of licensees do, system by system, would determine that the aux feed pumps were inoperable which is an action statement right away under loss of instrument error conditions.

MEMBER BONACA: Yes.

MEMBER SIEBER: So if you didn't have PRA, you would still have that issue that you would have to deal with.

MEMBER BONACA: Very significant, yes.

MEMBER APOSTOLAKIS: Yes, I don't know what that means.

MEMBER BONACA: What is means that in licensee space, if you have an efficiency -- even if the system is likely to work, you call it inoperable.

MEMBER APOSTOLAKIS: Now you had the PRA. You said you were upgrading it. Is that what you said? And you found this?

MR. SCHWEITZER: Yes, we were going through an upgrade to the PRA to include human factors.

MEMBER APOSTOLAKIS: So the first around, the PRA did not even look at these things?

MR. SCHWEITZER: Did not include the human factors aspect.

MEMBER APOSTOLAKIS: Okay. Was that an IPE or a PRA?

MR. SCHWEITZER: I can't -- I'm not totally sure on that.

MEMBER APOSTOLAKIS: Does the licensee get any credit for the fact that they, themselves, found it?

MEMBER SIEBER: Yes.

MR. LOUDEN: Typically, yes you would. And that's -- from day-to-day events, yes. Our program is set up such that there is recognition of licensee-identified activities. That's also countered with the overall significance. So when you find yourself in a particular finding of this nature where you have high significance, it's acknowledged that it was licensee identified. But nevertheless, it places -- it falls where it falls. I mean if it came out red in that area per our program, then that's where it would stay.

MEMBER APOSTOLAKIS: Okay. Thank you.

MEMBER SIEBER: Yes, the color doesn't change. Where the mitigation might come in is in the enforcement process. If you were to exact a civil penalty, the fact that you found it promptly and corrected it and did, you know, all kinds of good things might lessen the amount of the fine you would pay.

And conversely, if the NRC found it or nature found it, self-revealing, and you ended up with an accident, the civil penalty would go in the other direction. But that's usually where it would come in if it comes in at all. The color is the color.

MR. LOUDEN: The color is the color. And then if we were doing the other piece where we were outside of SDP space, just as you described, over in the traditional enforcement path, and we were into escalated enforcement --

MEMBER SIEBER: Yes.

MR. LOUDEN: -- yes, there are factors, escalation and mitigating factors that play into this. And certainly identification credit is one of those.

Okay, following our inspection, we issued a red finding in July of 2002 associated with this event. The licensee had requested that we evaluate the issue against some of our criteria in Manual Chapter 0305 which applies to old design issues, meaning an issue that had some legacy to it but was not necessarily indicative of current performance.

So we conducted an inspection starting in September to review that. And it was as we were finishing that review that we were informed by the licensee that the second event, which eventually became the second event, a second condition occurred with the modification associated with the flow orifices in this same recirc line.

So at that time, we conducted another special inspection to review the circumstances surrounding that. And it was during that time when we identified that there was design-control issues associated with that modification and that there were certainly corrective action elements that could have played into even resolving the first red issue. So, therefore, we didn't feel that that old design issue credit was warranted.

It was in the cover letter of that report that we made the final determination for the red finding. And informed the plant that they would be placed in Column 4 of the Action Matrix.

And a month or so later, at the conclusion of the Agency Action Review Meeting in 2003, in the letter following that meeting is where we informed the licensee that we would be conducting a 950003 Supplemental Inspection later in the year.

Next slide. And I basically covered that.

Let's go on to the next slide. The Supplemental Inspection which was conducted -- the purpose of the Supplemental Inspection is to be more diagnostic and to look deeper and broader into the various areas that have been identified as known problems. And we also look in areas that were not so apparent for the specific issue that placed the plant in Column 4.

One example of that would be we did the Appendix A to the procedure, which looks at the Emergency Preparedness Program. Early in 2002, we had identified a white finding associated with I believe it was exercise critiques. And we had other issues associated with the Emergency Preparedness Program.

So we used that knowledge to include in our plan for this inspection to do that appendix. And that resulted in additional findings in the EP area, which I'll discuss in a moment.

We completed this procedure and this

inspection in three parts. We had three teams, one of six people, one of five, and another of ten. And the three areas were the Corrective Action Program, then the Emergency Preparedness Program, and then the larger team at the end was an integrated team looking at Engineering, Operations, and Maintenance, and other areas.

Next slide. The teams were comprised mainly of inspectors from other regions and from headquarters. This assists us in getting a different perspective and a fresher look at some of the areas that we had been following within the region. And we found that to be very effective.

The results of the 950003 identified several findings in the various areas. And the results of that inspection combined with the observations from our baseline program and our residents, we resulted in five general areas of concern.

The next slide is -- and Mr. Cooper referenced these five areas. And I have them there on this slide in front of you. Human performance and corrective actions were captured within those five areas.

Next slide. These five areas then formed the basis for what ultimately lead to the Confirmatory Action Letter that was issued on April 21st, 2004. And at the same time, as Mr. Cooper also mentioned in his presentation, the licensee had been working on an improvement plan, they called the Excellence Plan, at their site. And it encompasses a lot of things, both operationally and business related.

What the licensee focused on, they developed a subset of action plans to address the specific items within the CAL that were the result of the 950003 inspection. And that was included in a commitment letter sent to us in March of 2004 that included the 143 items that you heard referenced during Mr. Cooper's presentation.

Next slide. Last year as far as inspections, we did our normal baseline inspections. Two particular teams noteworthy: the Safety System Design and Performance Capability Team in June and then a Problem Identification and Resolution Team in September.

Both of those teams were expanded in membership beyond the norm, approximately doubling -- we doubled the number of inspectors and the number of hours that we would normally place on that.

The reason we did that was twofold. One, we wanted to ensure that we could get sufficient sample size that we had an accurate read on the real state of the programs that we were looking at. And two, we also wanted to take the opportunity to look at some of the progress the licensee was making with some of their 143 items for the particular areas that we were looking at. So we took advantage of that as well.

We also conducted two special inspections last year. And the purpose of those special inspections were to directly look at the progress the licensee was making in addressing the action items per the Confirmatory Action Letter.

A number of the items are a sequence or in a series of things that you have to develop or that they planned to develop. And so some of them offered themselves to be looked at on interim just to gauge progress and status and to see if they were proceeding on track as described in the commitment letter.

Next slide. Also to note, within the normal ROP process, we also identified -- we had carried the Corrective Action Program and the human performance area as substantive crosscutting issues under our ROP. The PI&R area was identified in our end-of-cycle letter in 2003. And the human performance area we identified in our end-of-cycle letter in 2004.

Next slide. As far as progress on these two areas and performance to date, human performance, we have seen improvement in that area, particularly within the last year. The licensee did experience some human performance errors during last year's outage, which was at about this time last year. We've seen a notable improvement in the last year in the human performance area.

What we're using to gauge that are the performance indicators the licensee tracks on this. We also, through our direct observations day to day with the resident inspectors on site, as we are looking at activities closely to evaluate not only if there was an equipment failure or if there was a technical aspect to the problem, but we also are looking at it with the eye at was there a human performance issue here? Or was there something that was different from before?

We were looking for a change. And we're continuing to look at that, particularly during the current outage. Again, we wanted to focus on a time frame when the organization was stressed. Being in an outage condition certainly would qualify for that.

And we've seen a difference in the human performance errors, both in the number and the severity of them during this outage compared to the outage of a year ago.

With regard to the Corrective Action Program, this slide states -- I wanted to -- I broke them up a little bit from yesterday's to make it clearer. The Corrective Action Program, when I addressed that, the program itself, that being the procedure, the process, it is sound.

It's a fleet-wide process. It's the same process that is used at -- I believe at all of the NMC plants. And it has been used effectively. Through our inspections, we've noted effectively at other NMC plants.

However, the real issue here at Point Beach with this program is a matter of implementation. In particular, a piece of the implementation. We're satisfied with the identification piece of it. And somewhat with the prioritization of the issues.

Where we've had problems in the past and we still have indications of where areas need to improve are in the area of timely corrective actions and long-lasting, effective corrective actions.

And really that's -- if you flip to the

last slide then -- and I'll go to the second bullet first. That's the real key of what we're looking at right now as we're going forward.

We understand the elements. We understand what the licensee has done. We understand that if they -- from our assessment, if they go through the plans, that they should be successful. But we're really focused on sustainability and long-term effectiveness. And that's what remains to be evaluated for the remainder of this year.

We have seen progress in all of the five areas. There are varying degrees of how much progress that has been seen. Certainly some greater than others. But there has been some progress.

And again, our focus for the remainder of this year, and as the licensee completes their items for the CAL, we'll be looking at and assessing the sustainability of those actions.

MEMBER POWERS: How many -- or how long of a period do you generally think it takes -- I mean it will be different in every case, I understand, before you can declare something sustainable? I'm looking for an intuitive number here.

MR. LOUDEN: What's that?

MEMBER POWERS: I'm looking for your

intuition here, not some well-honed scientific answer.

MR. LOUDEN: I don't know if there is a well-honed answer. I know it's a real tough question to answer but I'll try it anyway.

You know that was one of the challenges that we had. We knew going into this that one of the factors per 0305, I mean when you look at some of our criteria that we are to evaluate against, one of the line items right there is sustainability of the actions that they take.

So then how do you -- what do you use as a measure I believe is your question. And so what we tried to do when we looked at the commitments that the licensee provided to us in their commitment letter and we attached to our CAL, we had extensive dialogue with them so that we could understand what did these measures mean and were these measures that could play into making a decision on sustainability.

For example, there are some in there which it doesn't just, you know, a number can be achieved. For whatever activity, 25, you hit 25, you check it off. That doesn't necessarily show sustainability.

So what you'll see in here, we tried to factor in or to have the licensee consider was a duration to it. You achieve a number over a 90-day rolling period, over a six-month period. And they're variable. That was the way we're trying to assess it in a certain sense.

And then from a programmatic sense, we're looking at overall -- as I mentioned with the human performance piece, are the actions -- are the frequency of the problems reducing? Are the severity of them reducing?

I mean especially human errors. I mean they're going to occur. So what we're trying to assess is does the licensee have a program in place and are they reinforcing it so that it would provide you with some assurance that this would be sustainable long term.

MEMBER POWERS: You wouldn't look at things like is it sustaining through management turnover?

MR. LOUDEN: Sorry.

MEMBER POWERS: You wouldn't look at things like gee does this program continue on its trend despite a changeover of some particular manager?

MR. LOUDEN: Absolutely. It's separate from the given management at the time. The Corrective Action Program -- and that's one -- we look at the Corrective Action Program on a daily basis. I appreciate the sensitivity you have for it for the topic that we're discussing here today with license renewal.

But it also serves as a foundation that we look at very closely within the Reactor Oversight Program and the process. So on a daily basis, the resident inspectors are looking at how the program and the process is working separate from -- I mean certainly management factors could be considered when you're looking at a change. But once it has been established, what we're trying to gauge is how is it working?

How is it being -- not only is it being followed through the process, but how is it being received? Do the workers in the field who see the problems, who certainly can identify -- have the opportunity to identify the problems, are they reporting the issues?

Those are the types of things that we look at not only on a daily basis but also with our special inspections that we have and our regional inspections.

MEMBER POWERS: I think your answer is fine. I mean I don't know how I would answer my question.

MR. LOUDEN: That's fine.

MEMBER POWERS: And I like yours a lot. But what I would just comment to the Committee is that it seems to me when we're thinking about the issues of safety -- what sometimes gets called safety culture is this seems to be a particular question that would be interesting to explore is how do you know some change is sustainable? And how do you measure the sustainability here in some objective fashion/

Because I think as you've quite accurately stated here, this is not something that comes with a label on it, yes, this is sustainable and this other thing is not. And it would be interesting to explore that.

MEMBER ROSEN: Well, I think the question, Dana, comes down to monitoring. You have to make a judgment. I recognize the staff has to do that about the ability to sustain in order to close the CAL.

But then after that, what are you going to do to monitor that, in fact, your judgment was correct? That it was sustainable because it is being sustained?

MEMBER BONACA: Yes, that's a good point.

MEMBER POWERS: Well, I think that's -- I see that as confirmatory. What I'm worried about right now, Steve, yours is a correct thing to worry about, yes. I agree with you.

At some point, somebody has to make a decision yes, this is sustainable. And you can't wait ten years to say yes, it was sustained. I mean he's got to do that beforehand. But how does he do that?

MEMBER ROSEN: Yes, I understand that. There are two questions here.

MEMBER POWERS: Yes, two questions.

MEMBER BONACA: I asked yesterday, Mr. Louden, to comment on the quality of root cause evaluations because I think that they are a window of sustainability. At least that's an opinion I have.

And that's really the process by which you see -- you test things like questioning attitude, focus on safety, you know, I mean you reach some root cause evaluations and you say is this a root cause evaluation? I mean, you know, even asking that question it didn't go far enough.

And I think when I look back at the performance on the issues that led to the first red finding, all through the years, clearly there was no questioning attitude. I mean because there were very clear pointers to the loss of air and yet there was no response to that.

So maybe you want to comment on what you see insofar as root cause evaluation because I know you review them. And you told us yesterday --

MR. LOUDEN: We review them and some of them that we read, we have no issue with. Certainly some of them we look at, we have questions that take us back to ask similar questions we would have asked a year ago. That being what about the extent of condition? Is the extent of condition adequate? Is the timeliness -- is the timing of the correction action appropriate? Those questions still come up.

And so in my bullet that I listed on the slide on the Corrective Action Program of some areas still needing improvement, those are examples within the root cause evaluation particularly of what I'm speaking to.

And, again, needing improvement, the way I'm using it here, is to help us in making the decision and the determination that you all are talking about, about sustainable.

One question, I believe -- I can try to answer one question. The program does allow for us after the plant comes out of Column 4, whenever time that would be, built in the program, we are allowed -- we are budgeted additional hours, 200 hours, that we can use and expend to do follow up inspections to check certain areas.

And certainly the Corrective Action Program will be one that we will use those hours to verify and answer the question you asked. Did this work? Is it sustainable? So the program does allow for us some budgeted hours for that.

VICE CHAIRMAN SHACK: What is the inspection effort increase associated with the Confirmatory Action Letter? What do you do in excess of your normal inspections associated with this?

MR. LOUDEN: I'm going to use some hours that I know and then some maybe FTE estimates -- and they are estimates. But just to give you a feel.

Our baseline program say with the resident inspectors, and I will use these numbers ballpark, I'm not sure if I have them exact -- typically, would run between 1,800 and 2,000 hours a year. For the 950003 inspection, we expended almost 2,000 hours for that one inspection.

And right now, my estimates -- and these are rough estimates -- but I'm looking at an additional, so far for follow up about 1,200 hours. And again, that's just a guess. But it gives you a feel for -- it is significantly above the norm.

MEMBER POWERS: I have a question really

not directed to you but perhaps to the previous speaker. I've had a little chance to examine this diagram for excellence. And I just have a question or two about it.

It seems to me that the plan is meant -- is focused very much on addressing currently operating issues. But what we're asking really now -- I mean what is of primary concern to us, if the commitments for license renewal actually are going to be met.

And when I look at this diagram for excellence, it's really a map for accomplishments on what I would call prescribed activities. And I don't see elements that might be associated with things like initiative, questioning attitude, having up-to-date knowledge, technical excellence.

And it seems to me that those kinds of things might be especially important for the activities associated with license renewal. And I wonder if you could comment on that.

MR. COOPER: Yes, sir. If you look at that diagram, there are a number of attributes. And then there's further definition. Looking at that, I would look at the pillar of site excellence. Then I would go down to organization excellence. And some of the attributes have to do with being accountable, being predictable. We further define those as doing what we say we'll do. So --

MEMBER POWERS: Well, I mean the truth is as you sit down now and you say okay, I'm going to do this, well I would hope that in the course of doing that, you would look and say well, no I was wrong about that. I should have done something more. That's the element that I'm not seeing here.

MR. COOPER: You're right. And that is one of the elements. And it doesn't show on that picture.

One of the things -- on one of the other slides I talked about is this recurrent -- what I would call check and adjust or reevaluate. I believe it was on actually the slide before the Picture of Excellence.

If you go in there, what actually occurs is on a monthly basis, the senior leadership team looks down, looks at what is in the Excellence Plan relative to the challenges that are before them. And it says they make an evaluation based on current performance, based on current commitments.

Do we have the right priorities? Do we need to add priorities? Do we need to drop back a priority? And that makes its way back into the

Excellence Plan.

And they look at things like corrective actions. They look at things like site commitments. They look at things like current assessments. So there is this -- at least monthly and sometimes more frequently, are we putting our resources in the right place and are they properly integrated? That's going on in the background. And it's not showing on that particular picture.

Does that answer your question?

MEMBER POWERS: Well, it probably precipitated about five more.

I have, however, another one that burns just a little bit. And it's a problem every manager faces. You know what you're saying.

MR. COOPER: Yes.

MEMBER POWERS: Do you know what's being heard?

MR. COOPER: That is a good question. One thing I've learned as you manage is often what you say and what people really hear you say are to different things. And so you have to go out and you have to validate that the folks are hearing what they say.

I'll tell you some of the things that give me assurance that the people are hearing what I think

I'm saying or what the senior manager is saying.

First of all, we use the nuclear oversight organization to periodically pulse and survey the people. I believe it is -- at least quarterly, they go out and they do a formal assessment or they do a questionnaire. We get input from there.

We do periodic safety culture evaluations, which is at least every other year and some of the sites every year.

These daily meetings that I've talked about where we sit down and talk about performance. I, when I'm on site, I'm not on that site -- since I have three sites, I'm not there every day -- I routinely sit down at these -- what we call D-15s, the daily 15 meetings, and I listen to what people are saying. And they have an opportunity to ask me questions.

The senior management team goes out and does this. So we are periodically going down in the organization and doing this. Are they hearing what we're saying? Am I saying the right thing? So we do that periodic assessment.

Now if I was to say does every person in that organization know exactly what I think, the answer would be no. But I will tell you, looking at an overall preponderance, they understand it. But that is a challenge and we work on it every day.

MEMBER APOSTOLAKIS: I was a little intrigued by what you said, Mario, at the beginning. That all this is really irrelevant to the license renewal process, is it not?

MEMBER SIEBER: Yes.

MEMBER APOSTOLAKIS: I mean they can have the worst safety culture in the world, maybe the last slide from Mr. Louden would have been -- yes, this is the worst plant we've ever seen, and still we could grant the extension.

MEMBER BONACA: That's correct. And that's the way the rule is framed now.

MEMBER APOSTOLAKIS: So we could grant the extension and then shut them down because of those issues.

MEMBER BONACA: Yes.

(Laughter.)

MEMBER BONACA: That's exactly the process.

MEMBER APOSTOLAKIS: This is the process.

MEMBER BONACA: The process is, you know, that's the future action. I think in this particular case --

MEMBER APOSTOLAKIS: So we're just granting you an extension to keep you down for a longer period.

MEMBER BONACA: Well, the main concern that we expressed here, that is the reason why we're here on this issue, and that's why I tried to focus on only two of the concerns here, there are many more, is one is, you know, to what extent are these deficiencies in the organization are now effecting the establishment of commitments, et cetera? I mean the NRC only audits a few of them. You cannot audit all of them. Many of them are not laid down yet. They're just promises. So that's the first question.

Now if this plant was going through license renewal in 15 years, I would say well, you know, 15 years is a long time. And something has to happen before. But the first plant will go in five years. And five years is not a very long time particularly for recovering cultural issues.

From experience in seeing older sites, at times there is success or there is no success in recovering certain programs. So that's the first question.

The second one is really the nature of Corrective Action Program. It's so fundamental, as you said, Mr. Louden, to everything that goes on around the site. But particularly license renewal would depend for it, you know. And so here we're not saying that that's a condition. We're only saying we would like to know.

MEMBER APOSTOLAKIS: Yes, okay.

MEMBER BONACA: And we would like to see that, you know, we would like to see that it has been recovered. That would be the best of all worlds. Or at least it's on its way.

MEMBER ROSEN: Beyond this discussion, Mr. Matthews earlier mentioned that if we think this is not the right way to do business, to separate these things, we have the opportunity to suggest a change to the regulation. And obviously that's not something you take too lightly. But this is something that's there.

MEMBER APOSTOLAKIS: That would make us very popular, Steve.

MEMBER BONACA: Well, I mean yes, the Committee has not discussed this possibility.

MEMBER POWERS: Is there any particular job requirement in our charter that says popularity is important?

(Laughter.)

MEMBER APOSTOLAKIS: It's not a requirement.

MEMBER SIEBER: It's no change. We're not popular.

MEMBER POWERS: Is it on our Plan for Excellence?

(Laughter.)

CHAIRMAN WALLIS: It's in our criteria for promoting professors at MIT.

(Laughter.)

MEMBER BONACA: It seems to me that the usefulness of this session has been exhausted.

(Laughter.)

CHAIRMAN WALLIS: Well, I have a question about that, Mario. We've spent all our time on these inspection findings and the licensee response. And the staff evaluation of the licensee response, which is all very interesting.

But the subject of the session is license renewal. And there are some questions about license renewal, like the handling of vessel embrittlement and so on. We just don't have time to do that.

MEMBER BONACA: No, this was not our plan because we did not see -- I mean it is a unique approach but they are proposing one of the ways the license renewal allows you to use. And so there is nothing that the Committee has to made a decision on right now.

CHAIRMAN WALLIS: So our letter will not refer to the license renewal. Just to this particular aspect of the issues.

MEMBER BONACA: Well, I think that we will deal with those issues when we come to the final SER.

CHAIRMAN WALLIS: But I think the Committee members who weren't here yesterday ought to have some idea of whether there are license renewal issues of importance. Maybe you could summarize that?

MEMBER BONACA: We cannot identify any stumbling block at this stage. As I mentioned at the beginning of this presentation, we didn't any stumbling block. We felt that the fact if this application had been presented -- I mean the SER had been presented a couple of months from now, many of these issues -- or the issues to do with license renewal, like scoping would have been dealt with and closed.

And so Mr. Matthews has --

MR. MATTHEWS: I just wanted to make a couple concluding remarks. This does conclude the staff's presentation, both from the standpoint of license renewal activities and also those related to the safety of existing operations and the implications for the future.

My expectation and I think the staff's expectation is and our view is that the Committee has sufficient information to write a letter addressing the Committee's findings regarding the staff's review of the applicant's license renewal application with the focus being on the requirements of Part 5054.

And to the extent that it is possible, as you discuss it among yourselves, segregating those findings from comments you may wish to make with regard to the implications of what you've heard relative to the existing circumstances and performance for the safety of continued operations for the near term and also extending through the period of continued operations, that would be beneficial to the staff if you were able to segregate your comments in those regards.

I also wanted to add as a second comment that we, too, would like to say farewell to Mr. Rosen. But it's because we thought his interactions with the staff on a range of subjects have been extremely beneficial. I speak, I think, for the whole staff in that regard.

They were productive comments and you'll be missed. Thank you very much.

MEMBER ROSEN: Thank you very much.

MEMBER BONACA: With regard to the letter, you know, we do not write a report until the final SER comes because there are so many issues still open. And unless we see a measure flaw, okay, or a concern that requires some change on the part NRR, so we will not comment on the SER until you come up with the final SER.

MR. MATTHEWS: I should have prefaced my remarks. I meant at the conclusion of the staff's review.

MEMBER BONACA: Yes, okay.

MR. MATTHEWS: And thanks for that clarification.

MEMBER BONACA: Yes. All right.

Are there any other questions?

(No response.)

MEMBER BONACA: If not, I want to thank you very much for your presentations and your time. And also Mr. Cooper for that. And with that, I turn it over to you, Mr. Chairman.

CHAIRMAN WALLIS: Thank you. We're going to take a break. But since you're all here, I'd like to discuss a couple of things off the record. Could we close the record so we don't have these?

(Whereupon, the foregoing matter went off the record at 9:49 a.m. and went back on the record at 10:07 a.m.)

CHAIRMAN WALLIS: The next topic is policy issues related to new plant licensing. I'll turn to Dr. Kress to lead us.

MEMBER KRESS: Well, thank you.

Today we want to welcome Mary Drouin and her friends back for some of our ongoing collegial discussions on the technology-neutral framework for new plant licensing. For this framework, the staff has identified a number of policy issues, some of which we've already heard about and talked about, and some have already been dispositioned.

But there are some that still remain, and today we want to discuss and give Mary the benefit of our thinking on two of these. One of them is: what level of safety, or acceptable risk if you want to put it that way, should we shoot for for new plants? That is, how do we interpret the Commission's expectation for a higher level of safety for new plants?

And the second issue is one that we've discussed before. You know, we had a classic letter of on the one hand, and then on the other hand, and what -- was it Truman that said, "Give me a one-handed advisor, please"?

But anyway, that issue is dealing with integrated risk at a site versus plant design parameter risk. And we do expect to have a letter on this. The staff plans to go to the Commission with their options and their preferences on the options at the end of this month I think on --

MS. DROUIN: Correct.

MEMBER KRESS: So with that as kind of an introduction, I'll turn it over to Mary to get us started.

MS. DROUIN: Thank you very much. My name is Mary Drouin from the Office of Research. With me today is Marty Stutzke from NRR. Also, I want to acknowledge that this is not just, you know, input and work from Marty and I, but there is a whole team that has supported us, other individuals from NRR, also from Research. With us today is Stu Rubin, my Branch Chief David Lew, and Jit Singh. We've had support from OGC that has helped us, EP, etcetera. And Brookhaven National Labs. I don't want to forget them.

Okay. Why are we here today? As Dr.

Kress said, we have two policy issues that we want to brief you on, and we're asking approval on our recommendations that are going forward to the Commission at the end of this month. The two issues both relate to enhanced safety. When you go back and look at SECY-03-0047, there were seven policy issues raised there.

The first one was the Commission's expectation for enhanced safety. The Commission gave approval for enhanced safety, but now we're at the next part is -- how do we implement it? Also, though, the Commission said, you know, they approved our recommendation. They also wanted to know more about the integrated risk.

Both of these are fundamental to the framework and also to support preapplication reviews, which is one of the reasons -- one of the biggest reasons why we're going forward with these recommendations now and we're not waiting until the end of the year -- for those two reasons.

Just a little bit of background here, as I said, you know, SECY-03-0047 talked about seven policy issues. The first issue was on the expectation of enhanced safety, and we recommended in 03-0047 that implementation of enhanced safety, through a process that was similar to the evolutionary LWRs, that that's what we move forward with.

The Commission did give approval for that, but they did come back and ask us in their SRM to talk about the options and the impacts of integrated risk, and so that gave birth to the second issue that we're going to talk about today is how to treat integrated risk.

CHAIRMAN WALLIS: Now, I don't know what the first bullet means. I mean, it says implementation in health safety through a process similar to that used.

MS. DROUIN: I'm going to get into that.

CHAIRMAN WALLIS: You're going to get into that? You're going to explain that?

MS. DROUIN: Yes.

CHAIRMAN WALLIS: Okay.

MS. DROUIN: We then went with SECY-04-0157.

MEMBER ROSEN: Mary, could you go back to the --

MS. DROUIN: Sure.

MEMBER ROSEN: -- prior one? Because you had a sub-bullet there that I want to be sure I understand. The sub-bullet under the second red bullet. When using probabilistic or risk information, modular reactive designs should account for the integrated risk posed by multiple reactors necessary to achieve the overall electric output. What do you mean by that?

MS. DROUIN: Well, a plant -- they could come in with this modular reactor concept where a particular module might be 100 megawatts. I mean, I'm just making up a number. So to have an equivalent of today's size, they would have multiple modules. And how would we treat that? Do we treat each module individually, or how do we deal with the risk for --

MEMBER ROSEN: Well, you haven't told us. You just said this is just a statement of the problem.

MS. DROUIN: That's correct.

MEMBER ROSEN: Okay.

MS. DROUIN: The Commission came back and we said we should be considering these things. When we look at enhanced safety, we need to think about modular reactors.

MEMBER ROSEN: And later on in this presentation you'll talk more about that bullet?

MS. DROUIN: Correct.

CHAIRMAN WALLIS: And explain that? Because --

MS. DROUIN: I mean, what you'll see is that we don't differentiate between whether it's a module or a reactor of typical size. You know, we are not looking at in our options -- when you look at the integrated risk across reactors, multiple reactors, you know, the size of the reactor.

MEMBER KRESS: Now, when you say "risk," are you talking about the QHOs? Or are you talking about some version of core damage frequency?

MS. DROUIN: When I use the term "risk," I'm talking about the consequences, the health effects.

MEMBER KRESS: Good.

MS. DROUIN: To me, that's what risk is.

MEMBER APOSTOLAKIS: So there are two comments here that one can make. First of all, I recommend that you delete the words "when using probabilistic or risk information." Period. Modular reactor design should account for the integrated risk. That's what the statement should be. In other words, if I choose not to use PRA, I'm not getting out of this.

MS. DROUIN: I understand. These are just quotes from the paper.

MEMBER APOSTOLAKIS: Yes. Whatever.

MS. DROUIN: I mean --

MEMBER APOSTOLAKIS: So --

MS. DROUIN: -- the previous paper is already written.

MEMBER APOSTOLAKIS: Well, we always learn.

MS. DROUIN: Yes. I'm --

MEMBER APOSTOLAKIS: So it shouldn't be there. The second --

MEMBER KRESS: Go ahead. I'm sorry. I thought you were through.

MEMBER APOSTOLAKIS: I think you are not addressing the issue of core damage frequency at all in the paper I read. You are just talking about, as you say, the consequences.

MS. DROUIN: That is correct.

MEMBER APOSTOLAKIS: Is there any reason why you're avoiding the core damage frequency issue? I mean, remember, the ACRS was split. That's okay.

MS. DROUIN: Without getting into the details, I mean, there's two primary --

MEMBER APOSTOLAKIS: No, it's not a detail. It's a big thing.

MS. DROUIN: No, no, I'm not saying that it's not a big thing. Without going into the details, there's two primary reasons why we did not look at that in one of the options is -- there's technical problems with trying to do it on a technology-neutral level, trying to say what do you mean by core damage -- on technology-neutral is -- we're not even sure it's feasible.

MEMBER APOSTOLAKIS: Is it a new thing now, because I remember Mr. King in one of the meetings here saying, "Yes, we can define core damage for all technologies." This is --

MS. DROUIN: Well, we had proposed -- we were not sure at that time that we could, but we were looking into it. Since then, we've just run into a lot of difficulties trying to do it. It would take a lot of time, a lot of resources, and we're not sure at the end that we would be successful.

MEMBER APOSTOLAKIS: I understand that.

MS. DROUIN: That's one of the reasons.

MEMBER APOSTOLAKIS: No, that's fine. But it seems to me that even in a technology-neutral framework, in the name of defense-in-depth, you have to say something about prevention. I mean, you can't just have statements only on the risk, which is a correct statement, I do agree with that. But don't you think we have to have something about prevention?

MS. DROUIN: Well, when you get into the framework, you will see that the protective strategies deal with prevention and mitigation. But this is getting into what -- the level of safety. At a high level, you know, what do we want to be our minimum level of safety? To me, those are two very different answers -- questions.

MEMBER APOSTOLAKIS: I mean, damage in the fuel, for example, is that something -- that's something we don't want. Can we say something about it? I mean --

MS. DROUIN: Well, I think when you get to the next level of the framework, you know, in -- in meeting what your minimum level of safety would be, you would get into those kinds of questions, and you would write your requirements to support that.

MEMBER KRESS: This is reminiscent of the time back when ACRS had a letter recommending that core damage frequency be elevated to a primary goal. And I think this is the same sort of discussion. Should it be in the framework, or should it be right up front as a part of the --

MEMBER SIEBER: Well, it's a surrogate.

MEMBER APOSTOLAKIS: Maybe you don't need to call it core damage.

MEMBER KRESS: No. No, you wouldn't call it that.

MEMBER APOSTOLAKIS: But some sort of prevention or --

MEMBER KRESS: Prevention goal of some kind or --

MEMBER APOSTOLAKIS: Yes.

MEMBER DENNING: I'm struggling as to why you consider core damage frequency necessarily to be a prevention goal. I think it's a surrogate -- it's used as a surrogate, and it happens to be -- it's quite different for lightwater reactors and for other kinds of reactors.

And, obviously, when Mary was talking about for her risk consequences she meant the frequency of consequences. Implicit in that is the -- is both the prevention and mitigation.

MEMBER APOSTOLAKIS: Yes. But the Commission and the staff for decades now has determined that the prevention part is about 1,000 times more important than the mitigation, in the sense that the core damage frequency is 10^{-4} and the LERF goal is 10^{-5}.

So if you say nothing now, you might say, well, gee, I'm tolerating damage of the fuel and release of radioactivity. But as long as I can contain it successfully, everything is fine. And I don't think that everything is fine if you do that. Preventing releases, even within the containment, is a major goal of this agency.

If you look at this strictly speaking, you know, literally, you don't see anything that tells you that you have to do that. I agree with Mary that there may be difficulties defining what that intermediate --

MEMBER KRESS: I think it needs to be --

MEMBER APOSTOLAKIS: -- but something needs to be said, in my view.

CHAIRMAN WALLIS: But, George, there might be a good reactor design which emphasizes containment more and still has the same risk to the surrounding population. I don't know why you have to stick with having core damage frequency with such a large fraction of --

MEMBER APOSTOLAKIS: Because -- well, I'm not saying it has to be 1,000 to 1. But still, it seems to me the public would not tolerate these kinds of incidents.

MEMBER KRESS: I'm pretty sure they wouldn't either. I think it is a goal of the agency and the industry --

MEMBER APOSTOLAKIS: No.

MEMBER KRESS: -- not to have a damaging event to the core.

MEMBER APOSTOLAKIS: That's right.

MEMBER KRESS: Whenever we decide what that is.

MEMBER APOSTOLAKIS: Yes. I agree with Tom.

MEMBER KRESS: And it's much more important to have that than it is to mitigate.

MEMBER APOSTOLAKIS: And the industry, of course, for the current generation of reactors is doing the LERF analysis only because we are forcing them to do it.

CHAIRMAN WALLIS: You're saying you --

MEMBER APOSTOLAKIS: They don't know what --

CHAIRMAN WALLIS: You think you know what the public thinks. I mean, I've talked to students about TMI, a hundred students, non-engineers. And they say, "What's the big deal? There was a lot of core damage, but nothing got out." To them, the containment is the more important part. They don't care about the core damage.

MEMBER APOSTOLAKIS: I don't believe the majority --

CHAIRMAN WALLIS: It's just an accident.

MEMBER APOSTOLAKIS: -- of the American people think that way --

CHAIRMAN WALLIS: How do you know? How do you know?

MEMBER APOSTOLAKIS: -- TMI? I don't believe that. I said I -- I.

CHAIRMAN WALLIS: Well, I have a sample of 100 students. So it's --

MEMBER KRESS: You guys are arguing about what is policy, and policy is set by the Commission itself, and the Commission has set policy already. So, you know, it doesn't do us much good. There's a policy that the --

CHAIRMAN WALLIS: But is the staff trying to describe what kind of policy should be set?

MEMBER APOSTOLAKIS: But the Commission has already set the policy.

MEMBER KRESS: There's already a policy.

MEMBER APOSTOLAKIS: This 1,001 is not something that happened randomly.

CHAIRMAN WALLIS: Maybe it did.

MEMBER SIEBER: Maybe I could change the

subject a little bit, since we aren't going to solve this in the next five minutes. Why do you even refer to the electrical output? You know, if you put out a lot of electricity, is it okay to be a little riskier? You know, who cares? Let's make hydrogen --

MS. DROUIN: I really apologize that I quoted from a previous SECY paper here.

(Laughter.)

MEMBER SIEBER: WE're not blaming you. Don't take it personally.

MS. DROUIN: But, you know, if I can move on, I think -- thank you.

And SECY-157 is when we first noted to the Commission that in looking at enhanced safety, for new plant licensing -- that's what we're talking about here is policy for new plant licensing that -- what should be the level of safety to be achieved.

And I apologize because I -- this is not the right wording I have here. We're not asking for a goal. This is not a goal we're saying. We want the limit.

MEMBER KRESS: This is regulatory acceptance.

MS. DROUIN: Yes.

MEMBER KRESS: Good. Good for you, Mary.

MS. DROUIN: We said in SECY -- and I'm going to come back to these.

MEMBER APOSTOLAKIS: The first green goal you don't want?

MEMBER KRESS: It's not a goal. It's --

MEMBER APOSTOLAKIS: Which goal don't you want?

MEMBER KRESS: It's not a goal.

MS. DROUIN: It's not a goal.

MEMBER KRESS: It's an acceptance criteria.

MEMBER APOSTOLAKIS: Wait a minute, wait a minute, wait a minute. I thought the Commission's position for years now has been you can't do that.

MEMBER KRESS: Well, for the safety goals that we have, but now we're back to a policy issue for new plant licensing. And if you're going to do it on a technology-neutral basis, and do it in a risk-informed way, your goals are -- once again, they're not criteria that have to be met.

I think they are shooting for criteria that have to be met for new plants to be licensed. I applaud them for this, because this business of the goals has been a burr in my saddle for a long time.

MEMBER APOSTOLAKIS: I think it's going to be very hard to actually get criteria --

MS. DROUIN: What we're saying here is that when we look at the framework, you know, we're trying to set the safety -- the level of safety that we want this framework to achieve, so that when we develop the criteria and the guidelines, and we implement these criteria and guidelines and write the technology-neutral regulations, when the licensee has met those regulations that risk level, that level of safety, has been achieved.

So it's how it -- how it's going to help us formulate how we write the regulations. So this isn't going to be some goal that's going to be out there for the licensees to go off and achieve. It's the goal -- it's the target or the limit that we want to set within our framework, so that when we try and meet the expectation of enhanced safety, when they've met these regulations, they have met this level of safety.

MEMBER APOSTOLAKIS: But isn't that the same thing that we're doing now, that the agency is saying if you meet our regulations, there's no undue risk that the -- not disagreement, but the point is that the agency refuses to say what this undue risk is. It just says, "If you meet our regulations, there is no undue risk to public health and safety." And I think you are following the same thinking.

MEMBER KRESS: No, I think they're defining what undue risk is.

MEMBER APOSTOLAKIS: Yes. And I just -- I have a problem defining that. We've heard so many times in this room that the determination of no undue risk is the result of a long process which uses quantitative measures, calculations, plus a lot of judgment. So are you now going to eliminate the judgment?

MEMBER KRESS: Well, not exactly, no. But we're going to put quantitative values on this undue risk.

MEMBER APOSTOLAKIS: So you're rapidly galloping towards risk-based regulation.

MEMBER KRESS: Oh, no. There will be defense-in-depth associated with it.

MS. DROUIN: No. There's going to be defense-in-depth in there, there's going to be --

MEMBER KRESS: I mean, you can't get away from the fact --

MEMBER APOSTOLAKIS: Why do you think this is important to do?

MEMBER KRESS: Well, personally, I think

it would be difficult to write a technology-neutral framework without something like that as the anchor to the thing.

MEMBER APOSTOLAKIS: It could be easily a goal.

CHAIRMAN WALLIS: But, George, it's also important I think for the public -- I mean, this vagueness about, "If you meet the regulations, it's okay," that could mean anything. But if you say, "Your risk is so much," you have given them something definite.

MEMBER KRESS: It's time we got away from that business of --

MR. THADANI: Mr. Chairman, if I may comment on this subject matter. You said meeting the regulations means no undue risk, but legally what you would hear would be substantial compliance with regulations. And now you have to define what you mean by substantial. And you can see some relationship now.

MEMBER APOSTOLAKIS: But that makes it even weaker.

MS. DROUIN: When we get into the options, you will see one option is we -- we continue business as usual. That is one option.

MEMBER KRESS: It's always an option.

MS. DROUIN: Not the one that we're recommending.

CHAIRMAN WALLIS: I think we have to let Mary go ahead.

MEMBER KRESS: Yes, Mary, go ahead. We --

CHAIRMAN WALLIS: She's got a lot to say.

MS. DROUIN: In coming up with the options and guidelines, we follow the same guidelines that were discussed in SECY-03-0047. There were these six guidelines that we noted to the Commission. We saw no reason for coming up with new guidelines. I mean, these are all related to the same -- all these policy issues are related, and we thought we should be consistent.

CHAIRMAN WALLIS: Well, how does number 1 fit in with enhanced safety? I mean, it's got the same risk, but you're doing enhanced safety. How can you do that?

MS. DROUIN: Consistent with the Commission's policy statement on the safety goals.

CHAIRMAN WALLIS: Do you mean the present risk is not consistent?

MS. DROUIN: No, the present --

MEMBER SIEBER: For a few plants, it's

true.

MS. DROUIN: I'm talking about that when you look at enhanced safety --

CHAIRMAN WALLIS: How can you enhance safety by keeping the risk the same as it was in '86?

MS. DROUIN: I don't think that says that.

CHAIRMAN WALLIS: Well, it seems --

MS. DROUIN: It says consistent.

CHAIRMAN WALLIS: -- it needs to say that.

MS. DROUIN: And consistent to me is -- does not mean the same. The same means it's exactly the same.

CHAIRMAN WALLIS: So by enhanced safety, then you mean the risk is not consistent now? I mean, I have trouble with the logic, but --

VICE CHAIRMAN SHACK: If it's less than it is now, it's still consistent with the safety goal.

MS. DROUIN: It's still consistent.

CHAIRMAN WALLIS: Because safety goals are somewhere way above our present performance?

VICE CHAIRMAN SHACK: No. No.

CHAIRMAN WALLIS: Well, then, how can you enhance --

VICE CHAIRMAN SHACK: But you're meeting the goal. If you're much less than the goal, you're meeting the goal.

MEMBER SIEBER: In space.

MS. DROUIN: These are what we're using for the options we have, and we don't want to propose an option that's inconsistent --

MEMBER KRESS: It's guidance on how you're --

MS. DROUIN: Right.

MEMBER KRESS: -- going to go about formulating your options.

MS. DROUIN: That's right. We want it to be risk-informed, we want it to be performance-based, we want to use a technology-neutral approach. We want to use the Commission's performance goals that are in the strategic plan that deal with safety, efficiency, effectiveness, openness. We want to consider previous Commission guidance on these issues. I'm going to get into those in the next slides.

And we want to look at the practicality. You know, is the approach feasible? You know, what are the time and resources that it would take to implement that option? So these were all the things that we used in formulating and evaluating the different options we came up with.

CHAIRMAN WALLIS: Now, the safety goals

are related to the probability of getting cancer or something like that?

MS. DROUIN: You have two safety goals. You have your early fatalities and your latent cancers.

CHAIRMAN WALLIS: So that as medical treatment of cancers improves, the safety goals change.

MEMBER APOSTOLAKIS: Or as people quit smoking.

CHAIRMAN WALLIS: Yes.

MEMBER APOSTOLAKIS: Yes. These are questions the agency faced 30 years ago, so --

MEMBER KRESS: Yes. They've decided to look at it at one particular year and fix it there. You know, both goals change with time, because one of them has to do with the normal level of accidents, but --

MEMBER POWERS: Why would you do that? I mean, I agree with you the decision has been made to do that. But I thought one of the beauties of defining the goal, as it were, is -- the way they did was that, in fact, it recognized that as societies become richer they become more risk-averse.

MEMBER DENNING: One problem with those

goals that I'd like to comment on, though, and that is their individual goals. They're not well suited towards cost-benefit plans and considerations. Have you considered options related to more societal-related goals rather than these individual-oriented goals?

MS. DROUIN: Can you bear with me as we go through? I mean, I'm hoping we're going to cover all of these as we go through each of the options, and we're going to go through the pros and cons of each one.

MEMBER BONACA: The other question that I had with regard to the previous slide -- it's interesting. I mean, there is no definition. However -- or no consideration of how many plants you may have in this country at some point in the future.

MS. DROUIN: Well, when you look at a nationwide goal or limit, and you try and set that -- and essentially what you're doing is setting a limit on the number of plants that could be built, because as you --

MEMBER BONACA: Or setting an objective for the level of safety of the individual plants. I mean --

MEMBER KRESS: Well, as we argued once

before, I think that -- that has to be dealt with with the equivalent of the core damage frequency.

MEMBER APOSTOLAKIS: That's right.

MEMBER KRESS: And it ought to be addressed somewhere in there.

MEMBER APOSTOLAKIS: Not here.

MEMBER KRESS: Not -- not in here.

MS. DROUIN: And you start getting into legal problems when you look at it.

MEMBER BONACA: Well, you're talking about policy. I asked the question -- there has been some discussion of -- or the issue I guess -- it became moot when the construction stopped. At that point -- but certainly when there were objectives of --

MEMBER APOSTOLAKIS: But there was an assumption that there would be something like 1,000 plants.

MEMBER BONACA: Yes, you're right. So --

MEMBER POWERS: Why would you do that, Tom? I mean, it seems to me that when we calculate consequence analyses we carry those out first to 10 miles, and then they go as far as 50, and in some cases, more for interest than anything else, you carry them out to 500, though by that time the results are kind of flaky at that point anyway.

So if I take an individual wandering around Knoxville, for instance, he is not susceptible to the impacts from all of the reactors in the country. He is only susceptible to those within 25 kilometers or so of him.

I mean, it seems to me that it's not the total number of powerplants in the vicinity -- I mean, in the nation. It's just those close to it.

MEMBER KRESS: Well, I have two minds on that. One of them is if you're dealing with -- with the prompt fatalities, latent fatalities, and societal effects, it does deal with strictly the plants that are within your vicinity. They don't care about the plant across the country on there. You set the limits based on what plants you can be impacted by.

The core damage frequency, on the other hand, is -- is not to me a -- a -- it's a design parameter that expresses a desire not to have a core damaging event anywhere in the whole world, because an accident anywhere is an accident everywhere is the concept.

So it's a -- once again, it's a policy thing. This is a desire that people have, or the Commission has, and it may not be logical from the standpoint of -- of how to protect individuals around the plant. But it is, in my mind -- you know, if you have --

MEMBER POWERS: I agree with that, but I don't quite understand why that translates into a nationwide or a worldwide consideration in the number of reactors.

MEMBER KRESS: Oh. Well, my feeling is if you had a -- let's just talk about LWRs, so we know what we're talking about with the core damage frequency. If you had a core damage frequency of 10^{-4} per hundred LWRs in this country, there is a certain expectation of having a core damage event over a given amount of time of the life.

Now, if you had 1,000 reactors, that expectation is 10 times as high. And, once again, it's -- what is an acceptable frequency of that is -- is a policy-type thing. But once we decide on what it is, it is, in my mind, associated with the total number of reactors, especially in this country and worldwide, and it's also associated with how long they exist, both time -- time in which they operate and the number of them, impacts on whether or not there is a certain probability of having a core damage event.

So in my mind, if you're interested in limiting that probability, you set a limit on the core damage frequency and that will -- that limit should depend on the total number of reactors you have and how long they are expected to exist. This --

CHAIRMAN WALLIS: Well, I think, too, you can't just do it on individual risk. I think a guy sitting in Vermont would feel very disconcerted if people in California were killed by an event. It's not just my risk that's concerned. It's --

MEMBER KRESS: Well, that's one reason you want --

MEMBER POWERS: You're extraordinarily generous. I'm not sure I would --

CHAIRMAN WALLIS: I don't know about New Mexico, but, you know --

MEMBER KRESS: Well, I think there would be hell to pay if we had a risk that had a core damage event anyway.

MEMBER POWERS: You're just gringos over there. We don't really care.

MEMBER KRESS: Yes, let's go on.

CHAIRMAN WALLIS: Yes, we've got to move on. This is a huge --

MS. DROUIN: Okay.

CHAIRMAN WALLIS: -- topic, really.

MS. DROUIN: There's three policy

statements that we used quite a bit in coming up with our options in the evaluation. The first one is on the advanced nuclear powerplants, and this is the one where the Commission has given direction and said that they expect that the advanced reactor designs will comply with the Commission's safety goal policy statement.

Then, when you look at the policy statement on several reactor accident, this is -- they had two comments that are important, where the Commission has determined that these plants -- and they're talking about the existing ones -- pose no undue risk, but they do expect that for your advanced reactors that you have a higher standard of safety -- severe accident safety performance.

MEMBER KRESS: This is real governmentese, isn't it?

MS. DROUIN: Yes. And then, when you look at the policy statement on the safety goals, again, the Commission repeated that the current plants are posing no undue risk, that our regulatory practices are ensuring that the basic statutory requirements, adequate protection of the public is met. So --

CHAIRMAN WALLIS: Well, saying that something should be bigger doesn't really say anything. It doesn't say by how much. I mean --

MEMBER KRESS: That's why I said it's real governmentese.

MEMBER APOSTOLAKIS: Well, the Commission can do that.

CHAIRMAN WALLIS: Well, how long are they going to wait until --

MEMBER APOSTOLAKIS: The Commission doesn't have to --

CHAIRMAN WALLIS: -- they say by how much?

MS. DROUIN: Well, that's what we're doing.

MEMBER KRESS: That's Mary's job. She's going to --

MEMBER APOSTOLAKIS: That's Mary's job.

MS. DROUIN: Well, supposing what we -- what we mean by that -- this is our interpretation of these policy statements.

MEMBER KRESS: And it's our job to say whether we agree or not.

MEMBER APOSTOLAKIS: Okay. Let's move on to the real thing now.

(Laughter.)

MS. DROUIN: So here are the two issues. You know, what shall be the minimum level of safety that new plants need to meet to achieve the enhanced safety? We're defining that. And how shall the risk from the multiple reactors -- you can say multiple or modular issues. We have more than one reactor, regardless of its size, at a single site. How should that integrated risk be accounted for?

MEMBER APOSTOLAKIS: Very good.

MS. DROUIN: Okay. The first issue -- we have four options that we have identified. The first option is we say we're just going to use the current process, so that we would not explicitly define what we mean by "minimum level of safety" that you need in defining enhanced safety. So in a case-by-case determination, you would be making this.

So in the near term, on your ongoing preapplication reviews, each time you would make -- you would come up with whatever criteria you're going to come up with to determine what you mean by enhanced safety.

MEMBER KRESS: It sounds like a terrible option.

MS. DROUIN: And it also means that in the technology-neutral framework, we would not specify it. So --

MEMBER APOSTOLAKIS: I think it's better

to say is not quantitatively defined, not explicitly.

MS. DROUIN: It's not defined.

MEMBER APOSTOLAKIS: Quantitatively.

MS. DROUIN: Qualitatively -- we don't define it now qualitatively.

CHAIRMAN WALLIS: How would you do it non-quantitatively?

MEMBER APOSTOLAKIS: I give you five rules. If you meet them, I have explicitly specified my level of safety. Meet those five and you're okay. Now, Ashok makes it a little worse by saying "substantially." Okay. Meet four out of the five and you are okay. I am not quantitative, but I'm very explicit, right?

CHAIRMAN WALLIS: But you haven't defined the level of safety.

MEMBER APOSTOLAKIS: Right now, you have to meet the rules.

CHAIRMAN WALLIS: You haven't defined the level of safety. You've just defined the rules.

MEMBER KRESS: I don't think we can dwell much on option 1, because I don't think anybody is going to support it.

MEMBER APOSTOLAKIS: I think realistically this is probably the only one that will survive, though.

MEMBER ROSEN: Unless we start talking about the others, it will.

MEMBER APOSTOLAKIS: Okay. Thank you.

MS. DROUIN: Option 2, this is the one where you define the minimum level of safety as the quantitative health objectives. So the QHOs, as expressed in the safety goal policy statement, we will use those to define the minimum level of safety to demonstrate that enhanced safety has been achieved for new reactor designs.

The QHOs would be used to assess in the -- for our current reviews under -- our current designs under review. We will be using the QHOs right now to determine that enhanced safety has been met. This would be integrated right into the framework at the very beginning, defining the level of safety.

So, again, the technology-neutral regulations would be written, you know, such that when they're met the safety goal level of safety would be achieved.

MEMBER DENNING: Mary, how is that currently interpreted as far as multi-unit plants per site that have the same boundaries, the same one mile, the same 10 mile? Like if you have 10 reactors, does that force each one to be one-tenth of the total or --

MS. DROUIN: Now you're talking about integrated risk, and that's the next issue. That's the next issue.

MEMBER DENNING: But today how is that interpreted? It's just per plant, isn't it? They don't --

MS. DROUIN: This is per plant.

MEMBER DENNING: Even though that doesn't make any sense.

MS. DROUIN: It's just per plant. Right now, you don't have to look at integrated risk.

MEMBER APOSTOLAKIS: Let me -- there is a question here. On slide 5, you said that one of the general guidelines in assessing options was to be consistent with the Commission's 1986 policy statement on safety goals, which you are referring to here.

MS. DROUIN: Right.

MEMBER APOSTOLAKIS: But it seems to me you are not consistent, because the Commission never intended the QHOs to be minimum. They were goals, and they freely admitted that some of the plants can be above the goal. You are changing the nature of the Commission's statement. Is that still consistent with the Commission's statement?

MS. DROUIN: I don't think we're changing the nature.

MEMBER APOSTOLAKIS: You are making it minimum level.

MS. DROUIN: We're making it the minimum level. I think that's consistent.

MEMBER APOSTOLAKIS: That's not what they meant. I mean, in fact, I remember when the IPEs came out you told us that there were 19 units --

MS. DROUIN: That is for current set of plants.

MEMBER KRESS: That's right. The safety goals were intended strictly to apply to the current. Now we're going to take something that wasn't intended for future plants and try to fit it into future plants.

MEMBER APOSTOLAKIS: But we are interpreting that way. I don't think -- the statement by the Commission never says that.

MEMBER KRESS: Well, they didn't have the future plants in mind when they --

MEMBER APOSTOLAKIS: I'm sure that was --

MR. THADANI: Yes. Let me comment, Mary. Maybe I can help here. Tom is exactly right. Safety goals were developed and the statement -- policy statement came out in 1986 reflecting current operating reactors, population of about 100 reactors, the sort of thinking that went into the development of that policy.

Since then, the Commission has approved, as you know, three advanced lightwater reactor designs. Part 52 of our regulations do go beyond what the current regulations are, and they do refer you to the issue -- what Mary is talking about.

And we have applied this in approval of the three advanced lightwater reactor designs -- meet the surrogate objectives as a minimum, and 10^{-4} core damage frequency and 10^{-5} large early release frequency. That's all there. That's reviewed/approved in our safety evaluation reports.

The Commission's statement goes beyond in terms of expectation. They expect these plants to be substantially safer. The question is: is 10^{-4} still an appropriate surrogate objective? Are there factors that have changed since early to mid '80s that would say, "Let's rethink this policy"? What is happening worldwide? And have things changed here nationally that might influence that decision? And that's the real issue.

MEMBER APOSTOLAKIS: Well, I'm not saying that this is wrong. I mean, you are offering a policy option to the Commission, and they are free to change if it is inconsistent with the earlier statement. They are the ones setting the policy, so there's no problem with that.

I'm just wondering whether you have really -- whether you are sensitive to the fact that this is not really consistent with the original --

CHAIRMAN WALLIS: I think that's a good -- you might want to rewrite the statement on page 5, so that it lets you do this. So that there doesn't appear to be this inconsistency.

MEMBER APOSTOLAKIS: But it's a policy proposal, so it can be different. It's a different interpretation of what they said almost 20 years ago.

CHAIRMAN WALLIS: To go back to this page, Mary, it seems to me that QHOs only refer to dose to the public, so LERF becomes the only measure. CDF is unimportant with this option, and you could have a very good containment and a not so good ECCS system. LERF is the only measurement, right?

MEMBER APOSTOLAKIS: No, not even LERF.

CHAIRMAN WALLIS: Well, actually, the consequences of the LERF are the -- right.

MEMBER ROSEN: Or you could have fuel

that's so robust that it never lets the fission products out.

CHAIRMAN WALLIS: I just wanted to clarify, that's what you're saying with this slide.

MEMBER ROSEN: It's not just the discussion of containment.

MS. DROUIN: Not exactly. And I'm going to get back to that when we come into the advantages and disadvantages.

CHAIRMAN WALLIS: Well, that's what it appears to be saying. CDF is unimportant. You are looking at dose --

MS. DROUIN: That's not what this is saying.

CHAIRMAN WALLIS: Well, that's what it says to me.

MEMBER KRESS: Not necessarily.

MS. DROUIN: No. It says that, you know, at the minimum level we're going to write the regulations to ensure that people meet both of those safety goals.

MEMBER KRESS: Well, let me reiterate --

MS. DROUIN: The early fatalities and the latent fatalities.

MEMBER KRESS: Let me reiterate something

Rich said, and that is if -- if you look at the current structure of the regulations, hidden in various places in there are things having to do with societal risk. That's total deaths, total cancers, land contamination. These things are hidden in the regulations in things like site characteristics and things to -- they're in there, and they're -- in my mind, societal risk, although it's implicit to most -- to most extent, is part of adequate protection.

Now, if you want to capture the current regulatory structure in a technology-neutral way, it seems to me like you have to capture the societal risk somewhere. QHOs don't do it.

Now, my feeling is that you need some -- QHOs are fine. I love them. But you need something else to capture societal risk, so I think this is an incomplete statement of the minimum level of safety. Could you react to that?

CHAIRMAN WALLIS: So what you're saying, Tom, is that you could have an accident which was slow, late release --

MEMBER KRESS: Oh, yes.

CHAIRMAN WALLIS: -- and you evacuate everybody, there's no fatalities, no one has any dose of any sort --

MEMBER KRESS: That's right.

CHAIRMAN WALLIS: -- and yet you cannot go back over 1,000 square miles.

MEMBER APOSTOLAKIS: No, you can't do that, because the QHOs require you to assume that there is one guy at the perimeter.

CHAIRMAN WALLIS: Well, that's a stupid guy.

MEMBER APOSTOLAKIS: You do not evacuate that guy.

(Laughter.)

CHAIRMAN WALLIS: That's a very strange regulation.

MEMBER APOSTOLAKIS: Because it's individual; it's not societal.

MEMBER KRESS: That's not true. It's calculated by looking at the one-mile zone and seeing how many prompt fatalities you have divided by the population of that one-mile zone. That has nothing to do with guy on the --

MEMBER APOSTOLAKIS: But you can't say that if I build a reactor in the middle of a desert there is nobody around; therefore, I automatically meet the QHOs.

MEMBER KRESS: Yes, you can.

MEMBER APOSTOLAKIS: The Commission would never accept that.

MEMBER KRESS: Yes, you can, though.

MEMBER APOSTOLAKIS: No.

MEMBER KRESS: You can do that.

MEMBER APOSTOLAKIS: This is how it's calculated, guys. I mean, we've had this discussion before. This is how --

MEMBER DENNING: He said the way it was calculated, not -- you don't put a guy at the fencepost. That's different. You're talking about --

MEMBER KRESS: That's for 10 CFR 100. That's part of the regulations, but it's not --

CHAIRMAN WALLIS: You can buy the reactor and have as many core damages as you'd like and not release anything, not hurt anybody, meets the QHOs.

MEMBER APOSTOLAKIS: And I still don't think that's acceptable.

CHAIRMAN WALLIS: Why not?

MEMBER APOSTOLAKIS: Because you can't melt the reactor.

CHAIRMAN WALLIS: Well, George, you are always the guy who wants to think outside the box, and you're giving us all these constraints of how you can't think about that.

MEMBER APOSTOLAKIS: I still stay within the box there. You don't want the reactor to be melting -- to melt.

CHAIRMAN WALLIS: I know. You're giving us too many constraints, I think. This would be a more open conversation.

MEMBER ROSEN: I don't want the conversation to be more open.

(Laughter.)

CHAIRMAN WALLIS: Well, you're the most conservative liberal around here.

MS. DROUIN: Well, what I really wanted to try to get was --

MEMBER APOSTOLAKIS: Wait a minute.

MS. DROUIN: -- these four options, and then come back and go through the advantages and disadvantages of each.

MEMBER APOSTOLAKIS: I want to understand this issue. As I recall, the policy statement says that the individual risk or the guy, you know, within so many miles will have this probability of death. It doesn't say that you can take this guy and evacuate him.

Now, when it comes to how we calculate, maybe if we calculate the total number and divide by the number of people --

MEMBER KRESS: We don't calculate them because it's an --

MEMBER APOSTOLAKIS: I don't think the intent of the QHOs was that if there is nobody around you can melt and do whatever you like. That was never the intent. And I think this issue has been raised in the past, and we talked about it and we said, "Well, this is how it's calculated, really, but the intent was something else."

I think if you go back, it will say the general accident and probability of death due to accidents for an individual in the United Sates is three 10^{-4}. That individual -- the risk from reactors should be 1,000 times less. That's what it says.

CHAIRMAN WALLIS: So if it's in the desert --

MEMBER APOSTOLAKIS: That doesn't put him here or put him there.

CHAIRMAN WALLIS: So if it's in the desert, the risk to him is going to be much less.

MEMBER APOSTOLAKIS: No, that's not the intent.

MEMBER DENNING: Well, in a sense, George is right, because if there's somebody effectively there, then he is exposed to the risk. I mean, it is divided by the number of people. But, you know, the things like the plume dimension, and stuff like that, those do reduce the risk to the people within one mile, and stuff like that.

MEMBER APOSTOLAKIS: Absolutely. Absolutely.

MEMBER DENNING: So we're going to move on, then.

MS. DROUIN: Okay.

MEMBER KRESS: But still keep in mind this question of societal risk.

MS. DROUIN: Okay. Option 3 is we say that we would actually define some risk objectives, some type of surrogate for the minimum level of safety.

MEMBER KRESS: Now that doesn't mean you might define a societal risk objective. That's just a surrogate for the QHO.

MS. DROUIN: Right. Surrogate --

MEMBER KRESS: So this is not the option I was talking about with 2.

MEMBER APOSTOLAKIS: So this is not other risk objectives. This is a subsidiary objective.

CHAIRMAN WALLIS: Other surrogates.

MEMBER APOSTOLAKIS: Surrogates.

MS. DROUIN: Some type of surrogates.

MEMBER APOSTOLAKIS: But it seems to me that as a result of all these discussions, somewhere in there, or perhaps in option 2, you should say that -- define the minimum level of safety as a quantitatively-held objective, with some option to enlarge the set.

MEMBER KRESS: Yes, that would be my --

MEMBER APOSTOLAKIS: I think, you know, like land contamination or societal risk or something. I mean, we don't necessarily have to stick to the '86 goals if we are reopening the issue. And let the Commission decide whether they want to do that.

MS. DROUIN: Option 4, develop new QHOs.

MEMBER APOSTOLAKIS: You're right. I should have looked at slide 11.

MEMBER KRESS: But, unfortunately, I think you have in mind there change in the prompt fatality safety goal and the latent, but we may think those are all right, but you're going to add something else to this.

MS. DROUIN: No, this --

MEMBER ROSEN: I don't want to risk thinking what she might have in mind.

MEMBER KRESS: Okay. Yes, yes.

MEMBER ROSEN: I would prefer to know what she has in mind.

MS. DROUIN: There was not anything -- they would be more stringent.

MEMBER APOSTOLAKIS: But it wouldn't be fun here if we didn't try to second guess Mary.

MS. DROUIN: It doesn't mean that they necessarily -- it doesn't mean that they wouldn't be broader.

MEMBER ROSEN: It does not mean that they would not be broader. It means they could be broader.

MS. DROUIN: It could be broader. But they would be more stringent, because we're trying to get to enhanced safety.

MEMBER ROSEN: So it could include land contamination.

MS. DROUIN: It could include land contamination.

CHAIRMAN WALLIS: So these are called health objectives. So what you really mean is develop new quantitative objectives?

MS. DROUIN: Yes. That was a -- we should not have probably put the word "health" there.

MEMBER KRESS: Okay.

CHAIRMAN WALLIS: It seems to me not unreasonable to take a new look at these objectives when we've got the chance now, or ask the Commission to do it.

MEMBER APOSTOLAKIS: Are we still looking into this, by the way? Because the messages we're getting from the Commission is that this is not going to continue. I mean, are we really spending a lot of energy on something that will not continue?

I think that Commissioner Merrifield in particular said at the conference recently that we don't have money for all this. Nobody is asking for a new reactor, to build a new reactor, so why spend any effort on this? Is it something that this is a continuing effort?

MS. DROUIN: Well, all I can tell you is that I know that the Chairman is going to some conference -- I don't know if it's in Paris -- or something pretty recent, and all the topics that were sent up to the Chairman to select from the Office of Research to talk about, he picked one topic and it was on this program.

MEMBER APOSTOLAKIS: The new reactor licensing? Well, that's good.

MR. SCOTT: Can I insert something here?

To clarify what Commissioner Merrifield said -- this is Mike Scott. Commissioner Merrifield said that -- I think you're referring to his remarks at the RIC, right, George?

MEMBER APOSTOLAKIS: Yes.

MR. SCOTT: He was -- my understanding of what he was saying was that the next generation, the non-lightwater reactors, he saw as less likely. To say that they're not spending money on new reactors I think would be inaccurate. There's an expectation that a lot of money is going to be spent, because they're expecting combined license applications near term.

MEMBER APOSTOLAKIS: No, no. I think he made it very clear that thinking about a new regulatory system for future reactors is something that the agency cannot afford right now. It has too many commitments in terms of license renewal, in terms of all sorts of things.

MEMBER ROSEN: On the other hand, Mary and Marty are here, so somebody is paying them. Or unless you are pro bono today.

MS. DROUIN: No, we're not pro bono. It's in our budget. It's in our budget for fiscal year '06. This is what -- we've had, as you know, a myriad of SECY papers that have gone forward to the Commission. The Commission has not come back and said, "Don't do this."

MEMBER ROSEN: So let's keep on assuming -- let's go on on the assumption that the --

CHAIRMAN WALLIS: Yes. I think if we're going to write a letter, you're going to have to convince us of some of these advantages and disadvantages, so we can make a decision. We need to move on.

MS. DROUIN: Okay. Going back to option 1, using the current process, you know, we don't see that there's a lot of advantages there. You know, you aren't going to have to make any changes to the way we do business. You know, it provides the maximum flexibility -- that goes without saying.

But when you start looking at the disadvantages, you know, you -- not necessarily having a technology-neutral, risk-informed, or performance-based approach, it's not clear that it's supporting the Commission's expectations when you talk about enhanced safety in particular.

When you start looking at similar designs, you could lead to very different results. When you're doing this on a case-by-case basis, instead of just fundamentally coming in and making it part of your structure, you're much more likely to be challenged by stakeholders. We don't think it's very scrutable, again, because you're doing everything on a case-by-case basis.

It relies a lot on subjective judgment. You know, I think we're going to get into result inconsistency and uniformity. One of the biggest things that the Commission has applauded this agency on is that with our current regulatory structure we have predictability and stability.

When you start looking for new plants, when you're doing this on a case by case, you certainly aren't promoting stability and predictability.

MEMBER APOSTOLAKIS: I would --

MS. DROUIN: So we think this one is -- is very fraught with disadvantages.

MEMBER APOSTOLAKIS: I think you went out of your way to identify disadvantages. It would be a little more convincing if you eliminated some of these. For example, reliance on subjective judgment -- I don't think any regulatory system will ever not rely on subjective judgment. You clearly don't like this, and you are beating it.

(Laughter.)

It's obvious to me. And if I were a Commissioner, I would send it back to you. I think you are right, but you should be a little bit more reserved in your criticism. Could lead to different results. Come on. Can you ever imagine a regulatory system that would always lead to the same result?

MS. DROUIN: Well, I think --

MEMBER APOSTOLAKIS: You have a lot of good points, though.

MS. DROUIN: These are all the same points we look at for each one of them. We give them all equal play.

MEMBER APOSTOLAKIS: So you're saying in the future there would be options that will not rely on subjective judgment.

MS. DROUIN: Well, I think when you come in and you define, "Here's our level of safety," it's the QHO. That's not subjective anymore, George.

MEMBER APOSTOLAKIS: But you have -- it says -- how do you call it? Ah, geez. On the left of your figure. Something about defense-in-depth and all that, and you have administrative stuff. What was the word that you used?

MS. DROUIN: Yes. But we're here at the

high level, George. What is the minimum level? We're saying in this option you're not defining that, and you're going to define it. Each time a new applicant comes in, you're going to define it. You aren't --

MEMBER APOSTOLAKIS: That's right.

MS. DROUIN: That's subjective.

MEMBER APOSTOLAKIS: That's not --

MS. DROUIN: That's subjective.

MEMBER POWERS: Mary, I want to ask a question. Isn't one of the advantages of this that you can -- because it's a case-by-case decision all the time, can't you take account better of local conditions?

MS. DROUIN: I'm not sure what you mean when you say "local conditions."

MEMBER POWERS: The actual site where it's going to be located.

MS. DROUIN: Absolutely.

MEMBER POWERS: That may be what you mean by flexibility. I wondered if that doesn't need to deserve a bullet of its own. I'm not sure you -- I guess what I'm saying is that maybe you need to expand a little bit on what you mean by flexibility.

MS. DROUIN: There.

MEMBER ROSEN: I, for one, know this

devil. I'd like to hear about the new ones.

MS. DROUIN: Okay.

CHAIRMAN WALLIS: I would, too, because I think the current process just cannot be used for some new designs. It's not a question of using it -- the advantages. It just doesn't apply.

MEMBER POWERS: Could you explain that a little more?

CHAIRMAN WALLIS: That's why they have a design which has different -- has confinement rather than containment, has a fuel which is claimed can never had a core damage accident, and so on. I mean, how do you apply the present rules to that sort of thing?

MEMBER POWERS: I mean, I don't -- I've never seen a difficulty with confinement versus containment, if it's properly implemented. I can't imagine a core that would be immune to any kind of a damaging event. I simply can't imagine that.

CHAIRMAN WALLIS: Well, except fire. Let's say fire -- well, but there are so many regulations now that are specific to lightwater reactors.

MS. DROUIN: This is not saying that when you look at the -- all this is saying is that when you get in the new design, we're trying to determine if that new design has achieved enhanced safety. That's what the issue is here.

It's not whether or not what regulation under the current process applies, you know, because it -- for the current -- a new design that's going to come in right now, that's under current review, they're going to have to make the determination -- right now they're doing it on an ad hoc basis, and they're going to make the determination based on something that's not defined -- has that design achieved enhanced safety?

We're saying we want to define what we mean by that. So the next three options provide a definition.

CHAIRMAN WALLIS: So the disadvantage of the present system is it does not clearly define the level of safety.

MS. DROUIN: It doesn't define what you mean by "enhanced safety," what is that minimum safety that if you reach you have achieved enhanced safety in that design.

CHAIRMAN WALLIS: So option 1 doesn't meet your requirements right then and there. We have to go on to this one.

MS. DROUIN: Okay.

MEMBER SIEBER: And this one doesn't either.

MS. DROUIN: No, this one does. Option 2 does. Enhanced.

CHAIRMAN WALLIS: Are we talking about --

MEMBER SIEBER: Only by virtue of the fact that not all existing reactors meet the current set.

MS. DROUIN: Well, that's a misleading statement, because --

MEMBER SIEBER: I apologize.

(Laughter.)

MS. DROUIN: The reason is when you look at the current set of regulations, and you calculate the risk based on what they have to do just to meet the current regulations, there's not a plant that will meet the safety goals.

MEMBER SIEBER: Okay.

MS. DROUIN: Because they take credit, and rightfully so, for things but they -- they don't -- a BWR, for example, to me that's the easiest plant to demonstrate it with. They meet the safety goal, because they take credit for a lot of systems that they aren't required to have.

MEMBER SIEBER: Right. Well, there are --

MS. DROUIN: Now, if you calculated the risk and removed the credit for those things, and only gave credit for what they're required to have to meet those safety functions, they aren't going to come close to meeting the safety goals.

MEMBER KRESS: You're absolutely right, Mary.

MEMBER SIEBER: And I like this one the best.

MS. DROUIN: So now those things that --

MEMBER APOSTOLAKIS: So what is the conclusion from this argument? I mean, this is a good argument.

MS. DROUIN: I'm saying that when you now are required to meet the safety goals, which means we are now going to write the regulations, they would, for example, have to have -- they'd have to have more than just their present ECCS.

MEMBER APOSTOLAKIS: And why, since they were not required to have those systems, they installed them anyway?

MS. DROUIN: Well, they didn't install them for that function.

MEMBER KRESS: They were there.

MS. DROUIN: They were there.

MEMBER KRESS: They had to take advantage of it.

MS. DROUIN: And they're taking advantage of them. The service water --

MEMBER KRESS: Well, like the hydraulic system that drives the control rods.

MEMBER APOSTOLAKIS: Oh, okay.

MEMBER SIEBER: And it also puts water in.

MS. DROUIN: It always put water in.

MEMBER KRESS: Yes. I don't see Level 3 PRA being a disadvantage.

(Laughter.)

MEMBER DENNING: Be a little more specific, Mary, in terms of what really meets the goal in your interpretation? You do a Level 3 PRA that's got uncertainties. What corresponds now to meeting the goals, the .1 percent goals? What do you say, then, makes the -- you meet the goal?

You're a plant. Are you saying there's a regulatory requirement that you have to do a Level 3 PRA and with the median value or the 95th percentile value? What specifically is this saying that Level 3 PRA has to do?

MS. DROUIN: You're going to have to go and calculate all the way to your Level 3 in your consequences.

MEMBER DENNING: Okay. And then, what corresponds -- what says that you've met the .1 percent? What's your level of confidence, then, from the PRA?

MS. DROUIN: Well, that would all have to -- first of all, that would all have to be worked out.

MEMBER KRESS: If you go by the safety goals, it would be the mean. And I hope you -- I hope you get away from that, though.

MS. DROUIN: In terms of, you know, the uncertainties are going to have to be addressed.

MEMBER DENNING: Now, is this just conceptual, or is this every plant then has to do the Level 3 PRA before it's constructed? And then, what happens when you construct it and you've got a real plant, and you no longer satisfy it? You've got to then make whatever changes are necessary to get you below the goal? Is that what happens?

Because, I mean, you know -- I mean, if we're talking about a future plant, there's no reality to that PRA. I mean, if we say there's reality in the PRAs we do today. I mean, even that has an element of -- a substantial element of judgment in it, and you do it for the plant --

MEMBER POWERS: It is, in fact, metaphysical.

MEMBER DENNING: What's that?

MEMBER POWERS: It is metaphysical.

MEMBER DENNING: Well, it is very much, I mean, just the concept of what does probability mean. It's a subjective assessment of the probabilities. But in any event, I'm just trying to get a feeling as to, are you really -- is this just conceptual, or is this -- what you're saying is this is really the basis of the regulatory framework, that people are going to have to do this PRA before they've constructed their plant, and that's really what the term --

MS. DROUIN: No.

MEMBER DENNING: -- acceptability or is this just conceptual?

MS. DROUIN: No.

MR. STUTZKE: This is Marty Stutzke, if I can jump in. Part 52 requires for design certification that a design-specific PRA be done. What we don't have now is the scope of that PRA. Just is it a Level 1, is it a Level 3, external events? It's not well specified how much PRA needs to be done currently.

MEMBER APOSTOLAKIS: But it seems to me there is another issue here. If you -- if the Commission accepts this, and the industry knows this, then there will be a lot of work, it seems to me, defining subsidiary goals, defining even design basis accidents perhaps, or something else -- the whole structure with which the designers will have to comply, and that structure will have as the anchoring point that the Level 3 PRA will meet whatever goal we have.

And so there will never a case where you -- you do this thing in the abstract and then you build a plant and you don't meet it. I mean, there will be a hell of a lot of requirements emanating from this that the actual designers will have to meet.

MS. DROUIN: that's right.

MEMBER ROSEN: It will be a --

MEMBER APOSTOLAKIS: And as a result --

MEMBER ROSEN: It will be a continuous touchstone during the design.

MEMBER APOSTOLAKIS: There will be feedback, of course.

MEMBER ROSEN: With the iterative use of the Level 3 PRA as the design matures and evolves.

MEMBER APOSTOLAKIS: Yes. So they are

trying to anchor it somewhat, and there have been --

MEMBER ROSEN: It's perfectly reasonable.

MS. DROUIN: That's all we're saying.

MEMBER KRESS: Level 3 might even use a fictitional site.

MEMBER APOSTOLAKIS: But I still think you are a little unfair. Your columns -- advantages and disadvantages -- betray your bias. And I think you will do much better without changing your actual recommendation by helping these a little bit.

CHAIRMAN WALLIS: You want an equal number on both sides for every one?

MEMBER APOSTOLAKIS: I don't know what I want.

(Laughter.)

CHAIRMAN WALLIS: Well, thank you.

MR. THADANI: Let me comment. Again, this is Ashok Thadani. I think, Mary, the committee might actually benefit a great deal in saying, when you talk about current process, do you mean Part 50 or Part 52? Because recognize there are additional requirements in Part 52 regarding -- relating to PRA and relating to safety goals.

CHAIRMAN WALLIS: Yes.

MR. THADANI: And so the committee should recognize today's regulations for new reactor designs do call for certain things.

Now, in this proposal, how much further are we going -- proposing to go -- and the policy issues as they relate to those differences. I think it's -- it might help --

MS. DROUIN: I understand that, but -- but it doesn't tell you in Part 52 what is meant by enhanced safety. And that's why I have to keep bringing you all back to -- that's what we're talking about here is: how do we meet -- how do we implement -- the Commission has told us, and they approved for enhanced safety. They haven't told us how to interpret enhanced safety. Part 52 does not tell us, you know, an interpretation of enhanced safety.

MEMBER ROSEN: On the other question, does Part 52 tell us that they mean a Level 3 PRA?

MS. DROUIN: No.

MR. THADANI: It does relate to the scope of the PRA.

MEMBER ROSEN: But it doesn't tell us -- I mean, it doesn't say Level 3. It says "all modes"?

MR. THADANI: It says "all modes" -- internal, external.

MEMBER ROSEN: Right.

MR. THADANI: But it does not say Level 3.

MEMBER ROSEN: Right. And that's what this adds.

MR. THADANI: I understand. I want to be sure the committee recognizes that under Part 52 there are certain requirements in place for new reactor designs.

MEMBER ROSEN: I don't see that Level 3 requirement as being showstopping. It just becomes, as George says, something that's used from the beginning 'til the end.

MEMBER APOSTOLAKIS: That's right.

MEMBER ROSEN: But this is good.

MEMBER APOSTOLAKIS: You're not going to license --

MEMBER ROSEN: Just as any other PRA, without Level 3, in future plants should be used from beginning to end and was used in the AP1000, and so on. They used it as a design tool. It's a very good thing to do.

MEMBER SIEBER: So the practice doesn't change. All you're doing is defining what it is you want.

MEMBER ROSEN: Right. Defining how to do it in more detail and broadening it somewhat.

MEMBER SIEBER: Yes.

MS. DROUIN: Okay. Option 3. Now, you know, we've moved away from using the specific QHOs, and we would actually define some other --

MEMBER SIEBER: Surrogates.

MS. DROUIN: -- some kind of surrogates, some other risk measures.

MEMBER APOSTOLAKIS: So this is surrogates now for the QHOs.

MS. DROUIN: Right.

MEMBER SIEBER: Which will be different, depending on the design.

MS. DROUIN: Well, that's where -- no, it would be technology-neutral.

MEMBER SIEBER: You would like it to be.

MS. DROUIN: Not like it to be. We've written -- we're creating a technology-neutral document, you know.

MEMBER APOSTOLAKIS: Don't you in your book, your report, on the new framework promote the idea of the consequence -- frequency consequence thing with the dose.

MS. DROUIN: Yes.

MEMBER APOSTOLAKIS: Well, that would seem to be a nice surrogate. In fact, that's what your report says, that this would apply to all reactors. So I -- I mean, there are ways -- you don't have to deal with LERF, which I agree is not always applicable. But the frequency consequence -- and then, of course, Dr. Kress has some ideas about what consequence is.

But the staff proposes dose, and it seems to me that's a reasonable thing to do.

MEMBER KRESS: That's not unreasonable.

MEMBER APOSTOLAKIS: It's a very reasonable thing to do. And the uncertainties will not be as large as in the Level 3, of course. I mean, here is one instance where it might work.

CHAIRMAN WALLIS: Well, one of the major consequences of a CDF, even if no one has heard --

MEMBER APOSTOLAKIS: No, this is not CDF.

CHAIRMAN WALLIS: -- it hurts the industry substantially, it hurts the agency --

MEMBER APOSTOLAKIS: Yes.

CHAIRMAN WALLIS: -- in all kinds of ways. That has to fall into the equation somehow.

MEMBER KRESS: Why are you switching --

MEMBER APOSTOLAKIS: Half an hour ago you were against --

CHAIRMAN WALLIS: Because you seem to be

restricting the conversation. We should open it up. Let her go through all these things.

MS. DROUIN: But I don't think that the frequency consequence -- that's a curve, that's a continuum. We're trying to set, you know, a limit. We're trying to come up with a surrogate. I don't view the frequency consequence curve as a surrogate.

MEMBER APOSTOLAKIS: Why not?

MS. DROUIN: I mean, it's a way of meeting a surrogate. But I don't --

VICE CHAIRMAN SHACK: Well, I mean, if you set the frequency consequence curve up, so that you meet your QHO, it's now a surrogate for the QHO.

MEMBER DENNING: What's your dose? How do you define your dose in that case, in that frequency consequence? Dose -- is it a population dose or what?

MS. DROUIN: We had two different options. It's been a while since I've thought about it, to be honest. We had talked about doses, but we had also talked about -- we had it in our --

MEMBER DENNING: Because if it's a population dose, it's a -- over a large population. It's not individual risk.

MS. DROUIN: I don't remember to be honest. It's been a while since I've thought about it.

CHAIRMAN WALLIS: This option 3 would help a great deal if you had some idea of what these other risk measures might be.

MS. DROUIN: Well, that's the problem.

MEMBER KRESS: If the -- I think you'll find it virtually impossible, on a technology-neutral basis, to come up with surrogates. We'd better stick with what we know about -- we'd better stick with QHOs.

CHAIRMAN WALLIS: But then you might need other ways to -- other surrogates? For certain types of reactors, you might different surrogates?

MEMBER KRESS: No, I don't think so. I think you stick with QHOs.

MEMBER POWERS: I mean, it seems to me that the surrogates will emerge naturally from -- once you have a specific design, because you'll define what is the most critical feature of that particular design.

MEMBER KRESS: Well, the reason LERF ends up being a relatively decent surrogate for the prompt fatality safety goal is that when you calculate for LWRs what magnitude of early release you get, and what prompt fatalities against that, the variety of sites we have now, it turns out that the -- that LERF, if you -- if you take that that -- the variation in the prompt fatalities is only a factor of four or five.

And so if you take the mean, you don't miss -- you're going to miss it for a lot of sites. It's going to be four or five times higher. Some sites are going to be four or five times lower per given LERF value that you get out of the plant. But the --

MEMBER POWERS: I will defy --

MEMBER KRESS: -- to me, it's because the sites have been constrained in terms of population by site suitability characteristics that we have in the rules. And so the constraints that are in the rules fix the LERF good enough that it's a -- it's a relatively good surrogate. To me, we need to get away from it, though.

MEMBER POWERS: I will defy you to do a calculation of LERF that I cannot just devastate in criticisms.

MEMBER KRESS: Oh, of course.

MEMBER POWERS: That's the problem.

MEMBER KRESS: This is strictly a Level 3 calculation.

MEMBER POWERS: Those that you -- I mean, it seems to me that if you had a specific design -- for instance, let's take this hypothetical buried reactor. It will be the elevator damage frequency that will quickly become the surrogate.

MEMBER APOSTOLAKIS: Which damage frequency? Elevator.

MEMBER ROSEN: Elevator damage frequency.

MEMBER POWERS: Sure. Sure. I mean, it dominates everything.

MEMBER ROSEN: I'm not familiar with the term.

MEMBER POWERS: Well, the way you release radioactivity from an underground site is you fail the seals on the elevator.

MEMBER ROSEN: Okay. And --

MEMBER POWERS: And so elevator damage frequency will quickly become your surrogate, because it's easy to calculate and it's easy to use and it's --

CHAIRMAN WALLIS: Unless it's a big enough accident.

MEMBER SIEBER: You have to push the "door close" button.

(Laughter.)

CHAIRMAN WALLIS: Well, the problem with

this is you're not really telling us what these risk measures are. And you say Level 3 PRA not needed, but presumably something like it is needed to evaluate these risk measures which we don't know about. So --

MEMBER KRESS: Yes, I think so.

CHAIRMAN WALLIS: It's all too academic. It's not even academic. It's not defined.

MEMBER APOSTOLAKIS: So let me understand this. Defining risk measures means subsidiary, right? Not expanding. That's option 4.

MS. DROUIN: That's option 4.

MEMBER APOSTOLAKIS: Okay.

MS. DROUIN: And these you would tie to the QHOs. We haven't defined them, because we haven't been able to so far. That's why we don't recommend continuing down this path, because we think that there is a significant uncertainty in being able to do this. And trying to do it, we think we'd be expending a lot of time and resources without any potential success.

Even if you could, we think you're going to need a lot of data and experience from your PRAs.

MEMBER APOSTOLAKIS: I think the reason why we define subsidiary objectives for LWRs is because we recognize that doing -- basing all the decisions on a Level 3 PRA and changes at that level is meaningless because of the huge uncertainties. Huge uncertainties. I mean, if I want to change the frequency of testing some pump, and I want to see the impact of that on the QHO, I mean, I'm out of my mind.

So we went back and said, "Well, gee. If you look at CDF, it's easier to calculate," and so on. So that kind of advantage I guess is hidden there -- when you say Level 3 PRA is not needed, I guess that's what you mean by that.

MS. DROUIN: Right. But also, remember, we were able to do that because we had all this data and experience from numerous Level 3 PRAs. That if it had not existed, we would not have been able to come up with surrogates for the LWRs.

MEMBER APOSTOLAKIS: I don't know about numerous Level 3. Mary, there are very few of them. Level 3? There are very few PRAs that are Level 3. Most of them are out of Southern California.

MS. DROUIN: We had a lot of experience, and we had the NUREG-1150 plants. And when you go and see how the 1E-4 and the 1E-5, the reason those are acceptable surrogates is because we were able to show, based on the data and the experience from these PRAs, that those were acceptable surrogate numbers.

MEMBER APOSTOLAKIS: But let's take your

example there with the PBMR. I mean, if we ever plan to build one of those, I really would like to know what is the frequency of damage in the fuel? I really want to know that, and I --

MEMBER KRESS: You're arguing for another CDF-like thing.

MEMBER APOSTOLAKIS: Yes.

VICE CHAIRMAN SHACK: And that is accident prevention, which doesn't come up in these risk and safety requirements.

MEMBER DENNING: No, there's quite a difference. What they're defining as their maximum accident is something that Dana is going to argue with. In their maximum accident they get a very small release -- temperature goes up, you get some release, and they are pebble --

MEMBER APOSTOLAKIS: Release where?

MEMBER DENNING: Release from the plant. You get some release from the fuel, from the plant. But Dana is going to say, "Hey, but what about if you had steam ingression," and, you know, or severe air ingression? Stuff like that, which they're not considering as a -- within their domain of credibility.

So what's really -- so they -- in this

maximum accident they have, they definitely have some limited core fuel damage. But it's not the level of Chernobyl or stuff like that. And so the question still is: well, what really is core damage? Because in that one case, which is what they would say is their maximum possible -- you know, you get some level, and Dana is going to say, "But what if you had steam?" And then, it could be orders of magnitude worse.

MEMBER ROSEN: It's not just Dana.

MEMBER DENNING: Right. I understand. But I heard --

MEMBER ROSEN: It may only need to be Dana, but there are a lot of people who have --

CHAIRMAN WALLIS: Can we move to the next slide, Mary? Are you ready for that or --

MS. DROUIN: I'm --

MEMBER APOSTOLAKIS: You haven't sold us on this one. Could you move us to the next one?

MS. DROUIN: Yes.

MEMBER KRESS: We've got another whole issue to deal with.

MS. DROUIN: This one is you would define some new measure.

CHAIRMAN WALLIS: That would just be the

first step, though. You'd have to then do everything else.

MS. DROUIN: We think that there would be considerable time and resources. I mean, you know, all of these, when you look at the quantitative -- the fact that we would actually -- whether it's option 2, option 3, or option 4, they have very similar advantages. It's really on the disadvantages that becomes on the --

CHAIRMAN WALLIS: It doesn't require any time at all. The Commission can meet and decide to do it. Then that hasn't changed anything.

MS. DROUIN: I'm sorry?

CHAIRMAN WALLIS: If you don't use the QHOs now, they could make the QHOs 10 times as stringent tomorrow by just a Commission decision. That doesn't change anything, because it's not used as a basis for licensing decisions.

MEMBER KRESS: You can't do that.

MS. DROUIN: I guess I'm not following what you're saying. Again, we're saying that we are trying to define what the level of safety would be, so that you have -- you've shown enhanced safety. Our option 2 says we're going to use the QHOs. Option 3 says we're going to define some new risk measures.

And there's two -- remember, there's two parts to that. It's defining the measure plus what that quantitative objective is that goes with that measure.

CHAIRMAN WALLIS: Option 4 would have to be combined with option 2, then. You'd find some more stringent QHOs, and then follow option 2.

MEMBER SIEBER: Right.

MS. DROUIN: And then, follow option 2? I guess I'm not understanding.

CHAIRMAN WALLIS: Option 2 says define the safety level as the QHO.

MS. DROUIN: Right.

CHAIRMAN WALLIS: And then, if the Commission decides to have more stringent QHOs, that's just on top of it. It's not a separate option.

VICE CHAIRMAN SHACK: Well, option 2 is the current QHO. I mean, there's --

MS. DROUIN: It's the current --

VICE CHAIRMAN SHACK: -- there's an implicit adjective there.

MEMBER KRESS: Yes. I would argue that those QHOs that we currently have are probably a pretty good definition of a level of safety. But they need something more to deal with societal risk. So I think -- I think there is a third QHO that's needed, and it deals with societal risk. And I would -- I would say my option 2 would be, yes, those QHOs are a pretty good level, but let's add a third one.

MS. DROUIN: I mean, option 4 is brand-new QHOS.

MEMBER KRESS: Yes, I don't want --

MS. DROUIN: Option 2 --

MEMBER KRESS: I like option 2.

MS. DROUIN: -- QHOs as defined in the safety goal.

MEMBER KRESS: I like option 2, though, with the additional QHO to account for societal risk. That's part of adequate protection in the current regulations. And also, I think option 2 ought to address the prevention metric in some way also.

MEMBER APOSTOLAKIS: Address what?

MEMBER KRESS: The prevention method, what would be the equivalent of a CDF.

MEMBER APOSTOLAKIS: Oh, all of them would have that.

MEMBER KRESS: Yes.

VICE CHAIRMAN SHACK: To me, the prevention metric, in fact, gives you a societal metric, too. I mean, if you don't prevent accidents, then you don't have societal --

MEMBER APOSTOLAKIS: If you don't remember --

VICE CHAIRMAN SHACK: The other way around, the societal measure doesn't do anything for you in terms of accident prevention. You can still build a big containment. The reactor can fail every week.

MEMBER KRESS: I guarantee you, I can build a reactor with a prevention metric and exceed a reasonable societal risk. It will not guarantee you'll meet an appropriate societal risk.

VICE CHAIRMAN SHACK: If I make the accident prevention number low enough --

MEMBER KRESS: Yes.

MEMBER ROSEN: But to make it low enough, uncertainties get so large that you don't know.

MEMBER KRESS: But then you're really -- yes, I agree, if you make it low enough you can.

MEMBER APOSTOLAKIS: Could it be -- would it be possible, so that you don't have to revise this completely, to acknowledge whatever option you want to propose, that in the future there will have to be some statement regarding the prevention versus mitigation thing, and leave it at that.

MS. DROUIN: That is inherent -- not inherent. Explicitly -- I didn't have the -- I don't have that viewgraph with me, but when you look at the framework document, you know, and we -- we say, you know, that we have this hierarchical approach. We start with the Atomic Energy Act and we say, "Okay. What's the level of safety we want to meet?"

And then, underneath that we come with our protective strategies. And the protective strategies -- explicitly we say we're going to have accident prevention and mitigation.

MEMBER APOSTOLAKIS: So that table that I remember with the prevention and mitigation, and then the product result, 10^{-5}, and you say that each sequence has to be one-tenth of that -- does all this survive?

MS. DROUIN: Yes. Yes. Yes. None of that goes away.

MEMBER APOSTOLAKIS: It still though -- it wouldn't hurt to say, you know, prevention/mitigation is already covered, or something to that effect.

MS. DROUIN: You know, because all we're trying to say here is, how are we achieving enhanced safety. That's all -- you know, it's just that little piece.

MEMBER APOSTOLAKIS: I understand that. But it seems to me it wouldn't hurt to mention that this is covered already.

MS. DROUIN: I mean, there's no problem with that.

MEMBER APOSTOLAKIS: That's all I'm saying, because prevention is really very important.

MEMBER KRESS: We'd better move on to the next issue, because we're running out of time in a hurry.

CHAIRMAN WALLIS: We may go until 12:00.

MEMBER KRESS: Let her at least go through this issue pretty fast, so we can get a good feel for what it is without -- because we are running out of time.

CHAIRMAN WALLIS: Well, I think these are all important matters.

MEMBER KRESS: Oh, absolutely. Absolutely. I think it deserves our time, but I -- I think this second issue is just as important as the first one.

MEMBER APOSTOLAKIS: Maybe we should have a subcommittee meeting at some point.

MEMBER KRESS: We probably have --

MEMBER APOSTOLAKIS: We have to write a

letter first.

MEMBER KRESS: We need a letter. That's why we --

MS. DROUIN: We had a subcommittee meeting on this.

MEMBER KRESS: Yes. Yes, we did.

MS. DROUIN: Yes. Okay. Well, I'm going to give myself a break and let Marty take over. Maybe he'll get us through faster.

MR. STUTZKE: And I was going to suggest, in the interest of time, we might jump over to slide number 20.

MEMBER KRESS: Good idea.

MR. STUTZKE: So to make it clear, when we talk about integrated risk, we're talking about collective risk or combined risk of reactors on a given site. The genesis of this issue was in terms of modular plants like pebble bed, but we've come to realize you need to expand it to include all types of reactors.

I think there's been considerable thought among the staff -- the issue is, if you have 1,000-megawatt electric plant, is that the same as 10 100-megawatt plants in risk space? That's what we're trying to wrestle with is --

CHAIRMAN WALLIS: In terms of risk-benefit space, yes.

CHAIRMAN WALLIS: Perhaps yes, perhaps no. But then, if you get into risk prevention, risk metrics like core damage frequency, do I divide -- you know, do I set some target and divide by the number of modules on site, you get into these sorts of issues. And it's hard to grapple with.

So we've defined three options here. The option 1 is basically business as usual. There would be no explicit quantification of integrated risk on site. We would consider -- continue I guess looking at the number of modules or something like that in context of a siting decision.

MEMBER KRESS: Siting criteria, some sort of siting criteria.

MR. STUTZKE: Right.

CHAIRMAN WALLIS: So each module, no matter what its power level, would have to have the same CDF goal, if there is one.

MEMBER SIEBER: Not the same.

CHAIRMAN WALLIS: The same as the present ones.

MEMBER SIEBER: Individual goal. Develop it on an individual basis.

MEMBER APOSTOLAKIS: I guess you look at each unit separately.

MEMBER SIEBER: Separately.

MEMBER APOSTOLAKIS: That's what it says.

CHAIRMAN WALLIS: If you have 100 10-megawatts, it still be 10^{-4} each, which would give you 10^{-2} per site?

MR. STUTZKE: That's right.

MEMBER APOSTOLAKIS: This is per unit.

MR. STUTZKE: That's right.

MS. DROUIN: But they would have to meet whatever gets approved under issue 1.

MEMBER KRESS: But that's for CDF. You would add them up, though, for the LERF.

MR. STUTZKE: Yes.

MEMBER KRESS: Yes.

MEMBER APOSTOLAKIS: What?

MEMBER KRESS: You would summate all the modules for the LERF type issue, but for CDF you would --

MEMBER APOSTOLAKIS: But it says no quantification of integrated risk by any measure.

MR. STUTZKE: We would look at a per reactor basis and calculate whatever the risk is, and whatever the total is is whatever the total is.

MEMBER APOSTOLAKIS: That's what this says.

MEMBER KRESS: Yes, okay.

MEMBER APOSTOLAKIS: Now, whether you like it is a different story.

MEMBER SIEBER: Let's move on, then. Let's move to option 2. We don't like option 1.

(Laughter.)

MEMBER ROSEN: Who is the "we" in that?

MEMBER APOSTOLAKIS: I'm tempted to say that I do.

MEMBER KRESS: I don't like option 2, because I view this -- quantifying the integrated risk as more of a site selection criteria than anything, because you aren't going to mess with the plants that are already there.

MR. STUTZKE: Right. Let me summarize. Option 2 says we would look at integrated risk only of the new reactors built on a site, and that's in contrast to option 3 that says we would add in the existing reactors plus new reactors on site.

MEMBER KRESS: I think --

CHAIRMAN WALLIS: It won't be on the same site.

MEMBER KRESS: In my mind, you would --

your view should be the new reactors are going to add very little to the risk.

CHAIRMAN WALLIS: We don't know yet.

MEMBER KRESS: Huh?

CHAIRMAN WALLIS: We don't know yet. It might be the same risk as the old one.

MEMBER KRESS: It's going to add very little to the risk. But what you want to do is look at the sites and the plants that are already on them, and see what kind of risk they pose, and maybe exclude some of those sites, even though adding a new one on there is not going to add much to the risk. It's more a perceptive thing. You're going -- I don't --

MS. DROUIN: That would be option 3.

MEMBER KRESS: That's option 3?

MR. STUTZKE: That's option 3 --

MEMBER KRESS: Okay. That --

MR. STUTZKE: -- is to look at the whole integrated risk.

MS. DROUIN: The key to option 2 is that the Commission has said that your existing plants pose no undue risk. So, we said, okay, the current plants pose no undue risk. So in looking at integrated risk, then we're only going to look at the new stuff that would be added to the site.

MEMBER SIEBER: Right.

MR. STUTZKE: Except the existing plants.

MEMBER SIEBER: So, yes, you'd grandfather those.

MS. DROUIN: That's right. That's right.

MEMBER SIEBER: Yes.

MEMBER KRESS: Well, I think --

MEMBER SIEBER: That's okay.

MEMBER KRESS: Yes, it's okay. But the -- it doesn't get you very far. I want something that gives you a site characteristic.

MEMBER SIEBER: Well, on the other hand, there are some sites that have existing reactors on it where when you integrate risk for new modules you may be real close to the health objectives.

MEMBER KRESS: Not likely.

MEMBER SIEBER: Well --

MS. DROUIN: Well, remember, on this one -- yes, on this option, the individual reactors would have to meet whatever level of safety was done --

MEMBER SIEBER: For that reactor.

MS. DROUIN: -- for the first issue. So if option 2 got selected, for example, which says, you know, the QHOs, any new reactor individually would have to meet the QHOs.

MEMBER SIEBER: Right.

MS. DROUIN: And now we're saying individually they'd have to meet it, and collectively they would have to meet it. So those two things combined, you're adding essentially -- I hate to use the word "zero," because that becomes a legal term. But you're not adding any undue risk to the site.

MEMBER ROSEN: Let me see if I understand. In this case, let's say you had a site with two big reactors on it, and you want to add two more PBF, two more small reactors. If you just look at the risk of the two more small reactors, that's -- and you say, okay, we understand what that is and it's okay, what if the -- instead, the proposal was to add 20 small -- new small reactors. Now you'd say it might not be okay, is that right?

MS. DROUIN: No.

MEMBER ROSEN: Because --

MS. DROUIN: No.

MEMBER ROSEN: -- the 20 may take the site above some limit?

MS. DROUIN: No. Because individually and collectively they'd have to meet the QHOs. So whether you add 1 or 50 or 100, the collective risk cannot exceed the QHOs of all of those combined.

MEMBER ROSEN: But if you wanted to add 100, it might have to be a different reactor than if you wanted to add 10 -- a much safer reactor.

MS. DROUIN: Sure.

MEMBER APOSTOLAKIS: That's what she's driving at.

MEMBER ROSEN: Well, I just wanted to be sure I understand.

MEMBER APOSTOLAKIS: Yes. If you have 100, you want them to be safer.

CHAIRMAN WALLIS: And this risk would include common cause failures of several of these modules?

MS. DROUIN: Oh, yes. Absolutely.

MEMBER APOSTOLAKIS: Everything except safety conscious.

(Laughter.)

CHAIRMAN WALLIS: Or risk as risk-benefit, and I find it rather difficult to divorce the risk that I tolerate from the benefit I get from the megawatts.

MEMBER KRESS: Well, you just assume that's already been quantified.

CHAIRMAN WALLIS: Well, I'm not sure that it has when you start talking about --

MEMBER KRESS: When we talk about .1 percent of the risk it would take, that's saying that we're willing to accept that risk for the benefits of nuclear power. That's what that's saying.

CHAIRMAN WALLIS: So you accept the same risk from an MIT research reactor as you would from a 1,000-megawatt plant?

MEMBER ROSEN: Well, of course. It's so much more valuable.

MEMBER DENNING: Let me make a quick comment on Graham, because I think it really is important, and that is because we're dealing with these individual risks, that's only people that live within 10 miles or 1 mile, they're not the people that get the benefits. You know? So that's where you really -- if you want to do a tradeoff between cost and benefits, you need the societal safety goals.

CHAIRMAN WALLIS: But that's what all risk really is. All risk decisions eventually are risk-benefit decisions.

MEMBER DENNING: Well, we can say that, but these goals do not lend themselves to cost-benefit analysis. It's just the risk that individuals within 10 miles or 1 mile experience.

MEMBER KRESS: That's right. Okay.

MR. THADANI: Rich, it's really more than that, because you're looking at potential cancers. So you do go out further than 10 miles.

MEMBER DENNING: No, wait a second. If you leave aside the safety goal --

MR. THADANI: If you live within a 10-mile limit --

MEMBER DENNING: Not with this quantitative safety goal. You go to 10 miles, just the cancers within 10 miles, divided by the population within 10 miles.

MR. THADANI: Right.

MEMBER APOSTOLAKIS: How do you divide the population? Do you mean you take everybody, put them in the denominator?

MEMBER DENNING: Yes, that's what you do.

CHAIRMAN WALLIS: So something like a Chernobyl isn't measurable on this table at all.

MEMBER KRESS: Okay.

MR. STUTZKE: I wanted to point out some --

CHAIRMAN WALLIS: You going to end up choosing option 2, and you haven't really told us much about it. You just said quantification of integrated risk, but you've not said how you're going to do it. Are you going to tell us how you're going to do that quantification of integrated risk?

MEMBER ROSEN: This is a policy decision. You don't need to --

MEMBER APOSTOLAKIS: Why are we commenting on policy, by the way? Are we --

CHAIRMAN WALLIS: Well, you just have a policy decision, and you've got to quantify integrated risk and argue about how to do it. Is that what --

MEMBER KRESS: Well, if Mary wants the benefit of our judgment --

MEMBER APOSTOLAKIS: No, but we are sending -- who are we sending the letter to?

MEMBER KRESS: It goes to -- we're sending it to the Commission, because --

MEMBER APOSTOLAKIS: And they told us to stay away from policy issues.

MEMBER KRESS: Ahhh. This is -- they said for us to get involved in --

MEMBER POWERS: Unless they want us to comment on the policy, George.

(Laughter.)

MEMBER APOSTOLAKIS: They what?

MEMBER POWERS: Unless they want us to

comment on the policy.

MEMBER KRESS: Yes. Stay away, unless we want you to comment. They want our opinion on this.

MEMBER POWERS: They'll let us know whether they want us to stay away or not.

(Laughter.)

MEMBER APOSTOLAKIS: I'm serious now. Maybe our letter should focus only on the technical merits and demerits of each one.

MEMBER KRESS: Well, that's probably all it will --

MEMBER APOSTOLAKIS: Because otherwise you're going to --

MEMBER KRESS: We're going to stick to --

MR. STUTZKE: Well, it's true. For both options 2 and 3, I think there is a substantial effort to develop suitable methodology for calculating integrated risk that should not be overlooked. Common cause between various modules, things like this, there have been some efforts in the past that I'm aware of, but this deserves some serious attention on how to do this.

MEMBER APOSTOLAKIS: On the other hand, Marty, though, if this is a real thing, we can't just say we're not going to look at it by fiat. Does anybody feel that these common cause failures -- use that term -- among modules is important?

MEMBER KRESS: Yes.

CHAIRMAN WALLIS: Yes.

MEMBER APOSTOLAKIS: Then we should look at them. I mean, what is this? We can't legislate them out.

CHAIRMAN WALLIS: Yes. They're going to --

MR. STUTZKE: You would have to look at the --

MEMBER KRESS: What I would do here --

MEMBER APOSTOLAKIS: Yes, but we're not choosing this.

MEMBER KRESS: With this option, I would have put it a different way. I would have said, "We're going to quantify the integrated risk at a proposed site for both existing and new reactors." But what I'm going to do with that quantification is not the second bullet under advantages. We're not going to -- we're going to say that the integrated risk must not -- would not exceed the QHOs.

What I would have said is that if -- if the integrated risk from the current plants on there already exceed the QHOs, then we're going to exclude that site.

MS. DROUIN: Well --

MEMBER KRESS: For the new reactors.

MS. DROUIN: -- no. No.

MEMBER KRESS: We're going to leave that site alone, because it already has adequate protection. And we're not going to apply the QHOs to it.

MS. DROUIN: I disagree with that. The option should be, in my mind -- that's the applicant's decision. He can decide that he's going to go modify his current plants. That's a viable option. Why would we not want him to do that?

MEMBER APOSTOLAKIS: Well, that's consistent with what Tom said.

MEMBER KRESS: That's consistent with what I said. I said if they already received the QHO, I'm not going to --

MEMBER APOSTOLAKIS: They exceed --

MEMBER KRESS: -- grant a site permit. But if they want to go back and change their plant and still come in, then that's all right.

MS. DROUIN: Yes.

MEMBER KRESS: I wouldn't say you have to do that.

MS. DROUIN: No. That's an option.

VICE CHAIRMAN SHACK: If you want to build new plants on that site you have to do it.

MS. DROUIN: That's right.

CHAIRMAN WALLIS: So why does 3 go beyond the Commission's expectations?

MEMBER APOSTOLAKIS: What is this?

CHAIRMAN WALLIS: I think option 3 is not a bad option, really. It excites us.

MEMBER APOSTOLAKIS: Because it addresses existing reactors as well, right?

CHAIRMAN WALLIS: Well, only if you want to add new ones to them.

MEMBER KRESS: Yes. It doesn't deal with --

CHAIRMAN WALLIS: It doesn't do anything to them unless you want to add --

MEMBER KRESS: I like 3 better.

MEMBER DENNING: Well, I'm not sure that's true. I think that it does -- I mean, even without putting any more new reactors on here, we might not satisfy this today, because we have multiple reactors on a site, and we're not --

MEMBER KRESS: We wouldn't do anything about that.

CHAIRMAN WALLIS: It would be grandfathered.

MEMBER KRESS: We'd just grandfather them, because they already have adequate protection. We're not going to require them to meet the --

MS. DROUIN: You may not require them to meet it, but you're going to require the licensee to assess it.

MEMBER KRESS: Yes. Okay. That you would do, yes.

MS. DROUIN: That's going beyond the Commission's expectations for your existing reactors.

MEMBER ROSEN: It requires him to assess it, whether or not he wants to use the site for additional reactors?

MEMBER KRESS: I think you ought to have to.

MS. DROUIN: Well, he has to on this --

MEMBER BONACA: Does it mean he has to perform a Level 3 for each of the units as --

MS. DROUIN: I mean, for option 3, since you have to look at existing reactors, you have to assess the risk from those reactors.

MEMBER ROSEN: Whether or not you intend to use the sites for new reactors.

MEMBER KRESS: No, no. If you're going to --

MS. DROUIN: If you're going to want to use that site --

MEMBER ROSEN: I want to be real sure of that.

MS. DROUIN: Yes. If you aren't considering that site for a new reactor, it's --

MEMBER ROSEN: It depends how you read it. It's perfectly --

VICE CHAIRMAN SHACK: You could well go back and look at the existing site. You're still going to have to explain to the public why it's okay for this site to be over that limit and any other new site where you want to build a plant you have to be under that limit.

MR. SCOTT: That amounts to option 4. That's not discussed here. Go back and look at all of them.

CHAIRMAN WALLIS: What I have trouble with in this whole process, and I wanted to have some sort of Statement of Considerations, what's the basis for considering all these options and then establish --

MEMBER APOSTOLAKIS: They have a whole report.

CHAIRMAN WALLIS: That's the whole report, and we're not getting that today.

MEMBER KRESS: Well, kind of. She gave the ground rules.

CHAIRMAN WALLIS: Yes.

MEMBER KRESS: Basis of one of the slides.

CHAIRMAN WALLIS: Yes. But these are the solutions to a problem. I'd like to have it very fully defined what this problem is.

MEMBER SIEBER: These are the key policy questions that we're trying to --

MEMBER KRESS: I think we're basically there. Are you done?

MR. STUTZKE: I'm done.

MEMBER APOSTOLAKIS: In summation.

CHAIRMAN WALLIS: What's page 23?

MEMBER SIEBER: Two and two.

CHAIRMAN WALLIS: But how do you integrate two and two under the new policy?

MS. DROUIN: We're asking for the Commission to come in and say, "You've approved enhanced safety. We're going to interpret the enhanced safety to mean that the level of safety is the QHOs."

CHAIRMAN WALLIS: Essentially it's for

both.

MS. DROUIN: That's option 2 for issue number 1. For issue number 2, you know, the Commission asked us, "Well, how are you going to deal with integrated risk for new plant licensings?"

CHAIRMAN WALLIS: The same way.

MS. DROUIN: And we're saying we're going to do the same way. We're going to look at the QHOs for just the new plants that come on. We're going to essentially grandfather the old ones because you've already said that those pose no undue risk. So since we're keeping the level of safety for each one to meet the QHOs, the integrated risk, so that whether you add two new reactors or 10, or whatever, the combined collective risk from the new ones also has to meet the QHOs. That's what we're recommending to the Commission.

If the Commission approves that, then we will the process of how do we implement that now in the framework. Now, that's the path we're going down. We don't want to go and spend all this time creating a framework based around those two positions, and the Commission comes back a year a later and says, "Oh, I don't like this." So we want to be up front --

CHAIRMAN WALLIS: We're going to be asked to approve recommendations which could have very far-reaching implications for the agency based on an hour presentation from you? That's an extraordinary thing to put on this committee.

MS. DROUIN: Well, we have come to the subcommittee and discussed this in detail.

MEMBER KRESS: We've heard this before.

MEMBER ROSEN: Not the choices, but the --

MEMBER KRESS: Well --

MEMBER ROSEN: We've heard about the issues.

CHAIRMAN WALLIS: Well, let's see how it works out.

VICE CHAIRMAN SHACK: I mean, this says that South Texas, for example, meets the expectations for new reactors.

MEMBER SIEBER: They have enough mitigating equipment. All they need is another vessel.

MS. DROUIN: I don't think -- why do you say that South Texas meets this?

VICE CHAIRMAN SHACK: You don't think it meets the current QHOs?

MS. DROUIN: I don't know that they do. If I did a risk assessment strictly at what they're required to have --

MEMBER SIEBER: No, no, no.

MS. DROUIN: But that's what we're talking about.

VICE CHAIRMAN SHACK: Well, that argument I do find puzzling. I mean, we license a reactor with systems. You know, whether they're required to have those systems, or not required to have those systems, you're licensing a reactor design. He then can't say, okay, I'm going to take these systems out now that you've certified my reactor, because I'm not required to have them.

MS. DROUIN: But he's not required to use them for that function. What he's taking credit for is analyzing his --

VICE CHAIRMAN SHACK: Well, then, you're going to need an awful lot more detailed regulations than I think you've got. You know, it sounds to me like you're going to put the procedures in the regulations. When the pipe breaks, thou shalt turn on the ECCS.

MS. DROUIN: No, no.

MEMBER SIEBER: Yes.

CHAIRMAN WALLIS: It might have helped to keep --

MEMBER SIEBER: Keep the main feedwater system running.

CHAIRMAN WALLIS: Write the procedure for the plant.

MEMBER APOSTOLAKIS: This doesn't solve it.

CHAIRMAN WALLIS: Tom, are we going to be finished at quarter to 12:00, do you think?

MEMBER KRESS: I think we're through.

MEMBER APOSTOLAKIS: We're done.

CHAIRMAN WALLIS: I was asking Tom.

MEMBER KRESS: I'm about to turn it back to you, Mr. Chairman.

CHAIRMAN WALLIS: I have a meeting at 12:00, okay? So I am done.

George, we were asking about whether the committee is done.

MEMBER KRESS: I think we're through. Well discuss this more. We'll get to the letter writing.

CHAIRMAN WALLIS: So we will take a break, then, or --

MS. DROUIN: Can I ask when you're going to be discussing this and doing the letter writing?

MEMBER KRESS: It's on our agenda to start discussing it --

MEMBER SIEBER: This week.

MR. SCOTT: Probably about 5:00.

MEMBER KRESS: Well, we will probably talk about the main issues at 5:00, but the real debate I think will probably come about when we have a draft letter to talk about, which would be on probably Thursday. I'm trying to figure out the -- yes, Thursday at 3:00. Well, I don't know.

MEMBER SIEBER: Maybe even 3:30.

CHAIRMAN WALLIS: Maybe you'll just have to stay around.

MEMBER KRESS: Yes. I think somewhere Thursday afternoon we will have a debate about it. It won't happen tonight.

MS. DROUIN: I just wanted to get it on my calendar, try and be here at that time.

CHAIRMAN WALLIS: You may have to be around --

MEMBER ROSEN: Thursday afternoon, bring your cot.

CHAIRMAN WALLIS: Or be available somewhere where we can call you.

All right? We will now take a break.

MS. DROUIN: I have a ASME/ANS meeting,

but we usually finish at 3:00, and then I'll come straight here.

MEMBER KRESS: Well, Mary, thank you all for bowing up under our intense questioning. Once again, we appreciate it.

MS. DROUIN: Thank you very much.

MEMBER KRESS: Back to you now.

CHAIRMAN WALLIS: We are through. We're going to take a break until quarter to 1:00.

(Whereupon, at 11:46 a.m., the proceedings in the foregoing matter went off the record for a lunch break until 12:45 p.m.)

CHAIRMAN WALLIS: We'll come back into session.

The next topic has to do with fire risk requantification and probabilistic risk analysis, and Steve Rosen is going to take us through it.

MEMBER ROSEN: Thank you, Mr. Chairman.

The research part of NRC and EPRI have collaborate to consolidate recent research in the state-of-the-art of fire PRA, and these esteemed gentlemen are here to tell us about that effort, which as culminated in the publication NUREG-6850, a weighty document that is much to be admired.

Please --

MEMBER POWERS: It leaves much to be denied?

MEMBER ROSEN: That is much to be admired.

MEMBER APOSTOLAKIS: For sheer size. It represents the weight of our efforts.

MEMBER POWERS: He who is a spokesman for PRA ought not complain about the length of a document.

MEMBER ROSEN: Please, Mr. Hyslop.

MR. HYSLOP: Thank you, Steve.

My name is J.S. Hyslop. I'm a senior reliability and risk analyst in the Office of Nuclear Regulatory Research.

I have two folks who helped work on this program beside me. Bijan Najafi of SAIC. He was a technical lead for EPRI in this program. Bob Kassawara played the role I did for EPRI.

Steve Nowlen is also here. Steve is the technical lead for NRC. He's from Sandia National Labs.

We met with the Subcommittee for half a day last month, May 4th. So this is the follow-up presentation to the full Committee.

First of all, an MOU on cooperative nuclear safety research was prepared by Research and

EPRI on fire risk. And this is one of several elements on that MOU. Another example is the V&V of fire models.

Essentially this MOU is a part of a broader program on fire research.

The primary objective of this program, which I'm talking to you about today, the fire risk requantification study, is to develop field tests and document the state-of-the-art.

We've briefed the ACRS before, as I said, the Subcommittee was briefed in May. And so the purpose is to brief the full Committee on the final NUREG/CR-6850 EPRI 1008239 entitled "EPRI/NRC Research Fire PRA Methodology for Nuclear Power Facilities. And this version addresses public comments.

CHAIRMAN WALLIS: Has EPRI really written a million reports?

MEMBER ROSEN: Eight thousand two hundred and thirty-nine.

MEMBER POWERS: It's a little bit like the year 1, you know.

MEMBER ROSEN: Perhaps you could clarify what it is you want from ACRS?

MR. HYSLOP: Well, we're interested in a letter from the full Committee. We plan to publish in

August. We'd like to have a letter indicating your views o this report. So, this -- first of all, later in my presentation I talk about the role that we hope this report will play in our regulatory arena; that is it's currently referenced in the Reg Guide on NFPA 805. And we expect that to be endorsed in part, if not in full in the Reg Guide later.

And also, this is a little bit of a unique program.

MEMBER APOSTOLAKIS: So we are reviewing the Reg Guide today?

MR. HYSLOP: No. What you're doing, I'm going to tell you about the fire PRA methodology document. The Reg Guide itself is a different presentation, and that's being lead by NOR. This is being lead by Research.

MEMBER ROSEN: The Reg Guide and this are, in that sense, separate, George.

MEMBER APOSTOLAKIS: I know.

MEMBER ROSEN: You can love the Reg Guide and hate this or you could hate the Reg Guide and love this, or any combination thereof.

MEMBER APOSTOLAKIS: Or you can hate both.

MEMBER ROSEN: Well, yes, possible.

MEMBER APOSTOLAKIS: Or love both.

MEMBER ROSEN: All four.

MR. HYSLOP: So the second reason is this is a project with EPRI and it's the first of the type that we've had for a while where we've actually done analyses as opposed to just collecting test data and going separate ways. And I think a statement in support of this work would also be in support of the program that we exercise to carry out the work.

Okay. So the roles of the participants. Research and EPRI developed and tested the methods. The methodology consists of 16 procedures and associated appendices. And all procedures were tested.

We had three volunteer pilot plants support the testing. These procedures were tested for their viability and effectiveness by these pilot plants. And three pilot plants were PWRs, Millstone Unit 3, D.C. Cook and Diablo Canyon.

CHAIRMAN WALLIS: They have not yet finished, is that right?

MR. HYSLOP: Two have finished to the extent they're going to be finished. I'll talk about.

Basically two of those plants we performed demonstration studies with. That is, we tested all the procedures. However, those plants did not implement our procedures themselves fully in their fire PRA.

CHAIRMAN WALLIS: They were not pulled together into the PRA.

MR. HYSLOP: Right. There was a change in priorities associated with those. However, we have another pilot plant which we've recently brought on board, Nine Mile Point Unit 1, the older unit of the two. And it's our expectation that our methodology will be applied fully in that plant and so that we can get plant wide insights, something that we're missing from the first two pilots.

CHAIRMAN WALLIS: And there's something different about doing the whole job than just testing pieces.

MR. HYSLOP: Agree.

CHAIRMAN WALLIS: And I just pointed that these other two plants didn't finish.

MEMBER ROSEN: When do you think Nine Mile 1 will be done? They're just starting now? It's a multiyear project?

MR. HYSLOP: You want to answer that, Bijan?

MR. NAJAFI: They're scheduled to finish u p their results the first quarter of next year. And I would say, if I had to put an estimate, they're about 25 percent into the project?

CHAIRMAN WALLIS: That's faster than I would have anticipated. It's good.

MR. HYSLOP: So besides those pilot plants, other participating licensees provided a peer review of the methods. We had a presentation in the Subcommittee, and the lead peer reviewer spoke for the peer review team and indicated he felt that our work was a step change progress.

MEMBER APOSTOLAKIS: Who is this person?

MR. HYSLOP: Dennis Hennecke. Step change--

MEMBER APOSTOLAKIS: Can you explain to me, first of all, that sentence doesn't seem to have a verb.

MR. HYSLOP: Pardon me.

MEMBER APOSTOLAKIS: But anyway, how different in a step way is this methodology from design and fire risk assessment of 1981? What does it do that is really new?

MR. NOWLEN: This is Steve Nowlen from Sandi.

I think that's going to bounce right over to me.

I think you'll see a lot of similarities in some aspects of it. For example, the overall structure of how a fire PRA is conducted will look very similar.

MEMBER APOSTOLAKIS: It's actually the same.

MR. NOWLEN: It's virtually the same. The overall process, the framework. We did an in initial review and we concluded that the framework that was used in those early studies works. We had a couple of other reports that looked at the same question and again concluded that the overall framework works.

What you'll see is, and again and what Dennis' point was, was that he saw it as a step change improvement in the process. So you'll see there have been improvements from relatively incremental improvements in things like fire frequency. The overall approach is the same, but we believe that we've done a better analysis of data, we have more complete data so we've been able to refine that a bit.

On the opposite end you'll see things that are essentially new. For example, even in those early studies there was a recognition of the spurious operation issue. But there was really no concise structured method for incorporating that systematically into the PRA. There is now.

And in other areas, you know, so that sort of represents the two ends of the spectrum and in between you'll find a bit of everything.

MEMBER APOSTOLAKIS: But the key finding or innovation the design Indian Point PRAs did that allowed all this happen is the idea that when redundant trains come the closest, then you do a heat transfer calculation with the fires to see whether you can lose both. This was the key idea which has survived. Everything else I agree with you is either improvements or add-ons and so on. And that tends to be lost in the history of time, so I thought I was going to bring it up.

MR. HYSLOP: And there's another area --

CHAIRMAN WALLIS: But the idea came from UCLA in the time when you were there?

MEMBER APOSTOLAKIS: Absolutely.

CHAIRMAN WALLIS: All right.

MEMBER APOSTOLAKIS: From the Department of Philosophy. No, I'm serious. This was the key idea, and it has survived.

MR. HYSLOP: So the peer reviewers reviewed the procedures in many stages. They didn't participate in the testing or demonstration studies, but they provided a lot of constructive comment.

And the peer reviewers were Duke Power, Florida Power and Light, Exelon, Nuclear Management, Southern California and CANDU Owners Group.

MEMBER APOSTOLAKIS: J.S., why didn't you have any peer reviewers from the fire safety community, fire science, or did you have any? Like at Maryland there are two or three people?

MR. NOWLEN: Well, we did bring in a few individuals in key areas to provide --

MEMBER APOSTOLAKIS: You are an expert. I'm sorry.

MR. NOWLEN: No, no.

MEMBER APOSTOLAKIS: I mean outsiders.

MR. NOWLEN: Yes. We had Ali Mosleh involved in the project.

MEMBER APOSTOLAKIS: A famous fire expert. Come on, give me --

MR. NOWLEN: Statistics. We need a statistical expert.

We brought Dennis Bley in to provide insights in the area of human reliability analysis.

We brought in Andy Ratchford, who is an Appendix R circuit analysis type to provide us with review in that area. But fundamentally the way we structured the project is that the EPRI effort was a collaborative effort that certain licensees had paid money to participate in the project. And as we were developing the program plan we said well, what role can these people play? They've paid a price to sit at the table, in essence. Let's take advantage of it.

So what we did is we utilized those participating utilities who were nonpilots to act as a peer review team for us. And that's how --

MEMBER APOSTOLAKIS: And did you have anybody from NIST?

MR. NOWLEN: No. They were all taken basically from the non-pilot utility participants.

MEMBER APOSTOLAKIS: Don't you think that is a deficiency? Shouldn't you have somebody?

What's the name of this fellow now who used to be at NIST and he's at --

MR. NOWLEN: Quintiere.

MEMBER APOSTOLAKIS: Who?

MR. NOWLEN: Quintiere?

MEMBER APOSTOLAKIS: Yes. Somebody like that who has published numerous papers on fire science and all that. I mean, it probably would have been helpful.

MR. NAJAFI: Let me try to respond to that.

There were some areas of expertise that we went to ask for peer review to specialized people. An example, like Steve mentioned, that we have done a lot of work in this document, more than previous PRA methodology in the area of the circuit analysis. That's a big -- the step change. So we went to people that have traditionally done circuit analysis work for outside review, like Andy Ratchford.

The mention you making from people at NIST and particularly Jim Quintiere is more applies to the fire science, an area of fire modeling. This document when it comes to that area more talks about processes. It does not say specifically what fire model to use, what's the theory and science behind those theory of those models. There is a separate project that is dealing with these issues of fire science.

MEMBER APOSTOLAKIS: Validation.

MR. NAJAFI: Validation. In those areas we do go to NIST, we got to Quintiere, we do go, hopefully not yet, maybe people like Hesskesdt. Those are more appropriate for those part of it. This is what I would say a multi disciplinary layer. So we went to HRA outside experts like Dennis Bley. We went to statisticians to verify our methods for frequency, like Ali Mosleh. We went to when it came to the circuit, we went there.

But to fire science, the depth of it belongs to other projects. We don't address it in this document.

MR. HYSLOP: So this document that we've been speaking about, is a consensus document between EPRI and Research.

We had debates, collegial debates, but in the end we've reached consensus on this entire document.

For the expected use of the methodology, as I alluded to earlier, we expect this to support the implementation of the new rule, 10 CFR 50.48 (c).

We expect it to support analyses under the current fire protection regulations, exemptions/deviations or other plant changes like risk-informed tech specs.

Research is developing review guidance for the staff for NFPA 805 relates changes.

This works currently having a big impact on the development of the ANS sire risk standard. Basically Bijan, Steve are writing members of the standard. They're working on this project and there's many people working on this project are working on the standard.

Also, we expected to support analyses and reviews of fire protection inspection findings, phase 3s. This work played a large role in development of the phase 2 SDP. Both the phase 2 SDP revision and this work was going on at the same time, and so insights from this program were carried over in the development of the phase 2 that's in Inspection Manual Chapter 0609, Appendix F.

MEMBER ROSEN: And before you get off this, I just want to emphasize for the Committee just how important some of these points are.

The one first I would like to mention is the point on consensus. There were built into this study a number of features to deal with the lack of consensus should it arise, because it was a unique regulator and regulated industry cooperation that was going on. And those were important to build in up front. But because of the good work and good spirit in the work consensus was achieved on every point. I think that was particularly useful, and a useful result and needs to be reemphasized. So I just did.

The other thing is the first bullet on this slide support for the new rule 50.48(c). 50.47(c) is risk-informed fire protection program under NFPA 805. Plants can transition under 50.48(c) to a risk-informed fire protection program. But to do that, they're going to have to do a fire reanalysis. And to do that, they need this methodology.

And so all these are connected. And I think it is very important to understand those connections.

MEMBER APOSTOLAKIS: Now, we're going to review the Regulatory Guide tomorrow that deals with NEI 04-02, which is the implementation of 10 CFR 50.48(c). So I guess you guys would agree then that if we say that the fire risk assessment is what this requantification study does, then we would be right. But the current state-of-the-art in fire risk assessment is this.

MR. HYSLOP: Yes. We believe this is the best available methodology to get risk insights. This is the best of it. This is it.

MEMBER ROSEN: And it has in it, George, just because I know your particularly interest in uncertainty, it has the best compilation of requirements for uncertainty analysis that I've seen.

MEMBER APOSTOLAKIS: Good.

MEMBER ROSEN: So some of the key measures that we would use are I believe here.

MEMBER APOSTOLAKIS: Well, it's

interesting though that the Regulatory Guide doesn't mention it.

MR. HYSLOP: Well, the Regulatory Guide does mention this. It references this document, the last version I saw. Is that still correct, Paul?

MR. LAIN: Yes. Yes, it does.

MR. HYSLOP: And getting back to Steve's point about consensus. Our process specifically allowed for differences in opinion, translating all the way to the end and documenting separate positions. But we just didn't have to go there.

So we made improvements in areas important to fire risk with the consideration of resource constraints. There were several ways that we advanced the state of art that Steve recently mentioned.

We wrote down best practices, that is consolidated existing research. We analyzed more extensive data where appropriate. Modified existing methods and developed new approaches. And we'll talk more about that later.

So Research has several ongoing analytical programs. One of which was mentioned earlier is the V&V of fire models. And, of course, there's a relationship between a fire PRA and fire model V&V. The fire modeling tools provide an input to fire PRA, determine equipment which is damaged, critical to CDF.

This V&V is required for NFPA 805 applications under the new rule.

The V&V is a formal extensive process for verifying the theory and validating the model versus data.

In limited cases we've used empirical correlations for fire models in our document. We've used them in a probabilistic model for frequency of fire damage to the main control board and in characterizing cable fires as well.

And these fire models address cases where your computational fire models are inadequate. It's very difficult to get a sophisticated model to model damage within a cabinet. So that may fill important gaps that we needed to fill to address all the issues in fire PRA.

This document is not a reference for fire models. Any V&V for 805 applications is left to the analyst.

We done V&V per ASTM standard on this. We feel the models are reasonable or best current practice.

I want to note that this NUREG/CR-6850, however, serves a broader audience than NFPA 805. You don't need V&V for exemptions or deviations, or fire protection SDP analyses. So, of course, you need quality but that's going to be determined by the analyst.

MEMBER APOSTOLAKIS: Well, what you're doing is not competing with NFPA 805? No, not at all.

MR. HYSLOP: No. No.

MEMBER APOSTOLAKIS: But it's supporting NFPA 805?

MR. HYSLOP: It's supporting it. I'm just saying the V&V is an 805 issue specifically and there are many other applications that don't require V&V for regulatory purposes.

MEMBER APOSTOLAKIS: Right.

MR. HYSLOP: That's all I'm saying.

MR. NAJAFI: I'd like to add also that this V&V project is also being done jointly by EPRI and Office of Research and is building on the precedent established by the fire risk methodology.

MEMBER APOSTOLAKIS: Have we ever been briefed on this?

MEMBER ROSEN: Yes, we had a short discussion of it. But I wouldn't call it a full briefing. It was just a short, maybe one hour's worth.

MEMBER APOSTOLAKIS: Okay.

MEMBER ROSEN: On what is being done, but not any of the detail.

MR. HYSLOP: So for further comments, we received comments by both industry and consultants; Duke Power, Florida Power and Light, two consultants EPM and RDS. We received comments from NRR as well.

No public comment required Research and EPRI to significantly adjust our approach.

We had a few comments on the state-of-the-art limitation. For example, we have one comment asking us to elaborate on our detailed quantification guidance. But the detailed HRS was beyond our scope because of the limitation of the state-of-the-art and the amount of resources required to address it. I mentioned that earlier.

Other comments were minor clarifications.

For millstones, we put out a draft report for public comment in October of 2004 for 60 days. We've addressed those comment. We're meeting today with the full Committee of ACRS.

We have a public fire PRA methodology workshop which is noticed on the website. It's going to be held in Charlotte, North Carolina from June 14th to 16th. There has been a lot of interest in this workshop.

We intend to publish in August 2005.

We have a BWR pilot that we've talked about. And they've begun. And we hope to get plant-wide insights from a full implementation of the PRA in this pilot.

Should issues come out from this pilot, we're holding open the possibility of revision in the methodology.

MEMBER ROSEN: Do you see this as a limitation of pilot only to a BWR or will you get all the lessons learned that you need for PWRs as well?

MR. HYSLOP: Well, we'll get a lot of the lessons. Because, you know, a lot of the things are similar. The plant model might be a little different. There night be a few circuit issues that we don't run across.

I'm not sure. Have we addressed, would you say, most of the circuit issues in our PWRs, do you know? Pretty much?

MR. NOWLEN: Well, that's really had to say. I mean, you know, because even for the PWRs we didn't get an exhaustive top to bottom answer. I can't say with high confidence that we've addressed all those issues, no. That's one of the reasons we're holding out the possibility of republishing. If we gain new insights, we want to have that ability to reflect those in the methodology.

Actually, I should let Bijan say this. But no one plant gives you all the insights you need.

MR. HYSLOP: Yes. Yes.

MEMBER ROSEN: But I guess you didn't quite
answer directly my question, which was the difference between Ps and Bs and whether or not you needed to go with a P to try to get more of that insight? Are there things that will specifically come up in a P that wouldn't come up in a boiling water reactor that you might need a pressurized water reactor pilot as well?

MR. NAJAFI: When you do these pilot applications, among other things, there are two kinds of insights, two categories you're for. One, you're looking for practicality and applicability of process. Does it work? Can it be used. The other piece is that you want to find out what is it going to tell you when it's done. Would you believe what you see at the end?

For the first process, the difference between Bs and Ps, we have done one in P. We've done it at Millstone. So we've tested the procedures and they do work.

For the second piece, even having one application of a B and a one application of a P, in my mind it may give you some insight but it would not be sufficient. A methodology has to go into public domain to be used for a few years and get several plants using it until you gain some substantial insights.

As it's indicated by the IPEEE program, we gain insights from that because a number of plants used it. So we gained generic insights of what the fire has done.

So when it comes to the process, we have to sit in a PWR and it does work. We used it in Millstone.

MEMBER ROSEN: Are you thinking about ultimately -- well, maybe you should think about ultimately some sort of a peer review process, like we do now with internal events PRA. What do you think about that?

MR. NAJAFI: For the long run I think that is a good idea. In fact, we have even started in the process for us, at least, to start collecting information and library from users. There are already at least three or four plants domestically that even have started using this process or methodology on their own. And there's one internationally that they intend to start using that process as early as maybe this year or next year.

We keep close tabs on that. We intend to get their lessons learned. All their insights collected. And then feedback into this process. And when there is need, if there is need, to learn from those users. Yes, that's something definitely needs to be done, and we have started the process but it may take a couple of years.

MEMBER ROSEN: Is in the standard, the fire PRA standard a peer review process?

MR. NAJAFI: No. No, no.

There is a peer review process for the ANS standard, yes.

MEMBER ROSEN: For the standard itself.

MR. NAJAFI: For the standard itself.

MEMBER ROSEN: No, I'm not asking. I'm saying in that standard, in the ANS fire PRA standard does it require a peer review process to be applied out of the utilities just like there in the internal events PRA?

MR. NAJAFI: Yes. There is a peer review process for a fire PRA. Not a fire PRA methodology.

What we're talking about is to the ANS standard like ASME standard, has a section about how you peer review a fire PRA. That's different.

What I'm talking about is a review or a peer review, which George mentioned before, of this methodology.

MEMBER ROSEN: I understand the distinction.

MR. NAJAFI: Yes.

MEMBER ROSEN: And I was asking about the first thing you asked. I think the peer review part of the ASME standard for internal events is very valuable and has had a significant impact on the quality of internal events PRAs in the industry. And developed a cadre of people who talked to each other, and all the things that come from that sort of effort. I think I'm suggesting that a mirror process for fire PRA be thought about the practitioners.

MR. NOWLEN: Yes. The ANS standard does include a section that specifically references the broader peer review and recommends or requires that the same process be applied to your fire PRA with some specific callouts of the issues that are specific fire.

MEMBER ROSEN: Not there yet, because we

don't have a new method yet being used broadly. When we have a new method and when it's used broadly, I think it would be very valuable to have that additional peer review.

Go on, J.S.

MR. HYSLOP: Basically we had a very diverse project team and they addressed the areas critical to fire PRA. A lot of experience, relevant experience. These people were principal authors of the fire PRA methods in the U.S. for the past two decades. Experience with the strengths and weaknesses. And, again, this document reflect consensus of the team.

MEMBER APOSTOLAKIS: The human reliability analysis, is that based on ATHEANA?

MR. HYSLOP: Alan, can you hear me?

MR. KOLACZKOWKSI: Yes, I can.

MR. NOWLEN: By the way, just so everyone knows, Alan Kolaczkowski from SAIC who was part of the NRC Research side team is with us on the telephone.

MR. HYSLOP: Did you hear George's question, Alan?

MR. KOLACZKOWKSI: I did.

No, the procedure as written does not specify any specific HRA method. It recognizes that licensees may want to use existing methods, whatever they are; THEARP, HF, CREME, whatever to take their internal events PRA and extend it to become a fire PRA. The procedure is flexible enough that any method can be used as long as you properly account for the unique fire effects in a fire PRA.

MEMBER APOSTOLAKIS: So what this method does then is it specifies the unique context that a fire creates and then you go ahead and use a method to quantify human reliability.

MR. KOLACZKOWKSI: That is correct.

MEMBER APOSTOLAKIS: Shouldn't that method be ATHEANA, though?

MR. KOLACZKOWKSI: I'm sorry. Could one of the methods be ATHEANA?

MEMBER APOSTOLAKIS: Shouldn't that method be ATHEANA, not one of the methods? It should be the method.

MR. KOLACZKOWKSI: Well, I think to specify that everyone should use a method is probably over prescriptive and probably does not need to be done. I mean, could ATHEANA certainly be used? Absolutely. Would it be a good idea? In some cases, yes. But I don't NRC wants to go to the point of prescribing a specific method just as it does now not prescribe a specific method to do the internal events PRA.

MR. NOWLEN: Yes. I'll jump in with one additional comment. We mentioned that we reached consensus in all aspects. I think that perhaps you could say this is one area where we chickened out just a little bit. We just decided that it was not reasonable for us to prescribe ATHEANA. We were also not willing to go so far as to say any particular method was acceptable or was considered best current practice. So in this area we didn't go that. We rather took a somewhat different view and said "Well, here are the issues that you need to address that are specific to the fire analysis. And you have to provide the justification for what your HRA analysis does."

MEMBER POWERS: Mr. Nowlen, there is a relatively famous study in which they used a variety of different HRA methods for a particular problem. And essentially came up with, say, charitably a broad spectrum of results. Don't you invite that when you allow such great flexibility in the choice of HRA methodology?

MR. KOLACZKOWKSI: This is Alan Kolaczkowski again with SAIC.

I don't know if we're trying to invite that. I think on a totally different front but certainly related to this work there are activities in place, which I know the ACRS full Committee is very aware of in which the HRA community is undergoing a number of activities trying to, if you will, pull itself together, get formity in the use of the methods. Yes, I think you're all aware of the Good Practices document. Of course, the ASME standard provides some aspects as to what --

MEMBER POWERS: Well, not to cut you off, Alan.

MR. KOLACZKOWKSI: -- proper HRA. So I think on a different but certainly related the HRA community is attempting to solve the issue that you bought up, Dana. And I guess we're just trying to take advantage that, but short of prescribing a specific --

MEMBER POWERS: But you seem not to have. You seem to have abandoned the field. I mean, you had the opportunity to take advantage of that and put out something that you might call best practices. But you said, no, you'd just use whatever heck you want and provide some sort of justification of it. I mean, it seems like you did exactly the opposite of what you said.

MR. NOWLEN: It's not quite that dire, I don't believe. We have provided specific guidance on screening, for example. And we have provided a fairly extensive discussions of the factors that needed to be considered in a HRA analysis. But for us it was a matter of resources, in effect, that we could not take on the broader issues of HRA analysis in general that would need to be addressed before we could get to the specific issues of HRA for fire. And so we choose not to expend our resources in that direction.

MEMBER POWERS: So what you're saying is this has all been premature?

MR. NOWLEN: No. I would not say that. This is --

MEMBER POWERS: Oh, I'm sure you wouldn't. But I might.

MR. NOWLEN: This is simply an area where additional work is needed and appropriate. And the report goes into some detail about this as an area of additional need.

We clearly acknowledge that in a sense you could say yes, we quit the field to some extent. We did not tackle this issue headon. We took it as far as we felt we reasonably could, and then we had to say that's as far as we can reasonably go, and that's where we stopped.

MEMBER APOSTOLAKIS: Isn't John Forrester the guy whose running ATHEANA?

MR. NOWLEN: Yes. John Forrester is the Sandi staff member who is leading the ATHEANA effort. And he was a strong advocate for ATHEANA. But again, I don't believe we could have possibly reached consensus where the industry would agree that the ATHENA method is the only way to do fire HRA. That was not reasonable.

MEMBER ROSEN: Well, I think we've aired that subject, J.S.

MR. HYSLOP: Okay. So the next slide shows the PRA process flow chart. It's fairly typical for fire PRA analysis. It shows one path to perform a fire PRA, but clearly there are many analysis paths that could have been taken.

Briefly, you parse the plant up. Identify components for the PRA model, which includes instrumentation. Because instrumentation often isn't identified specifically for an internal events PRA, so it's a little different here.

You trace the cables where you need to.

MEMBER APOSTOLAKIS: Yes. Let's talk a

little bit about it, because I agree with you in the olden days we really focused on task 3, or what you call task 3 cables. Right?

MR. HYSLOP: Yes.

MEMBER APOSTOLAKIS: The first PRAs were cables?

MR. HYSLOP: Yes.

MEMBER APOSTOLAKIS: Cablecentric.

Now, you mentioned instrumentation.

MR. HYSLOP: Yes.

MEMBER APOSTOLAKIS: I mean, the instrument itself you're talking about, and what other components are you talking about?

MR. HYSLOP: Well, we're talking about instrument and cables that could lead to failure of the instrumentation.

MEMBER APOSTOLAKIS: Well, the cables all right. We understand the cable.

MR. HYSLOP: You want it? Go ahead.

MR. NOWLEN: Yes. The process started by picking the components that you want to credit in your fire PRA. Then based on the components you selected, which would include key instrumentation, you would then pick all of the associated cables for each of those components that you've now selected, which also implies that you at some level then need to trace those cables.

MEMBER APOSTOLAKIS: But then what you're saying is that I already have a fire, I know what damage I have and I want to take credit for some components. And what I'm coming from is there is a fire in this location, what is it that I have to worry about.

MR. NOWLEN: Yes.

MEMBER APOSTOLAKIS: And up until recently we worried about the cables only. Now you're saying if there's a pump next to it, I have to worry about physical damage to the pump or you don't worry about it yet?

MR. NOWLEN: No. We are still in terms of damage states, very cablecentric. It still dominates. It's cables, yes.

MEMBER APOSTOLAKIS: So I'm talking about J.S.'s statement or what you have there in yellow, task 2 fire PRA component selection.

MR. NOWLEN: Right.

MEMBER APOSTOLAKIS: Is it cables or not?

MR. NOWLEN: Task 2 is not cables. Task 2 is credited components that feed down to task 5 --

MEMBER APOSTOLAKIS: What do you mean

credited? I don't understand.

MR. NOWLEN: Do you want to take credit for a particular pump being operable as a part of your post-fire safe shutdown process.

MEMBER APOSTOLAKIS: So I have already assumed I have a fire?

MR. NOWLEN: Well, okay.

MEMBER APOSTOLAKIS: That's where you lose me. If I start with a fire, I have to worry about its impact on the plant.

MR. NOWLEN: Yes.

MEMBER APOSTOLAKIS: I'm an old guy, you know. I remember the Zion PRA. It was just damage on the cables. Now J.S. tells me no, it's damage on other things, too. What other things?

MR. NOWLEN: Yes. In that sense, yes. You are assuming that you are going to have a fire.

MEMBER APOSTOLAKIS: Yes.

MR. NOWLEN: And now you want to say what plant components functions, capability am I going to credit given that I have a fire to achieve safe shutdown?

MEMBER APOSTOLAKIS: But don't I have to know the damage first before I start blaming credit.

MR. NOWLEN: No. No. Because what this

builds on, is it builds basically on two pieces of information. You begin with your Appendix R safe shutdown analysis --

MEMBER APOSTOLAKIS: Oh.

MR. NOWLEN: -- which has already made assumptions about what equipment you're going to credit for post-fire safe shutdown. And you supplement that with anything that you want to take credit for from your internal events PRA, which takes credit for many things beyond the Appendix R system. You merge those two and reconcile any differences, and you come up with now a list of fire PRA components that are going to be taken into the plant safe shutdown model.

The cables then are the link between those systems and the potential damage states.

MEMBER ROSEN: Cables and instrumentation?

MEMBER APOSTOLAKIS: Yes. But before I get--

MEMBER ROSEN: Not power cables. Just --

MR. NOWLEN: No, no. Power cables as well. Power control instrumentation --

MEMBER ROSEN: Power and instrumentation service.

MR. NOWLEN: Absolutely. On any component. So components would include electrical buses. Electrical buses would include the control for the electrical bus as well as the power cables for the electrical bus. Pumps would typically have instrumentation. Your reactor, you know, you've got key reactor vessel --

MEMBER ROSEN: Including circuits that simply provide indication and information to the operators?

MEMBER APOSTOLAKIS: Yes.

MR. NOWLEN: Yes. In some cases those are picked as well.

MEMBER ROSEN: Right.

MR. NOWLEN: Critical ones. You wouldn't necessary model every single --

MEMBER ROSEN: Not everything.

MR. NOWLEN: Right.

MEMBER ROSEN: But if there's a step in your safe shutdown analysis for an operator to do something based on some received signal, then that signal cable has to be available.

MR. NOWLEN: Precisely. And that's a very good example of exactly the way the procedure is written.

MEMBER APOSTOLAKIS: I am not clear.

I have a fire in -- and I go and I'm

trying to find out kind of initiating event, where am I entering in the event trees. And I find that I, you know, by damaging a bunch of cables I end up a small LOCA. Then I know what I need to mitigate a LOCA and I can do what you were just saying; I will need these components. But before I get there, I have to know I have a small LOCA, which is a result of the damage. And that damage is damage on cables only, which is not correct? You don't assume any other damage.

MR. KOLACZKOWSKI: This is Alan Kolaczkowski at SAIC. Let me try to answer that.

There is a step in the task 2 procedure that's a little different from the rest of the procedure in that its focus is to identify the very thing you're talking about, George. What initiating event is going to happen for each fire that's postulated in each compartment. And that is based on what equipment is in that compartment and/or what cables pass through that compartment.

MEMBER APOSTOLAKIS: But you're not looking at damage to the equipment. Only to cables?

MR. KOLACZKOWSKI: No. Possibly damage to the equipment. For example, a rather unique case is there are plants that still have copper tubing as part of their instrument air system. You could postulate that the fire melts some of the copper tubing, therefore you lose your instrument air pressure. And as far as the plant is concerned, it looks like a loss of instrument air. That would be the initiating event postulated for that specific events.

MEMBER APOSTOLAKIS: And you are giving guidance to people how to do these things.

MR. KOLACZKOWSKI: Yes.

MR. NOWLEN: Yes. Now there are many physical components that would not be vulnerable to a fire. And there's a list of those that we recommend you assume are invulnerable. Check valves, major piping systems as long they're not soldered joints; things of that nature.

In general, for example, with a pump. Take a pump. If a pump is in this particular location, the fire will usually attack the cables leading right up to the pump. I mean, there's a cable drop. So for most, even things like valves, pumps, motors it's usually the cable that's the vulnerable component. So, yes, in those cases we would attack the cable in the fire scenario. But there are cases where you may also attack -- the instrument error is a good example. Where you could attack certain types of other components besides cable.

Instrumentation in their main control board, for example, would be another one. Where the instrument itself may be more vulnerable to damage because it's solid state and a cable is relatively robust compared to a solid state circuit board.

MEMBER APOSTOLAKIS: Are you also including damage due to smoke?

MR. NOWLEN: In a qualitative sense, yes. Quantitatively no because the data's just not there. But there are recommendations for including a qualitative judgment as to the extent of where smoke might cause additional damage.

MEMBER APOSTOLAKIS: But that would really be a step change in the methodology, would it not?

MR. NOWLEN: It's a step change, yes.

MEMBER APOSTOLAKIS: Yes. Is anybody in the world independently of nuclear power, outside, developing models for damage to cables or instruments due to smoke? Is anybody looking into it?

MR. NOWLEN: Not that I'm aware of. The only industry that I know that was looking at was the telecommunications industry.

MEMBER APOSTOLAKIS: Yes.

MR. NOWLEN: Because of the experience they had with some of their switching center fires.

MEMBER APOSTOLAKIS: Right. Exactly.

MR. NOWLEN: I don't know to what extent that work's underway.

Actually, I'll add a second one. The Navies of the world have been somewhat concerned about this issue as well. Their focus has generally shifted towards new cable formulations that would minimize the hazard of smoke to equipment. So I'm not aware of any specific equipment vulnerability studies. They're going after what they call the FRNC, fire-retardant non-corrosive cables.

So there are people out there, you know, and a lot of this work was fairly active ten years ago. And the difficulty is it hasn't led to a lot of quantitative insights. Lots of qualitative insights available. Not much that you could quantify and, for example, a fire model.

MEMBER APOSTOLAKIS: Okay.

MEMBER ROSEN: J.S., please.

MR. HYSLOP: Okay. So we'll move on to quantitative screening and pick up our screening post-fire HRA that we talked about in the fire model.

We perform a scoping fire modeling to eliminate components from consideration.

Then we move on to the more detailed

aspect of the fire PRA process, flow chart where we either perform a probabilistic circuit analysis or detailed fire modeling, or both. Basically wherever you get your bang for the buck. If you can refine your fire modeling estimate and rule out multiple spurious you do that. On the other hand, you may just want to quantify low probability circuit analysis issues.

Then you quantify, consider uncertainty and sensitivity and --

MEMBER APOSTOLAKIS: Are you coming back to the quantitative screening? Are you going to say any more about it?

MR. HYSLOP: I wasn't. What's your question?

MEMBER APOSTOLAKIS: You will?

MR. HYSLOP: No. I don't have anything else in presentation.

MEMBER APOSTOLAKIS: What is quantitative screening?

MR. HYSLOP: Quantitative screening is the consideration of fire ignition frequencies. Screening values of HRA. Your consequence, your CCDP. In the first stage. In the second stage there's a screening where you apply simplified fire models at a heat release rate, a very high percentile heat release rate and then you eliminate components. There are a couple of levels of screening.

MEMBER APOSTOLAKIS: But are you using the concept of limiting fire scenario anywhere?

MR. HYSLOP: No. No, we're not.

MEMBER APOSTOLAKIS: The maximum expected fire scenario?

MR. HYSLOP: The heat release rate that we use in the case where we actually look at fire damage from a source, we're using the 98th percentile of our heat release rate distribution.

MEMBER APOSTOLAKIS: Okay.

MR. HYSLOP: And that's what we're using.

MR. NOWLEN: I'll also add a point that those two terms, maximum and expected and limiting fire scenario, are specific to 805, obviously. And as a team we choose not to attempt to define those terms because it was beyond the scope of the project in terms of that's something that really needs to be debated publicly by the regulatory with industry to define what those terms mean.

So you will not find those terms used in our document, limiting fire scenario and maximum expected. We simply did go to that --

MEMBER APOSTOLAKIS: Well, maybe the

reason is is that they are inconsistent with the fire PRA. And you don't have to answer that.

MR. NOWLEN: Within the project, I have to say I cannot answer that question.

MEMBER APOSTOLAKIS: I know you cannot. I can, though. And they are.

Let's go on. Let's on. We're slowing down so much. J.S., please.

MEMBER ROSEN: Okay, J.S.

MR. HYSLOP: Okay. We're moving on.

I was going to talk in detail about some of these tasks. We talked a little bit about the fire PRA component selection. Essentially, some of the advances over the IPEEE that contribute to important components are consideration in multiple spurious actuations and key instrumentation, as we've indicated. We got some public comments in these areas. One asked for a search for new scenarios, any associated components for spurious actuation or other contributors.

One example I can think of is you might not model SRVs in an internal events model but for fire it might be necessary because you might fail the pores. So you have a new consideration.

We've added more on unique manual actions, including instrumentation needed as well as accounting for equipment effects.

You know, certainly we need to identify cables for instrumentation where manual actions rely on a few key indications.

We also need to be aware that if the procedure requires us to de-energize a piece of equipment like a -- well, you certainly can't count on for later feed and bleed; things like that. So you need to be aware that something you do in a procedure early on can effect you later. That's what that means.

So you perform a cable selection for all the fire PRA components, as we said. And we factor all of this in our fire-induced risk model in task 5 for purposes of quantitative screening.

So for post-fire HRA task 12, we've developed screening level human error probabilities and they range from ten times the internal of XPRA, ATPs to one for extremely challenging circumstances. We've provided an identification and discussion of performance shaping factors for detailed analysis. There, you know, stress, smoke, high temperature indications are examples. And we try to be as plant specific and scenario specific as possible in those applications.

Our procedure does not provide detailed quantification guidance, as we've indicated.

Public comments. The major public comment caused us to remove discussion of fire specific pre-initiator HFEs. Basically that could apply to fire protection systems, barriers, program elements. We often treat with data, for example. We actually quantify the unavailability of fire doors with data. So you certainly wouldn't want to incorporate an HFE that overlaps or confuses that quantification.

This does not preclude plant specific HRA or fire specific pre-initiator HFEs as long as you don't double count it in this case.

MEMBER APOSTOLAKIS: Why did you remove these? I'm sorry, I missed it.

MR. HYSLOP: We removed them because we felt like we could treat them with data. Typically you have data, for example, associated with the unavailability of fire doors. So if you got that data in your quantification, then you don't want to add pre-initiator human failure events that would also count for the same type of activity that you've already accounted for in the data.

MR. NOWLEN: Yes. The version of the procedure that went out for public comment had a discussion of the incorporation of fire specific pre-event human failures. And as a result of the comment, it became clear that there was a little bit of a disconnect between what was done in other places with that discussion. So the discussion of specifically incorporating those into the HRA was removed. And in its place there's a discussion that says if you want to do fire specific pre-initiator actions, then you have to go back and consider that, for example, the reliability of a fire protection system already includes human induced failures. For example, the failure to restore operability after maintenance. Those are already in the generic reliability.

So if you want to do it, you need to go back and revisit these other values. That was the change.

MR. HYSLOP: So we also added general guidance on the use existing HRA methods, but no specific quantification guidance as we got requested from one comment.

As we had, the existing methods may not be fire-specific, but we talked about a process on how to modify the PSFs.

We made significant improvement in fire frequencies. Most of our fire sources are now component based. We don't parse equipment, say cabinets, according to a room. We're now looking at it more based on plant population. And this allows for more consistent refined and reasoned compartment scenario frequencies that reflect plant configuration.

We've done an extensive analysis of the event data. If you remember, IPEEEs took the full fire frequency and modified it by a severity factor, which was generic, not very scenario specific.

First of all, we've gone through all events and characterized them as potentially challenging or not. And our potentially challenging is a little boarder than has been used in the past. We look at fires that could be challenging and one particular configuration, although they might not in other, so we capture those.

And we have also developed severity profiles which are linked to our fire frequencies. We basically consider the frequency, the heat release rate/severity profile and the suppression as a set. Need to be used as a set. If you do something to one, you need to look and see if there's an impact on the other.

So we had a lot of discussion and adjustment during peer review. We went over events several times based on challenges from our peer reviews on whether or not they were challenging, the fires were challenging.

MEMBER APOSTOLAKIS: Did you include transient fuels?

MR. HYSLOP: Yes, we did.

MEMBER APOSTOLAKIS: In which bullet am I supposed to understand that?

MR. HYSLOP: Well, we went over the events -- well, I didn't say it specifically, so maybe you aren't.

MEMBER APOSTOLAKIS: So there may be, you know, somebody makes a mistake and leaves a -- you have allowed for that?

MR. HYSLOP: Transient fuels are considered in a --

MEMBER APOSTOLAKIS: Is that a judgmental kind of thing or do you have actual information? I know there have been a few instances where people left, you know, not large but amounts of fuels that shouldn't be there.

MR. HYSLOP: Well, generally, we have an event reports.

MEMBER APOSTOLAKIS: I'm sorry.

MR. HYSLOP: We have reports, the event

reports--

MEMBER APOSTOLAKIS: There are sufficient number of those?

MR. HYSLOP: Yes. To find on the turbine building, but there are a fair amount.

MEMBER APOSTOLAKIS: Yes.

MR. NOWLEN: But it also does factor in the inspection report, insights that were gained back in the days of the Army studies, for example, where they looked at these transients that have been identified. So it incorporates our best current understanding of what the nature of the transient fire might be.

There is a process for providing a relative ranking of your fire compartments for the likelihood and whatnot that a transient fire would occur in a particular location. And to some extent that's judgmental. The analyst is asked to assign weighting factors on three different factors to each area and then you basically ensure that you reconstruct the plant wide frequency of transient fires, which does come from the events.

So there's a number of pieces that come together here, but transients are treated in some detail.

CHAIRMAN WALLIS: A transient fire is a fire due to some transient fuel being present rather than a fire which is itself a transient?

MR. HYSLOP: Right.

MR. NOWLEN: The idea is it's transient versus situ; things that are fixed in place versus things that could be found anywhere.

MEMBER ROSEN: Fuel.

MR. NOWLEN: It's the fuel. The initial fuel, yes.

MR. HYSLOP: I'm going to talk about task 9, which is the detailed circuit analysis. Earlier for component selection we considered all potential failure modes. Now we're looking at those failure modes a little more realistically. This is generally reserved for cases in which quantitative screening indicates a clear need in advance for further analysis.

As I say, we're more realistic so we need to do a detailed failure modes analysis. And the objective is to screen out cables that cannot impact the ability of a component to complete its accredit to the function.

This is primarily a deterministic function, however it's risk-informed. And I'll get to that in my public comment.

One of the public comments was to provide enhanced risk-informed guidance to focus the analysis on failure modes on concerns. We basically looked at those circuit analysis issues that were important top cut sets. They're deterministic analysis in those cases.

We also incorporated guidance for the human factors interface. One of the earlier assumptions was to look at the recovery action and if it was simple, felt high confidence that we would get done, the circuit analysis issue would be dropped, not carried further. Well, we decided to change that. Now the circuit analysis issues are carried into task 12 on HRA analyses to determine the likelihood of those and of the manual action.

Task 10 is where the probabilities come in. We've got two methods presented. One uses the expert panel results, that's the EPRI expert elicitation. Another is a computational based analysis. We developed a method for spurious actuation probability which goes beyond the test configurations, the NEI test configurations. If you remember that was a seven conductor cable and there was one conductor wrapped around it. Well, we now we've got an approach to analyze configurations above and beyond that.

MEMBER ROSEN: Have you published in that any forum other than in 6850?

MR. HYSLOP: No. No. It hasn't been published. And we also realize that it would be beneficial to get some data on that and, hopefully, during the Bin 2 we'll be able pick up a little data.

This probabilistic circuit failure mode likelihood analysis requires a great deal of knowledge. Circuit design, cable type as whether you got thermoplastic, theromost, construction, installed configuration, conduct versus cable tray, etcetera.

It's generally reserved --

MEMBER POWERS: How many licensees have all that information?

MR. HYSLOP: I don't know. Do you know, Bijan?

MR. NAJAFI: One thing I wanted to clarify, I guess your question also coming back to yours, the information about the expert panel results and some of the computational method, maybe earlier version of it, were published in two EPRI reports last year.

MEMBER ROSEN: I was thinking of peer

review journals. Archival type.

MR. NAJAFI: No.

MR. HYSLOP: And a question about how many utilities have all this data available to do the probabilistic circuit analysis?

MR. NAJAFI: Every nuclear power plant in the United States has access to this data as part of that EPRI report.

MEMBER POWERS: They'd need information about their plant.

MR. NOWLEN: I think I understand the question. This is one of the areas where we see there's a significant potential challenge for licensees to gather all this in formation to really do this level of analysis, which is one of the reasons it's in the flow chart where it is. It's relatively late in the process, you're in detailed quantification, there are alternatives to pursue other types of information. But this gets into the cable. Tracing, you have to know whether is it in a conduit or is it in a cable tray. The initial cut is to take the conservative assumptions for those factors you don't understand. And if you find that if they're significant, then you go back and chase more information. So for those cases where it's having an impact on your result, you would chase the information.

MEMBER ROSEN: You haven't answered the question. Do you know how many by percentage, how many?

MR. NOWLEN: Well, I think given the way we've written our procedures, I'm not sure there's any one plant that would have this information for every cable that they're likely to have interest in in the PRA. Do they have it for some cables? Absolutely. Most of their Appendix R cables will be relatively well documented. They'll know whether they're in raceways. They know what types of cables they have. They know how many conductors, that sort of thing. It's actually the routing information that gets a little bit more difficult. But when we begin to pick up other types of systems, there's information available at the plant but it's never been interpreted in a fire context.

For example, there are electrical analysis will have identified cable types. They will have done studies on the cables, for example, so they'll have information on in general the nature of the raceway that it's in. They may not know specifically where it's at. So there's a lot of information available, but bottom line is, no, they are going to be chasing additional information.

MEMBER ROSEN: Do you know a circuit raceway cable program known as EE 580?

MR. NOWLEN: I'm not familiar with that one, no.

MR. NAJAFI: Let me try, now that I can understand the question and answer.

This type of information about the cable design, cable type and what is in, it is much easier in every plant to find if the cables are in cable trays. They generally have much better information in their cables in the cable trays.

In some plants they have cables in the conduits. So that is a second tier.

When it gets even harder is to know a specific cable type design when it's inside, let's say, a main control board. That's the hardest part. To know what's inside, where is it and what circuit type.

But cable trays are easy. Conduits okay. Inside cabinets are the hardest part.

MEMBER SIEBER: I think plants that were built pretty late, like the late 1980s, they use pull tickets where you had a ticket for every cable that you pulled, where it's terminated, what trays it went through. And we had that for our latest units, but we did not have it for the units built in the 1970s.

MEMBER ROSEN: And that information was computerized at some plants.

MEMBER SIEBER: Yes. Well, you have to run a program to actually figure out what's connected to what and where the cable goes.

MR. NOWLEN: Yes. We ran into that issue with both of our pilots, in fact. They each had older style cable routing databases. And it was quite a challenge to translate that into something that you could query in the context of a PRA.

MEMBER SIEBER: That's right.

MR. NOWLEN: So, again, it's one of those resource uncertainties depending on how hard that task is going to be, that will have a significant impact on the overall scope of the project. And, yes, a lot of these older databases are not well suited to our needs.

MEMBER ROSEN: Now in most cases, however, if you're pushed hard enough you can do a hand-over-hand tracing in a compartment of where it goes to, except in cases where the trays have been filed with some fire retardant material. In that case, you might not be able to anymore.

MEMBER SIEBER: Hand-over-hand topped on a cable tray that's got 75 cables in it.

MEMBER ROSEN: Not impossible, but --

MR. NOWLEN: It's not impossible. It's a substantial amount of really unpleasant work. And so, again --

MEMBER SIEBER: Well, they're usually tagged on the end so if you can find the end, you're okay.

MR. NOWLEN: That's right. They'll typically -- you know, finding end points. You can find where it enters a cable tray and you go to the other, and it comes out the other end so you know it didn't dive off somewhere strange in between.

Yes, you know the cable, the fire retardant coatings that were applied, complicate the issue because you can't break in under that coating anymore. If they're wrapped in fire barrier materials, you can't just tear the wrap up and go after it. So there are significant challenges here, yes.

MR. NAJAFI: Also, to add in terms of the resources. Our experience in the last two plants show when you get to this task 10, the level of effort is almost an order of magnitude less.

MEMBER SIEBER: Yes.

MR. NAJAFI: What you have to do the most, it occurs in our task 3 and the majority of it, almost it could be in some old plants that you'd have to go through drawings. That task could be 50 percent of the entire job to do.

MEMBER ROSEN: All right, J.S., let's go on.

MR. HYSLOP: Okay.

MR. HYSLOP: Okay. So basically this support the bullet that this was reserved only for those cases that can't be resolved through other means.

Now for task 10 continuation on the circuit failure mode likelihood analysis. There's some key insights here.

We feel that we really improved our knowledge here, but the uncertainties are still high. The practical implementation is challenging, as was just stated. It's a challenge to manage your resources in this circuit analysis work.

We also feel that a further analysis of the existing test data would be beneficial as well as follow-on tests. Basically, you could analyze the data more and get more information fire timing duration out of it.

And then Research also -- but we have plans to do tests. We have plans to do the Bin 2 test, part of the RIS 2004-03. And so we will be getting more information.

We got comments from the public and peer review on this. There was some extensive discussions regarding the most appropriate way to tally spurious actuation probabilities. I guess in PRA we're interested whether a valve would change state from a spurious actuation, whether if it's open it would go closed or vice versa.

The expert elicitation focused on whether the target conductors for either open or closed would be contacted by the energized conductor. PRA is only interested in a single outcome. And fortunately, the test showed that meltable target conductors were contacted by an energized conductor during these tests.

I guess the consensus from the team was that as applied the expert panel values were generally conservative.

We also requested some additional independent review of the circuit analysis method. We solicited it. It was favorable, but the reviewers acknowledged there was a fairly high uncertainty in what we were doing.

In the detailed fire modeling, there we addressed single, multi compartment and main control room fire scenarios. Approach is traditional. Identify fire sources, fire growth/spread/damage, consider detection/suppression and then a CCDP.

We also developed some special models to account for nuclear power plant fire scenarios beyond the capabilities of existing computational fire models.

Task 11 was a fairly weighty task. There's a lot in there. I've got a few slides on that.

First of all, is the heat release rate in severity. The IPEEE in many cases used a fixed heat release rate and single severity factor for an ignition source. We now have a distribution which ties heat release rate to severity factor. This distribution was based on expert judgment and it captures the high intensity fires that often weren't captured in the IPEEE.

If you look at the diagram on the right, there's a peek heat release rate distribution versus probability. Probability versus peek heat release rate. And the vertical lines shows the minimum tensity leading to spread and damage, and our severity factor is at that part of the distribution beyond the vertical line. So that's how they capture the severity

MEMBER POWERS: Are you sure this is a probability density function?

MR. HYSLOP: Yes.

MEMBER POWERS: Not probability?

MR. HYSLOP: It's normalized. Probability equals one under there, so it's a true probability.

MEMBER POWERS: No, it's a density function.

MR. HYSLOP: Oh, a density function. Sure. Sure.

Basically we used this function for scoping fire modeling. Because we used the 98th percentile in scoping fire modeling to determine whether components are damaged.

MEMBER POWERS: What you mean is that you assumed all density factors are in the top two percent when you scope and then you find out what gets damaged?

MR. HYSLOP: Yes. And if it's damaged, then you keep it and you carry it on to refined modeling.

We developed some special models. We developed a model to address high energy arcing faults. This is entirely new. It's critical to the switchgear room. This is am empirical rule set based on operating experience. It consists of two phases. There's a high energy phase, kind of an explosive phase where we have a zone of influence for ignition of secondary combustibles and physical damage. And in that phase we don't allow any credit for fixed or manual suppression, suppression by the --

MEMBER POWERS: I'm sorry. Can I go back to that density function?

MR. HYSLOP: Okay.

MEMBER POWERS: Why is it not log-normal?

MR. HYSLOP: Go ahead.

MR. NOWLEN: That's not intended to be representative of anything. It's just an arbitrary curve drawn on the figure to illustrate the idea of having a minimum intensity leading to failure. It's completely an artificial construct. Most of these were, in fact, modeled with a log-normal distribution. I don't know if we used it in all cases. But I know the vast majority we did with log-normal.

This was just an Excel construct.

MEMBER POWERS: So if I thought of that as the log or the P-T release rate, I'd probably be more right?

MR. NOWLEN: You'd probably be closer to right, yes. Yes.

MEMBER POWERS: I'm sorry.

MR. HYSLOP: So we have a high energy phase and then we have a thermal phase or the enduring fire from the ignition of combustibles. And we treat that like any other fire source where we allow suppression versus damage.

We have a model for the main control board. It's critical to control room fire risk and it's a probabilistic model for the frequency of fire damage for target sets in the main control board.

It's most useful for those main control boards where there are no dividers and it gives a sense for determining targets and damage.

We've got a cable fire model, critical --

MEMBER ROSEN: Hold on. These new efforts not in any archival journals?

MR. HYSLOP: No. These were the first time these were published. This is it.

MEMBER ROSEN: In NUREG 6850?

MR. HYSLOP: Yes. Both of those two don't appear anywhere else. Well, wait. We do have a high energy arcing fault model in the SDP. But it's simpler. You want to talk about that, Steve?

MR. HYSLOP: Yes. The SDP uses a very similar rule set, but as far as publication goes, these have been presented at various conferences, but not a referee journal article yet. So it has been disseminated both -- and by the way, both within the general fire protection community and in the nuclear risk fire group. But it's been more conferences, not the referee journal article.

CHAIRMAN WALLIS: This model for the propagation inside the main control board. Presumably that is a framework and someone then has to make it specific to the particular plant?

MR. HYSLOP: Yes.

CHAIRMAN WALLIS: So it may not be that easy to figure out the coefficients and things that go into the model?

MR. NOWLEN: Well, we've got that all documented and the Appendix discusses that particular model so that you can recreate our calculation. And the main factors that go into play is generally the overall size of your particular main control board, the overall dimensions. If you have a very small main control board, then in a sense you're concentrating the main control board fire frequency in a smaller zone, so you'd end up with higher probabilities for any one. But it is documented to the point where someone could with relative easy recreate it.

MR. HYSLOP: We have some other special models. I'll just name them. Several of them are consolidations. Fire propagation to adjacent cabinets, passive fire protection features and smoke damage or consolidation. We have approaches for hydrogen fires and turbine generator fires. These are new.

We have an approach for detection and suppression where you have probability of non suppression, which is a conditional probability that the first will last long enough to cause a damage. And the approach is fairly comprehensive. It looks at prompt detection and suppression, automatic detection/suppression, manual detection/suppression. And this is a case where we also analyze more extensive data. We look at those long duration fires and we now incorporate those specifically in our values for suppression reliability.

So it's an improvement over previous methods that we're analyzing more data and we have an explicit framework for analysis.

MEMBER APOSTOLAKIS: But wait. The probabilities are the result of expert judgment, I assume. They look at all this stuff, what automatic detection capability do it I have or manual and so on, and --

MR. HYSLOP: Well, some are based on data. But there are valves that have been around for automatic -- based on demand, whether or not an automatic -- the system is going to go off. And they're in many books. And they've been around.

MEMBER APOSTOLAKIS: But the conditional probability that the fire last long enough to cause postulated damage.

MR. HYSLOP: Well here --

MR. NOWLEN: This is the weighing of damage time versus time to suppression. So it's similar to past practice. It's just been --

MEMBER APOSTOLAKIS: But it's really a competition of the two, isn't it?

MR. NOWLEN: Precisely. Yes.

MR. HYSLOP: Yes.

MEMBER APOSTOLAKIS: Here though you're saying if it takes 23 minutes to damage those cables, what is the probability that in these 23 minutes I'll detect and suppress?

MR. NOWLEN: Right.

MR. HYSLOP: Right.

MEMBER APOSTOLAKIS: And if it takes ten minutes, then I'll have a different probability?

MR. NOWLEN: Correct.

MEMBER APOSTOLAKIS: And is this probability so sensitive to these minutes?

MR. NOWLEN: Yes.

MEMBER APOSTOLAKIS: How do you know?

MR. NOWLEN: The main piece that's quite sensitive to the timing is the manual suppression, which tends to be the most important piece. So, you know, the likelihood that a fire lasts an hour is very low, but the main fire -- detection is done using fire models. We predict the time to detection and fold that into the overall suppression event tree as a time factor.

The suppression event tree is pretty typical you come up with end states of how you got to suppression, whether it was manually detected and manually suppressed, for example, given failure of your fixed systems versus actuation of an automatic system. And each of those has a different time -- a translation time, basically, of how you got from here to there. So the combination of the probability that you end up on each end state with the transition time associated with the end state is then weighed against your prediction of the damage time to estimate the likelihood that that fire then was either damaging or not, the probability --

MEMBER APOSTOLAKIS: Are you going separate this in all of this stuff?

MR. NOWLEN: There are uncertainties in some aspects of it, yes. Not in every single rigorous aspect, but to the extent that you can --

MEMBER APOSTOLAKIS: But the important thing is to have the uncertainty in the final number. I mean, if you come up with fractions of times that you are suppressing it or nonsuppressing it, given a certain period of time, that should be some --

MR. NOWLEN: Yes. And, again, it's primarily driven by the uncertainty of the manual suppression curves. And those are characterized as a representative curve with uncertainty bounds.

MEMBER APOSTOLAKIS: Yes.

MR. NOWLEN: There's also the other part of uncertainty that's folded into this is this concept of the distribution of heat release rate. Any one fire source can give you multiple heat release rates each having some likelihood of occurrence. So there's uncertainty that comes in through the heat release rate because, obviously, the higher the intensity of the fire, the shorter the damage --

MEMBER APOSTOLAKIS: At least the principal uncertainty.

MR. NOWLEN: Yes. That's the real driver. Yes. And that one is treated explicitly through our distribution of heat release rate, which you generally would -- and treat a certain number of discrete cases and then refold those back into the final answer.

MEMBER ROSEN: We're going to talk about uncertainty later.

MR. HYSLOP: It's coming up.

MEMBER ROSEN: But it's soon.

MR. HYSLOP: Okay. So we talked about the V&V of fire models. And how we're treating them. We got a comment on it.

Alan, you there?

MR. KOLACZKOWSKI: Yes.

MR. HYSLOP: Okay. So this is task 15 the uncertainty and sensitivity analysis. It addresses the process for uncertainty and sensitivity analyses, a process for treating modeling and data uncertainties.

MEMBER APOSTOLAKIS: Now that's where you have to tell us how you do that.

MR. HYSLOP: Alan?

MR. KOLACZKOWSKI: This is Alan Kolaczkowski, SAIC.

The procedure is written to develop -- basically to describe a process for developing the uncertainties that you're going to quantify or somehow treat in the analysis. It does not a priori define a specific -- of uncertainties. However, ones that are crucial to the final risk are included such as the ones we've been talking about. We have a distribution about the heat relates. We have a distribution with regards to fire detection and suppression frequencies, those kinds of things. But we do not necessarily identify the bounds for every item that you might to specify as being uncertain the fire PRA model.

MEMBER APOSTOLAKIS: But there are two areas, though, where one might want to see some estimate of the model uncertainty. One is in the code that might be used for heat transfer calculations to calculate, for example, the time to damage. And the second which I understand you're recommending a number of codes without saying use this one, right? CFAST and so on.

And the other area is the human reliability analysis, the response to the fire which, again, if you use one model you don't know what another model might produce.

Is there any attempt to quantify those uncertainties?

MR. HYSLOP: Well, the V&V approach is the approach that's addressing the fire models, not this approach. We're simply saying the model's right there.

MEMBER APOSTOLAKIS: But the model itself may have some uncertainty associated with its predictions.

MR. HYSLOP: Sure.

MEMBER APOSTOLAKIS: I mean, do you recognize that here? You acknowledge it?

MR. KOLACZKOWSKI: Yes, to that extent, George, we do. We do talk about the new possibility identify sensitivity analyses that we'll use. But you may postulate, for instance, in the model to how sensitive the results are to change the model structure.

MEMBER APOSTOLAKIS: Speak closer to the microphone, Alan. We can't hear you.

MR. KOLACZKOWSKI: Okay. It does address sensitive analyses as being to identify how robust your answer is to initial changes in your models.

MEMBER APOSTOLAKIS: Okay. All right.

Have you done -- not you personally, I mean the project. Have you done a sensitive analysis that will tell me what the top five drivers are? We already identified one, the heat release rate. I agree from day one, February 1, 1981 it was -- okay.

What are the other four?

MR. KOLACZKOWSKI: We have not -- while we have tested the procedures on an individual basis, as I think as has already been expressed, with the first two pilot plants we were not able to do an integrated overall testing of all the procedures all the way through to the point where we actually had a fire PRA and results and we could look at what was dominating.

MEMBER APOSTOLAKIS: Can you tell us after you do the pilots what the top five model uncertainties are or parameter uncertainties so that someone, you know, in a utility who wants to do this and doesn't want to be innovative, doesn't want to change the state-of-the-art, will have some guidance as to where to pay attention? I think that would be extremely useful and already we have identified the first one. If you guys can do that, that will be great.

MEMBER ROSEN: I think the report is pretty clear in task 15 and this Appendix V, I guess it is, that there are requirements for calculating the uncertainty. Actually calculating it in the fire ignition frequency area. But also in the post-fire human reliability area.

The rest of the areas, the 6950 suggests that there be a quality review. In other words, a second review, not a quantification which is a weakness, I think.

MR. NOWLEN: It is a combination of those explicit quantification of uncertainties, sensitivity studies and in some cases quality reviews for example to get at completeness of your plant model. You know, it's typical of the internal events as well. You have to ask yourself how complete is your model of the plant. Say, shutdown response we have the same issue. How complete was your consideration of potential circuit analysis issues. You have to do a review, and we've recommended that a peer review is a good process for doing that to learn from others. Well, we saw this at our plant, is it possible at yours? Did you consider it?

So I think in some areas the completeness review based on a peer review is an appropriate way to deal with that. In other cases, we can quantify and we recommend that we do quantify.

In the specific area of the fire models we make recommendations as to quantifying uncertainties associated with your fire models. But we did not, for example, attempt to quantify the uncertainties associated with CFAST. That was not our job.

MEMBER APOSTOLAKIS: But is it something that in the future must be done?

MR. NOWLEN: I believe the V&V effort is the area where that is being done. And they are looking at the uncertainties associated with these models calculations, reliability.

MEMBER APOSTOLAKIS: And where is the uncertainty with respect to smoke impact?

MR. NOWLEN: That's another one of those that is very difficult to quantify.

MEMBER APOSTOLAKIS: That's right.

MR. NOWLEN: It would be done in the sense of a sensitivity study. That is, if you were to assume widespread smoke damage, how would that change your results? Are you sensitive to the assumption there? Since we can't really quantify smoke impact, it's hard to quantify the uncertainty in smoke impact, as well.

MEMBER POWERS: Steve, when you talk about smoke impact are you talking about immediately during the fire or its immediate aftermath?

MR. NOWLEN: Yes.

MEMBER POWERS: What does the agency do, probably J.S. is not the right person to ask, but I'll ask anyway. I mean, the fact is that smoke particles themselves, fairly acidic typically. And so they go in and they get onto to connectors and things like that. They have no trouble today. You have no trouble tomorrow. Six months from now that connector is corroded. And now you have troubles. What do you do about that?

MR. NOWLEN: I can't really speak for the agency, obviously. But, you know, these are fairly well known phenomena in the fire community. So it is true, smoke after a fire there is some pretty extensive cleanup that needs to be done. And, again, going back to the telecommunications, they've really pioneered the methods for identifying what needs to be cleaned up and then going in and actually cleaning up.

MEMBER POWERS: And if we regulated the telecommunications business, we'd be in good shape. But we don't.

MR. NOWLEN: Yes, but those same technologies have translated directly to nuclear power industry. And the same techniques apply. So there is a pretty good understanding of what you need to be aware of, you know, what levels of smoke are a long term hazard, which in long term it's relatively light levels of smoke can cause long term problems for a component.

And then the methods for, you know, when is an object recoverable versus write it off and replace it. So I think that's a fairly mature technology that has in fact found it's way directly to the licensees. It was pioneered, really, by the telecommunications, but it's now -- you know, you can pick up a phone book and find services that specialize in post-fire restoration of electronic equipment, for example.

MEMBER APOSTOLAKIS: Yes, but that doesn't help you with the analysis.

MR. NOWLEN: No. In our analysis we are limited to the time frame of the fire. We're not looking at a fire that occurs now and six months later I have a component failure. That is outside of the scope of the fire PRA.

MEMBER POWERS: But if we're ever going to integrate fire PRA and normal operations PRA, we've got to figure out some way to handle that. And, I mean, that -- this morning we spent some time talking about how we're going to utilize risk in defining criteria for future plants. And without integrating these two areas together, that discussion was essentially a feat.

MEMBER APOSTOLAKIS: Can you explain the first sub bullet under "Some changes were made?"

MR. HYSLOP: Yes. Basically there were discussions on uncertainties for each task, each procedure. And we got a comment requesting that we consolidate that under task 15, which is the task for uncertainty and sensitivity. So we just removed the discussion to one area as opposed to having it distributed all among the report.

MEMBER APOSTOLAKIS: Well, the thing that worries me is that years ago I was asked to review a fire PRA. And when I mentioned the uncertainties, looked at me as if I was from Mars. They said nobody does that. Why do you want us to do it? Has the attitude changed now? Is the industry willing to actually do uncertainty analysis in the fire area?

MR. NAJAFI: Let me try to answer that.

The attitude is that way because IPEEE, which is the biggest experience that industry has, did not require it. Has that attitude changed? It remains to be seen. Once this goes out and people do new. But it's very clear -- that it states that that is a critical issue that you need to pay attention to.

We have not gone and created a whole new science for uncertainty. I mean, this document does not do that. Does not advance the science of uncertainty in anyway. All it does it makes a list of these -- are they unique uncertainties due to fire. Things that are important to fire.

Example, fire model uncertainty. These are things.

And also, in addition to that, it says some can be quantified and should be quantified. Some needs to be addressed through sensitivities because you can't come up with distribution, at least for the current state-of-the-art. There's some that you can't even do any of it, weakness or whatever. It's just an acknowledgement. It's there. But we can't tell you anything to do about it.

And the model uncertainty, by the way it's a good point to bring it up that you said this document it does not get again get to the depth of the model uncertainty. It just mentions that as a point. It says there are -- we talk here about the parameters that are input to the model and we deal with the uncertainty of those.

For example, did you pick all the right scenarios? You may have missed some scenarios. But when you put in, let's see, CFAST, what it comes out of how you trust the number, that is not here. That's something that in part V&V project is supposed to address to say what is the validity or accuracy of the numbers given a specific set of input.

MEMBER ROSEN: All right. Wrap it up, J.S.

MR. HYSLOP: All right. I have two more slides. I'll go through this one quickly.

CDF insights. This is compared to the IPEEE and it's in the author's judgment, since we haven't applied this throughout an entire PRA.

We expect the overall range of CDF --

MEMBER ROSEN: Why don't you wrap it up on that one.

MR. HYSLOP: Okay.

MEMBER ROSEN: How did you make that judgment? I mean, is there any basis for that or is it just --

MR. HYSLOP: For what?

MEMBER ROSEN: For the first one? To reflect the overall range of CDF for the fleet of plants to be maintained.

MR. HYSLOP: Well, we looked at the

overall range, which is quite broad, from 10 to the minus 7 -- minus 4. We recognized that our methodology to have some increases and some decreases. And so we made a general statement that as far as we know right now, we don't have any issues that are going to drive the CDF up tremendously or drive it down without some competing fashion.

MEMBER ROSEN: Okay. I was confused. It's the second one I have.

MR. HYSLOP: Well, let me go to that then.

MEMBER ROSEN: Yes.

MR. HYSLOP: So we do expect that the individual risk profile of some plants to change. There are some plant specific configurations, poor separation for instance where multiple sprays is likely to be more important. For example, high energy arcing faults have the potential to dry things up. On the other hand, our main control board model allows us to make more refined determinations of damage. That could drive us down --

MEMBER ROSEN: Well, you're saying things could move around?

MR. HYSLOP: Yes.

MEMBER ROSEN: Plants that are pretty good now might find that they are not so great? Some plants that think they're great or think they're in poor or might be better than they think.

MR. HYSLOP: Yes.

MEMBER ROSEN: And that's what I think will happen.

MR. HYSLOP: Yes. That's what I'm saying. But all in all we feel we feel like this methodology needs to continue to be applied, continue to get insights, continue to grow.

So however, cable tracing is still going to be a major resource requirement in circuit analysis. That hasn't changed. We just have to address it through screening aspects and hope we don't get there too often.

MEMBER ROSEN: And what you're saying by addressing it through screening aspects means that not everybody has to trace everybody cable?

MR. HYSLOP: Yes. There's fire damage estimates that may eliminate components from consideration, that may eliminate multiple spurious, so that's what I'm trying to say.

MR. NOWLEN: And I would even go further that no one should have to trace every cable in their plant. That should not --

MEMBER ROSEN: Okay. But there will be

cases where it will be beneficial to do so and people will determine it's possible and it will be helpful, and people will --

MR. NOWLEN: Absolutely.

MR. HYSLOP: Okay. We the last slide and then to wrap up.

We feel this is the best available method to estimate fire risk and obtain insights. You know, certainly the methodology will continue to evolve in applications, but this is the best.

We feel that improvements will benefit the state-of-the-art. We talked about spurious actuations, about some Bin 2 testing and about an equation that goes beyond the EPRI Research testing configurations. Certainly more information on those would be helpful.

We have screening approach for HRA. A detailed approach. We need to put some effort into that.

For low power and shutdown operations there's some differences between low power and shutdown methodology and full power. Granted, there's a lot that carries over, but there's frequencies on availability, plant model, that's a different issue.

And then finally for plant specific assessment of fire fighting, we feel it would be beneficial to capture individual characteristics and fold that into the fire PRA.

Thank you.

MEMBER ROSEN: Thank you. It's a very good presentation, a very good piece of work. It is imperfect. There's still work to be don. But I think it's a vast improvement over what we had before in terms of guidance available to do these things.

MEMBER APOSTOLAKIS: Can we have a detailed presentation in the future of an actual pilot applications? Not just the insights, the nitty-gritty, you know. They did this and they did --

CHAIRMAN WALLIS: It's all going to be one, isn't it? It's going to be one pilot, isn't it?

MEMBER POWERS: It seems to me that such a detailed presentation would be in the domain of the Fire Protection Subcommittee.

MEMBER APOSTOLAKIS: Absolutely. Absolutely.

MEMBER POWERS: I would suggest you speak to the gentleman on your left and he will arrange that for you.

MEMBER APOSTOLAKIS: Okay. Because usually the Committee does not hear things like that, even the Subcommittee. They tell you what --

MEMBER POWERS: Well the Subcommittee could hear and figure out if the full Committee needs to.

MEMBER APOSTOLAKIS: But they don't come into the Subcommittee room --

MEMBER POWERS: I mean, it's been traditional for the Fire Subcommittee to stay on top of the field. And attend various conferences and things like that. So it's not necessary to plunge into details.

MR. HYSLOP: I think we might to speak to the licensee to see if there's any proprietary information.

MEMBER APOSTOLAKIS: Well, we can swear.

CHAIRMAN WALLIS: That's something consider, right?

MR. HYSLOP: Well, but it's something that you need to ask.

MR. NOWLEN: Yes, but the way it's structure right now is that the final analysis belongs to the licensee. Our parts of it, the demonstration studies are public. But what the licensee does in the end is their study. So we wouldn't --

CHAIRMAN WALLIS: Maybe if they're very proud of it, they'll want to present it to us.

MR. NOWLEN: They could very well be. But it would certainly take their --

MEMBER APOSTOLAKIS: They can skip the vulnerabilities.

MEMBER ROSEN: All right. Thank you, Mr. Hyslop.

MR. HYSLOP: Thank you.

MEMBER ROSEN: Gentlemen.

Chairman, back to you early by 18 minutes.

CHAIRMAN WALLIS: I think you're late.

MEMBER SIEBER: I think you're late.

CHAIRMAN WALLIS: You're late. We've lost some time. We've been using a little bit on every --

MEMBER ROSEN: No, no. I think we took our hour and a half.

CHAIRMAN WALLIS: You took an hour and a half, plus eight minutes.

We've been slowly slipping.

We will take a break until 20 minutes to, realizing that we've got a lot to do yet with the next item.

(Whereupon, are 2:34 p.m. a recess until 2:40 p.m.)

CHAIRMAN WALLIS: Let us come back into session. I will hand this over to my colleague, Dr.

Shack, to lead us through the intricacies of the single-failure criterion.

VICE CHAIRMAN SHACK: Okay. We're going to talk about the evaluation of the broader change to the single-failure criterion. The single-failure criterion arise from the GDC and in the analysis of design-basis accidents. In the design criteria, the objective of the single-failure criterion is to achieve high safety system reliability. High reliability can be achieved in a number of ways. The single-failure criterion forces the designer to use redundancy to achieve high reliability. We could refer to this as the structuralist approach to reliability. However, we know from experience that the single-failure criterion is not always sufficient to assure adequate reliability.

PRA methods could be used to provide a rationalist approach to reliability. The required reliability would be a function of the frequency of the challenge, and it would consider support systems, as well as safety systems, and it would consider common cause and other types of multiple failures. Like all rationalist approaches, it would depend strongly on the quality of your PRA.

In the analysis of design-basis accidents, the current approach sometimes focuses attention on events with very low frequency, and with low probability system failures that may, in fact, have low risk significance.

Sufficiently unlikely, and low risk significant single-failure sequences could be removed from design-basis. Design-basis accidents based on PRA analyses that could include multiple failures, and would represent a much larger portion of the actual risk could be added.

Although this issue has arisen most recently in the development of a risk-informed 50.46, the Staff has been tasked to consider a broader change single-failure criterion in the regulations, and they're here today to brief us on their progress in defining potential alternatives, and the pros and cons of these alternatives, and Hossein is going to make this presentation to us.

MR. HAMZEHEE: Thank you. Again, my name is hossein Hamzehee. I'm the Section Chief in PRA Branch of Office of Nuclear Regulatory Research. Next to me is John Lane, Senior Risk and Reliability Engineer of the PRA Branch also, office of Nuclear Regulatory Research. I would also like to introduce other team members that are sitting in the back; Bob

Youngblood and Scott Newberry of ISL, Incorporated; and Ted Ginsberg and Gerardo Martinez from Brookhaven National Lab. So in case there are more detailed questions that we cannot handle, we'd ask the folks in the back to help us out.

With that, let me just quickly tell you why we're here, which is consistent with what Dr. Shack mentioned. The purpose of this presentation is to provide --

CHAIRMAN WALLIS: That's a single-failure.

MEMBER SIEBER: I liked it better the first way.

VICE CHAIRMAN SHACK: We notice this is the high tech presentation.

MEMBER ROSEN: You notice it was easy to fix. If it happened with the computer, you'd have to wait.

MR. HAMZEHEE: Well, the purpose of this presentation is really to provide a summary of status of our evaluation of a broader change to single-failure criterion, and also give you a summary of planned follow-up activities. And what we would like the ACRS is to provide some feedback, hopefully via a letter on the work completed to-date on risk-informed alternatives, and also the planned follow-up activities that we'll go over shortly.

MEMBER APOSTOLAKIS: So no oral feedback.

MR. HAMZEHEE: I beg your pardon?

MEMBER APOSTOLAKIS: No oral feedback.

MR. HAMZEHEE: Hopefully written, but oral is fine, too.

Now I understand we have about no more than an hour, an hour and 20 minutes, so we would like to quickly give you some background, and a summary of technical approach and the work completed to-date. And then we would also like to provide a summary of NRR major comments and where we are with those planned follow-up activities, and quickly go over schedule. And if time permits, we'll have provided two examples for each alternative. We can also present those three examples in a summary fashion.

Again, as was mentioned earlier, there was an SRM on March 31st, 2003 that was on the risk-informed changes to 10 CFR 50.46. And in that SRM, the Commission approved most of the recommendations that Staff made on possible changes to LOCA requirements. And you've seen and heard in the last few months presentations on proposed rulemaking on 50.46.

In the same SRM, the Commission also

directed the staff to risk-inform the requirements of LOCA coincident with loss of off-site power. And in addition, they directed us to pursue a broader change to single-failure criterion and inform the commission of our findings beyond what was considered for the request for LOCA/LOOP. Now this one was done, mainly it runs to that directive.

Now again, our interpretation of broader change is to risk-inform alternatives that could apply to all plant functions, and safety and non-safety functions and systems, not just to ECCS. And that could definitely lead to changes that would impact licensing, programmatic activities such as testing, inspections, and plant performance marshaling activities.

MEMBER BONACA: So running on any component, it would be applicable to any component with respect to whether it is safety-related or not safety-related.

MR. HAMZEHEE: Yes, except that the single-failure criterion as we speak only apply to safety-related systems. But when we risk-inform them, they could apply to non-safety related. That's a risk-informed approach, but currently it's only for safety-related, as you know.

MEMBER BONACA: Yes. Because, I mean, in the past application for that condition have led to significant oversight.

MR. HAMZEHEE: Correct. Now before we go further, let's just make sure we all have a common understanding of what single-failure means. The term "single-failure" is defined in 10 CFR Part 50, Appendix A, as follows: "A single-failure means an occurrence which could result in loss of capability of a component to perform its intended safety function." And then it also talks of "multiple failures that may result from a single occurrence are considered to be a single-failure." And a good example is loss of the support systems, like if you lose a diesel generator, that's one occurrence, but that could impact four or five front line systems. So you say this is not a single failure.

MEMBER APOSTOLAKIS: But for years now people have been saying that the single-failure criterion does not include common cause --

MR. HAMZEHEE: It does not. Common cause is different.

MEMBER APOSTOLAKIS: But wouldn't the common cause be multiple failure resulting from a single occurrence?

MR. HAMZEHEE: Yes.

MEMBER APOSTOLAKIS: So why isn't it included?

MR. HAMZEHEE: That's the way it is currently in the design.

MEMBER APOSTOLAKIS: Is it because the focus of this definition is hardware, not causes?

MR. HAMZEHEE: Correct.

MEMBER APOSTOLAKIS: Okay. So common cause failure is a single cause.

MR. HAMZEHEE: Yes.

MEMBER APOSTOLAKIS: But that cause may be anything.

MR. HAMZEHEE: Yes. But when we go over some of these alternatives where you risk-inform and common cause failure is a major attribute to risk-inform those -- because you cannot ignore it any more.

MEMBER APOSTOLAKIS: Correct.

MR. HAMZEHEE: And that's based on the risk -- that's all covered. Now we'll talk about them shortly. And then it says that: "The fluid and electrical systems are considered to be designed against an assumed single-failure, if neither a single-failure of any active component, assuming that passive components function properly, nor a single-failure of a passive component assuming that active components function properly result in a loss of capability of a system to perform its intended safety function." This is the definition in Appendix A of 10 CFR Part 50.

CHAIRMAN WALLIS: Only fluid and electric systems? I mean, how about mechanical systems which have various components, and have to move and do something. There's no application to them?

MR. HAMZEHEE: Yes. It says fluid and electrical. Fluid here we mean mechanical systems, as well.

CHAIRMAN WALLIS: Fluid means mechancial?

MR. HAMZEHEE: Correct.

CHAIRMAN WALLIS: That's new to me. Okay.

MR. HAMZEHEE: I believe that's what we mean by fluid systems are mainly most of the mechanical systems.

MEMBER APOSTOLAKIS: Hossein.

MR. HAMZEHEE: Yes, sir.

MEMBER APOSTOLAKIS: What is the reason, if you know, of this one and two, a single-failure of any active component assuming passive components. I mean isn't that the whole idea of a single-failure criterion to assume a single-failure?

MR. HAMZEHEE: Correct.

MEMBER APOSTOLAKIS: Why does it have to tell me assuming that the other stuff is working?

MR. HAMZEHEE: Because here they want to emphasize that there are two types of components, active and passive. And as we go over our presentation, some of the requirements regarding passive components are not as clear as for active components. So here they're saying that for active components, assuming all your passive components work, they have to be functional, as well as the other way around, for clarity purposes. But technically you're right, either one could precede the purpose of single-failure criterion.

And then there's an associated footnote that I'm sure Steve remembers. It's been there for many, many years, that says: "Single failures of passive components in electrical systems should be assumed in designing against a single-failure. However, the conditions under which a single-failure of a passive component in a fluid system should be considered in designing the system against a single-failure or under development. So you see there are not clear guidelines for passive components to fluid systems, so you may see some flexibilities, how licensees apply some of these rules --

CHAIRMAN WALLIS: Are there guidelines about what a component is? I mean, almost every component has sub-components, and how far do you go down before you come to --

MR. HAMZEHEE: The simple definition is a component is, for instance, an MOV, an AOV, a pump, a circuit breaker.

CHAIRMAN WALLIS: But it's not a particular part of the pump.

MR. HAMZEHEE: Those are sub-components.

MEMBER APOSTOLAKIS: But you don't apply the single-failure criterion to those, I don't think.

MR. HAMZEHEE: No, you don't. However, if they fail, they would impact the functionality of your component. Then you're talking about the component.

CHAIRMAN WALLIS: But there could be redundancy in those other sub-components.

MR. HAMZEHEE: Yes.

CHAIRMAN WALLIS: Okay.

MEMBER APOSTOLAKIS: I think they're looking at it the way a PRA would develop, perhaps a fault tree.

CHAIRMAN WALLIS: Yes. It's a component.

MEMBER APOSTOLAKIS: You really don't go

down to the 2000 sub-components --

CHAIRMAN WALLIS: The bolts and all that.

VICE CHAIRMAN SHACK: It's sort of tied to function.

MR. HAMZEHEE: That's correct.

MEMBER APOSTOLAKIS: But isn't this footnote essentially negating the second sentence.

MR. HAMZEHEE: That's why we have it here. That's why if you go over alternatives to explain to you what --

MEMBER APOSTOLAKIS: It's always confusing to me. It says do one or two, but then there's a footnote that says we cannot do two now.

MR. HAMZEHEE: It doesn't say we cannot. It says --

MEMBER APOSTOLAKIS: Guidance.

MR. HAMZEHEE: Correct. But that doesn't mean that you have to ignore them. As I said, if you go back and look at industry, they have ways of addressing these things. It's not that they've been totally ignored.

MEMBER APOSTOLAKIS: Okay.

MR. HAMZEHEE: Now this is the common understanding of the single-failures. Now let's go back and talk a little about some of the background information.

CHAIRMAN WALLIS: Wait a minute. This bit that was under development, that was under development when this was written?

MR. HAMZEHEE: Yes.

CHAIRMAN WALLIS: So it's been under development for two decades or so?

MR. HAMZEHEE: For many years.

CHAIRMAN WALLIS: Still it's under development?

MR. THADANI: Since 1971.

CHAIRMAN WALLIS: Thirty-four years.

MR. THADANI: Thirty-four years. And I might just comment on what Hossein said. I think George was correct in what he said, in this historically for design-base accidents, we have applied single-failure of active components, not passive components. In other words, you don't postulate a design-base accident in one pipe, and fail another pipe. Rather, you fail active single components.

CHAIRMAN WALLIS: But you could fail an ECCS, some sort of pipe in the ECCS system as a result of a LOCA somewhere else.

MR. THADANI: If it's a consequential

failure, you need to consider, but not as an independent single-failure of a passive component.

MR. HAMZEHEE: That's correct, yes. Now SFC requirements mainly exist in two major contexts, one is in the general design criteria of 10 CFR 50, Appendix A, which identifies safety functions and associates safety systems to which the SFC apply. There's also a design-basis accident guidance of Chapter 15 of Reg Guide 1.70 and the Standard Review Plan. And then it's also important to realize the single-failure criterion is one element of NRC defense-in-depth concept.

CHAIRMAN WALLIS: In a way it is, but in another way it's a stop-gap. If you're not doing this PRA-type analysis of the probability of these failures, you do the best you can. You assume the worst single-failure.

MR. HAMZEHEE: That's correct.

CHAIRMAN WALLIS: Which is sort of a substitute, rather than a defense-in-depth --

MEMBER APOSTOLAKIS: In some sense, in fact, it limits defense-in-depth.

CHAIRMAN WALLIS: Yes, it does, because it could be something else.

MEMBER BONACA: The other point that I was making before, I mean, there is a presumption that you will, first of all, determine the safety-related components, that you have an understanding of those. And you don't apply the single-failure to the non-safety related components. And I point out that in every transient analysis, they never include the PORVs before Three Mile Island, and that modeling was totally neglected because the PORV was not safety-related; so, therefore, you don't model it. And so, therefore, you take the single-failure on that one.

MEMBER APOSTOLAKIS: I don't think there is anything profound here. Those smart guys, they realize they needed low probabilities of failure. They couldn't quantify that, and they said do this. This is really the simplest way that you have.

CHAIRMAN WALLIS: But it's a kind of bounding approach, isn't it?

MEMBER APOSTOLAKIS: Achieve high reliability, that's what they wanted.

MEMBER ROSEN: It was believed to be a bounding approach, but it turns out not to be.

MEMBER BONACA: Not to be, because there were instances where this segregation a priori eliminated elements and you had no basis for doing it on a --

MEMBER APOSTOLAKIS: But that was the intent.

MEMBER BONACA: I understand.

MEMBER APOSTOLAKIS: The intent was deterministic methods to achieve low probabilities of -- this is the key. At that time, nobody was talking about common cause failures. Eppler published the first paper in 1969.

MR. HAMZEHEE: Okay. Now back to the presentation. By the same token, we have to agree that accomplishment of key safety functions should not be dependent on a single element of design construction and operation of nuclear power plants.

(Teleconference music.)

CHAIRMAN WALLIS: It's going to talk next.

VICE CHAIRMAN SHACK: It's in a background mode.

MR. HAMZEHEE: And again, as was mentioned earlier, single-failure criterion promotes high safety systems or safety function reliability, but that's not the only way. That's one of the major elements of promoting high system reliability. And it's also important to emphasize that other regulations, guidelines, and programs with SFC promote highly reliable system or safety functions. And these are programs like QA requirements, tech specs, testing, inspections, and others.

Now based on the experience, we see that application of single-failure criterion has sometimes led to redundant system components that may have no risk significance based on the PRA results. And good examples are double-ended guillotine break LOCA coincident with loss of off-site power, and the worse single-failure, which in this case is diesel generator. As we've seen in the 50.46, that has a very low probability.

MEMBER APOSTOLAKIS: I guess the English in the first statement is not quite right, is it? You mean that the application of the single-failure criterion--

MR. HAMZEHEE: Requires you to have redundant components that don't have --

MEMBER APOSTOLAKIS: That don't have.

MR. HAMZEHEE: Yes.

MEMBER APOSTOLAKIS: This I think you could interpret it has led to redundant components which have low risk significance as a result of the SFC.

MR. HAMZEHEE: That's why I also expand on it, so that there's no confusion. But we mean is that sometimes you require redundancy when they have low risk significance using PRAs. That's what it means.

MEMBER APOSTOLAKIS: Is there in 50.46 the requirement to assume that you have coincident loss of power, off-site power? Is that really the result of the single-failure criterion, or is it even more stringent than the single-failure criterion?

MR. HAMZEHEE: No. The only single-failure related issue here is the last part of it, that says you also have to assume one diesel generator failing. That's part of the design-basis.

MEMBER APOSTOLAKIS: Yes, that's what I would do. But it seems to me that LOOP is the next recommendation.

MR. HAMZEHEE: That's correct.

MEMBER ROSEN: And was more unlikely then than it is now with the deregulation.

MR. HAMZEHEE: That's correct.

VICE CHAIRMAN SHACK: They were prescient.

MEMBER ROSEN: Well, I didn't say it was very unlikely now. I just said the situation then with the integrated electric companies meant that they weren't as severe -- the constraints that we see on switch yards and electric systems now, which have gone back the other way making this marginally less remote possibility than it was then, but it's still quite remote.

MR. HAMZEHEE: If you question me too much about 50.46, I need to turn to NRR folks because I am not the expert on the proposed rulemaking on 50.46, so I have to be careful about how much I tell you about that one.

MEMBER ROSEN: But that first line, if you could do some quick numbers for me, can't you, Hossein?

MR. HAMZEHEE: Yes.

MEMBER ROSEN: How low is low? Design-basis LOCA is what, ten to the minus --

MR. HAMZEHEE: One-E minus 5 or 6.

MEMBER ROSEN: Let's take 5. And LOOP is what?

MR. HAMZEHEE: One-E minus 2 or 3.

MEMBER ROSEN: So that's minus 7 we're at now.

MR. HAMZEHEE: And failure of one diesel is point one.

MEMBER ROSEN: So that's 10 to the minus 8, at least, probably lower.

MR. HAMZEHEE: Yes.

MEMBER ROSEN: Okay.

MEMBER APOSTOLAKIS: Roughly, it's supposed to be bounding.

MR. HAMZEHEE: That's what he was doing, just some rough estimate. Anyway, let's just focus on single-failure criterion. And again, the application of worst single-failure assumption for design-basis accidents could, in some cases, result in unnecessary constraint on licensees, and we all know that.

CHAIRMAN WALLIS: Well, it doesn't just affect risk, it affects things like calculating or Appendix K-type thing. If you change your probability of successfully calculating your 2200 degrees, you don't know what effect that has on risk. It's not comentioned, so you may be doing something which is not really commensurate with your measuring here, which is your PRA.

MR. HAMZEHEE: Well, again, I think under proposed rulemaking for 50.46, we went through a lot of details on this. And what we're saying is some of those events, if they have very low probability, then do you need to require the same level of regulatory oversight and requirements, rather than some minimum mitigation capabilities; not that you ignore it, because you need those for uncertainties, for safety margins, and all those other things that you mentioned.

MEMBER POWERS: Steve, could I come back to your scoping calculation? You came up with ten to the minus 8, assuming that each of these elements were independent.

MEMBER ROSEN: Right.

MEMBER POWERS: But they're not independent in an earthquake.

MEMBER ROSEN: Right. It's possible. They're intended to be independent by design, because both the diesels and the piping is supposed to be seismic-designed.

MEMBER POWERS: But if the earthquake fails the piping, it will assuredly fail everything else?

MEMBER ROSEN: I don't know that. I'm not expert enough.

MEMBER DENNING: It would be an extremely big earthquake to fail the piping, huge.

MEMBER ROSEN: But then you add in --

MEMBER DENNING: Yes, but the calculation was wrong anyway, because we looked at two -- used loss of off-site power as frequency, and you used LOCA as a frequency, and what you really have to do is consider conditional - like you have a LOCA and a conditional probability within a short period of time that independent, you would get an extremely low value there. The real question is if you have a loss of coolant accident, is it likely to trigger the loss of the power. In any event, it's a very low value.

MEMBER ROSEN: It would be lower -- if you did it correctly, the way you suggest, that's even lower.

MEMBER DENNING: It would be very low if they really are independent.

MEMBER ROSEN: That's why I --

CHAIRMAN WALLIS: They're teetering on the edge of instability already, and you suddenly cut out a reactor, you could set off this --

MR. HAMZEHEE: That's right. Sometimes, as you said, you could have a higher loss of off-site power frequency if you have a LOCA.

MEMBER ROSEN: You can't say that it's necessarily going to happen, because grids are designed to lose a single largest --

CHAIRMAN WALLIS: No. No. That's a conditional probability.

MR. HAMZEHEE: There could be some dependencies. We don't know exactly how they're related.

MEMBER ROSEN: It's a subject of current interest. Right?

MR. HAMZEHEE: Correct. Now again, as we mentioned, the single-failure criterion has not always been applied uniformly for the passive components in the fluid systems, and that's mainly because of the footnote we reviewed a few minutes ago. And the last bullet is trying to focus in the areas where the single-failure criterion by itself, it was not enough to get some of the systems at the high reliability enough. But other regulations, programs, and guidance made it at the acceptable and adequate level. And examples are like the station blackout rules, and the ATWS rules, that we realize you need a little more than just SFCs, and these are based on risk insight, so it's a two-way street.

Now the next slide is where we tried to develop this potential risk-informed alternative. We have to make sure that we're consistent with some of the existing policy issues, and these are some of the highlights of the policy issues that we had to comply with to come up with final alternatives. And that is a proposed risk-informed and performance-based alternative to single-failure criterion need to be consistent with the Commission PRA Regulatory Policy

Guidance, which in summary emphasizes that we should maintain defense-in-depth. We have to maintain adequate safety margin, as you already mentioned.

CHAIRMAN WALLIS: If you say that single-failure criterion is a defense-in-depth measure, and you want to maintain it, how are you ever going to erase it if you have no measure of what's acceptable defense-in-depth?

MEMBER APOSTOLAKIS: That's why 1.174 says philosophy, maintain the defense-in-depth philosophy.

MEMBER POWERS: 1.174 doesn't actually say that. There is no philosophy in it.

CHAIRMAN WALLIS: There is no philosophy in that?

MEMBER APOSTOLAKIS: It says maintain the defense-in-depth philosophy.

MEMBER POWERS: I believe it says one --

CHAIRMAN WALLIS: We can easily check that.

MEMBER APOSTOLAKIS: In the safety margins, it doesn't.

CHAIRMAN WALLIS: That's another problem, safety margins are not usually defined.

MR. THADANI: George, it says safety margin, also.

MEMBER APOSTOLAKIS: But not philosophy.

MR. THADANI: Not philosophy, but maintain safety margin.

MR. HAMZEHEE: And then we have to be aware of the security constraints, especially now that we're coming with some guideline and checklists, and also consideration of uncertainty, as we all know. And also, any potential risk-informed performance-based alternative should be consistent with the Commission guidance on the phase approach to PRA quality. And it should also be consistent with the Commission backfit and reg analysis guidance and policy. And also, an alternative should be consistent with other ongoing risk-informed activities, such as the proposed rulemaking on 10 CFR 50.46 and LOCA/LOOP exemption request by BWR Owners Group.

CHAIRMAN WALLIS: Has anybody figured out the basic question of how do you risk informed defense-in-depth, because that's what we're talking about.

MEMBER APOSTOLAKIS: The PRA actually quantifies defense-in-depth.

MEMBER POWERS: That's the rationalist argument there. Actually, it quantifies the need for defense-in-depth.

MEMBER APOSTOLAKIS: No, but if you look at what we quantify, we quantify the redundant trains. That's what we know how to do. We don't put the --

MR. HAMZEHEE: And I think also PRA may help us decide how much defense-in-depth we need.

MEMBER APOSTOLAKIS: Well, that's a controversial part. That's what Dana said.

CHAIRMAN WALLIS: Well, maybe what you have to do is reclassify this single-failure criterion, not as being defense-in-depth, but being a surrogate for this PRA, and then replace it by the PRA. Then you don't get into this logical problem.

MEMBER APOSTOLAKIS: Exactly. That's why I said at the beginning that this was a means for those guys in the 60s to achieve low probability of failure, which was very reasonable.

CHAIRMAN WALLIS: But in the write-up, the Staff has defined this as being a defense-in-depth measure.

MEMBER APOSTOLAKIS: Well, everything they did in the --

CHAIRMAN WALLIS: SFC is one element of the defense-in-depth .

MEMBER APOSTOLAKIS: That's right.

MR. HAMZEHEE: And then next we quickly

want to go over the evaluation process. As part of this effort, we try to develop a process to identify and evaluate potential risk-informed and performance-based alternatives to single-failure criterion. And if you go back to the next slide quickly, and I do not intend to spend a lot of time on this flow chart, but I just want to quickly go over it so that you get an idea as to how we started to define these potential alternatives.

So we start from the left, go all the way to the right. We first had to understand clearly what the intent of existing single-failure criterion is. And then based on that, we had to review the regulations, guidelines, implementation documents to make sure that we know the history and the intent. And then we made an attempt to define the desirable attributes that alternatives should have, and I'll go over those attributes quickly.

And then based on these desired attributes, we looked at the existing SFC and said all right, how well do we meet these attributes? And the ones that we don't meet, are the ones that we focus on to develop alternatives; otherwise, it's going to be hard to just define alternatives without knowing exactly what they do and how they serve us.

And once we did that, then we come up with a list of possible alternatives. So in other words, what you see in this report is maybe a number of them, but at the beginning, we had a lot of ideas, a lot of alternatives. Many of them did not make it to the report, and didn't include it, but that's how we started the process.

And then we developed the risk, and then we looked at those and tried to complete the list, and also look at implementation. Now once we're ready to finalize the list of alternatives, we have to do enough work to understand implementation aspect about these, because alternatives may sound good, but once you start implementing, you realize that some of them may not be implementable. And there's some slides on these that I'll discuss later.

MEMBER APOSTOLAKIS: This is for current reactors. Right?

MR. HAMZEHEE: Yes. This is mainly for current operating reactors. That's correct. And then we realize sometimes there are some constraints that we have to apply to this method, so we look at a constraint and look at the alternatives, and there's some of them should not be there. Then we eliminate those based on those constraints. And then at the end, we come up with a final set of risk-informed performance-based alternatives to SFC.

CHAIRMAN WALLIS: Now these are specific to each SFC.

MR. HAMZEHEE: Correct.

CHAIRMAN WALLIS: And also, to each plant?

MR. HAMZEHEE: These are right now for all existing operating power plants that have to comply with the single-failure criterion requirements.

CHAIRMAN WALLIS: If you're going to use risk-informed, you've got to look at the PRA which is plant-specific. It may be that these SFCs play a bigger role in some plants than in others.

MR. HAMZEHEE: Correct. So we have not done any plant-specific work.

CHAIRMAN WALLIS: That makes it very difficult to implement.

MEMBER APOSTOLAKIS: But isn't your major constraint the fact that the plants have been designed under the SFC?

MR. HAMZEHEE: Yes, that's correct. That's exactly right.

MEMBER APOSTOLAKIS: So some of the things you might say here may not necessarily apply to future reactors. Right?

MR. HAMZEHEE: That's correct. That's right. All right. Let's go back to the previous one, John. So that was the process. And again, as you notice in that flow chart, there's one major step to define the design attributes. And the design attributes that we defined for our work are the following; it should provide functional reliability. And when we say "reliability" here, we mean anything that would make a system available. Now things like common cause failures is one element that would impact the system reliability. Human error is another element that could impact the system reliability. Test and maintenance unavailability are some other elements that could contribute to the reliability of that system or component, so that's what we mean by reliability. It has all those elements.

And then maintaining defense-in-depth, again consistent with Reg Guide 1.174, any attribute had to have some of the guidelines in 1.174 to make sure it's a risk-informed approach and not a risk-based.

CHAIRMAN WALLIS: So single-failure criterion assumes that all the other systems are available?

MR. HAMZEHEE: As I said, single-failure

is looking at one system, and says if you have one failure in that system, can that system still perform its intended safety function.

CHAIRMAN WALLIS: But there's also the question of availability due to maintenance, which could be the cause of failure of that, or it could be something else.

MEMBER BONACA: You assume it was single-failure at the time.

MR. HAMZEHEE: Unless it's a support system, then if you take, for instance, a diesel generator, you're right. Then in turn, the system that is supported by diesel generator may not be available, but this is that case of the definition that says if there's an occurrence, multiple failure as a result of one occurrence that's called single-failure.

MEMBER ROSEN: There's another case too, Graham, and that's if the process fluid to a system is to break; for instance, if the steam supply to the high pressure cooling injection pump is the break, then it takes out the pump, and then you consider another single-failure besides that.

CHAIRMAN WALLIS: You add another one on.

MEMBER ROSEN: Yes.

MR. THADANI: May I comment on that, Graham. All other equipment is assumed to be functional if it meets certain classifications in terms of safety systems. But there's a presumption that non-safety systems are not available.

MEMBER ROSEN: And systems damaged by, or made inoperative, because of the consequence of whatever the LOCA is --

MR. HAMZEHEE: Exactly.

MR. THADANI: Yes.

MEMBER ROSEN: -- are not available.

MR. HAMZEHEE: That's correct. That's where you look at one system at the time, assuming everything else is available or functional. And then we have the alternatives should use performance-based regulatory approach because, again, this is risk-informed performance-based alternative. It has to be amenable to effective implementation. And we talked a little bit about this, and what we mean here is that it has to be official use of NRC and licensee resources, and it has to be amenable to licensing and regulatory oversight. And all these things are important because if they're not, then it's not going to work. So it's a very important part of the whole process, and it should be coherent with other risk-informed regulatory initiatives.

And last but not least, it has to maintain design requirements that contribute significantly to as-built or built-in plant capabilities that are necessary to resist security threats. So this is a security that now we have to put in the equation whenever we come up with any other alternatives.

These were the design attributes that we developed and tried to compare alternatives against these attributes.

CHAIRMAN WALLIS: Now if we had a risk-based regulatory system, all of this stuff would be in the PRA. You wouldn't need any of these single-failure criteria?

MR. HAMZEHEE: I'm sorry, I did not --

CHAIRMAN WALLIS: If we had a risk-based system and all of these failures were properly modeled in the PRA, presumably we wouldn't need any single-failure criteria?

MR. HAMZEHEE: That's true. If they had low risk significance, you're right.

MEMBER APOSTOLAKIS: Any risk significance.

CHAIRMAN WALLIS: It doesn't matter whether they're risk significant at all. It's all modeled in the --

MEMBER APOSTOLAKIS: Because you would base everything on reliability numbers, and probabilities.

MR. HAMZEHEE: But what I mean is --

MEMBER ROSEN: Well, you still would --

CHAIRMAN WALLIS: Yes, if you're going to bring in some other criterion, but everything is only risk-based.

MEMBER APOSTOLAKIS: He said risk-based, so we don't need defense-in-depth. Risk-informed, yes.

MR. HAMZEHEE: But what I mean is even on risk-based, if you were risk-based, but you realize that there is a system that is not designed against single-failure, and it is highly unreliability, and contributes significantly to plant rest, then you have to take some measures to apply single-failure. That's what I mean.

MEMBER APOSTOLAKIS: If the probability is low enough --

MR. HAMZEHEE: If it's low enough, yes.

MEMBER APOSTOLAKIS: Yes. And we have an example of existing reactors.

MR. HAMZEHEE: Yes. But what I mean --

MEMBER APOSTOLAKIS: There is a single-failure that is catastrophic.

MR. HAMZEHEE: Yes.

MEMBER APOSTOLAKIS: And we don't have any redundancies, the vessel.

MEMBER SIEBER: The problem is that if a mitigating system is not safety-related, you don't have the controls in place to assure that it's available and reliable. And so when you apply a PRA to the entire plant and say I don't need to deal with single-failure criterion in this area and that area, because I can rely on non-safety-related systems, that doesn't buy you anything in regulatory space, as I see it, because there's no controls that will limit and control the availability and failure frequency, because of the way you maintain and operate the plant.

MEMBER APOSTOLAKIS: Presumably, the risk-based environment, all that staff has taken into account in the evaluation of probabilities.

MEMBER POWERS: It's all in the past.

MEMBER APOSTOLAKIS: We are mixing now the safety-related part with the PRA.

MEMBER POWERS: Yes, well, it's all in the past what's in the PRA.

MEMBER ROSEN: George is saying if you

believe the PRA.

MEMBER APOSTOLAKIS: Well, he said risk-based. Presumably, you believe it if it's risk-based.

MEMBER SIEBER: Yes.

MEMBER APOSTOLAKIS: And all that stuff is there.

MEMBER SIEBER: That models the plant up to today, not tomorrow.

MEMBER APOSTOLAKIS: If it's not risk-based, then you have to worry about other things, as well. Yes. I think we're making a much bigger deal about this than it deserves. We really are, as a --

MEMBER SIEBER: Okay. Then we recommend that we keep the single-failure criteria.

CHAIRMAN WALLIS: Well, we still have to make the decision, George.

MEMBER APOSTOLAKIS: No, but I mean seriously, folks; I mean, it was a way of imposing redundancy.

CHAIRMAN WALLIS: But now they're proposing to change it, so we have to figure out what's reasonable.

MEMBER APOSTOLAKIS: I don't even know what the broader change means.

MEMBER BONACA: It wasn't only the -- I

mean, in addition to provide you with redundancy, it provided you with a much better understanding of your whole system, because you took out one component of the system at a time, and did all this analysis.

MEMBER APOSTOLAKIS: Because you didn't have event-based.

MEMBER BONACA: Exactly right. It was a way to get the same understanding. The presumption was you didn't have to address every gate either, because many mitigation systems were highly reliable.

MEMBER SIEBER: It made it easy for the operation, because they knew what division they were working with.

MEMBER ROSEN: Most of the time.

MEMBER SIEBER: Most of the time.

MR. HAMZEHEE: Now we have identified as part of this effort three alternatives, plus a baseline alternative. The baseline alternative is where we are today; that is, this alternative continues to make risk-informed changes to regulatory requirements that involve specific issues. So today we are baseline alternative, and examples are proposed rulemaking on 10 CFR 50.46, even though the main concern was not single-failure criterion, but as part of that, we're addressing that specific issue, or

LOCA/LOOP requirements.

Now this alternative, the baseline alternative, is a good way of making measurable progress over time on a case-by-case basis; rather than trying to address all the related issues at the same time, which could take time to make progress. But again, this is not going to be a broader change to single-failure criterion, because you're really not going to look at that in a global sense. And again, this baseline alternative may have some limited improvement and coherence with other risk-informed activities, because again, you're looking at specific issues.

And as part of this alternative, the only thing that we are not currently doing in this baseline alternative is considering, is to resolve or clarify that footnote on the passive components. So if one was going to adopt this alternative today, it's not just what we're doing today, but also go back and try to figure out how to clarify that footnote in Appendix A.

CHAIRMAN WALLIS: Well, the other thing is the extreme alternative, is to simply abolish it across the board, and figure out how to do it better, how to fulfill the objective better. And he hasn't gotten to the final abolish though, has he?

MR. HAMZEHEE: Yes, now we have Alternative One. We have three alternatives, as I mentioned, and I'll quickly go over these three alternatives. The first one is the alternative that would risk-inform failure assumptions made in design-basis accident analysis in Chapter 15 of Final Safety Analysis Report. That's really the main objective of this alternative, or the main feature.

MEMBER APOSTOLAKIS: Can you remind me what the DBA analysis is? Isn't that the thermal-hydraulic analysis?

MR. HAMZEHEE: Correct. These are the thermal -- that's correct.

MEMBER APOSTOLAKIS: Conservative cause --

MR. HAMZEHEE: Correct. That you ensure you have adequate safety margins, such as peak cladding temperature of 2200 degrees Fahrenheit.

MEMBER APOSTOLAKIS: So that's a DBA analysis.

MR. HAMZEHEE: Correct. Maximum oxidation level of less than 17 percent, or hydrogen production less than 1 percent, and all those. So what we're trying to do under this alternative is to risk-inform it. And again, as you see down the line, the single-failures resulting in sequences with sufficiently low frequency would no longer be required in design-basis accident analysis.

MEMBER APOSTOLAKIS: What does that mean?

MR. HAMZEHEE: That means if you have -- in the design-basis accident analysis, you have to first take an initiating event, let's say LOCA. And along with that you have to make an assumption of the worst single-failure of a safety system. And when you do that, then you calculate your safety margin.

What we say here is if the frequency of that initiating event and failure of that component is too low, you can remove that requirement from design-basis accident analysis.

MEMBER APOSTOLAKIS: And what is too low?

MR. HAMZEHEE: Well, the next page will explain what we mean by "low", but just to be responsive to your question, we have -- if this alternative was to be adopted today, then we would have to define quantitative criteria as to what "low" means. If I could just use my own quick risk insight, I would say less than one to minus six, for instance.

CHAIRMAN WALLIS: It's just the frequency of these events? It's not --

MR. HAMZEHEE: And the failure probability of that component.

CHAIRMAN WALLIS: It's not the resulting core damage frequency.

MR. HAMZEHEE: Yes. Correct. No, no, no; no core damage.

CHAIRMAN WALLIS: It's the frequency alone.

MR. HAMZEHEE: Correct.

CHAIRMAN WALLIS: And then if there were a core damage frequency of one, the worst it could be would be two to the minus six.

MR. HAMZEHEE: Correct. In other words, this could result in a CDF change of maybe one to the minus eight.

CHAIRMAN WALLIS: Right.

MR. HAMZEHEE: Or it could not be any higher than the frequency of the sequence, I mean at worst.

MEMBER POWERS: Additional probability is one.

MR. HAMZEHEE: Correct.

MEMBER APOSTOLAKIS: Wait a minute. You mean only the fail -- you're not looking at the whole sequence, so the sequence may not even lead to core damage.

MR. HAMZEHEE: Definitely. This is just a sequence that they use to calculate the safety margin in thermal-hydraulic evaluation. It's a design-basis accident analysis. Now that, then you have to run it through your PRA model to really see what the impact is on CDF and LERF, for instance.

MEMBER APOSTOLAKIS: But if it doesn't lead to core damage, why do I care?

MR. HAMZEHEE: Well, because right now the licensees are required to every time they refuel, or put in new, and go through the new cycle to do safety analysis to show that they have adequate safety margin, when they refuel or change the fuel, and when they do that, the limited conditions are for all those pre-defined initiating events in Chapter 15, and the worst single-failure assumption. This is how they do their calculations.

Now we're saying when you do that, if you don't think that single-failure is necessary based on some quantitative measures, then you can remove those from your analyses. What does that mean? That means you may potentially get more margin, and you can use it for other purposes. Now we'll get there later.

MR. THADANI: Hossein, one clarification. Single-failure criterion does not apply to all transients in Chapter 15. It's a design-based accident where you apply single-failure criterion.

MR. HAMZEHEE: Correct. That's right. That's why we said all those accidents in Chapter 15. Now there may be some initiating events in PRAs that are outside design --

MR. THADANI: No. Let me repeat, single-failure does not apply to all the events in Chapter 15. That's large break LOCA, steam line break, you apply single-failure.

MR. HAMZEHEE: Main feedwater --

MR. THADANI: Feedwater line, all the breaks you apply.

MR. HAMZEHEE: Yes, you're right.

MR. THADANI: But you don't apply to any transients, abnormal operation occurrences, which are in Chapter 15.

MR. HAMZEHEE: All right.

MEMBER APOSTOLAKIS: But really, I don't understand this. The third bullet says "multiple failures and sequences" --

MR. HAMZEHEE: I haven't gotten there yet. You're ahead of me. Let me just go --

MEMBER APOSTOLAKIS: Yes, but I mean it's in the context of whether you have a consequence or not.

MR. HAMZEHEE: Yes.

MEMBER APOSTOLAKIS: You're saying no, it's independent of whether I have core damage or anything. I just look at the product of the initiating event frequency and the failure, and if that is low enough, I make a decision.

MR. HAMZEHEE: Well now, wait. What we're saying is based on that quantitative requirement, you can potentially remove that requirement from your design-basis accident analysis. However, there's a next step. The next step says if now you want to make any changes, you have to meet the guidelines in Reg Guide 1.174. That means then you have some CDF LERF criteria that says well, the change in CDF as a result of removing all these sequences, if you appropriately go back to your PRAs and change the model so that you can see what the impact is, should not be more than some frequency.

CHAIRMAN WALLIS: Is this going to have any effect on -- is there any evidence that doing this will change the probability that they'll meet the criteria, let's say, for 50.46? If the worst break was a small break LOCA where the operator screws up or something, this isn't going to make any difference, is it?

MR. HAMZEHEE: Well, as a matter of fact, this proposed rulemaking for large break LOCA is a special case of this alternative.

CHAIRMAN WALLIS: But maybe that's not the worst I've got, anyway.

MR. HAMZEHEE: That's correct.

CHAIRMAN WALLIS: So I don't know. We don't know what the consequence would be of doing this.

MR. HAMZEHEE: That's right. But if you really want to implement it all the way through, then you also have to acknowledge or understand clearly what the impact would be on potential plant risk, such as on CDF and LERF. And then you worry about the consequence.

CHAIRMAN WALLIS: That's when the plant actually wants to make some changes.

MR. HAMZEHEE: Correct. That, and also, if you look at the last sub-bullet under this, you see that we say that you need to use PRAs to demonstrate that the cumulative frequency of all sequences excluded from DBA are less than some threshold that has to be defined. And also now going back to the multiple, because George brought it up, but I want to emphasize that this is not just removing things.

Now in the design-basis accident analysis you may only make a single-failure assumption. Now there may be from PRA results some multiple failures that could have the same frequency or higher than the single-failure and that initiating event. Now we're saying if they exceed some threshold, they should be added to the design-basis accident analysis. So you may take some, remove some, you may add some.

MEMBER APOSTOLAKIS: I'll have to understand that a little better, Hossein. I'll take your word for it right now.

MR. HAMZEHEE: For right now, and then we can look at some examples. And again, some of the details we have not completed yet, so if all of a sudden we decide to use this alternative and make a rule, then we need to go back and to really look how you can implement it, how the mechanics work.

MEMBER APOSTOLAKIS: This is the same Alternative One as in the Executive Summary. Right?

MR. HAMZEHEE: Correct.

MEMBER APOSTOLAKIS: Risk-inform application, the rest have see the DBA analysis.

MR. HAMZEHEE: That's correct.

MEMBER APOSTOLAKIS: So you're saying

here, "permit removal of sufficiently unlikely non-risk-significant single-failure sequences from the design-basis." How would you know they're non-risk-significant?

MR. HAMZEHEE: Again, what we mean here is if you have some -- for instance, currently let's talk about large break LOCA. This is an example that we're actually dealing with right now. If the frequency of large break LOCA is less than one to the minus six, and if that meets our quantitative threshold, then we say we move that from design-basis accident analysis, and call that transition break size, for instance. This is what it means.

CHAIRMAN WALLIS: Ah, but the problem is transition break size, that brings in new requirements. If you --

MR. HAMZEHEE: Well --

CHAIRMAN WALLIS: -- simply said remove it, forget about it, that's easy to understand.

MR. HAMZEHEE: Again, what we're saying is it has to meet some guidelines and it has to be defense-in-depth, so maybe we have to provide some risk-informed requirements for the things that you will need.

CHAIRMAN WALLIS: Defense-in-depth might

limit what you can do.

MR. HAMZEHEE: Correct.

MEMBER APOSTOLAKIS: Anyway, this particular alternative doesn't really deal with risk. It deals with the frequencies of combinations of events.

MR. HAMZEHEE: It does, but then to finalize it, and to implement it, you have to meet the guidelines of Reg Guide 1.174.

MEMBER APOSTOLAKIS: If you make changes.

MR. HAMZEHEE: If you remove any of them from design-basis, if you make any changes.

MEMBER APOSTOLAKIS: You're right.

VICE CHAIRMAN SHACK: You're removing it because you know that it leads to low risk.

MR. HAMZEHEE: That's correct.

VICE CHAIRMAN SHACK: You've looked ahead at the PRA.

MR. HAMZEHEE: Just because of the common sense, if just initiating event frequency and a failure is less than some amount, you know that the impact on CDF cannot be any greater than that. So right there, you're having some risk insights.

CHAIRMAN WALLIS: It's really frequency-informed, rather than risk-informed.

VICE CHAIRMAN SHACK: Well, it's risk-informed because of the frequency. Nobody says that a large break LOCA is a no-nevermind.

CHAIRMAN WALLIS: Nobody says?

MEMBER SIEBER: Not yet.

VICE CHAIRMAN SHACK: It says low risk-significant because it doesn't happen very often. If it does, it's a serious event.

MEMBER SIEBER: If you don't have all your safety systems, it becomes even more serious.

MR. HAMZEHEE: And then again, as it was mentioned earlier, why do we do this? What is it for the licensees, for instance? It could provide some higher predicted safety margin, so they can use it for other purposes.

MEMBER APOSTOLAKIS: So could you call this then -- this alternative would frequency-inform the failures, not risk-inform.

MR. HAMZEHEE: Well, it is risk-informed because our ultimate goal is to look at the impact of any of those changes on plant risk.

VICE CHAIRMAN SHACK: He picks his threshold frequencies by looking at the risk associated with it.

MR. HAMZEHEE: Because that's one element of risk, so if that element by itself is below some threshold, you know that it cannot be any greater than that threshold.

MR. THADANI: Hossein, can I help you?

MR. HAMZEHEE: Yes, please.

MEMBER ROSEN: George, suppose you're talking about a low pressure safety injection system where single-failure applies for certain size break. That low pressure safety injection system is also used in its RHR, Residual Heat Removal, form to take care of many other potential events. Now if you're going to change the reliability of that system, low pressure safety injection system, you need to make sure you go through a risk analysis, look at all the cut sets and so on, where that system may be needed, and you assess the impact on all those accident sequences to see what happens if you make this change. And that's really what Hossein is trying to say, I believe.

MR. HAMZEHEE: That's correct.

CHAIRMAN WALLIS: I thought you were saying it's so unlikely that you didn't really need to do that. It was so unlikely.

MEMBER APOSTOLAKIS: Well, I guess the fourth sub-bullet there is the key then.

MR. HAMZEHEE: That's correct. So it is

risk-informed.

CHAIRMAN WALLIS: So that's the cumulative frequency.

MR. HAMZEHEE: Next slide, please.

MR. THADANI: Hossein, this doesn't address I thought one other question. You said it's coherent, but if you take LOCA/LOOP separately, apply ten to the minus six, if you take transition break size and apply ten to the minus six, you take single-failure criterion separately and apply ten to the minus six criterion, is that being integrated to make sure that -- you said it's coherent, but --

MR. HAMZEHEE: Yes, but I think ultimately if we decide to replace SFC with any of these alternatives, we have to make sure we understand what the cumulative impact on risk is of all these changes, if that's what you're talking about. In other words, if this only change is one to the minus six, we have to look at the cumulative impact of other changes, as well. Is that what you're asking, Ashok?

MR. THADANI: I'm saying you come up with LOCA/LOOP later on.

MR. HAMZEHEE: Yes.

MR. THADANI: But you would have integrated that in here.

MR. HAMZEHEE: We should, yes. I think that's the correct way.

CHAIRMAN WALLIS: This will provide an incentive for plants to have better PRAs, because in order to justify this, they have to --

MR. HAMZEHEE: Absolutely, yes.

CHAIRMAN WALLIS: There might then be a reward for having a really good PRA? That would be a great thing.

MR. HAMZEHEE: It's a reward, and also a requirement, not the reward; because remember, we mentioned we have to be --

CHAIRMAN WALLIS: There might be some plants who would apply for this, and they wouldn't get it because their PRA wasn't good enough. Another plant might get the --

MR. HAMZEHEE: That's why up front we said it has to be consistent with the PRA phase approach quality, because under that program we define how good the PRAs have to be, what elements of it have to be reviewed, and the whole thing. So if it doesn't pass the test, they can't even enter.

MEMBER SIEBER: That could work the other way. You could have a poor PRA, and be able to claim things under these concepts. And if you improved your

PRA, all of a sudden you wouldn't be allowed to, so you can't make the assumption that --

MEMBER ROSEN: I don't think that would work because your poor PRA would not have passed peer review.

CHAIRMAN WALLIS: It couldn't get through the door in the first --

MEMBER SIEBER: Well, that's one of the checks and balances.

VICE CHAIRMAN SHACK: I don't think this would be -- this sort of thing would not be an enabling rule like 50.46, where you pass the rule and nothing changes when you come in. If you came in and you --

MR. HAMZEHEE: You changed this.

VICE CHAIRMAN SHACK: -- change this, you changed this.

MR. HAMZEHEE: That's right.

MEMBER SIEBER: But you're doing the same thing in a --

VICE CHAIRMAN SHACK: You have to be sure up front of what you're doing here.

MR. HAMZEHEE: That's correct.

VICE CHAIRMAN SHACK: You get to look at it again each time they propose a change.

MEMBER SIEBER: When you risk-inform the tech specs, for example, change tech specs to give you more allowed outage time on a diesel generator or high pressure pump, you're doing the same thing to a lesser extent than you are by looking at these concepts. And it seems to me that there should be coherence between that effort and whatever happens to the single-failure criterion so that the regulations continue to make sense.

MR. HAMZEHEE: Correct. That's right.

MEMBER SIEBER: So the two of them are married.

MEMBER APOSTOLAKIS: I propose that we hear about the other two alternatives before we have a --

MR. CARUSO: I just have a question, please. Where in this process do you quantify the uncertainty, and how do you consider the answer?

MEMBER APOSTOLAKIS: In the fourth sub-bullet?

MR. CARUSO: Anywhere in this alternative.

MEMBER APOSTOLAKIS: Yes, in the sub-bullet.

MR. CARUSO: What does it mean? How do you -- what --

MEMBER APOSTOLAKIS: When he says "sufficiently low frequency", presumably he wouldn't be challenged, whether he says it's ten to the minus eight.

MR. CARUSO: Plus or minus how many orders of magnitude?

MEMBER APOSTOLAKIS: To be determined.

MR. CARUSO: And someone has to quantify that.

MEMBER APOSTOLAKIS: And it will have to be addressed there. Right, Hossein?

MR. HAMZEHEE: Yes. Yes.

MEMBER APOSTOLAKIS: He is not proposing numbers right now.

MR. HAMZEHEE: We're just trying to familiarize you with the concept, and to some degree the mechanics, but once you start applying them, then you have to understand what kinds of uncertainties are involved, how to quantify it, if the uncertainty is high, how to supplement it by defense-in-depth and other elements of defense-in-depth philosophy.

MEMBER ROSEN: So you're going to specify thresholds, including uncertainty.

MEMBER BONACA: A question I had, Hossein, was, this could be done under Reg Guide 1.174.

MR. HAMZEHEE: Correct.

MEMBER BONACA: However, it cannot be done right now because you have to stay within the licensing basis, and so this would be an enabling step, I mean, allowing the licensees to submit individual requests for eliminating, for example, one system from their design-basis on this basis.

MR. HAMZEHEE: Correct.

VICE CHAIRMAN SHACK: You would do this as a 1.170 defense, this would be a plant-specific --

MR. HAMZEHEE: Well, once we agree, and let's say tomorrow everybody agrees that Alternative One should be used in lieu of SFC, then it becomes a generic-type change, and it's not plant-specific any more. Then all the plants can come -- it depends. If it's voluntary, then they can stay where they are, or they can apply for this risk-informed alternative.

MEMBER BONACA: You would have to perform an analysis, and there would have to be an evaluation on their 1.174 guidelines.

MR. HAMZEHEE: Correct.

MEMBER BONACA: So right now you cannot do that, because the requirement 1.174 is that you are still operating within the licensing-basis.

MEMBER APOSTOLAKIS: But my understanding is that this is not going to remove any hardware.

MR. HAMZEHEE: Not this alternative, no. That's correct.

MEMBER APOSTOLAKIS: Okay. This is just in and out of the --

MR. HAMZEHEE: This just tells you - that's right, for the analysis, what to include and what not to include. It does not change anything.

MEMBER APOSTOLAKIS: And you are not removing anything.

MR. HAMZEHEE: Not under this alternative. That's correct.

MEMBER APOSTOLAKIS: Okay. Is there any chance Alternative Two will come in the next hour or so?

MR. HAMZEHEE: Ask your colleagues. All right. Should we go to Alternative Two?

CHAIRMAN WALLIS: Yes.

MR. HAMZEHEE: All right. Alternative Two --

CHAIRMAN WALLIS: The probability is now one, George.

MEMBER SIEBER: Not yet.

MR. HAMZEHEE: Now Alternative Two would risk-inform the application of SFC to safety-related systems based on their risk-significance, or safety-significance. This alternative tries to take advantage of current safety categorization process that was defined in 10 CFR 50.69, "Risk-Informed Categorization and Treatment of Structures, Systems, and Components."

This one usually under 50.69, the process is done at the component level. Here we tried to jack it up at the system level, so you know what the risk categorization of the safety-related systems are.

Now briefly - I'm not going to go over the whole thing because we don't have time, and a lot of you may already understand or be familiar with 50.69 - but under 50.69, there are four major RISC categories that are defined in the four blocks. RISC Category 1 and 2 are for safety-significant systems, 1 is safety-related system, 2 is non-safety-related systems. RISC Category 3 and 4 are for low safety-significant systems. Again, 1 is safety-related, 1 is non-safety related.

For instance, if you look at 1, the 1 is the most important because it's safety-related, risk-significant, or high safety-significant. RISC Category 4 is the least important because it's non-safety-related and low safety-significant.

Now where this alternative falls is how to treat those systems that are in RISC Category 3, and it's similar to 50.69. Now under this alternative, we define three sub-alternatives; again, some of them may or may not be risk-informed, but these are variations that we could define. And then once we do pros and cons, we definitely see which one makes more sense, or is more risk-informed, which one is not.

CHAIRMAN WALLIS: The problem is you say it's based on the level of defense-in-depth desire. I don't think that's a very good formula.

MEMBER APOSTOLAKIS: It says that? Where is it?

CHAIRMAN WALLIS: That alternative, that bottom bullet.

MR. HAMZEHEE: Well, that means --

CHAIRMAN WALLIS: Based on the level of defense, so you have to evaluate the level of defense desired before you decide whether to remove it.

MR. HAMZEHEE: Yes. What we meant here actually is, right now we define three sub-alternatives. But these three sub-alternatives, some of them may not make it because based on some other guidelines, they don't have enough defense-in-depth, so that's what we mean by desired defense-in-depth.

CHAIRMAN WALLIS: Once you've made the decision, you no longer have to worry about the --

MR. HAMZEHEE: That's right. That's correct.

CHAIRMAN WALLIS: Once you've made the across the board decision.

MR. HAMZEHEE: Correct.

CHAIRMAN WALLIS: You're not going to look at each one of them and say --

MR. HAMZEHEE: No, no, no, no. In other words, let me just quickly go over three sub-alternatives. Then if you take one, because of the desired defense-in-depth, then you stick to that, and that's how you apply it. 2-A, it says that if you have a safety system that has two trays or more, one tray you maintain as-is safety-related with the same requirements. The other one you can remove it from service. Now right there you may say what about defense-in-depth, and you're right.

MEMBER ROSEN: Remove it from service?

MR. HAMZEHEE: That is not physically remove it, but you can like tag it out and say now this is no longer required, but it's physically still within the plant.

CHAIRMAN WALLIS: It still works?

MEMBER SIEBER: No.

MR. HAMZEHEE: It may not, yes. Again, I'm not saying -- that's why I warned you at the beginning, we're not advocating it. These are just combinations of alternatives. Let me go through the other two alternatives. You see that there's some that are better or more risk-informed.

MEMBER APOSTOLAKIS: If this system is not --

MR. HAMZEHEE: If it's in RISC Category 3. All these are those systems that are RISC Category 3.

MEMBER APOSTOLAKIS: Low safety-significant.

MR. HAMZEHEE: Yes. They are safety-related, low safety-significant.

MEMBER BONACA: But the point is that you may have combined systems that may give you something more significant.

MR. HAMZEHEE: Correct.

MEMBER BONACA: Okay. So how do you make a logical assumption that says since I already classified this low, I can just assume.

MR. HAMZEHEE: All right. Let me then go back, because --

MEMBER BONACA: I don't understand.

MR. HAMZEHEE: The same process was brought up and dealt with under 50.69. Again, when you do the RISC categorization, I don't want to get into the details, but the performance measures you choose somehow take care of your concern. In other words, they may look at performance measures that are, for instance, for system importance that says what is the contribution of a given system to my CDF.

Now you may have your highly reliable system that tomorrow may go down the drain. Then what? We also look at risk achievement work that says if this system fails with 1.0 failure probability, what's the consequence on CDF? So that if they're a highly reliable system that could change performance overnight, then that raw is going to capture that, and that's an other importance measure that we use to define RISC categorization. So there are a lot of these things have been captured in 50.69, and we're just adopting those.

MEMBER SIEBER: When we reviewed 50.69 in the Campaign and South Texas Project pilot, I got the feeling that we were given a concession to the regulations by allowing changes in special treatment requirements. I felt comfortable with that because there was data presented, a study presented by South

Texas which basically said operability and availability do not change in any significant way when you move from safety grade to commercial grade. So to me, system still available, it will still most likely function, if required. Now we suggest that we're going to take the system out of service, we're going to tag it out, which means it's guaranteed not available.

MR. HAMZEHEE: That's right. And that's why 2-A --

MEMBER SIEBER: And I think that's a far cry from 50.69, and you shouldn't be trying to draw any kind of conclusion or relationship between what we approved in 50.69 and what we're suggesting --

MR. HAMZEHEE: Correct. And I would like to emphasize that the only thing we inherit from 50.69 is the RISC categorization process. That's it. Now the rest of them are new under different criteria. Now we have to see does it make it sense to do anything, to make any changes based on that categorization process. And your concern is right.

MEMBER SIEBER: Well, the one thing that I think is important is PRA models may be more appropriate components in the plant. Some of these RISC-3 things are in that category, not because the

PRA said it was inconsequential, but because some people got together and thought about it, the expert panel, and said this really doesn't make any difference.

MEMBER ROSEN: We can model it, but it won't show up in the dominant sequences, anyway, even if we model it.

MEMBER SIEBER: Yes, a lot of it isn't model.

MEMBER ROSEN: Because of that.

MEMBER SIEBER: And so this is not the Rock of Gibraltar that you really want to tie your boat to, in my opinion.

MR. HAMZEHEE: But again, let me go over other alternatives, then you see how that may -- which one may make sense. And then 2-B says that if you have a safety-related system that has two or more trains, one train you maintain as-is, safety related, and the one other one or more redundant trains can be reclassified as non-safety-related systems, but that doesn't mean you do anything. That's exactly what you said. That means they still are maybe the same as what you had before, but some of the regulatory requirements could change.

MEMBER ROSEN: I can see the parts guys

going nut with that one.

MEMBER SIEBER: I know.

MEMBER SIEBER: You just buy all safety-related stuff, and pay ten times more. Because you can't afford to take the chance of screwing up.

MEMBER ROSEN: That you might mix it up. Right.

MR. HAMZEHEE: And then the other extreme that gets closer and closer to a more structured approach is the 2-C. That says if you have a system of more than two trains, one will stay as-is, the other one you only provide operational flexibilities, nothing else. So that is maybe the least severe option.

MEMBER ROSEN: Like operational flexibility, like a very long AOT.

MR. HAMZEHEE: Exactly. You got it. Well, long, or some definition. Right now it's 72-hours, you may be able to extend it for three days, or 10 years if it meets the criteria. So these are the three sub-alternatives, and one can use one or the other, or combination. Gerardo, would you like to make some clarification? You've got to speak on the microphone, and you need to introduce yourself.

MR. MARTINEZ: I'm Gerardo Martinez from

Brookhaven Lab. I just would like to clarify that the Alternative 2 we're proposing is not -- we're not proposing to move the entire system, even if it's low safety-significant. We are proposing if we have a system that has some redundancy, then we will keep at least one train safety-related, and the flexibility comes from relaxing the other trains.

MEMBER SIEBER: I think that that needs to be carefully worded, because what you intend and what licensees will do may be two different things.

MEMBER APOSTOLAKIS: Also, speaking of wording, since you have RISC-2, calling it Alternative 2-A, B, C, confused me. Now the 2 refers to the alternative, not to the --

MR. HAMZEHEE: Correct. Under Alternative 2 --

MEMBER APOSTOLAKIS: I know. Maybe you ought to call them Roman Numeral - Alternative --

MR. HAMZEHEE: Next time we'll call them Roman Numeral I and II, and III.

MEMBER APOSTOLAKIS: Well, you just said the licensee may misunderstand. I was trying to figure out well, where the hell is --

MEMBER SIEBER: Use Greek letters.

MEMBER APOSTOLAKIS: Use Greek numbers.

MEMBER SIEBER: Greek numbers are worse.

CHAIRMAN WALLIS: What do they look like, George?

MR. HAMZEHEE: All right. Next, these are some of the further requirements and clarifications on Alternative 2, that once that alternative is applied, then we have to provide risk-inform requirements for each RISC category. So then we get into some of the implementation issues, and how to control licensee's actions. And also, this alternative we have to provide some performance monitoring for the reliability of the systems that are going to be changed. And this is mainly for -- well, that's enough.

And then, again, once you adopt Alternative 2, if you want to make those changes depending on which sub-alternative you follow, it has to meet the guidelines of Reg Guide 1.174, so that never changes. And again, this alternative is also coherent with the Risk-Informed Initiatives. And as you may have seen, and Steve mentioned, implementation of this alternative may require significant effort by the licensee and NRC, mainly because if you try to reclassify things, a lot of procedural requirements. NRC Staff has to come up with reg guides and all the other things, so it's not an easy thing to do. Any questions on Alternative 2?

MEMBER POWERS: Can I ask you a question about this alternative?

MR. HAMZEHEE: Yes, sir.

MEMBER POWERS: If I accepted this alternative, why would it not be applicable to the fire protection system?

MR. HAMZEHEE: Well, would you expand on it? For instance, are you talking about fire protection systems or fire protection program? If you have this system, if it's safety-related, it could apply. But remember, the first one, the single-failure criterion only applies to safety-related systems. Now a fire protection system has similar requirements, but is outside 10 CFR 50, Appendix A, then it's outside the scope. Somebody may want to in the future risk-inform fire protection, as well, but this may or may not apply.

MEMBER POWERS: Fire protection system historically not been susceptible to the single-failure criterion. It is a defense-in-depth system. Appendix R is the only place in the regulations that defense-in-depth is defined. Doesn't Alternative 2 force --

MR. HAMZEHEE: Currently, no. We did not intend for the fire protection --

MEMBER POWERS: But the reality of --

MR. HAMZEHEE: But if the licensee comes back and claims that this could also apply to fire protection, we have to go back and look at Appendix R requirements.

MEMBER POWERS: You come in and say well, why do you have to wait until the licensee -- you say okay, we're going to do Alternative 2. You've got to backfit here.

MR. HAMZEHEE: We need to meet on that if we were going to promote that alternative. You're right.

MEMBER POWERS: I think you're going to have to look at this. You've got to pack that here.

CHAIRMAN WALLIS: Are we going to the next alternative?

MR. HAMZEHEE: Yes. Now Alternative 3 - this alternative is more of a blended approach. So far you saw two different approaches. This is more of a blended approach. And what we mean by that is that this alternative is going to generalize single-failure criterion by applying a combination of quantitative targets, and requirements for redundancy and diversity. And quantitative targets are recommended at two levels. One is at the top level RISC targets which is CDF and LERF, and the other one is at the lower level for key safety functions that we define what the quantitative reliability target should be.

CHAIRMAN WALLIS: So you then would have to define these targets.

MR. HAMZEHEE: Correct. Yes.

MEMBER APOSTOLAKIS: Or you could use what Mary proposed in one of the early SECYs for new reactors, that for each initiator no sequence really should contribute more than one-tenth. I mean, that would define the lower level function reliability targets, and it would be consistent with the future reactors.

MR. HAMZEHEE: Yes.

MEMBER APOSTOLAKIS: But still, though, I'm a bit -- I mean, how would you handle the DBA issue?

MR. HAMZEHEE: Remember, this is a completely different alternative. It has nothing to do with DBA.

MEMBER APOSTOLAKIS: I understand, but what I'm saying is that can it be completely different? Because now, let's say I take LOCAs, and this is existing reactors. I have a good PRA, tells me what the contribution from LOCAs is. I don't want any sequence to be more than one-tenth of that contribution. And I identify one or two sequences that do have frequency lower than that, what would i do then? I would remove them from the DBA, from the design-basis, and also relax some of the requirements using 1.174?

MR. HAMZEHEE: Let me walk you through this, see if at the end you still have that question, because I am not sure I understand your whole question, and I don't want to respond to a question that I don't completely understand. So this one provides two levels of quantitative guidelines; one at the high level says that you have to maintain this kind of CDF and this kind of LERF, the RISC matrix. And then you go a lower level, look at your important safety function and say these safety functions have to maintain such-and-such reliability. And if you have those, then you meet this criteria.

In addition, you have to look at some diversity and redundancy requirements. For instance, this alternative says that if you have -- depending on the frequency of challenges or initiating events. For instance, this alternative says that if you have a frequent initiator, for that frequent initiator, you have to maintain a top level CDF and LERF. That's step one.

Step two, you have to maintain for that frequent initiator, certain unreliability. Let's say, for instance, if you're talking about post-trip decay heat removal function, you have to have unreliability of no greater than 1-E minus four, for instance. This is Level 2. In addition, because it's so important that some of the functions that have to be available and reliable, the third level then you say, I need to still prescribe or require redundancy for that system, and even diversity for that function. So this is an extreme case, that you have all kinds of requirements.

The other side of the spectrum is if you have an infrequent initiator; therefore, that you still have the top level CDF and LERF requirement, but for your functional reliability, instead of saying 1-E minus four, you may say I only need unreliability of 1-E minus two, because now I can afford it. And then with respect to diversity or redundancy, you may say I don't need any, or I only need redundancy. So this is a blended approach of using defense-in-depth, the diversity that you have, redundancy that you have. In addition, you apply some high level LERF and CDF requirements.

MEMBER APOSTOLAKIS: Why would you define reliability targets on functions and not on sequences?

MR. HAMZEHEE: No. Well, because you can go as low as you can, but you have to see how far it makes sense. Now if I'm a licensee and I want to apply Alternative-3, and I know one of the requirements for me is to maintain my post-trip decay heat removal function and certain reliability, and if I exceed it, NRC is going to be after me. I'm going to have low level targets at my plant. I am going to go and look at what are those systems that contribute to that function.

If there are three systems, I set goals for each system. Then I may set goal at the train level. That way, there is no way I exceed the threshold, or if I'm going to exceed, I have enough leading indicators that would tell me soon you're going to exceed that high level, and then you violate the equation.

MEMBER APOSTOLAKIS: But the sequences, though, are a more realistic description of what is going on, rather than function. Right?

MR. HAMZEHEE: Yes.

MEMBER APOSTOLAKIS: So why couldn't you

put the -- I mean, my understanding is that you are not prepared to recommend any of these alternatives as the best.

MR. HAMZEHEE: Correct.

MEMBER APOSTOLAKIS: You are still exploring.

MR. HAMZEHEE: Correct.

MEMBER APOSTOLAKIS: So why can't you then explore also the possibility of putting some kind of reliability targets on sequences, rather than individual functions? Because a function can be conditioned on what has happened before. Right? So you have to start thinking about it.

MR. HAMZEHEE: When you say sequences, are you talking about PRA sequences?

MEMBER APOSTOLAKIS: Yes, yes, PRAs. And you have already the major initiating events. Okay? You may use this general guideline of one-tenth and so on, and see whether you can formulate something there that would be Alternative 4, for example.

MR. HAMZEHEE: We can do that, and I'll let Bob talk soon. But what I am saying is you can do that, that's an option. However, from implementation perspective, which one do you think is easier for the plant personnel, to look at the functions or the PRA sequences?

MEMBER APOSTOLAKIS: Well, the functions too, though. They have to place them in some PRA context, don't they?

MR. HAMZEHEE: Well, eventually, yes.

MEMBER APOSTOLAKIS: Yes. So I don't think -- I mean, difficulty is concerned no matter what you do. This is right up there as the conservation of momentum.

MR. HAMZEHEE: Bob, would you like to expand on that, and introduce yourself, please.

MR. YOUNGBLOOD: Bob Youngblood, ISL.

MEMBER APOSTOLAKIS: I can't see you.

MEMBER SIEBER: As long as you don't change --

MR. YOUNGBLOOD: I'm with Hossein in not completely understanding your question, but I would like to say that we did look at the early SECYs. And in thinking about function here, we're thinking about families of sequences. And I think family of sequence is also a concept from those early SECYs.

MEMBER APOSTOLAKIS: That's what I mean, too.

MR. YOUNGBLOOD: And so this kind of initiator and failure of that kind of function is going to be a family of sequences. And so I think that we're not only receptive, but maybe already buy what you're advocating.

MEMBER APOSTOLAKIS: The thing is that if you try to put -- well, first of all, I'm not sure I completely understand all the details here, but if you try to put targets on the sequences, then you're also achieving what Hossein mentioned earlier; namely, the frequency of needing a particular function is built into the system; whereas, now you may declare that you need post heat removal will have to be this or better no matter what.

MR. HAMZEHEE: But that's not one of the options, though.

MEMBER APOSTOLAKIS: Maybe I'm talking about the same --

MR. YOUNGBLOOD: That's conditional on a particular family of issues.

MEMBER APOSTOLAKIS: Then maybe we're talking about the same thing.

MR. YOUNGBLOOD: We might actually be.

MEMBER APOSTOLAKIS: Ultimately, you get the sequence.

MR. YOUNGBLOOD: Yes. And while I'm up here, let me just point out in case it was missed, that the example that Hossein is working with actually was done, and it is a TMI requirement. They said for this class of initiators, meet this class of reliability. It was an overlay already.

MEMBER APOSTOLAKIS: Yes. I still get confused about the DBA issue.

MR. HAMZEHEE: You are still with Alternative-1.

MEMBER APOSTOLAKIS: No, I think DBA is everywhere.

VICE CHAIRMAN SHACK: The question I have with 2 and 3. What do they do with the DBA issue, I mean, if I implement 2 and 3, I still -- do I have to also implement 1 to get rid of them in the DBA? Otherwise, I'm going to have to live with them in DBA.

MR. HAMZEHEE: Yes. What it means in turn is that let's, for the sake of the argument, assume we pick Alternative 2. If you take Alternative 2-B, it says if you have a system with more than one train, one train you keep as-is, the other train or trains you can reclassify as non-safety-related. As soon as you reclassify a system as non-safety-related, then in the DBA requirement you cannot use it any more, because DBA only applies to safety-related system.

MEMBER APOSTOLAKIS: So you're --

MR. HAMZEHEE: You're done. Correct.

MEMBER APOSTOLAKIS: Now how about on Alternative 3?

MR. HAMZEHEE: What about Alternative 3?

MEMBER APOSTOLAKIS: Well, give me a similar example.

MR. HAMZEHEE: Alternative 3 is you don't reclassify anything.

VICE CHAIRMAN SHACK: If I haven't implemented Alternative 1, if I've removed it in Alternative 2 because I can no longer count on it, then when I put the single-failure criterion in to do my DBA analysis, my one system has disappeared, and I'm dog meat. So unless I implement both 2 and 1, I haven't gained anything.

MR. HAMZEHEE: Yes. Now if you have Alternative 3, that's why we said these alternatives are not going to only impact one program or one requirement. If you try to apply Alternative 3, then you have to go back and look at all the other requirements, and see how they would be impacted, and what changes you need to make.

Bob, do you have any additional clarification of this?

MR. YOUNGBLOOD: Bob Youngblood, ISL. The report has a very short mention of DBA under Alternative 3. And basically what is says is that, that the success paths that you credit to satisfy all this should be met with margin. And you could sort of work with that. You could overlay Alternative 1 on top of that, or maintain DBA stuff separately. If you went down to a single train system for a really rare initiator, of course, that wouldn't satisfy single-failure any more. And in that sense, the design-basis analysis would change. But the main idea that you need, that really is part of Alternative 3 is to make sure that your success paths actually work.

MEMBER APOSTOLAKIS: When you say post-trip decay heat removal function, you put a reliability target, ten to the minus three. How are you going to convince the NRC that this is a true --

MR. YOUNGBLOOD: Okay.

MEMBER APOSTOLAKIS: I mean, is it just the failure rates of the various systems that will be used, or are you also going to do a thermal-hydraulic analysis using the wonderful methods that these fellows have done, conservative, or best estimate, and all that? I mean, are you in DBA space, in which case you are constrained on how you prove something, or is it just failure rate, or both.

MR. HAMZEHEE: Again, some of the details of implementation have not yet been completed. That's why we are not making any recommendations. However, to respond to your question, if one says that you need reliability of let's say one to the minus four for decay heat removal function, is the question how are you going to measure and monitor them?

MEMBER APOSTOLAKIS: How are you going to prove it?

MR. HAMZEHEE: It's very similar to Reactor Oversight Process, for instance. These have to be determined and established. In Reactor Oversight Process you have mitigating system, performance index. There you look at reliability of a given system train based on some guidelines and equations, and you say this should be the threshold based on the impact. So there is a lot of work that has to be done to get there, so something similar, for instance, to Reactor Oversight Process can be applied here. Have we done all the thinking to know exactly how it's going to be done? The answer is no.

MEMBER APOSTOLAKIS: No. And what we're doing is we're trying to give you some hints as to what else you ought to think about. And I think Bill's comment and mine really tell you that you cannot address the issue of DBA in Alternative 1 only. You have to say something about it in the other alternatives, too.

MR. HAMZEHEE: Yes. And that's what --

MEMBER APOSTOLAKIS: I'm not asking you to give the answer now. This is something you have to think about, what exactly do we do with the DBA analysis in Alternatives 2 and 3.

MR. HAMZEHEE: Yes. And as a matter of fact, Alternative 3 may have impact on other requirements that we have to go back and very clearly identify, and then deal with them.

MEMBER APOSTOLAKIS: Yes.

MR. HAMZEHEE: So we understand.

MEMBER APOSTOLAKIS: I tend to like 3, by the way.

CHAIRMAN WALLIS: Have you finished with 3, or are you going to talk --

MR. HAMZEHEE: Are we going to take a vote on which alternative --

CHAIRMAN WALLIS: No. Are you going to talk about the next slide?

MR. HAMZEHEE: Yes.

MEMBER APOSTOLAKIS: Are you covering --

MR. HAMZEHEE: Very quickly.

MR. MARTINEZ: I'm Gerardo Martinez, Brookhaven Lab. To the question on how the Alternative 2 addresses the DBA - if you have Alternative 2, you know there are three sub-alternatives. 2-C keeps all trains safety-related, so you still have fully capability to meet DBA, so there's no really no change. The only facility you get is on the operational flexibility. If you have, for example, Alternative 2-B, you have one train safety-related, and the remaining ones are not safety-related, you cannot close them on safety-related just to have one. And what you have to do is you have to weigh the single-failure requirement. That's the way you would risk-inform the DBA.

MEMBER APOSTOLAKIS: In Alternative 2 it's fairly evident, and in 3 it's not. I think on 2, I think Hossein even --

MR. HAMZEHEE: Yes. Now if you're done with Alternative 3, I can move on, if we're running out of time.

CHAIRMAN WALLIS: I'm not done with the subject of alternatives. You've given us three. I think there should be more.

MR. HAMZEHEE: Yes. Well, let me now quickly go over --

CHAIRMAN WALLIS: I'm going to suggest one to you, just to throw it up, since you're sort of being creative here.

MR. HAMZEHEE: Yes.

CHAIRMAN WALLIS: You're imagining things. I suggest that you consider abolishing all SFCs, and you try to see what you would lose by doing that. What would be sort of the change in risk that you'd tolerate if you abolish them all, and then see which ones you might be able to justify reinstating.

MR. HAMZEHEE: I think it did --

CHAIRMAN WALLIS: Start nibbling away at these things, and all that stuff. It's better to get rid of the whole damned thing, and replace it if it has to be replaced with something better, or see if you've lost that much by abolishing it all. And if you abolished it and said well, use 1.174 to check on changes, would you really be damaging public safety if you did that? Look at these sort of extreme alternatives and see what happens, why you wouldn't do that.

MR. HAMZEHEE: All right.

CHAIRMAN WALLIS: Is that a useful thing to suggest?

MR. HAMZEHEE: Yes. And actually, we've

done some of those exercises, but we didn't document it. Yes.

CHAIRMAN WALLIS: Well, since you're already mentioning it, we're sort of brainstorming here.

MR. HAMZEHEE: Yes.

CHAIRMAN WALLIS: Look at other alternatives and explain to us why they were rejected, if they're going to be rejected.

MR. HAMZEHEE: That's a good suggestion. Now quickly on page 16, I want to re-emphasize again that this is also performance-based alternative, so all these alternatives, including Alternative 3, should follow some of the regulatory guidance, such as NUREG/BR-0303, that is "Guidance for Performance-Based Regulations", because all these alternatives require some kind of performance monitoring. And again, this alternative is more coherent with other risk-informed initiatives, and there could be some significant resource requirements on the NRC and licensees to implement these, because this is a whole different thinking.

Now conclusions. Any questions on the alternatives?

CHAIRMAN WALLIS: I think you might also

consider besides having more alternatives, some kind of a decision matrix for deciding between them, rather than just talking about them, so we have a logical way of deciding, rather than just talking about them, and then sort of guessing oh, I like this one, I don't like that one.

MR. HAMZEHEE: Well, we made an attempt, and it's in the report, to look at pros and cons associated with each alternative.

CHAIRMAN WALLIS: Then could you put them in some kind of metric, or some way we can --

MR. HAMZEHEE: Yes, that's right.

MEMBER ROSEN: A scoring system, basically.

MR. HAMZEHEE: Yes. But because we did not score them because we don't believe we are completely done with that --

CHAIRMAN WALLIS: You're not that far yet, but I'm suggesting when you actually come up to --

MR. HAMZEHEE: Yes.

CHAIRMAN WALLIS: -- one or the other, give some real measures to why it's better than the others.

MR. HAMZEHEE: Yes.

MEMBER APOSTOLAKIS: Actually, this table that you have in the Executive Summary is very nice. I really like that.

MEMBER SIEBER: Yes, that works.

MEMBER APOSTOLAKIS: It made it easy to compare.

CHAIRMAN WALLIS: The only problem is on a computer it doesn't fit on one screen so that you can read it.

VICE CHAIRMAN SHACK: There's an even better table in the draft SECY, because they put a little motivation on top of each column.

MEMBER APOSTOLAKIS: So now next time they will Alternative Roman I.

MR. HAMZEHEE: It's all Greek to me.

MEMBER SIEBER: That can get you in trouble.

MR. HAMZEHEE: We believe that we have identified and evaluated a range of risk-informed alternatives to single-failure criterion. However, we believe that additional evaluation and stakeholder involvements are necessary to assess the practicality of implementing any of these alternatives.

MEMBER DENNING: I think there's another element here, and that is that I think you need stakeholder involvement to determine is there really a motivation to do this; because basically what I've heard so far says, I don't see why we would want to do it. And just because it's such a major investment to do it, I don't see where there's a driver that says we're going to have safer systems because of it. So if the utilities don't have some driver that pushes for it, then why would we --

MEMBER APOSTOLAKIS: Option 0.

MEMBER DENNING: Yes. Option 0, but we have to find out what the stakeholder wants.

MR. HAMZEHEE: Sure. And hopefully, when we have the stakeholders' involvement, interactions, I think that is one of the major elements that has to be clarified. Absolutely. Especially if it's going to be a voluntary change, then you need to pay attention to it. Yes. Well, it could be unless - it won't be the case, but unless somebody finds that it should be changed, but so far based on the work we've done, based on where we are, we believe that the existing SFC has served the purpose, and it's done well so we're not going to just jump to a conclusion that it should be changed, but we have to look at all the alternatives. Look at pros and cons, put them in a matrix, find out which ones are stronger, weaker, and then at the end, find out if doing nothing is the best because of where we are, or some of these alternatives could improve safety. Would that also be beneficial to licensees. And all those factors have to be considered before --

MEMBER ROSEN: Well, you alluded to that in the beginning. You said that when you do your reload safety analysis, you would be able to take credit for some of the margin that develops here.

MR. HAMZEHEE: Correct.

MEMBER ROSEN: And if the licensees believe that margin is worth the difficulty, then you might have some stakeholder --

MR. HAMZEHEE: Driving force.

MEMBER ROSEN: If they don't see the value, then it's possible that you're trying to construct something that would never be used.

MR. HAMZEHEE: That's right.

MEMBER SIEBER: But you're responding to a Staff Requirements Memorandum.

MR. HAMZEHEE: Correct.

MEMBER SIEBER: That's a substantial motivation to continue on.

MEMBER ROSEN: That should be a good reason to do so.

CHAIRMAN WALLIS: That's right, but in the broadest view, you're actually doing something which will have some consequences.

MR. HAMZEHEE: Correct.

CHAIRMAN WALLIS: I've always asked the Staff this, when you do something like this, what are the consequences going to be, positive and negative?

MR. HAMZEHEE: Correct.

CHAIRMAN WALLIS: And the Staff never looks that far. They do something and say well, now we've opened the door for industry, and we'll wait and see if there are any consequences.

MEMBER DENNING: There is a question in mind, though, as to whether they've gone beyond the intent of the SRM; not that I'm saying that that's inappropriate, because I think that what you've done is appropriate within this, but I'm not sure that what was in that SRM really said go here.

MR. HAMZEHEE: That's correct.

MEMBER ROSEN: This is your interpretation of what's in the SRM.

MR. HAMZEHEE: That's right. And let me say what our interpretation was. Now if we're going to pursue follow-up activities, then maybe one step is to meet with the Commission again and make sure we understand exactly what's on their mind, and then follow-up.

MEMBER ROSEN: It would be a good thing to do early on.

MR. HAMZEHEE: Yes. And again, because of all these good things that we said, and all the discussions that we had, at this time we do not recommend one alternative over another until all the follow-up activities have been completed.

CHAIRMAN WALLIS: Well, this SRM is very broad, isn't it - pursue a broader change to SFC. That's a sort of carte blanche --

MEMBER ROSEN: I suppose they meant to leave it open.

MR. HAMZEHEE: Now quickly let me summarize our planned follow-up activities, because we also want to get feedback from you on these actions. As you may know, there was an SRM issued on May 9, 2005 that directed the Staff to work together to make risk-informed and performance-based revisions to 10 CFR Part 50. And currently, we are trying to respond to that, so we believe that the follow-up activities should be included in that formal program plan that we have to develop in response to that SRM. And whatever that plans tell us, we'll follow-up and continue our work in this area. And this is a good approach, because this would ensure that any changes to SFC are evaluated in a broader context with all other changes to Part 50 of 10 CFR.

The planned follow-up activities include additional evaluation of the implementation issues, interaction with stakeholders, maybe other alternatives could be identified that could be viable as a result of further interactions, and we get more feedback on driving force for the licensees, as well as practicality of these, more interactions with ACRS, and then we'll report back to the Commission.

MEMBER APOSTOLAKIS: Good.

MR. HAMZEHEE: Now if we have time, I would also like to take at least five minutes of your time to go over some of the general high level comments that we received from NRR.

CHAIRMAN WALLIS: You said if you have time, I think if we go to 4:30 that would be reasonable.

MR. HAMZEHEE: Yes, that would be sufficient. Yes. And I'll try to be reasonably quick. We sent a technical report to NRR and other offices, and gave them an opportunity to review and give us comments, and we got some good comments from NRR. And what you see here are the high level general comments that we received. And let me go over them and then tell you where we are.

The first one is the fact that the NRR reviewed it and gave us some specific comments on the draft report, and that they still should be considered before the report becomes final. And as a matter of fact, there were a lot of good comments. We're working on them as we speak. And hopefully in a short time, we'll be able to resolve most of them, unless we don't agree with some. But so far, most of the comments seem to be resolvable, so we're working on them.

And the general comments are the following; one of them, they believe that it would be more appropriate to postpone further effort and include it in the formal program plan discussed on May 9^{th}, 2005 SRM to make risk-informed changes to Part 50. And we agree, and as you heard us, this is what we are going to recommend or not recommend as one of our conclusions. And it is also included in our draft Commission paper.

The other comment is that overly broad replacement of SFC for currently licensed plants is not considered prudent. Efforts to risk-inform SFC need to proceed cautiously and systematically with clear understanding of potential safety and resource impact. Therefore, the report should focus more on pros and cons of broadening the relaxation of SFC versus not doing so. And we agree with this comment also. That is why we don't feel at this time we're going to make any recommendation, because again, it has to be very systemic, cautious, and these are right suggestions.

MEMBER ROSEN: It occurs to me that if that's what you're suggesting, that now have time to get some stakeholder input, perhaps in-process rather than after you get further own the road.

MR. HAMZEHEE: Correct.

MEMBER ROSEN: It might help a lot to have some up front.

MR. HAMZEHEE: Correct. Absolutely.

CHAIRMAN WALLIS: It will be interesting to see if you get any stakeholder input.

MEMBER ROSEN: You might be surprised.

MR. HAMZEHEE: That's why when you put it in 10 CFR and in the formal program plan to risk-inform Part 50, then they see it in the broader context. And then they may pay more attention to some, and less attention to others. So that would identify those specific interests.

And the next one is when the report is forwarded to the Commission, it should be made clear that it may be too early to recommend a specific alternative, and that outstanding technical issues exist which need to be resolved. Again, we agree, and we don't plan to make any recommendations at this time. And actually, recommend new alternatives until the follow-up activities are completed.

MEMBER APOSTOLAKIS: Let me understand something here. Is it conceivable that you will forward something to the Commission with which NRR disagrees?

MR. HAMZEHEE: Usually not. We always have the package to everybody's concurrence. And I don't remember, but maybe NRR wants to talk about it. Usually we get concurrence before it goes to the Commission. If there are rare occasions, my life with the NRC, I have not observed that, but that's I think where I should stop.

MEMBER APOSTOLAKIS: But it can happen?

MR. THADANI: It has happened, but on rare occasions.

CHAIRMAN WALLIS: Now when you give the Commission alternatives like this, they have the choice of coming back with an SRM which says pursue

Alternative 2. Once you give them the alternatives, whatever you say about being cautious and all that --

MR. HAMZEHEE: They always can ask us to do anything. That's right.

CHAIRMAN WALLIS: They may well come back saying we favor a certain approach

MEMBER SIEBER: It might not be a good one.

MEMBER APOSTOLAKIS: I don't disagree with that statement.

MR. HAMZEHEE: Well, hopefully with the type of effort we've done and the results and conclusions, that would help them get to where we think we should go, and how to continue.

MEMBER APOSTOLAKIS: The third bullet says the report should focus more on pros and cons of broadening versus not doing so.

MR. HAMZEHEE: Yes. In other words, I think we want to make sure we also evaluate in some detail where we are today, because it has served the purpose well.

MEMBER APOSTOLAKIS: But you haven't done that today.

MR. HAMZEHEE: Not enough. I mean, to some level we've done, but we have not done enough of evaluation, put it in the matrix and compare it to the scorecard and say this has three points, it has this, and all the benefits. We've done it to some degree. We have looked at some of the high level benefits qualitatively, but that can be done more if one wants to make a recommendation.

CHAIRMAN WALLIS: Why should you be working out all these benefits? Why shouldn't industry be working out all of these pros, and cons, and benefits?

MR. HAMZEHEE: That's very true, and I'm hoping that if we continue our effort, that is going to be done more or with help from the industry, as we are doing with 50.46. The Westinghouse Owners Group is looking at some of the safety benefits.

CHAIRMAN WALLIS: They have promised to do so.

MR. HAMZEHEE: Yes. You're absolutely right. And the last comment is, this report states that single-failure criterion is a proxy for reliability. Other benefits of SFC include avoiding excessive reliance on the particular element of plant safety, maintaining design-basis accident mitigating capability during maintenance. These other benefits need to be addressed more directly in the alternative.

We agree, however, there was just one occasion that this was mentioned, and other sections of the report talked about other elements. However, we went ahead and looked at the report, and fixed it, and clarified it so that it doesn't sound like this is the proxy to reliability, and that's the only thing.

MEMBER APOSTOLAKIS: Maintaining DBA, mitigating, doing maintenance - if you have one train, and you take it out from maintenance and you keep running, you don't have the reliability you want, so it is a proxy for reliability. This is not a serious comment.

MR. HAMZEHEE: Well, it's --

MEMBER APOSTOLAKIS: Excuse me. I can say that, you can't.

MR. HAMZEHEE: NRR, would you like to add anything? No?

MEMBER APOSTOLAKIS: Let's not make a big deal of it, but it really is --

MR. HAMZEHEE: But I think that requires clarification. To some degree, they want to make sure that we put it in the right context, that there are other elements. This is not just proxy to reliability.

MEMBER APOSTOLAKIS: And what I'm saying

is that you will not have the reliability you need if you have only one train and you go to maintenance. You will have to shut down.

MR. HAMZEHEE: All right. Yes.

MEMBER APOSTOLAKIS: The other three performance in a previous life made much more sense, especially when they say you should move cautiously.

MR. HAMZEHEE: Now before I go to the next to schedule, which is my last viewgraph. It should not take more than a couple of minutes, I would like to ask the NRR Staff is they want to add or expand on any of these comments, or should I go ahead? All right. Thanks. Okay. The next slide is the schedule.

MEMBER APOSTOLAKIS: When you say at NRR, who is it?

MR. HAMZEHEE: Why do you have to know, George? The Division of Engineering, and mainly they're represented by Division of System Safety and Analysis. And Jim Lyons is the Acting Division Director. He's sitting there. Mark Rubin is the Section Chief.

MEMBER APOSTOLAKIS: All right. That's good enough.

MR. HAMZEHEE: And some others, Steve Laur and Donnie, and Gareth. All the NRC Staff.

All right. Schedule - we completed a draft technical report in February of 2005, sent it to other offices for review and comment. We received the comments in May of 2005. We're briefing you today, which is June, 2005. We would appreciate it very much if get a letter from you by June 30th, because the last bullet is to issue a Commission paper with technical report by June 29th. So if we get the letter from you by the end of this month, we can provide your feedback into the Commission paper.

CHAIRMAN WALLIS: So what happens then?

MR. HAMZEHEE: And then once you see the SECY paper, you see that it says the conclusion is that we've looked at some alternatives; however, we need to do more work and meet with the stakeholders to make sure that all the viable alternatives have been defined.

CHAIRMAN WALLIS: What you're looking for is the Commission to give you the go ahead to go and do those things --

MR. HAMZEHEE: We did not ask -- well, that's right. This is informing of our findings and we're telling them what we're going to do as conclusions. But as you said, they may come back and direct us otherwise, so you help would help. And I think once you read the Commission paper, you see it's very clear how the work progresses, and what kinds of conclusions we're drawing, and where we want to go from here.

Now the only challenge, which I think we can achieve, is to resolve or address all NRR comments before we prepare the package, but I think we've made significant progress, so it should not be difficult, but it's challenging.

CHAIRMAN WALLIS: Are you going to issue this Commission paper before you even get public comments?

MR. HAMZEHEE: Yes. We're not going to get public comment on this, because this is findings of our effort to the Commission. But if we're going to follow-up, then we're going to meet with the public, get comments, feedback, and everything else.

MEMBER SIEBER: Now the real endpoint would be a rule making, because you've got to change Appendix A to implement for any of these alternatives.

MR. HAMZEHEE: If that is an alternative.

MEMBER SIEBER: That's two years away.

MEMBER APOSTOLAKIS: At least.

MR. HAMZEHEE: Again, it also depends on the formal program plan that we're working on right now to risk-inform Part 50. This may have a lower priority than some other activities, or it may have a higher. We don't know yet, because we have not completed that program plan.

MEMBER APOSTOLAKIS: How sympathetic is the Commission when they issue an SRM asking the Staff to do something, and the Staff comes back and says here is a number of alternatives, but we can't really recommend yet? Are they understanding or are they saying you didn't really respond to the SRM?

MR. LANE: Well, we'll find out.

MS. DROUIN: George, this is Mary Drouin. We do this quite often. I mean, when the Commission comes back with an SRM, we'll give them periodic status reports. And, Hossein, would it be fair to characterize this as a status report, where we are in response to the SRM?

MR. HAMZEHEE: Yes.

MS. DROUIN: And that's typical of what we do.

MEMBER APOSTOLAKIS: Oh, so it's not something that's unusual.

MR. HAMZEHEE: It's reasonable.

MS. DROUIN: That's true.

MR. SNODDERLY: Well, I think this is a

little bit more, because it --

MEMBER APOSTOLAKIS: A little more what?

MR. SNODDERLY: Correct me if I'm wrong, Hossein, because the impression I got from the SECY was that you plan to pursue these alternatives as part of the broader look at Part 50, which you're developing that formal program plan.

MR. HAMZEHEE: Yes.

MR. SNODDERLY: That you're going to fold it into that, so I thought that that was a little more formal.

MR. HAMZEHEE: It is, yes.

MR. SNODDERLY: You've done the work, you've looked at the broader changes. Now you're going to keep these in mind or pursue them further as you risk-inform Part 50 from an overall point.

MR. HAMZEHEE: Yes. That's correct. Any other comments or questions? Any comments from the audience, NRR, or Research Staff, or our consultant? Thank you.

MEMBER SIEBER: Thank you very much.

CHAIRMAN WALLIS: Well, we have made it to 4:30. Thank you very much. I very much appreciated your presentation and explanation of many things which were somewhat obscure to me before.

MR. HAMZEHEE: My pleasure.

CHAIRMAN WALLIS: We will take a break for 15 minutes, and then quarter to five when we come back, I'd like to look at where we are in terms of beginning to decide on what should be the substance of our letters on some of these important matters. You don't need the report.

(Whereupon, the proceedings in the above-entitled matter went off the record at 4:32 p.m.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Reactor Safeguards 523rd Meeting

Docket Number: n/a

Location: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Rebecca Davis

Rebecca Davis
Official Reporter
Neal R. Gross & Co., Inc.

Point Beach Nuclear Plant, Units 1 and 2
Discussion of Red Findings

Staff Presentation to the ACRS Plant
License Renewal Subcommittee
Patrick Louden, Branch Chief
Division of Reactor Projects, Region III
June 1, 2005

Point Beach Red Findings

- Licensee identified Auxiliary Feedwater system finding in November 2001
- Two NRC Special Inspections performed:
  - December 2001 – February 2002
  - September 2002 – March 2003
- 2003 Inspection identified second Auxiliary Feedwater system finding

Point Beach Red Findings

- Plant notified of final decision on first Red finding in April 2003
- Red Finding places Point Beach in Column IV of the NRC Action Matrix
- Second Red finding issued in December 2003

NRC Inspection Procedure 95003

- Supplemental Inspection 95003 conducted from August to December 2003
  - Diagnostic in nature
  - Focused on known problem areas
  - Results determine any necessary additional NRC actions
- Point Beach 95003 inspection completed in three parts

Point Beach 95003

- Teams comprised of inspectors from all NRC regional offices and included contractors
- Additional findings and violations identified
- Five general areas of concern identified through 95003 and baseline inspections

NRC Areas of Concern

- Five areas of regulatory concern:
  - Human Performance
  - Engineering Design Control
  - Engineering/Operations Interface
  - Emergency Preparedness
  - Corrective Action Program

Point Beach CAL

- These five areas formed basis for NRC Confirmatory Action Letter (CAL)
- CAL issued on April 21, 2004
- Licensee developed Commitment Letter based on their Site-Wide Excellence Plan
- Commitment Letter attached to CAL

Point Beach Inspections

- Baseline team inspection membership was expanded
- Special inspections were conducted to evaluate the licensee's progress in implementing Confirmatory Action Letter items.

Point Beach Current Performance

- Substantive Cross-cutting Issues
  - Substantive cross-cutting issues identified in the areas of Human Performance and the Problem Identification and Resolution
  - Also are identified as areas of concern in the Confirmatory Action Letter

Point Beach Current Performance

- Human Performance has been a licensee focus and recent improvement has been noted
- Corrective Action Program as designed is sound
- Some aspects of implementation of the program need improvement

Point Beach Current Assessment

- The licensee has made progress in all five Confirmatory Action Letter areas of concern

- The NRC focus is on sustainability of the licensee's corrective actions

Point Beach Nuclear Plant

SUSTAINING IMPROVEMENT

Doug Cooper
Senior Vice President

NMC

Point Beach Nuclear Plant

95003 Inspection Findings

- Corrective Action Program
- Human Performance
- Emergency Preparedness
- Engineering/Operations Interface
- Engineering Design

NMC

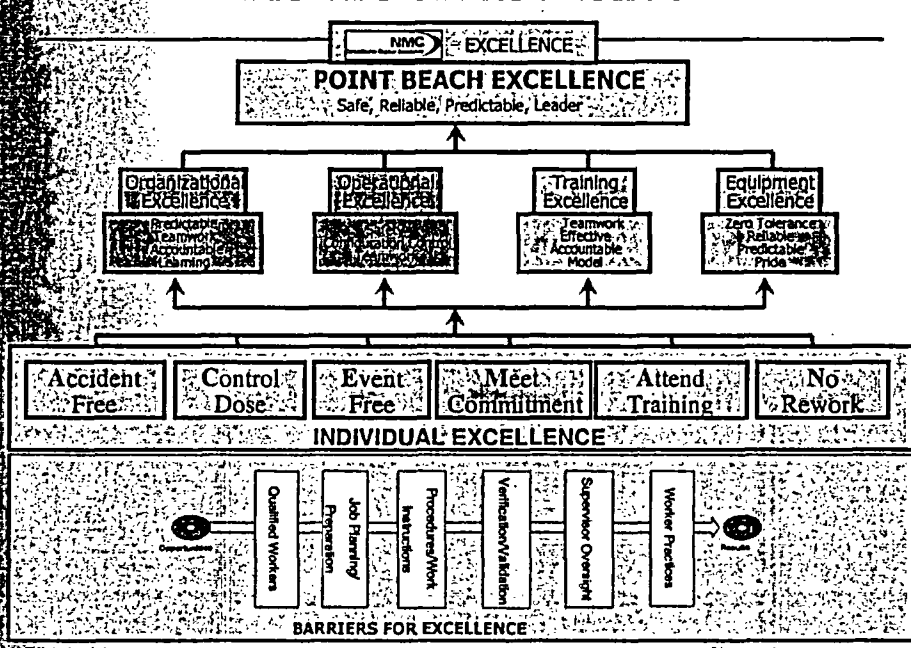
Point Beach Nuclear Plant

Site Excellence Plan

- Overhauled Comprehensive Excellence Plan
  - Internal / External Assessments As Basis
  - In Progress Prior To 95003 Inspection
- Resource Loaded
- Routinely Monitored and Updated

NMC

Picture of Excellence



Point Beach Nuclear Plant

Six Critical Milestones
"6 For Success"

- Dry Fuel Storage
- Spring Refueling Outage – 2005
- Confirmatory Action Letter (CAL) Closure
- Fall Refueling Outage – 2005
- Operations Training Program Accreditation
- INPO Evaluation

Point Beach Nuclear Plant

Results To Date
U2R27 Outage Goals

	Goal / Actual
• Accident Free / Personnel Safety	
• Lost Time Accidents	0 / 0
• OSHA Recordable Injuries	0 / 1
• Radiological Events	<1 / 0
• Event Free / Nuclear Safety	
• Unplanned Orange / Red Paths	0 / 0
• Reactor Trips (either unit)	0 / 0
• Safeguards Actuation (either unit)	0 / 0
• Loss of Shutdown Cooling	0 / 0
• Loss of Reactor Vessel Level Control	0 / 0
• Station Human Performance Clock Reset	0 / 1

Point Beach Nuclear Plant

Results To Date

- Successful Emergency Preparedness Exercise
- Human Performance-Related Issues Improved
- 134 OF 143 Confirmatory Action Letter (CAL) Items Completed
- 60 OF 65 Performance Measures In CAL Met Or Exceeded
- Engineering Related Calculations Longest Action To Complete
- Overall Improved Performance Observed in Excellence Plan
  - Oversight Assessments
  - Self-Assessments
  - INPO Reviews
  - Objective Performance Measures

Point Beach Nuclear Plant

NRC Public Comments On Point Beach

- Public Meetings– March 14 and April 19, 2005
  - Reiterated Importance Of CAL Completion and Outage Performance
  - Acknowledged Status of CAL Actions and Challenges in Calculation Project and EAL Revisions
  - Acknowledged Improvements In All CAL Areas
- Agency Action Review Meeting – May 25, 2005
  - Point Beach Continues To Operate Safely
  - Progress Being Made In All Areas Of Confirmatory Action Letter
  - Action Items Are Scheduled And Resource Loaded
  - Improvements Indicate Ability To Complete Commitments

EPRI/NRC-RES FIRE PRA METHODOLOGY

J.S. Hyslop, NRC/RES

Steven P. Nowlen, SNL

Bijan Najafi SAIC (for R. Kassawara, EPRI)

ACRS Full Committee

June 1, 2005

Rockville, MD

A Collaboration of U.S. NRC Office of Nuclear Regulatory Research (RES) & Electric Power Research Institute (EPRI)

BACKGROUND

- MOU between NRC-RES and EPRI on fire risk
- One of several elements on MOU
- Primary objective of this program: develop, field test, and document state-of-art
- Prior briefings of ACRS, including focused briefing in May 05
- Purpose: Brief ACRS on final NUREG/CR-6850, EPRI 1008239 "*EPRI/NRC-RES Fire PRA Methodology for Nuclear Power Facilities*" which addresses public comments

ROLES OF PARTICIPANTS

- NRC-RES and EPRI develop and test methods
- Three volunteer pilot plants support testing
- Other participating licensees provide peer-review of methods
  - Peer review indicated that step change produced in many areas of fire PRA methodology
- EPRI and NRC-RES reach consensus on documented methodology

EXPECTED USE OF METHODOLOGY

- Support for new rule 10CFR50.48c implementation
- Analyses under the current fire protection regulations (i.e. exemptions/deviations or other plant changes such as risk-informed technical specifications)
- Basis for staff review guidance that RES will develop for NFPA 805 related changes
- ANS fire risk standard
- Analysis and reviews of fire protection inspection findings (phase 3 SDP)

ADVANCEMENT TO STATE OF ART

- Improvements made in areas important to fire risk (resource constraints considered)
- Means to advance
  - Consolidate existing research
  - Analyze more extensive data
  - Modify existing methods
  - Develop new approaches

RELATIONSHIP TO FIRE MODEL V&V

- Fire modeling tools provide input to fire PRA
- Fire model verification and validation (V&V) is required for NFPA 805 applications
- In limited cases, fire models (empirical correlations) utilized
  - Address cases where computational fire models inadequate
  - Fill important gaps in fire PRA
- PRA Methodology document not a reference for fire models
  - Any necessary V&V left to analyst

PUBLIC COMMENTS

- Comments provided during public comment period by industry and consultants
  - Duke Power, Florida Power and Light, EPM, RDS
- Comments provided by NRR
- No public comment required NRC-RES and EPRI to significantly adjust our approach
  - Few comments on state-of-the-art limitation
  - Remaining comments were minor and clarifications

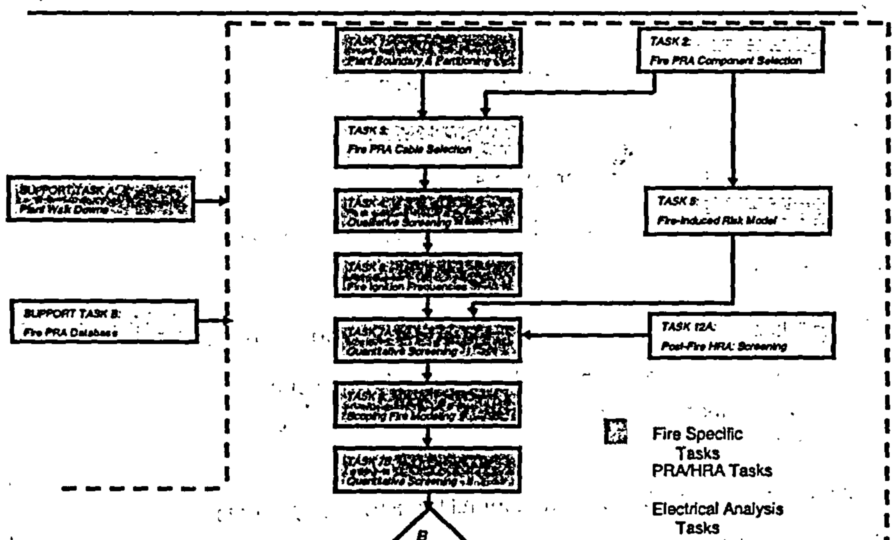
MILESTONES

• Draft report for public comment	Oct 2004
• ACRS	May/Jun 2005
• Public Fire PRA Methodology Workshop	Jun 14-16, 2005
• Publication	Aug 2005
• BWR pilot	2006
• Revision of methodology (if needed)	Dec 2006

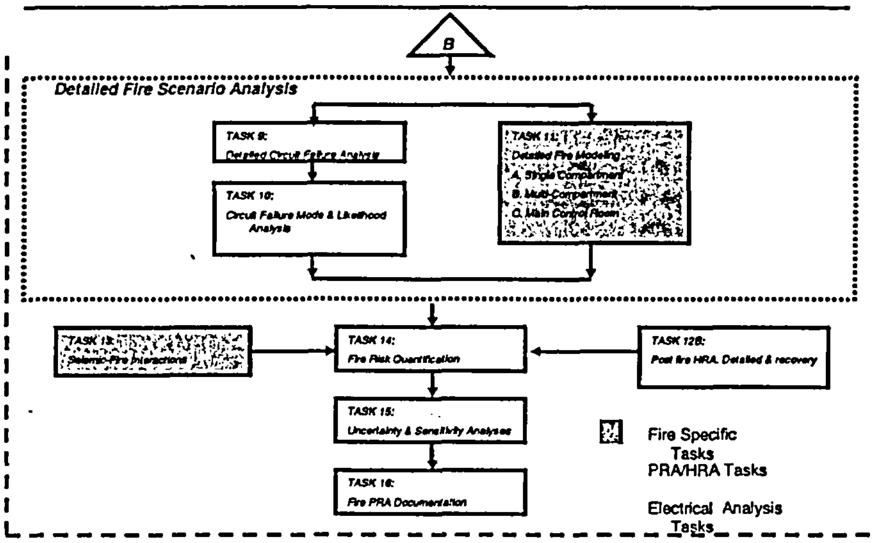
PROJECT TEAM

- Covers all technical disciplines critical to Fire PRA
  - Technical Lead: B. Najafi, S. Nowlen
  - General PRA & plant systems analysis: A. Kolaczkowski, R. Anoba
  - Circuit Analysis and Appendix R: D. Funk, F. Wyant
  - Human Reliability Analysis: J. Forrester, W. Hannaman, A. Kolaczkowski
  - Fire analysis: F. Joglar, M. Kazarians
  - Consultants: A. Mosleh, D. Bley
- Collectively, over 250 years of relevant experience
- Principal authors of documented Fire PRA methods in the US for the past 2 decades
- Experience with use of previous methods; their strengths and weaknesses
- The Methodology reflects the consensus of this team, EPRI and RES

FIRE PRA PROCESS FLOW CHART



FIRE PRA PROCESS FLOW CHART



Task 2: Fire PRA Component Selection

- Determines what will be credited in Fire PRA model
- Advances over IPEEE model
  - Multiple spurious actuation events
  - Key instrumentation supporting post fire operator actions
- Public comments
  - Added search for "new" scenarios and associated components
  - Added more on unique manual actions including supporting instrumentation needed as well as accounting for equipment effects as a result of actions
- Cable selection (**task 3**) performed for all fire PRA components
- Fire induced risk model (**task 5**) models these issues

Task 12: Post Fire HRA

- Main advances
  - Screening level Human Error Probabilities (HEPs)
    - Range from 10x Internal Events PRA HEPs to 1.0
  - Identification and discussion of performance shaping factors (PSFs) for detailed analysis
    - Plant and scenario-specific PSFs for estimating best estimate HEPs for significant fire scenarios
- Procedure does not provide detailed quantification guidance
- Public comments
  - Removed discussion of fire-specific pre-initiator human failure events (HFEs)
    - Those impacting fire protection systems, barriers, general fire protection program elements
    - Possible confusion/overlap with use of experience/data covered in other Tasks
    - Does not preclude plant-specific HRA of fire-specific pre-initiator HFEs
  - Added "general" guidance on use of existing HRA methods, BUT no specific quantification guidance as requested by one comment

Task 6: Fire Frequencies

- *Fire Frequencies*: significant improvements made here
  - Most fire sources now use component-based frequency
    - Allows for more consistent, refined, and reasoned compartment and scenario frequencies that reflect plant specific configuration
  - Extensive analysis of event data
    - IPEEEs typically used full unscreened event set for frequency and applied generic severity factors
    - We screened events for risk-relevance (potentially challenging)
    - We also utilize fire severity profiles that have implicit links to the final frequency event sets (more on profiles later)
  - This area was the subject of much discussion and adjustment during peer review
  - Several public comments requested clarification of specifics, no major changes

Task 9: Detailed Circuit Analysis

- Generally reserved for cases in which quantitative screening indicates a clear need and advantage for further analysis
- Detailed failure modes analysis
- Objective is to screen out cables that cannot impact the ability of a component to complete its credited function
- Public comments
  - Enhanced "risk-informed" guidance to focus analysis on failure modes of concern
  - Incorporated guidance for human factors interface

Task 10 – Circuit Failure Mode Likelihood Analysis

- Probabilistic Based Circuit Analysis
- Two Methods Presented
  - Expert Panel Results
  - Computation-Based Analysis
- Requires Knowledge About Circuit Design, Cable Type and Construction, Installed Configuration, and Component Attributes
- Generally Reserved for Only Those Cases that Cannot be Resolved Through Other Means

Task 10 – Circuit Failure Mode Likelihood Analysis

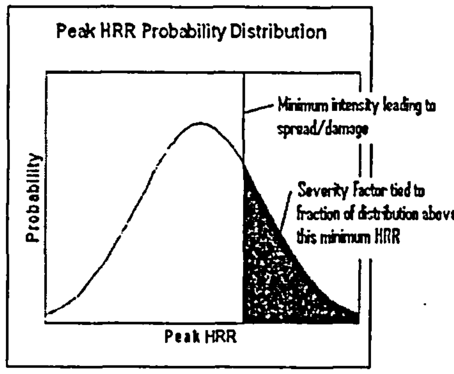
- Key Insights
  - Our Knowledge is Greatly Improved but Uncertainties are Still High
  - Practical Implementation is Challenging
  - Further Analysis of Existing Test Data and Follow-On Tests Would be Beneficial
- Public and Peer Review Comments
  - Extensive Discussions Regarding the Most Appropriate Way to Tally Spurious Actuation Probabilities (Many Subtleties for Implementation)
  - Team's Consensus is that Expert Panel Values are generally Conservative as currently applied
  - Additional Independent Review of the Circuit Analysis Method was Solicited (Favorable, but limitations acknowledged)

Task 11: Detailed Fire Modeling

- Scope: Define and evaluate specific fire scenarios
  - Single, multi-compartment, main control room fire scenarios
- General approach follows traditional pattern:
  - Identify fire sources and targets
  - Fire growth/spread/damage analysis including fire severity
  - Fire detection/suppression analysis
  - Final output is conditional probability of fire consequences given fire ignition
- Special models developed to account for NPP fire scenarios beyond the capability of existing computational fire models

Task 11: Detailed Fire Modeling
Heat Release Rate and Severity

- Previous methods (e.g. IPEEE) used a fixed HRR and severity factor
- New approach ties severity factor to a distribution on peak fire intensity
- HRR distributions developed for various ignition sources
  - Expert judgment based upon evidence from events and data
  - Captures high intensity fires
- Basis for scoping fire modeling (**Task 8**) which eliminates components from fire model



Task 11: Detailed Fire Modeling
Special Models

- High energy arcing faults (new)
  - Critical to switchgear room fire risk
  - An empirical rule set type model based on operating experience
  - High-energy phase, defined by a "zone of influence"
  - Thermal phase (enduring fire) treated like other fire sources
- Main control board (new)
  - Critical to control room fire risk
  - A probabilistic model for fire propagation inside the main control board
- Cable fires (modified from IPEEE approaches)
  - Critical to cable spreading room and cable tunnel fire risk
  - Fire spread in a single tray or cable tray stacks

Task 11: Detailed Fire Modeling Other Special Models

- Fire propagation to adjacent cabinets (consolidation)
- Passive fire protection features (consolidation)
- Hydrogen fires (new)
- Turbine generator fires (new)
- Smoke damage (consolidation)

Task 11: Detailed Fire Modeling Detection & Suppression Analysis

- Probability of Non-Suppression = conditional probability that fire lasts long enough to cause postulated damage
- Approach credits:
  - Prompt detection & suppression (by plant personnel or fire watch)
  - Automatic detection and suppression
    - Reliability and availability
    - Effectiveness (scenario-specific)
  - Manual detection
  - Manual suppression by fire brigade
    - Model based on operating experience – fire suppression time curves
- Improvements over previous methods:
  - More rigorous review/analysis of event data – long lasting fires
  - Explicit calculation framework (event tree)

Public Comments on Task 11

- Editorial/clarification comments including consistency with fire protection SDP, and NEI 04-02
- V&V of fire models
  - NFPA 805 requires that fire models are verified and validated.
  - Our report documents fire PRA state-of-the-art – broader applicability
  - "Models" are cited when team consensus concluded need is critical, and identified method represents a reasonable approach and/or current best practice
    - e.g., the "special models" discussed previously
  - We did not V&V recommended approaches

Task 15: Uncertainty and Sensitivity Analyses

- Addresses the *process* for uncertainty and sensitivity analyses
  - Modeling and data uncertainties
  - A comprehensive list of *specific* uncertainty sources for each task has been developed
  - Explicit guidance on quantification (e.g., uncertainty bounds) for each identified source is NOT provided
    - May be able to add as more demonstrations are performed
- Some changes were made as a result of public comments
  - Consolidated discussions of uncertainties from individual tasks under Task 15 (clarification issue)
  - Separated uncertainties to be addressed from technical quality issues
    - Discussion of both remains – see Appendix V
  - Added discussion on usefulness of sensitivities for screened compartments
  - Other minor clarifications and editorial comments included

INSIGHTS

- CDF Insights (in the author's judgment compared to IPEEE)
  - Expect overall range of CDF for fleet of plants to be maintained
  - Expect individual risk profile of some plants to change
    - Multiple spurious actuations, high energy arcing faults
    - Control room
  - Continued use of this methodology needed
- Cable tracing to support fire PRA still major resource requirement
  - Address via iterative, screening nature of fire PRA

ACRS Full Committee, June 1, 2005, Rockville, MD

Slide 25

A Collaboration of U.S. NRC Office of Nuclear Regulatory Research (RES) & Electric Power Research Institute (EPRI)

STATE OF ART IN FIRE PRA

- Best available method to estimate fire risk and obtain insights.
- Improvements will benefit state-of-the-art
  - Spurious actuations
  - Post-fire HRA
  - Low power and shutdown operations
  - Plant-specific assessment of fire fighting

ACRS Full Committee, June 1, 2005, Rockville, MD

Slide 26

A Collaboration of U.S. NRC Office of Nuclear Regulatory Research (RES) & Electric Power Research Institute (EPRI)

Policy Issues Related to New Plant Licensing

Presented to

Advisory Committee on Reactor Safeguards

June 1, 2005

Purpose of Presentation

- Brief Committee on the staff's recommendation on two policy issues
  - What shall be the minimum level of safety that new plants need to meet to achieve enhanced safety?
  - How shall the risk from multiple reactors at a single site be accounted for?
- Requesting approval on staff's recommendation on the two policy issues
  - Requesting approval in a letter

Background/History

- SECY-03-0047, Policy Issues Related to Licensing Non-Light Water Reactor Designs, March 28, 2003
  - Staff recommended that implementation of enhanced safety through a process similar to that used in the evolutionary LWR and advanced light-water design certification reviews.
  - The staff also recommended that the following considerations be applied:
    - When using probabilistic or risk information, modular reactor designs should account for the integrated risk posed by multiple reactors necessary to achieve the overall electrical output desired.
    - The incremental risk to the surrounding population from adding additional units to an existing site is expected to be small due to the enhanced safety characteristics of new designs.

- SRM (to SECY-03-0047), June 26, 2003, direction on the policy issues:
  - Approved the staff's recommendation on implementation of the Commission's expectation for enhanced safety in future non-LWRs
    - Requested the staff to provide further details on the options for, and associated impacts of, requiring that modular reactor designs account for the integrated risk posed by multiple reactors

Background/History (cont'd)

- In SECY-04-0157, "Status of Staff's Proposed Regulatory Structure for New Plant Licensing and Potentially New Policy Issues," the staff alerted the Commission to the new policy issue regarding level of safety
  - What level of safety should be the goal to achieve enhanced safety?
- SECY-05-0006, "Second Status Report of Staff's Proposed Regulatory Structure for New Plant Licensing and Policy Issues Related to Licensing Non-Light-Water Reactor Designs," dated January 7, 2005, the staff
  - The staff would submit final recommendations on integrated risk, containment performance, level of safety in mid 2005 to support pre-application reviews of new reactor designs.
  - Resolution of level of safety and integrated risk are also fundamental to the development of the Framework

General Guidelines in Assessing Options and Developing Recommendations

- Keep the risk to the population around a nuclear power plant site consistent with the Commission's 1986 policy statement on Safety Goals
- Utilize a risk-informed and performance-based approach, wherever practical, consistent with Commission guidance
- Use a technology-neutral approach
- Use the Commission's performance goals to assess the advantages and disadvantages of the options and to develop a recommendation
- Consider previous Commission guidance on these issues
- Consider the practicality of the options and recommendations

Previous Commission Guidance (Policy Statements)

- Regulation of Advanced Nuclear Power Plants
  - "…. the Commission expects, as a minimum, at least the same degree of protection of the public and the protection of the public and the environment that is required for current-generation light water reactors. Furthermore, the Commission expects that advanced reactors will provide enhanced margins of safety …. The Commission also expects that advanced reactor designs will comply with this Commission's safety goal policy statement…."
- Severe Reactor Accident Regarding Future Designs and Existing Plants
  - "Although in the licensing of existing plants the Commission has determined that these plants pose no undue risk to public health and safety, this should not be viewed as implying a Commission policy that safety improvements in new plant design should not be actively sought. The Commission fully expects that vendors engaged in designing new standard (or custom) plants will achieve a higher standard of severe accident safety performance than their prior designs."
- Safety Goals for the Operation of Nuclear Power Plants
  - "Current regulatory practices are believed to ensure that the basic statutory requirement, adequate protection of the public, is met."

Two Policy Issues

- What shall be the minimum level of safety that new plants need to meet to achieve enhanced safety?

- How shall the risk from multiple reactors at a single site be accounted for?

First Issue: Level of Safety Four Options Identified

- Option 1: Use current process
  - A minimum level of safety is not explicitly defined for achieving enhanced safety
  - A case-by-case determination of enhanced safety is made
  - A minimum level of safety would not be specified in the technology-neutral framework for new plant licensing

First Issue: Level of Safety Four Options Identified (cont'd)

- Option 2: Define the minimum level of safety as the Quantitative Health Objectives (QHOs)
  - The QHOs (as expressed in the Commission's Safety Goal Policy) are selected as the minimum level of safety to demonstrate that enhanced safety has been achieved for new reactor designs
  - The QHOs would be used to assess whether new reactor designs, currently under review, meet the Commission's expectation of enhanced safety
  - The framework would be developed based on a minimum level of safety defined by the QHOs
    - The technology-neutral regulations would be developed to achieve at least the safety goal level of safety

First Issue: Level of Safety Four Options Identified (cont'd)

- Option 3: Develop other risk objectives for the minimum level of safety
  - Other risk objectives would be developed for the QHOs on a technology-neutral basis similar to the subsidiary risk objectives, core damage frequency (CDF) and large early release frequency (LERF), developed for the current operating LWRs
  - Other risk objectives would be used to assess whether new reactor designs, currently under review, meet the Commission's expectation of enhanced safety
  - The framework would be developed based on a minimum level of safety defined by these new risk objectives

First Issue: Level of Safety Four Options Identified (cont'd)

- Option 4: Develop new Quantitative Health Objectives for the minimum level of safety
  - New QHOs, which are more stringent than the ones defined the Commission's Safety Goal policy statement, would be developed
  - The QHOs would be used to assess whether new reactor designs, currently under review, meet the Commission's expectation of enhanced safety
  - The framework would be developed based on a minimum level of safety defined by the QHOs

Option 1: Advantages & Disadvantages

Use Current Process

Advantages

- No changes needed to current regulatory practice
- Provides maximum flexibility

Disadvantages

- Not necessarily result in technology-neutral, risk-informed or performance-based
- Not clear that supports Commission's expectations
- Could lead to different results
- May be more likely to be challenged by stakeholders
- Not readily scrutable
- Relies on subjective judgment
- Likely not to result in consistency and uniformity
- Likely not to promote stability and predictability

Option 2: Advantages & Disadvantages

Define Safety Level as the QHOs

Advantages

- Eliminates need to develop criteria on a case-by-case basis
- Provides for a more efficient, scrutable and objective regulatory process
- Increases the level of consistency and uniformity
- Promotes regulatory stability and predictability
- Defines safety level that is technology-neutral, risk-informed and performance-based
- Implements Commission's expectations
- Allows flexibility, allows applicant to propose other risk measures

Disadvantages

- In providing the flexibility, may result in inconsistent approaches for similar designs in an increase in resources
- Level 3 PRA needed

Option 3: Advantages & Disadvantages

Define other Risk Measures as the Safety Level

Advantages

- Eliminates need to develop criteria on a case-by-case basis
- Provides for a more efficient, scrutable and objective regulatory process
- Ensures consistency and uniformity
- Promotes regulatory stability and predictability
- Defines safety level that is technology-neutral, risk-informed and performance-based
- Implements Commission's expectations
- Level 3 PRA not needed

Disadvantages

- Significant uncertainties regarding feasibility
- Not apparent that technology-neutral risk objectives tied to the QHOs can be developed
- LWR surrogates: CDF and LERF
  - Definition of core damage, for example, does not apply to the PBMR
- CDF and LERF quantitative objectives (1E-4/ry and 1E-5/ry, respectively)
  - Based on experience gained from substantial number of Level 3 LWR PRAs
- Data and experience needed
- Large increase in resources

Option 4: Advantages & Disadvantages

Develop More Stringent QHOs as the Safety Level

Advantages

- Eliminates need to develop criteria on a case-by-case basis
- Provides for a more efficient, scrutable and objective regulatory process
- Ensures consistency and uniformity
- Promotes regulatory stability and predictability
- Defines safety level that is technology-neutral, risk-informed and performance-based
- Implements Commission's expectations

Disadvantages

- Require considerable time and staff resources
- Need to identify type of analysis (or even develop new method) to demonstrate that these new QHOs have been met
- Likely to have significant concerns from external stakeholders
- Significant uncertainties regarding feasibility

Recommendation for Minimum Level of Safety

- Recommend that Option 2 be selected
  - ***The QHOs should be the minimum level of safety for new plant licensing in achieving the Commission's expectation for enhanced safety***
- Provides for a uniform application of safety level across all reactor technologies
- Promotes regulatory stability and predictability for new plant licensing
- Defines safety level that is technology-neutral, risk-informed, performance-based
- Implements Commission's expectations
- Consistent with level of safety adopted by the industry
- Allows greater flexibility to both staff and the applicant
- Feasible with the least impact on time and staff resources

Second Issue: Integrated Risk Three Options Identified

- Option 1: No consideration of integrated risk
  - The risk information is evaluated on a per reactor basis, not a per site basis
  - Integrated risk from new reactors would not be considered
  - Technology-neutral framework would not consider integrated risk

Second Issue: Integrated Risk Three Options Identified (cont'd)

- Option 2: Quantification of integrated risk at the site solely from new reactors
  - The integrated risk solely associated with new reactors at a site would not exceed the risk expressed by the QHOs
  - For ongoing design reviews, staff would ensure that their integrated risk not exceed the risk expressed by the QHOs
  - Criteria and guidelines in technology-neutral framework developed so that the integrated risk from new reactors not exceed the risk expressed by the QHOs

Second Issue: Integrated Risk Three Options Identified (cont'd)

- Option 3: Quantification of integrated site risk
  - The integrated risk from both existing and new reactors would not exceed the risk expressed by the QHOs
  - For ongoing design reviews, staff would ensure that the integrated risk from both the existing and new reactors not exceed the risk expressed by the QHOs
  - Criteria and guidelines in technology-neutral framework developed so that the integrated risk from both existing and new reactors not exceed the risk expressed by the QHOs

Option 1 Advantages & Disadvantages

No Quantification of Integrated Risk

Advantages

- Status quo is maintained with no consideration of integrated from multiple reactors at same site
- Least impact on time and staff resources

Disadvantages

- No quantitative assessment of or limit on integrated risk
- Risk to population near a site could be greater than the QHOs
- May be difficult to justify and communicate to the public

Option 2 Advantages & Disadvantages

Quantification of Integrated Risk of New Reactors Only

Advantages

- Qualitatively assesses and limits the total integrated site risk
- The integrated risk from new reactors would not exceed the risk expressed by the QHOs
- Preserves the current regulatory stability and predictability
- Consistent with Commission's statements

Disadvantages

- Full quantitative assessment of the integrated site risk is not evaluated
- Increases COL action items arising from ESPs and design certifications
- Public may find it difficult to understand why existing reactors should not be held to the higher minimum level of safety

Option 3 Advantages & Disadvantages

Quantification of Integrated Risk of both Existing and New Reactors

Advantages

- Quantitatively assesses and limits the total integrated site risk
- The integrated risk from both existing and new reactors would not exceed the risk expressed by the QHOs
- Relatively straightforward to communicate to the public

Disadvantages

- Disrupts the current regulatory process
- Significantly increases COL action items arising from ESPs and design certifications
- Goes beyond Commission's expectations
- Generic site may not bound the actual site
- May not be workable for construction of new reactors at existing sites if applicant unrelated to current licensee

Recommendation on Integrated Risk

- Recommend that Option 2 be selected
  - ***The integrated risk solely associated with new reactors at a site not exceed the risk expressed by the QHOs***
- Existing reactors, under current regulatory structure, found to pose no undue risk to public health and safety
- Ensures that any incremental risk to the site is insignificant
- Defines integrated risk criteria that is technology-neutral, risk-informed, performance-based
- Implements Commission's expectations
- Promotes regulatory stability and predictability for new plant licensing while preserving the current regulatory structure

In Summation

- Requesting letter from Committee
  - approving staff recommendation on the two policy issues, level of safety and integrated risk
- Staff SECY paper due to the Commission June 30, 2005

STATUS OF EVALUATION OF A BROADER CHANGE TO SINGLE FAILURE CRITERION

PRESENTATION TO ACRS

Hossein Hamzehee (415-6228)
John Lane (415-6442)
Office of Nuclear Regulatory Research

June 1, 2005

Status of Evaluation of Broader Change to Single Failure Criterion

Purpose:

- The purpose of this presentation is to provide a summary of:
  - Status of our evaluation of a broader change to Single Failure Criterion.
  - Planned follow-up activities.
- We are seeking ACRS to provide feedback (via a letter) on:
  - Work completed to date on risk-informed alternatives to current Single Failure Criterion (SFC)
  - Planned follow-up activities

Evaluation of Broader Change to Single Failure Criterion

Presentation outline:

- Background
- Summary of Technical Approach and Work Completed To date
- Summary of NRR Major Comments
- Planned Follow-up Activities
- Schedule

Broader Change to Single Failure Criterion

Background:

- In March 31, 2003 SRM on risk-informed changes to 10 CFR 50.46 (ECCS Acceptance Criteria), the Commission approved most of staff recommendations on possible changes to LOCA requirements, and also directed the staff to:

  - Risk-inform current requirements of coincidental LOCA/LOOP.
  - Pursue a broader change to SFC and inform the Commission of its findings beyond what is being considered for exemption request for LOCA/LOOP.

- This work was done in response to Commission directive to "Pursue a Broader change to SFC"

  - Our interpretation of "Broader Change" is RI alternatives that could apply to all plant functions (safety and non-safety).
  - Could lead to changes in licensing, programmatic activities (e.g., testing and inspections), and plant performance monitoring.

Broader Change to Single Failure Criterion

Background (Cont'd):

- The term "Single Failure" is defined in 10 CFR Part 50 Appendix A:

  "A single failure means an occurrence which results in the loss of capability of a component to perform its intended safety functions. Multiple failures resulting from a single occurrence are considered to be a single failure. Fluid and electric systems are considered to be designed against an assumed single failure if neither (1) a single-failure of any active component (assuming passive components function properly) nor (2) a single failure of a passive component (assuming active components function properly), results in a loss of the capability of the system to perform its safety functions."

  [Associated Footnote: "Single failures of passive components in electric systems should be assumed in designing against a single failure. The conditions under which a single failure of a passive component in a fluid system should be considered in designing the system against a single failure are under development."]

Broader Change to Single Failure Criterion

Background (Cont'd):

- SFC requirements exist in two major contexts:
  - GDC of 10 CFR 50 Appendix A which identify safety functions and associated safety systems to which SFC applies.
  - Design-Basis Accident (DBA) guidance of chapter 15 of RG 1.70 and Standard Review Plan (SRP)

- SFC is one element of NRC defense-in depth philosophy
  - Accomplishment of key safety functions should not be dependent on a single element of design, construction or operation.
  - SFC promotes high safety system (safety function) reliability
  - Other regulations, guidelines, and programs, along with SFC, promote high reliability; e.g., QA requirements, Tech. Specifications, Testing, Maintenance requirements, Inspections

Background (Cont'd):

- Application of SFC has sometimes led to redundant system components having low risk significance based on PRAs.

  - DEG LOCA coincident with LOOP and a DG failure.
  - Application of worst single failure assumption for DBAs may result in unnecessary constraints on licensees.

- SFC has not always been applied uniformly to passive components in fluid systems
  - A risk-informed alternative should also consider potential failure of passive components

- Application of SFC has not always led to safety system design with reliabilities that were commensurate with their safety significance.
  - SFC supplemented by other NRC guidance, rulemaking and programs contributed significantly to maintaining acceptable level of safety; e.g., SBO rule, ATWS rule, etc.

Policy Issues

- A proposed risk-informed and performance-based alternative to SFC need to be consistent with Commission PRA regulatory policy guidance.

  - Maintaining defense-in-depth
  - Maintaining adequate safety margin
  - Security constraints
  - Consideration of uncertainty

- A proposed risk-informed and performance-based alternative to SFC need to be consistent with Commission guidance on phased approach to PRA quality.

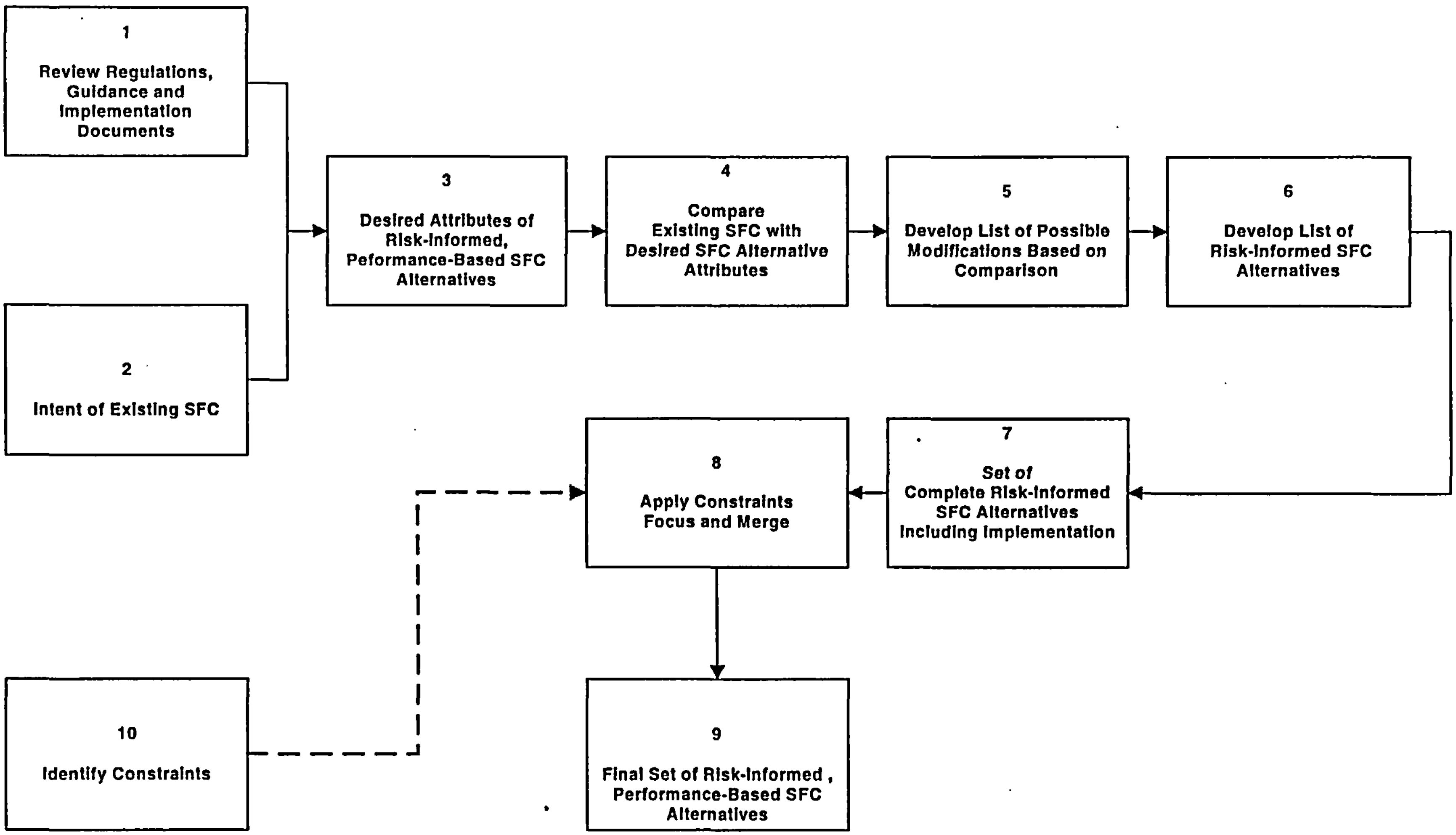
- A proposed risk-informed and performance-based alternative to SFC need to be consistent with Commission backfit and regulatory analysis policy.

- A proposed risk-informed and performance-based alternative to SFC need to be consistent with other on-going risk-informed activities; examples are:
  - Risk-informing requirements of 10 CFR 50.46
  - LOCA/LOOP exemption request from BWROG
  - Technical Specifications improvement

Summary of Technical Approach and Evaluation Results

Evaluation Process:

- A process was developed to identify and evaluate potential risk-informed and performance-based alternatives to SFC
  - This process is shown in a flowchart
- One major step of the process was to define desired attributes that a potential risk-informed and performance-based alternative should have. These attributes are:
  - Provide functional reliability
  - Maintain defense-in-depth
  - Risk-inform application of SFC in design-basis safety analysis
  - Use performance-based regulatory approach
  - Amenable to effective implementation
  - Coherent with other risk-informed regulatory initiatives
  - Maintain design requirements that contribute significantly to plant built-in capability to resist security threats



SFC Alternative Process Flowchart

Summary of Technical Approach and Evaluation Results

Baseline Alternative:

- This alternative continues to make risk-informed changes to regulatory requirements that involve specific issues, such as:
  - Proposed rulemaking on 10 CFR 50.46
  - LOCA/LOOP requirements
  - Risk-informed Tech. Specifications initiatives
- This alternative could result in measurable progress over time (one issue at a time) rather than attempting to address many related issues and regulations simultaneously.
- This alternative would not include a broad change to current licensing requirements to risk-inform SFC.
- Improvement of coherence among risk-informed programs would be limited under this alternative.
- This alternative would also consider updating the footnote in 10CFR50 Appendix A on passive failures in fluid systems.

Summary of Technical Approach and Evaluation Results

Alternative 1:

- This alternative would risk-inform failure assumptions made in DBA analyses in Chapter 15 of FSAR.

  - Single failures resulting in sequences with sufficiently low frequency would no longer be required in DBA analysis.
  - Unlikely initiating events would also be eliminated from DBA analysis.
  - Multiple failures in sequences with sufficiently high frequency would be added to DBA analysis.
  - Plant PRA will be used to demonstrate that cumulative frequency of sequences excluded from DBA is small.

- Potential plant changes proposed under Alternative 1 must also satisfy RG 1.174 guidelines.

  - This alternative could result in additional predicted safety margin.
  - Examples of potential changes are core peaking factors, power uprate, EQ requirements, allowed outage times

Summary of Technical Approach and Evaluation Results

Alternative 1 (Cont'd):

- Quantitative frequency criteria would be established for removal/addition of event sequences in DBA analysis.
- Proposed rule for 10 CFR50.46 could be considered special case of Alternative 1
  - SFC not required for LOCA sizes greater than Transition Break Size
- This alternative would be consistent with other ongoing risk-informed activities
  - 10 CFR 50.46
  - LOCA/LOOP
  - Framework for advanced reactors

Alternative 2:

- This alternative would risk-inform application of SFC to safety-related systems based on their safety significance.

- Risk-informed process proposed here takes advantage of current safety categorization process used in 10 CFR 50.69, "Risk-Informed Categorization and Treatment of Structures, Systems, and Components."

  - RISC-1 Systems: Safety Related & Safety Significant
  - RISC-2 Systems: Non-Safety Related & Safety Significant
  - RISC-3 Systems: Safety Related & Low Safety Significant
  - RISC-4 Systems: Non-Safety Related & Low Safety Significant

- This alternative includes 3 sub-alternatives based on level of defense-in-depth desired for RISC-3 systems.
  - Alternative 2a: Redundant safety-related train(s) would be removed from service
  - Alternative 2b: Redundant safety-related train(s) would be re-classified as non-safety-related
  - Alternative 2c: Operational flexibility would be provided for redundant train(S)

Summary of Technical Approach and Evaluation Results

Alternative 2 (Cont'd):

- Risk-informed requirements would be established for each risk category .
- Performance monitoring of system reliability would be required.
- Potential plant changes proposed under Alternative 2 must also satisfy RG 1.174 guidelines.
- This alternative promotes coherence with other risk-informed regulatory initiatives; e.g., 10CFR50.69, 10CFR50.46, etc.
- Implementation of this alternative is expected to require significant effort by NRC and industry.

Summary of Technical Approach and Evaluation Results

Alternative 3:

- This alternative would generalize SFC by applying a combination of:
    - Quantitative top-level risk targets (CDF and LERF)
    - Lower-level functional reliability targets commensurate with challenge frequency (e.g., post-trip decay heat removal function)
    - Requirements (targets) on redundancy and diversity

- This alternative would allow Licensees to determine which plant features to credit to meet targets.
    - Regulatory attention would be on plant-specific performance weakness relative to established targets.

- Extra licensee and regulatory attention would be directed to areas where plant redundancy and diversity do not meet targets.

Summary of Technical Approach and Evaluation Results

Alternative 3 (Cont'd):

- Performance monitoring would be required to determine whether performance targets are met, per regulatory guidance such as NUREG/BR-0303, "Guidance for Performance-Based regulation."
  - This applies to all 3 alternatives.
- This alternative promotes coherence with other risk-informed regulatory initiatives, such as Reactor Oversight Process.
- Implementation of this alternative is expected to require significant effort by NRC and industry.

Summary of Technical Approach and Evaluation Results

Conclusions:

- This work has identified and evaluated a range of risk-informed alternatives to current Single Failure Criterion.

- Additional evaluation and stakeholder involvement are necessary to assess practicality of implementing these alternatives

  - Interactions with stakeholders could result in identification of other viable alternatives.

- At this time, the staff does not recommend one alternative over another until follow-up activities are completed.

Broader Change to Single Failure Criterion

Planned Follow-up Activities:

- In response to a May 9, 2005 SRM, the staff will develop a formal program plan to make risk-informed and performance-based revision to 10 CFR Part 50.

    - The staff plans to continue follow-up activities and will include them in this formal program plan
    - This approach ensures that any changes to SFC are evaluated in a broader context with other risk-informed changes to 10 CFR Part 50.

- Planned follow-up activities include additional evaluation of implementation issues and additional stakeholder involvement.

Summary of NRR General Comments

- NRR has provided general and specific comments on the draft report that must be considered before the report becomes final. RES is working to resolve these comments as practicable. General comments from NRR are summarized below.

- It may be more appropriate to postpone further effort and include it in the "formal program plan" discussed in May 9, 2005 SRM to make risk-inform and performance-based revisions to 10 CFR Part 50.

- Overly broad replacement of SFC for currently licensed plants is not prudent. Efforts to risk-inform SFC need to proceed cautiously and systematically, with clear understanding of potential safety and resource impact. Therefore, the report should focus more on pros and cons of broadening the relaxation of SFC versus not doing so.

- When the report is forwarded to the Commission, it should be made clear that it may be too early to recommend a specific alternative, and that outstanding technical issues exist which need to be resolved.

Summary of NRR General Comments (Cont'd)

- The report states that SFC is proxy for reliability. Other benefits of SFC include avoiding excessive reliance on a particular element of plant safety, maintaining DBA mitigating capability during maintenance. These other benefits need to be addressed more directly in the alternatives.

Broader Change to Single Failure Criterion

Schedule:

- Draft technical report was completed in February 2005
- Draft technical report was issued for inter-office review/comment in March 2005 and comments were received in May 2005.
- ACRS briefing in June 2005
- Receive ACRS feedback via a letter by June 30, 2005
- Issue a Commission paper (with technical report) by July 29, 2005

Evaluation of Broader Change to the Single Failure Criterion

SFC Alternative Examples

Alternative 1
Example Description

- Illustrates potential for removal from design-basis an operationally-limiting, low frequency DBA sequence that includes an initiating event with a single failure

Alternative 1 Example
Key Features & Application

- Simplified containment event tree constructed for a double-ended MSLB in a PWR

- Limiting containment pressure event sequence: MSLB at low power with SFC = loss of DC bus

- Estimates for the IE frequency, low power probability and loss of DC probability, were obtained from typical PWR data

Alternative 1 Example Results

- Limiting DBA event sequence has frequency of 5E-10 /yr. Containment pressure for this event sequence is 41.85 psig (design pressure 42 psig)

- If all single failure sequences were removed from the MLSB analysis on the basis of low frequency, peak predicted containment pressure would be in the range 32-36 psig, therefore larger margins predicted

- Illustrates instance where low frequency event sequence, including SFC, may limit plant operations. Alternative 1 could provide more operational or performance flexibility

Alternative 2 Example Description

- Illustrates:
  - Potential for relaxation of SFC requirements for non-safety-significant, safety-related systems (RISC 3)
  - Enhancement of safety by now requiring monitoring of safety-significant, non-safety-related systems (RISC 2)

Alternative 2 Example
Key Features & Application

- BWR/4 PRA SPAR model plus 50.69 safety classifications used to classify all plant systems

- Use RAW importance measure to identify safety-related/low safety-significant systems and non-safety-related/safety significant systems

- 3 risk-informed sub-alternatives for relaxation of the SFC requirements are applied, including potential removal of redundancy requirement for low safety-significant systems. The impact on ΔCDF was evaluated.

Alternative 2 Example Results

- Four systems categorized as safety-related and low-safety-significant (RISC-3): Emergency Cooling Water, Standby Liquid Control, Core Spray, Reactor Building and Closed Cooling Water
- Bounding evaluation reduced all 4 RISC-3 systems to single train; ΔCDF = 1.2E-5 /yr
- 3 RISC-3 systems reduced to single train (SLC, CS, RBCCW) ΔCDF = 4.1E-7 /yr
- 2 non-safety related, safety-significant (RISC-2) systems (PCS, TBCCW) would require monitoring of reliability
- Illustrates potential for relaxing SFC requirements with small impact on plant risk and for increased safety as result of RISC-2 monitoring

Alternative 3 Example Description

- Illustrates
  - use of graded redundancy requirements based upon initiating event category
  - Guidance on diversity, and
  - Supplementation of SFC with top-level risk guidelines and safety function reliability targets

Alternative 3
Key Features & Application

- PWR PRA SPAR model
- Loss of offsite power initiating event (.03/yr)
- Decay heat removal safety function
- Based upon assignment of IE category "frequent" (>1E-2/yr)
  - A double-failure requirement specified for DHR
  - DHR functional unreliability target specified 1E-4
  - Overall plant CDF target specified 1E-4/yr
- Demonstrates how different combinations of DHR systems may be credited to satisfy the targets

Alternative 3 Example Results

- CDF (total, not just LOOP contribution) and DHR function unreliability computed for several combinations of DHR systems
- {EFW only} satisfies SFC, but none of the new targets
- {EFW + any other train} satisfies all targets
- {EFW + all other trains} provides increased flexibility
- Illustrates how plant system combinations may be used to address CDF and Initiator-category-specific targets on redundancy, diversity and functional reliability