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NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

FEBRUARY 4, 2000

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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MEETING: 469TH ADVISORY COMMITTEE

ON REACTOR SAFEGUARDS (ACRS)

U.S. Nuclear Regulatory Commission

11545 Rockville Pike, Conf. Rm. 2B3

White Flint Building 2

Rockville, Maryland

Friday, February 4, 2000

The committee met, pursuant to notice, at 8:30 a.m.

MEMBERS PRESENT:

DANA A. POWERS, Chairman

GEORGE APOSTOLAKIS, Vice Chairman

THOMAS S. KRESS, ACRS Member

JOHN D. SIEBER, ACRS Member

GRAHAM B. WALLIS, ACRS Member

ROBERT L. SEALE, ACRS Member

WILLIAM J. SHACK, ACRS Member

JOHN J. BARTON, ACRS Member

ROBERT E. UHRIG, ACRS Member

MARIO V. BONACA, ACRS Member

P R O C E E D I N G S

[8:30 a.m.]

DR. POWERS: The meeting will now come to order. This is the second day of the 469th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the Committee will consider a list of things that are longer than I can read in one breath. Among the things in this Committee's agenda for today are impediments to the increased use of risk-informed regulation, the use of importance measures in the risk-informing 10 CFR Part 50; proposed final revision of Appendix K to 10 CFR Part 50; report on the Reliability and Probabilistic Risk Assessment Subcommittee; report of the ACRS/ACNW Joint Subcommittee; NRC Safety Research Program report to the Commission; reconciliation of ACRS comments and recommendations; future ACRS activities, report of the Planning and Procedures Subcommittee; proposed ACRS reports.

The meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Mr. Sam Duraiswamy is the designed federal official for the initial portion of the meeting.

We have received no written statements from members of the public regarding today's session. We have received a request from a representative from Caldon Incorporated for time to make oral statements regarding the

proposed final revision of Appendix K to 10 CFR Part 50.

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

Do any of the members have opening comments they'd like to begin with for the beginning of the session?

[No response.]

DR. POWERS: Seeing none, I think we'll turn to the first item on our agenda, which is the discussion of the impediments to the increased use of risk-informed regulation, and the use of importance measures in risk-informing 10 CFR Part 50.

Professor Apostolakis and the esteemed Dr. Kress are jointly responsible for this particular area of great interest to the Committee. I believe that Professor Apostolakis has volunteered to go first on this subject.

DR. APOSTOLAKIS: Thank you, Mr. Chairman. We have several people who will share their thoughts with us today. We have three invited experts, and now I see the staff will make a presentation. I thought you were not going to.

MR. KING: No, we had always been under the impression that you wanted our thoughts on this.

DR. APOSTOLAKIS: We want your thoughts.

MR. KING: They're in the presentation.

[Laughter.]

DR. APOSTOLAKIS: So I propose then, to encourage the discussion, that our invited guests come and sit up front here, as well as Tom. Are you making the presentation?

MR. KING: The three of us. What we have done on ours is, we've combined thoughts on impediments, along with your topic on importance measures.

DR. APOSTOLAKIS: So if we start, then we start with you, and all three of you?

MR. KING: All three of us.

DR. APOSTOLAKIS: Okay, why don't you do that. I really would like all the presentations to be as short as possible, so that we'll have enough time to just discuss things.

If you feel that some of these items are generally known to people, please go over them very quickly, or just don't use the viewgraph at all.

MR. KING: We can get away with two viewgraphs.

DR. APOSTOLAKIS: Good. You can get away with a lot of things.

MR. KING: For the record, my name is Tom King, from the Office of Research, and with me are Gary Holohan

from NRR and Marty Virgilio from NMSS. We felt it would be useful to get the two program offices, as well as Research, because I think the things we're going to talk about cut across all the offices, and a lot of them are generic in nature.

From the handout, what I'll show are Slides 3 and 4.

DR. APOSTOLAKIS: Okay.

MR. KING: What we have tried to do is sort of organize things into six topical areas that we think cover the key elements of risk-informed regulations.

The first three are shown down the left-hand column. Then we've tried to put in the middle column, some of the more important activities that are going on under each of those elements, and then in the right-hand are what we call challenges, not impediments, because depending on the outcome of these challenges, they may or may not end up being impediments.

So I'm going to go through these quickly, and then we can talk a little bit about which ones we think are the major ones, and have any discussion we want.

The first element is policy. You know, we have a PRA policy statement. There is the White Paper that the Commission issued last year, giving definitions for risk-informed regulation.

We have a reactor safety goal policy, and NMSS is now working in response to the SRM they got on SECY 99-100 to develop safety goals and the approach for risk-informing their activities.

We think certainly some of the key challenges are the development of safety goals for the non-reactor activities because they cut across a number of different thing that affect and have different levels of risk.

I understand the EDO recently signed out a memo back, jointly, to ACRS/ACNW on where they're planning to go in this area.

Another key challenge is the issue of voluntary versus mandatory.

DR. APOSTOLAKIS: Are you using the word, challenge, instead of impediment?

MR. KING: I'm using the word, challenge, instead of impediment, because not everything that's on the plate today that we have to work on, that we've got in the challenge column, will end up being an impediment.

It depends on the outcome of how our work and how our resolution, proposed resolution of those things turns out. And some of them aren't even under our control, so -- but anyway, we use the word, challenge, because we don't want to give the impression that all of that stuff are impediments at this point.

The voluntary versus mandatory issue: You know, the Commission has made the policy decision on risk-informing Part 50 and Reg Guide 1.174 so that it's voluntary. You know, it could lead to two different regulatory approaches two different regulatory schemes that might cause in some people's minds, confusion.

That's certainly a challenge. Whether it's an impediment or not, I'm not sure.

There is also the issue of when we're going through and risk-informing Part 50, if we find things, gaps in the requirements that we think ought to be plugged, and some of those gaps would pass the backfit test, the issue before us is do we pursue those on a mandatory basis?

Our view at this point is that we would probably pursue those as mandatory. They would not be thrown into the voluntary, even though they were uncovered as part of working on this program that's being implemented in a voluntary fashion.

If we find some things that pass the backfit test, we may not leave those as voluntary.

DR. APOSTOLAKIS: So the challenge is to make -- to create the two systems, the voluntary and mandatory, or recognizing that you can't really have two systems, and the challenge is how to handle the mixture.

MR. KING: I think the challenge is how to handle

the mixture. Gary will expand on that.

And the other challenge is how do you handle things that would pass the backfit under a voluntary system?

Moving down to strategy, we have a different PRA implementation plan. We got criticized by GAO that we didn't have a real strategy for risk-informing agency activities.

We've now -- the EDO recently signed a memo out to the Commission, saying that we're going to develop such a strategy, and we're going to covert this PRA implementation plan into what we're going to call a risk-informed implementation plan. The first version of that is due to the Commission at the end of this month.

It will lay out more how we go about making decisions on what should be risk-informed, and the steps and activities that need to take place to get us there.

So, it's going to be a more comprehensive document and be more like a road map type document. Again, it's going to cause us to deal with the question of where we want to go, you know, what should be risk-informed in the agency, and what are the resources and the schedule that it's going to take us to get there.

There is also a concern that if we do all of this, how much of the industry is really going to utilize all this risk-informed approach, whether it's reactors, whether it's

the NMSS side of the house.

DR. APOSTOLAKIS: Why is that a challenge?

MR. KING: It's a challenge in the sense of, does the agency want to spend its resources doing risk-informed things that the industry isn't going to utilize? Where is the cost/benefit tradeoff, and where do you draw the line? How do you decide that I want to spend agency resources to do certain things when there's really a lot of uncertainty out there in terms of how much is going to be utilized when we're all done.

To me, that's a challenge, and we don't have an answer to that at this point. In my view, that's one of the more major challenges.

MR. HOLAHAN: I think it's clearly a challenge. If you look at the words that the Commission gave to the Committee to look for, examples of impediments to the increased use of risk-informed regulations in a voluntary kind of program, if the industry doesn't want to do it, and that's a voluntary choice, I mean, that's clearly going to slow down, and in some cases, stop the increased use.

So, it seems to me to fit the definition, definitely of a challenge, and potentially an impediment.

DR. POWERS: I can imagine that industry refusing or declining to make use or avail themselves of some of the opportunities for risk information in their licensing

applications could pose a challenge to the staff to continue to develop those items.

But I don't think it stops. It seems to me that one of the purposes of converting to risk information is that it serves NRC's own organizational goals, as well as serving the public and the reactor licensees. I see it as a way of focusing its manpower, as well as focusing the resources of the industry.

MR. KING: I think that's true for things like the plant oversight process where that's our program. We're going to risk-inform it and implement it.

Okay, the third item is staffing. I think I sort of wrote this as applying to NRC staffing, but I think it also could apply to licensee staffing as well.

Clearly, we've got training programs, we have a senior reactor analyst program. We're continuing to look at what the training needs are and what the staffing level needs are.

I think one of the big things that's going to influence that, what I call a challenge, is how much NRC prior review and approval is going to be necessary on these risk-informed applications.

Under Reg Guide 1.174, the staff has been reviewing and approving those submittals. The proposal on risk-informing Part 50, Option 2, the Special Treatment

Rules, is to come up with a scheme that would allow those to be implemented without a lot of staff prior review and approval.

We've got the same question in front of us for Option 3, the Technical Requirements. We don't have an answer to that yet, but the answer to that question is going to drive what kind of staffing, what kind of levels, what kind of qualifications, training, and so forth, is needed.

I think on the industry side, how much of the risk-informed regulatory approach they adopt is going to drive what kind of staffing and training they need on their side, too. So I think that's certainly a challenge. Whether it's an impediment or not, I don't know.

MR. HOLAHAN: What I see is the challenge in this area -- there are really two areas: One is do you have a core of real experts? I think we've done a pretty good job of bringing in or training experts.

The highest level of expertise is pretty good. But then there is the other 90 percent of your staff that you'd like to raise to at least some comfort level and working knowledge of risk-informed regulation.

I think that's a continuing activity that's going to go on for awhile. We have done sort of one round of training for everybody, but I think that clearly that's not enough, and we're going to have to continue on that end of

it.

MR. KING: Okay, the other three areas: Decisionmaking, which is really providing guidance documents, both through the industry and the staff to utilize. We're making progress in that area, certainly, with the Reg Guide 1.174, the plant oversight process, risk-informed enforcement.

We're working on risk-informing Part 50, and NMSS is embarking on looking at risk-informing their activities. So there is a lot going on.

To me, the two biggest challenges are the issue of selective implementation, which we have identified as a policy issue to the Commission. They recognize that. We still owe them a recommendation as to how to proceed in that area.

And that certainly can be tied to a couple of the other challenges. I think some of these challenges are not mutually exclusive; they're tied together.

For example, selective implementation is certainly tied to the perception by some people that risk-informed equals burden reduction, particularly if licensees are allowed to only pick the burden reduction items and not take the other side of the coin with it that adds to that perception.

DR. APOSTOLAKIS: Well, what's wrong with that?

Let's say that there is an issue where by using a risk-informed approach, you reduce burden? And there's another issue, by using risk-informed approaches, you're doing something else and maybe -- what's wrong with selecting to apply it only to the issue where you reduce burden?

MR. HOLAHAN: I think that example is okay.

DR. APOSTOLAKIS: All right.

MR. HOLAHAN: I think the issues that we try to deal with is the way they are related topics. You can get a biased approach to things if you just try to pick part of an issue.

DR. SEALE: I'm puzzled that you don't have the question of benefit assessment as a part of the decisionmaking list of activities. It strikes me that there are an awful lot of creative bookkeeping opportunities you might have here.

For example, we know that even recently, people who have gone in and looked at the applications of risk methods to quality assurance-related activities have reaffirmed that there is potentially a large cost savings for those people in that activity.

They paid the front-end costs, namely, they have put together a group to do the job, and so on, and that may be a cost that no one else is willing to, or others may not

be willing to bear on the front end of that process.

But when you calculate the benefit in terms of dollars, are you going to include the dollars saved by that entrepreneurial utility that goes out there and pays the piper to put together the group, do the job and make the proposal?

That's much more benefit-loaded, if you will, if I can coin a phrase, than if you just look at the NRC costs involved.

MR. KING: Being that it's a voluntary program we're not going through and assessing in any detail, the cost to licensees or the cost to NRC.

DR. SEALE: Then you don't really have a chance of a snowball of coming up with any winners on the cost/benefit.

MR. KING: Well, the thing we are doing is looking at the costs associated with any of these items that are burden reduction. We're using that to prioritize what we work on first.

DR. SEALE: Well, I could argue that QA is burden reduction.

MR. HOLAHAN: I think the argument that we have consistently used is that the people who are paying the bills are in the best position to decide where the burdens are. And when the industry came to us and said, QA, tech

specs, ISI and IST were their choices, I think they're in the best position to know that those are, you know, burdensome items.

And, you know, whether we do a lot of work to confirm that or not, I think really doesn't make a lot of difference.

DR. SEALE: Unless you come up with a decisionmaking process that's so loaded in the other direction that you do not confirm the utility indication that those are appropriate things to do.

MR. KING: Well, as Gary said, the industry has really identified the things important to them from a burden standpoint.

We're using that information in trying to prioritize what do we work on first, recognizing that there is also the safety side of that equation as well. If this were a backfit where we were imposing these things mandatorily, then, yes we'd have to a full blown cost/benefit.

But since it's voluntary at this point, we're not doing that, unless something from the safety side pops up that we want to impose it through that process.

MR. VIRGILIO: I just wanted to add, in sum, I think Tom's slide covers the issues, but if we back up a little bit and think about where we're going strategically,

we're looking at a number of performance goals.

One is maintain safety, and I see the opportunities to use risk-informed decisionmaking to fit very nicely into that maintain safety.

Another one of our goals is to make our programs more efficient and effective, and realistic. Here, again, I see an opportunity to use risk-informed thinking in that process or those processes that we use.

And the third area is burden reduction. I see an opportunity for us to use risk-informed thinking to reduce the burden on those industries that we regulate.

The fourth performance goal is increased public confidence. And that's the tricky one, because in moving forward in risk-informing our programs, we have to be conscious that for some of our stakeholders, that's perceived or interpreted as reducing requirements and making our regulated activities less safe.

So we have to balance that out. But as far as I'm concerned, it's maintain safety, increase efficiency, effectiveness and realism, and reducing the burden where this plays the biggest role.

MR. KING: All right, the second item, the slide, tools, I think there is a lot going on in improving PRA methods, as well as the basic tools that you use for doing thermal hydraulic analysis and so forth.

There are certainly some challenges in those areas. I'm not certain I would classify any of those as impediments.

We've been criticized for the lack of completeness in risk assessments by some external organizations. For example, PRAs don't address design and construction errors.

Some people have held that up and said, well PRAs are no good then. Or they say you have plants that look very similar, and PRA results come out different.

DR. POWERS: I guess I can fully imagine, and probably have even seen people say they don't address design and construction errors, and so they're no good.

But I think people are may not actively hostile to core damage frequency -- I mean, to PRA analyses have said, gee, that is a problem that we can address with the current technologies. Have they tried to assess how much of a difficulty that is or how much of a challenge that represents?

MR. KING: We have -- I don't think we have published anything, but we have gone back and looked at the kinds of design and construction errors that have been found in the past, and tried to assess the risk significance of those.

And it turns out none of those are very risk-significant. We do not have any program in place to

try and account for those in PRA models.

DR. POWERS: Well, I know that some of the investigators at the Joint Research Center at Innsbruck in Europe have been particularly interested in that area for reasons I'm not too sure about.

But they are active opponents of risk analysis. I wonder if they have found anything that would say that this is a debilitating flaw in the PRA technologies?

MR. KING: I'm not familiar with that particular piece of work, but I haven't heard anything that says it's a fatal flaw in risk assessment, that it doesn't account for design and construction errors.

MR. HOLAHAN: I think the other question you always have to ask yourself is, what's the alternative? It's not clear that the deterministic approach is any better at finding things that you don't know about. So you just deal with them as best you can in either system.

DR. KRESS: That's one of the reasons you use defense-in-depth.

MR. HOLAHAN: That's one reason you use defense-in-depth.

DR. KRESS: Let me ask you another questions about the tools, Tom. Do you consider the fact that you guys don't have, inhouse, inhand, a set of, let's say, surrogate PRAs that would represent the whole population of plants?

You know, you may need a whole set of them, but I don't know how many for your own use in assessing risk implications of things you do yourself, like the way you craft a regulation or the way you make a decision about something.

And instead of the fact that all the PRAs we have are out there and blown to the licensees, and there's no real regulatory requirement that they be used. Do you consider that any kind of an impediment or challenge?

MR. KING: Well, I think I disagree with your first statement. I think we do have tools inhouse that cover the spectrum of plants out there. I mean, we have plant-specific models through the accident sequence precursor program.

Now, they are being upgraded to add better containment modeling, shutdown, and so forth. There is still some work to be done, but they are plant-specific. We can use them and we do use them for looking at operating events, you know, for things like assessing inspection findings and so forth.

We certainly have the 1150 models, we have access to some of the licensee PRAs, the detailed models. So I don't think that's an impediment. I think we have enough.

DR. KRESS: Could you use those tools, say, to confirm importance measures for a specific plant?

MR. KING: We could certainly use those tools to calculate importance measures, apply importance measures and do the calculations ourselves, yes.

MR. HOLAHAN: Well, I think there is a little difficulty -- we're better off when we're using things a little more generically. Even the best of our models, it's hard to say whether we're keeping up to date with the actual plants.

DR. KRESS: With regulations, you would like to be generic anyway, if you could.

MR. HOLAHAN: Yes.

DR. KRESS: But you think you have sufficient tools inhouse now to represent the whole class of plants out there?

MR. HOLAHAN: Yes.

MR. KING: There is still some improvement that needs to be made.

DR. KRESS: Of course.

MR. KING: But I don't consider that an impediment.

DR. KRESS: Thank you.

DR. APOSTOLAKIS: I realize that it's risk-informed regulation, so I'm not using only PRA results. But isn't it a disturbing trend whenever we find a problem with the analytical tools, that we say, gee, you know, the

expert panel will take care of it?

The baseline inspection program will take care of it. We really don't rely on these numbers.

I think that's an impediment to progress. I think if we are using an analytical tool, it has to be sound. It doesn't have to be, you know, the best tool in the world. It could be an approximation.

But I think we're going too far justifying the use of analytical tools that are not really that good, by saying, well, that's only part of the process. In the integrated decisionmaking framework we have developed, the experts will take care of it.

Do you think that is an issue, or maybe a potential issue, impeding progress, perhaps?

MR. HOLAHAN: Well, this is a problem we've had all along, and maybe in that sense, it is a challenge or potential impediment, which is, if you want to make progress, you have to be in the production mode. You have to be prepared to make licensing decisions. You're prepared to use things in your inspection and oversight process.

In order to do that, you have to be willing to use what's currently available, and not wait for those things to get better, you know, to have the perfect model. So there is always this challenge of, if you want to make progress in the sense of actually, you know, using the information,

there's a pressure to use what currently exists.

And once you are willing to do that, it does relieve some of the pressure on producing, you know, better models.

DR. APOSTOLAKIS: That's right, especially if the regulator says this is fine.

MR. HOLAHAN: Yes. I mean, that's the nature of things. And the question is --

DR. SEALE: Are you too easy?

MR. HOLAHAN: Well, you know, what is the optimum amount of progress? Should you hold back and say I refuse to grant any relief until the models get better? In that case, maybe you come out with a better program, but you have to wait five years to get there.

Or do you say, well, let's make the best use of what we've got now, in which case the models are less perfect. The decisions are probably not as good, but you get, you know, the actual use and implementation of that at an earlier stage.

DR. APOSTOLAKIS: But that is a challenge, though; is it not?

MR. HOLAHAN: That is a challenge, and w have chosen on that point to be pragmatic, and that's -- if you remember the wording in Reg Guide 1.174, it basically says the models should be appropriate to their use. They

shouldn't be necessarily even the best that you can do; it's a practical approach.

MR. VIRGILIO: Mr. Chairman, if I can go back to Tom Kress's question for a minute, just to make sure that we have the complete answer.

One of the areas where risk-informing the materials is Part 70, the regulations that govern the fuel cycle facilities. One of the provisions of Part 70, if it were to be approved, would be to have each of the facilities perform an integrated safety assessment, an ISA.

One of the issues that we have right now before us, comments from many of the stakeholders on the proposed rule is the level of detail of information that they would submit to us on this integrated safety assessment.

The staff would like to have a fairly good summary of the integrated safety assessment so that we could use it as you suggest to make both plant-specific decisions, and also for broader decisions on where we go in our regulatory programs.

So I just wanted to make sure that you were aware of that as an issue that's being debated right now. Many of our stakeholder comments would be to say that they wouldn't submit any information about their integrated safety assessments, but just the brief summary.

MR. KING: Yes, and let me follow up with two

things: When I said we had adequate tools and it was not an impediment, I was talking about reactors only. I wasn't trying to speak for the NMSS side of the house.

DR. KRESS: Yes, I gathered you meant just reactors.

MR. KING: The other thing, to follow up on what Gary said, it is a two-edged sword. I mean, we've seen in our efforts to work with ASME to develop a standard for PRA that we've gotten some criticism saying, well, you've approved license amendments without a standard, so why do we need a standard?

That's somewhat frustrating in that we do believe the standard is important. We believe it's certainly key to allowing us to have things implemented without NRC prior review and approval.

Yet the fact that we're proceeding in approving license amendments now, today, without a standard, you know, to have that used against us or used against the standards effort is somewhat frustrating. So, call it a challenge.

DR. WALLIS: Tom, there is something about PRA which seems to me different from other things. In the areas of thermal hydraulics, you have models, and everybody knows the models are an attempt to make sort of engineering assessment of things.

But eventually, there is something called

validation. You actually do a test. You do system effects tests, where you test the whole thing, and then this is a check to say it works.

And the thing with PRAs is that there is all this structure put together, which most people would say is great, but then you don't have the system validation. People come up with numbers of $10^{(-6)}$ and $10^{(-8)}$, and they are bandied around. And there's a sort of suspicion in the back of your mind that, well, this isn't very accurate, because we haven't validated it; it hasn't been checked with reality.

And we can't do tests at that level of probability, anyway. And so people put, mentally, an uncertainty of a factor of ten or a hundred or something, on these numbers, and I don't know how you get around that.

MR. HOLAHAN: Well, clearly, you cannot do validation of the $10^{(-6)}$ kind of events. But that doesn't mean you can't do any validation.

And the validation of PRAs, in my mind, is operating experience. You compare your PRAs with operating experience, and you see, to the extent that you can, whether there are consistencies, and then work those, you know, more recent operating experiences into your models.

The tendency is that the models get validated on the high probability/low frequency end, and not the low

probability -- however I said that -- on the high probability --

DR. APOSTOLAKIS: The other way.

MR. HOLAHAN: On the high probability/low consequence, and not the low probability/high consequence end.

But so you do get some information on part of the curve, and a part of the old AEOD now -- segment that's still working in research, on operating experience and stuff like that, part of their job is to see that that makes -- that operating experience and PRAs, in fact, are being maintained as in the sort of validation mode.

MR. KING: I have a whole branch that does that now. The purpose is not solely to validate PRAs; it's to look for generic lessons and insights and so forth. But they look at issued reports on initiating event frequency. They have issued reports on system reliability, they have issued reports on accident sequence precursor program.

In general, they tend to confirm, as Gary said, that at one end of the spectrum where we have data, they tend to confirm that the PRA numbers are pretty reasonable.

DR. KRESS: I tend to agree with you that operating experience is the prime method of validating the PRAs. Now, I think what they do is help you assess the uncertainties where you have that experience.

It's the uncertainties on the other end that you get from other sources by, you know, expert opinion and whatever, the information you have, but to me, that uncertainty in the PRA results is the measure of validation. How uncertain it is, and if you have an uncertainty distribution, you have a measure of validation.

So that leads me to my question. The question is about your inhouse tools you had, how sufficient and good they are for your purposes and regulatory needs.

Do these have any capability of assessing uncertainties as you go along, routine assessment of uncertainties, or do you have to just rely on what uncertainty analysis that we already have, say, from 1150?

MR. KING: No. The PRA tools we have, you are able to model uncertainty, certainly parameter uncertainty. We don't model uncertainty of things like success criteria or some of the models, but they do model parameter uncertainty.

DR. KRESS: They do model parameter uncertainty -- Monte Carlo methods?

MR. KING: Yes, I think they're Monte Carlo. I'm not exactly sure.

DR. APOSTOLAKIS: I think they're Monte Carlo. I think it's important when we talk about validation, to also bear in mind that there is a second very important way for

validating models ,although the work is not really appropriately used in the same sense as in thermal hydraulics.

I think it's the community at large, the judgment of people. I mean, we have done -- we have had PRAs done all over the world for light water reactors.

And if someone comes up with an unusual accident sequence, you know, somewhere, the word spreads immediately. It's reviewed by everybody. Is this right? Why do they do this? Is there anything special about their reactor that we don't have?

And if people find that to be a reasonable finding, then immediately it is adopted. So after 25 years or so of doing these kinds of things -- and that applies to models, to methods, you know. Again, if you look at the history of the thing, the reactor safety study did not do much in the area of earthquakes and fire.

And Zion, Indian Point come up with fires and earthquakes as being the dominant contributors. The staff is shocked. What's going on? They reviewed it and that makes sense.

They start a major project at Livermore to study seismic risk. You know, eventually there is some stability. You don't have these evolutionary findings anymore. I mean, I think it's very unlikely that some group from somewhere

will come now and say, you know, for PWRs, here's a major accident sequence that all of you guys have missed.

So I think that's another measure. These are probabilistic models. I mean, you can't really have validation in the sense that you have it for mechanistic models.

DR. POWERS: George, let me ask you a question, and maybe the answer is that we just haven't achieved the stability, and I will accept that as an answer.

But I know that, for instance, Surry has been examined as kind of a base case for every major PRA effort that has been undertaken.

And it is my perception that every time we investigate Surry, we find something that's significant, and the plant undergoes changes.

I think that was true for WASH-1400. I think it was true for Nureg 1150, and I think it was true for the IPEEEs, if I'm not mistaken.

Is that something to be of concern?

DR. APOSTOLAKIS: I think you have to look more carefully at why you find things, and what is the significance of the things you're finding.

I don't think that you are finding things now of the same significance as, say, Indian Point coming and saying seismic risk dominates everything and is the number

one contributor, whereas before, just a month earlier, you thought that seismic was nothing, because, you know, of the redundancy and all that.

I don't think you find things like that anymore. Also, you know, it is a disturbing fact, there is no question about it, but it's not of great significance, I don't think.

I think it depends a lot also on when the PRAs were done, by whom, for what purpose. You know, there are all these administrative things.

DR. POWERS: I think you hit a very key point that we've got to bear in mind. There is a lot of baggage that it seems to me gets carried forward from WASH-1400 and a lot of pronouncements that came from blue ribbon panels about the nature of PRA in those days that really was very useful.

I'm glad that those panels said what they did, but really the technology has progressed a lot more.

DR. APOSTOLAKIS: Yes, it has progressed a lot.

MR. HOLAHAN: I think I'd like to agree with about two-thirds of what Dr. Powers said, and one-third of what Dr. Apostolakis said.

DR. APOSTOLAKIS: Agree or disagree?

MR. HOLAHAN: I would like to agree with two-thirds of what Dr. Powers said.

DR. POWERS: Thank you. Finally, I'm one up on

him.

[Laughter.]

DR. WALLIS: No, at this point, Dr. Apostolakis has more.

[Laughter.]

DR. APOSTOLAKIS: This is a validation now.

MR. HOLAHAN: And what I mean by that is, I think, in fact, each time you do a study -- for example, my recollection is that the latest of those studies was the IPE which showed that flooding was more important, and, as a matter of fact, was quite important.

And I have seen, you know, example after example of, in fact, the dominant risk having not been modeled at all previously in a plant, or it just jumps out.

But in most of those cases -- and this is the part that I agree with Dr. Apostolakis on -- in fact, some of those things that look like they're so important, in fact, get analyzed again later, and turn out not to be quite as important as you thought they were.

And sort of the shock value is remembered, but the realistic analysis sometimes takes a longer period of time. And so, in fact, the Surry flooding, which looked like the dominant risk for Surrey, in fact, I think, was not quite that.

But if we went back and did another study of

Surry, I think we would find something else. It wouldn't be probably the dominant thing, but there -- it's not unusual to find another important contributor.

DR. POWERS: Let me reveal some ignorance here, maybe, and ask a question which may not have an answer to it right away, and that's okay.

It is my perception that there are different styles within the community of people that do risk assessments, and that you can look at the results of a risk assessment and pretty well say, ah, this falls in this kind of style camp and this other one fall in this style.

The way you do that, at least to my somewhat naive view on the subject, is some risk assessments that I see -- Level I's I'm speaking of only -- have lots and lots of small contributors to the overall CDF, lots of them.

And others, especially those, I think, done by work sponsored by the NRC or maybe done by the NRC staff, seem to have a few of what they'd say are dominant events.

When you look in detail at them, the one with lots of what we call grass, I think, sometimes has simply broken down those dominant accidents more finely. Is that difference in style any challenge in this community or is that just an accepted variation in approach?

MR. HOLAHAN: You started out by saying maybe we couldn't answer this question.

DR. POWERS: Or don't want to.

MR. HOLAHAN: Well, there is clearly a challenge in communications. Even when we talk about sequences, they can mean different things, depending upon, you know, how they're modeled. I think there's always a challenge in how these things are done.

There is also -- in my experience, when you look at a dominant sequence and you look in more and more and more detail, usually you find out that there is some conservatisms. In fact, a part of the reason that a sequence is dominant is any conservatism put in it, tends to push it up above other things.

Perhaps part of what you see in this difference which is called style, is, I think when the NRC finds something that looks dominant, perhaps we don't have as much incentive, you know, to be more realistic as perhaps a utility which says this looks very bad and I think I need to understand it much better.

DR. POWERS: That's a very good point.

MR. HOLAHAN: From our point of view, we could leave that conservatism there, and --

DR. POWERS: Pose the question.

MR. HOLAHAN: And pose the questions. A licensee is more in the mode of having to answer that question, and they might, in fact, want to take more of the conservatism

out and continue the analysis.

DR. POWERS: I think that's a very useful insight to me.

DR. APOSTOLAKIS: Also, I'd like to make a comment on the earlier point. When I said that people would not be surprised and so on, I meant the state of the art. I didn't mean individual PRAs for individual plants, because those depend on a lot of other things.

But you don't have the major changes in the state of the art now that you had, say, 15 years ago.

DR. POWERS: Of course.

DR. APOSTOLAKIS: When you thought that the class of events was unimportant and somebody says, no, these are important. So it is at Surry they found that flooding was a dominant contributor, and that didn't surprise the community because they knew that flooding was something that could be up there.

It may have surprised people who had studied Surry before, but these are two different things, and I don't think we should mix the two. The application of a PRA to a particular plant, may be very good and may not be very good. It depends on when it was done.

They may have missed things, but as a state of the art, I think there's a difference there. Like maybe -- when was it? Several years ago when the results came from France

and then from other places that shutdown and low-power risk was almost the same as the risk from power operations, that was a shock.

MR. HOLAHAN: Yes.

DR. APOSTOLAKIS: Okay? So this kind of shock doesn't happen anymore, or the probability is very low; let's put it that way.

MR. HOLAHAN: The frequency is lower.

DR. APOSTOLAKIS: Yes.

DR. WALLIS: I'm a bit concerned about what you just said, Gary, about reexamining your assumptions when you get the answer that you don't want.

MR. HOLAHAN: I don't think I said anything about wanting that.

DR. WALLIS: Essentially you said that if you got this shock and there's this big thing, you go back and try to change the assumptions and the conservatism in order to get an answer you like.

Now, that doesn't characterize a very mature technology in which one has confidence in its ability to predict things.

MR. HOLAHAN: I don't want to agree to your characterization of what I said.

DR. WALLIS: Well, maybe we should look at the record and see what you said.

MR. HOLAHAN: I think I used the word, realistic, to get more realistic to deal with conservatisms in the analysis. And I think that's entirely appropriate.

DR. BONACA: One thing I'd like to point out is that you made a statement before, Gary, regarding the pragmatic approach. I think that, to me, is the key issue. Right now we're making steps that are commensurate to the current knowledge, really.

And certainly if we do not improve some of the standards, at some point, that's going to become an impediment to further progress.

So, it's a step at a time. It seems to me now we do what we can do, we learn in that process, because we are still learning at the regulatory level. I mean, each application is a new learning experience, it seems to me.

And I think we have to drive the standards up, but I don't think that the fact of lack of standards today impedes the use of PRA in a limited fashion, as we are doing right now.

And in the long run, of course, that would be an impediment to further progress. I think that if we put it in that perspective, then we can really make progress.

My concern is that if we list now, all the deficiencies that there are in the standards, and what we don't know, we'll never move and go further.

I would say that we had the same limitations 40 years ago when we started to build these power plants. For those who remember, we had primitive methodologies to use to design these plants, yet we didn't stop just because we didn't have them.

So, I think that's an important concept to maintain, and the point that you made about the pragmatic approach, I think is a key here.

MR. KING: Okay, the last item, communication: I think that's something we don't talk about very much. There is certainly the internal communication with the staff, and the external communication with the stakeholders.

We have done some things. I think the pilot programs are a good way to communicate with the industry or to illustrate to the industry, what it takes to do things and what the benefits are.

I think we have certainly had some stakeholder meetings, we've had some internal panel sessions to bring the staff -- to educate the staff a little bit. But I think the real issue is what kind of communication has to take place to get the staff buy-in to the new way of doing business, and to eliminate the perception that risk-informed just equals burden reduction.

DR. APOSTOLAKIS: It's not just the only thing, though. That's related to what I said earlier about our

willingness to accept less than perfect, let's put it that way, models and rely on judgment to make up for the deficiencies.

Let's not forget -- and this is something that if we try to forget, Dr. Wallis always reminds us -- that one of the most important stakeholders is the technical community out there. We keep talking about stakeholders and we think in terms of either the industry or the public, public interest groups.

The technical community is an important stakeholder. And if you have the technical community forming a bad opinion about something because they think it's sloppy or they can do whatever is convenient to them, you know, they really don't care about rigor, and if you dare raise the issue of rigor, they call you academic and dismiss you.

You know, that's bad, that's really bad. And eventually other stakeholders who have other agendas will pick up on this and come back and haunt you.

So I think it's very important for us to try to be as rigorous as we can. Rigor does not mean perfection. Rigor does not mean that you're not allowed to use approximations.

But if you use approximations, you better justify them. You better have some basis, rather than saying, yes,

I know that it's not quite right, I know it's wrong, sometimes, but the expert panel will take care of it.

That kind of attitude, I think, communicates in itself, the wrong message. You are not trying to communicate now something, but your actions communicate.

DR. POWERS: I fully support everything you've said there. I'm reminded --

DR. APOSTOLAKIS: It's not two-thirds and one-third?

DR. POWERS: No, this is 100 percent. I am reminded that one of the great triumphs of physical chemistry has been the Huckle Model for ion activities in solution. It's based on an approximation that everybody knows is technically wrong.

DR. APOSTOLAKIS: There you are.

MR. HOLAHAN: I'd like to follow up on those two thoughts, and Dr. Bonaca's earlier thought, because I think this is a key issue, and how the standard plays into it.

If you think of risk-informed regulations having two stages, let's just say the practical stage in which we're doing the best we can with the tools we have now, and a later stage in which the models are better and everybody has a copy of the models and there is more operating experience and all of that.

I think how the standard plays into those two

stages is seen either as a help or an impediment, depending on where you are. For example, the industry sees the standard as being an impediment to the practical stage; that it will make it more difficult to remain at the practical stage because it will be harder to accept the approximations.

The staff sees that not having the standard is an impediment to reaching this second stage, okay? And we're not really talking about having two standards, right, the standard for the practical stage and the standard for the later stage.

So what we see is a community arguing over whether the standard is to help us at Stage 1 or to help us at Stage 2. And how that all sorts out, I think, and how you view that, is a very big part of the issue.

DR. POWERS: And there are other viewers in this jousting match. I shouldn't call it a jousting match -- in this effort.

There is the academic community that works very much at developing a standard that ossifies the technology, and at a time when maybe we're poised to making even greater leaps.

MR. VIRGILIO: George, I'd just like to say that your point is very relevant in high level waste today as we move forward with the total system performance assessment

for Yucca Mountain. There are many out there, EPA and other sister agencies, and others in the technical community that are watching very closely, what we do.

The ACNW has offered us a lot of constructive criticism about making sure that we do this rigorously, that it is transparent to everybody as to how we do our modeling and what assumptions we use. And it's important that we do that in order to maintain the credibility of our decisions.

DR. APOSTOLAKIS: And I fully agree. But I also was referring to communities of scientists or engineers like statisticians, for example, or research types who really don't have any particular interest in what we do, but then they happen to find out.

They say, my god, what are these guys doing, you know? That is really terrible. We don't want to acquire a reputation like that.

So, I think we have to be careful. Although everything that Gary said -- and you'll see how magnanimous I am -- I agree with him.

I really think we ought to reserve time for the invited experts.

DR. KRESS: George, could I ask one more question?

DR. APOSTOLAKIS: Sure, sure.

DR. KRESS: I meant to ask this at the start: It may be -- may sound like a strange question, but it is a

serious one.

When you guys talk about risk-informing regulations, what, exactly, do you have in mind? And let me qualify this a little bit so you know why I'm asking the question.

Do you think, in terms of -- if I didn't have a reactor out there at all, and I wanted to craft a set of risk-informed regulations to guide the design, construction, and operation of some unknown reactor, some unknown facility, that I know, in essence, what the inherent hazard is, but that's about all I know because I don't have a design, I don't have things to look at, I don't have anything I can do a PRA with, that would be one view of what risk-informing the regulations would be, a whole revamped set of regulations that are so high-level that you're addressing functional things as opposed to specific hardware and designs.

The other view might be that it's unrealistic to think that. All we have out there is a set of reactors already, and they're all LWRs, essentially. And we have the designs and we have PRAs for all of them, and we have a set of regulations already on the books.

All we need to do is risk-inform now, go in and check the parts of these regulations that we can change by risk information and make them a little more coherent, make

them make more sense, and maybe just look at specific parts of the regulations and change those in very specific ways, but not revamp the whole system.

Could you respond to that, one of you?

MR. KING: I think your first option is risk-based, would have to be risk-based, if you don't have an design and you don't have any idea what the plant is going to look like. All you're really doing is setting some targets for CDF or maybe some --

DR. KRESS: You could put concepts of uncertainty and defense-in-depth in that some way.

MR. KING: You could, but to me, that's more of a risk-based approach. What we're doing is more directed towards the latter, a set of regulations we're looking at using risk information, and the plants are there today.

And we're going to make changes to that, but the changes aren't going to be putting risk goals in the regulations; they're going to be modifying deterministic requirements to better focus on the things that are important, and get rid of the things that aren't important.

But they will still be deterministic requirements.

DR. WALLIS: I suggest that the first one as a thesis topic for one of our great academic institutions. They can take this overview look at what would you do if you had this risk-based regulation of nuclear reactors?

DR. APOSTOLAKIS: Great academic institutions need grants to produce great work.

[Laughter.]

MR. HOLAHAN: Can I skip over that thought and go back to Dr. Kress's thought? Clearly, from a historical perspective, if you pick up the PRA policy statement of 1995, it's written in the context of what should we do at operating reactors?

It starts out with the Commission's policy is to increase the use of risk information. So it implies that we have something here that we're going to change.

Interestingly enough, I think what we have achieved, conceptually in Reg Guide 1.174, in laying out safety principles and guidelines, would be a very workable safety philosophy for a new reactor design or a whole new, you know -- in fact, you could argue that it doesn't even have to be for reactors.

Some of the thinking is that it could be used for other technologies as well. Clearly, from an historical perspective, it was, you've got these plants, and how are you going to do them better?

But the thinking has turned out to be more general than that.

MR. VIRGILIO: Dr. Kress, from a materials perspective, there are a couple of examples that I can draw

on, and one is our medical regulations that are being risk-informed. They're exiting regulations, Part 35, the fuel cycle facility, Part 70, existing regulations where we're now making them more risk-informed.

And it's not just the regulations. It's all of our programs. So it's our licensing programs; it's our inspection programs and our regulations.

Where I think we're starting off new with Yucca Mountain or the repository, is Part 63 where we're starting with a risk-informed regulation, not trying to change something.

You could argue that you could fall back on the old Part 60, but really I think that when I look at where we're going with repository, it is really starting off from a baseline and making a risk-informed regulation.

MR. KING: Okay, we're done.

MR. HOLAHAN: We were prepared to give you some thoughts on importance measures, but I think the Committee ought to decide whether it wants to cover that now or not.

DR. APOSTOLAKIS: What I was going to propose is that we talk about an hour with you. Maybe we can take the remaining time to start with the invited experts. I know you have a view viewgraphs here on the importance measures, and, of course, the experts have heard your presentation.

So if everyone is agreeable, I'd like to propose

that now we start with the invited experts. Please do not address issues that the staff has raised, unless you disagree. Just to repeat that some of the things are impediments, we're using up our time.

MR. HOLAHAN: Wouldn't you let them say they agreed with us, as well?

DR. APOSTOLAKIS: No. So maybe the emphasis of the discussion with the experts should be on the importance measures, unless you have some strong feelings, some strong opinions about the impediments, something that was not discussed or some disagreement, or violent agreement, so we'd make the best use of our time.

DR. WALLIS: I'd like to hear about the impediments, because I think the impediments, as seen from the industry side, are quite different.

DR. APOSTOLAKIS: I'm sure there are some differences, but let's not go down the list again and start repeating some of the things that the staff has said.

So, with that thought, would the three experts, please come up front here at the table?

MR. SINGH: Rick Grantom is not here yet.

DR. APOSTOLAKIS: Rick is not here yet? All right, then two of them.

We have Mr. Robert White, who is the Supervisor of Reliability Engineering at the Palisades Nuclear Plant, and

Mr. Tom Hook, who has appeared before this Committee several times. He's the Manager of Nuclear Safety Oversight at the San Onofre Nuclear Generating Station. I see that Mr. Hook has only three viewgraphs, so we'll start with him.

MR. HOOK: Thank you. I'll be brief, I promise.

DR. APOSTOLAKIS: If you have something important to say, don't be brief.

MR. HOOK: Okay. First of all, I'd like to cover the impediments to risk-informed regulation. And these are not in any particular order or priority.

First of all, one of the difficulties that my utility, and I believe the industry has, is the difficulty in quantifying the cost of performing the analysis and preparing the submittals to support various risk-informed regulatory initiatives, and also assessing the benefits in terms of regulatory burden reduction, as well as risk reduction.

Particularly at San Onofre, at my utility, we are pursuing risk-informed regulation primarily for its benefit to provide an improved safety focus on those structures, systems, and components that are most important to safety.

And the side benefit is the regulatory burden reduction. And in terms of the environment that causes us to demand or need an improved safety focus, of course, is deregulation and the resulting economic situation that

plants are going to find themselves in as a part of the competitive environment.

Second, there are a number of variations in PRA quality and scope. At San Onofre, we have gone to great extents to develop and maintain and improve the quality and the scope of our PRA. We have a full Level I, Level II, all modes, transition risk.

The only thing we don't have right now is a detailed external events for shutdown, and we're working on that. We're also working on a plant trip risk meter, and making a number of improvements to our fire analysis.

Here, this is a concern because there is a wide variation in the industry in terms of PRA scope, and I think there are a limited number of plants that have full-scope PRAs that are updated.

That presents a challenge in terms of addressing the significance of SSEs in terms of risk-informed regulation as to whether the scope is adequate to address the importance measures.

Thirdly, the regulatory review process: That has been an area of frustration in terms of -- I recognize that in pilot projects, there will be a lot of communication a lot of questions, a lot of RAIs that are required to ensure an understanding of what was performed in the analysis, and that the duration is somewhat dependent upon the extent of

the communication that's required.

However, as an example, at San Onofre, we made a submittal on risk-informed inservice testing, risk-informed IST, over a year ago, that was a followon to the Comanche Peak pilot, and it was basically a cookie cutter of the approach of the Comanche Peak pilot on risk-informed IST with some enhancements that we believe that would even improve the reviewability of the submittal.

But it's been over a year, and through three RAIs, we hear that we're close to getting an SER on this, but it's something that has frustrated us because we thought it would go a lot smoother and a lot faster than it did.

DR. POWERS: You're not the first person I've heard complain about RAIs associated with risk-informed regulation. I wonder if maybe the Committee could get some better appreciation of this issue, if you could -- I realize it's off the top of your head -- give some indication of what the nature of the RAIs were.

I have not looked at them for a particular utility. I have looked at some for South Texas, I believe, and it struck me as they were asking relatively remedial questions on PRAs. Is that -- maybe you can give us some idea on what you encountered.

MR. HOOK: In some cases, I think the RAIs reflect questions about details that were in the submittal that were

potentially difficult to find unless the submittal was looked at in detail.

Some of the questions relate to deterministic issues or programmatic issues in terms of implementation of the change process, after the requested change is approved, how fast you would and over what period and to what extent you would implement the changes, for instance, in valve testing changes.

They also referred to the quality of the PRA, which we have addressed in a number of earlier submittals in terms of peer review and the scope of the PRA.

I don't think any of the questions were bad questions, but the process of answering an RAI is time-consuming.

DR. POWERS: A very time-consuming challenge.

MR. HOOK: It's on the docket, it's a very -- whereas resolving the issues in a meeting, sometimes, as we found in some of our submittals, was a more effective way to resolve a lot of the issues, at least from my perspective.

DR. POWERS: Thank you.

DR. HOOK: I hope that answered your question.

DR. POWERS: That's why we have these conferences.

DR. HOOK: In terms of PRA standards to establish quality, this is something I believe we all know is being addressed through the ASME and ANS efforts to develop the SA

standard.

Why it's an impediment is, I think utilities are waiting, as we are, for some of the more important regulatory changes for these standards to be finalized before we proceed further because it's an uncertainty in terms of the acceptability of what we submit in the interim and whether or not we have to backfit some of the analysis or could fall into a situation where some of the work we did previously doesn't meet the standard and it's questioned.

Also, the standard hopefully will be out in less than twelve months, and at that point we can assess ourselves against the standard and provide that assessment as part of our submittal to the NRC. But I think that's holding things up. It's a temporary impediment for the industry moving forward.

DR. POWERS: How -- it's my perception that even when standards are just updates of previous existing that they take some substantial amount of time. I get to participate a little more closely in the developing of the NFPA 805 standard for fire protection. And it is a time-consuming effort. Are you being a little optimistic in saying that a twelve-month --

DR. HOOK: Well, that's the schedule for the ASME standard.

DR. POWERS: Have you seen one of those schedules

that hasn't been optimistic in the past?

[Laughter.]

DR. HOOK: No. But the schedule is actually more optimistic than that. I'm giving it some margin, and I'm presuming that everybody is tired enough at this point that they'll reach consensus. So I think things will move forward.

In terms of PRA staffing inadequacies, this is an area that I think will have a significant impact on the ability of licensees to prepare and submit risk-informed submittals in at least the next twelve months, or longer. I think there are a large number of utilities that have just the minimum amount of staff necessary to support compliance with the maintenance role, and now the new significance determination process. And I don't see, with a few exceptions, significant changes to those staffing levels for a large number of utilities, so I think -- at least for the interim -- you're gonna see a limited number of licensees that will have the staffing capability to submit risk-informed submittals with all the other work they have to do.

And as an example of also the level of experience, there are a lot of licensees that have some turnover in their PRA staffing, that don't have people familiar with their models, at least the original generation. And I think

there are a few plants, at least like San Onofre that have been fortunate to retain the people that were involved in the IPE and IPEEE effort. In San Onofre, six of our, eight of our engineers were involved in our IP and IPEEE, and the remaining two have over fifteen years-plus experience that we've hired since then. So I think we have an unusual staff at San Onofre in terms of size qualifications that is enabling us to be a pilot in a number of these areas.

In terms of current PRA focus on maintenance rule and SDP I alluded to earlier, we at San Onofre are somewhat overwhelmed by the changes that we're going to have to implement or at least oversee over the next six months in terms of the maintenance rule A4 and the NRC oversight process, which we are following closely in terms of being able to perform the same evaluations as, as the NRC for the phase 2 of the SDP and ensuring that our phase 3 support is available. And that's been a significant drain on my staff in supporting the licensing and compliance and engineering organization in the last several months.

Next, the -- I think there's a perception that a number of the previous pilots were marginally successful. I believe the industry as a whole believes the ISI has been a tremendous success, but there are plants, such as San Onofre, where risk-informed ISI doesn't make sense unless it's a significantly inexpensive type of analysis because of

unique attributes associated with their ISI program.

We believe the risk-informed tech specs has been successful, but it's been marginally successful in terms of the level of effort required to achieve each of the allowed outage time extension. We would characterize the graded QA as being unsuccessful at this point, and something that no one would want to repeat. And I think that scared off a lot of people from pursuing the greater Part 50 effort until at least the issues on the graded QA are resolved. So I think there's a perception from the industry that the pilots have been marginally successful, as well as some of the follow-ons.

Lastly, in terms of the, addressing quality issue in the interim until PSA standards are available, I believe there's been inadequate or insufficient credit given for the certification process or the owner's group peer reviews, the CO owner's group that we're a member of has gone to great lengths to ensure that quality issues related to our PRAs do not affect the overall conclusions of our submittals, so we've made joint application submittals, primarily in the technical specification allowed outage time area, where we've compared the results of all our analysis for a particular issue.

We've also gone in and looked in detail at the contributors to the different results that we did get, and

looking at initiating events, models, HR -- human reliability analysis, as well as dominant cut sets, and tried to resolve all of those differences to conclude whether or not they're modeling issues or actually plant design features that are different between the combustion engineering units.

And we believe that that detailed, what we call "peer review" or "cross-comparison" task as surrogate for the PSA standard was a, certainly a suitable process to establish that there are not significant modeling or errors in quality issues. And we didn't see that there was a significant different in the review time for our submittals than for other individual plants that has similar submittals on similar topics.

And in terms of the RAIs relating to quality, we still received a tremendous number of RAIs in that area. So we think that there could be more credit taken for those. And in terms of their value and ensuring that we aren't reaching the wrong conclusions in terms of these submittals in the absence of a PSA standard.

DR. POWERS: When an Owners Group does a certification of your analyses, what does the rest of the world see about this?

DR. HOOK: The rest of the world I don't think sees any more than the utility that's being certified wants

them to see, in terms of whether they submit that to the NRC as part of a submittal. The rest of the world, basically, that sees the certification are the members of the certification team from the other utilities, other licensees, as well as well as the Owner's --

DR. POWERS: Let me ask you a question. Supposed, by off chance, that I became a professor at say Dartmouth University -- an unlikely prospect at best -- and someone asked me to review a paper on a, say a thermohydraulics analysis. And the person who wrote the paper said, I used a code that was analyzed and certified by the Thermohydraulics International Consortium of Allied Experts, of which I was not a member, and so have faith and I won't bother to justify my equations and what not. I'll just give you the results. What do you think the chances are that I would advise the Journal to publish this paper?

DR. HOOK: I have no idea.

DR. POWERS: It's zero.

[Laughter.]

DR. POWERS: It's flat zero.

[Laughter.]

DR. POWERS: I think I use that as an example to say, you know, I think there are problems with getting a lot of credit for the certification process if I'm on the staff and I have to vouch safe, that I've done something good for

the public here, and they can't see what I got out of this certification process. Now maybe that problem goes away once you have a standard and you can attest to a standard, and somebody can look at what you've got. But the certification process is something that maybe makes you feel good. I'm not sure someone from the outside feels good.

DR. APOSTOLAKIS: On the other hand, again, if we start seeing good PRAs coming from the industry as a result of the certification process, maybe the NRC staff will say, well gee, this is a credible approach to, to guaranteeing quality, so it works --

DR. KRESS: But when you say "start seeing good PRAs," you're implying that there's another level of, in view of the PRA --

DR. APOSTOLAKIS: But I did not want to imply that. I'm sorry.

DR. POWERS: Well, I think it's, I think it is a problem when we have IPE submittals that get scourged as unfaithful to the plant design, that omit critical accident sequences. I think the industry has a problem with that --

DR. APOSTOLAKIS: But the IPs, Dana, did not go through this process.

DR. POWERS: I understand. I understand. I also understand that an external observer looking in on this stuff is going to be justifiably suspicious.

DR. APOSTOLAKIS: Of course, it's useful to bear in mind that we are the industry that does just about everything out in the open.

[Laughter.]

DR. APOSTOLAKIS: What shocks PRA practitioners when they start doing the work for other industries is the secrecy. Proprietary this; proprietary that. You can't discuss this in public. You can't publish this; you can't do that. It's really very, very different. Very different.

DR. SHACK: Just a question on your PRA focus on the SDP. Would you look at the SDP as a step towards risk-informed -- even if it's more work for you? I mean, is it something that you think is an improvement in the assessment process?

DR. HOOK: Yes. It's a definite improvement in the assessment process.

DR. SHACK: So even if it's more work for you, it's --

DR. HOOK: Right.

DR. SHACK: -- an improvement. How about the maintenance rule, the A4? Do you think that's a, a reasonable use of the risk-informed regulation?

DR. HOOK: Definitely. I would agree, yes.

DR. SHACK: Okay, so it's not really an impediment in any sense?

DR. HOOK: It's an impediment in that it's diverting resources in the interim that otherwise would be applied toward pursuing risk-informed regulatory changes. That's what I mean. There's just not the resources out there to do both in the vast majority of licensees.

Turning next to importance measures, first I'd like to say that in terms of the importance measures are out there, I think at least at my plant and I believe a lot of the industry -- we feel like the importance measures that are available, the risk achievement work and Fussell-Vesely or risk reduction work. Importance measure are acceptable as a screening tool for characterizing the importance of SSCs for risk informed regulation.

The caveat with that is that the importance measures that evaluate extrema, looking at the guaranteed failure or guaranteed success of an SSC are acceptable only when augmented by sensitivity analysis. And that's the key thing that I think differentiates our opinion from maybe some others' in the industry or the community is that importance measures by themselves are not adequate to determine that an SSC is indeed of low or high or no safety significance.

And relating to that, the uncertainty analysis issue I believe is something that is not as important to the industry at this point as to others because it's really

under-utilized by most licensees. Most licensees do not perform uncertainty analysis. And if they do, they don't know what to do with the results.

DR. SEALE: Tom, did he get to you or did you get to him?

DR. HOOK: Pardon?

[Laughter.]

DR. SEALE: Dr. Kress is very sensitive to uncertainty analysis.

MR. KRESS: It's one of my hobby horses.

DR. HOOK: Well, I just wanted to make the statement that it's not -- it's under-utilized. There are issues about the data that is used to develop the error factors for SSCs and how, if there's sufficient data for that that's being gathered at the plants, are you correctly correlating your like components in your uncertainty analysis. And I think the -- hopefully the PSA standard will resolve a number of issues about how to, and the expectations on uncertainty analysis. But I believe the, most of the industry is using sensitivity analysis right now as a surrogate for uncertainty analysis.

And furthermore, on sensitivity analysis I believe that the sensitivity should include model requantification. And if you're looking at a global type of change like a Part 50 change, it's a complete model requantification, looking

at all the impacted parameters, SSC reliability, availability, human error events, you're initiating infrequencies -- anything that's affected by the proposed change needs to be adjusted to bounding values that reflect potential expectations either based upon engineering judgment, prior data as to how these parameters will be affected by the changes you're proposing.

At San Onofre, we've taken that a step further, and did so for our risk-informed IST submittal. We looked at the impact of the valve maintenance surveillance frequency changes, input into our safety monitor with a year's worth of plant actual operating experience. We looked at the actual configurations that we'd entered over the year and changed the reliability of and availability, appropriately, of the valves and other, other parameters in the PRA to look at what would be the impact at the end of the year, had we had a longer surveillance interval for these valves as part of our proposed change. And I think that's one way to look at the overall effects of a particular change that's more effective than looking at various importance measures like Fussell-Vesely and risk achievement worth.

And in terms of looking at whether or not your plants' scope is sufficient in the PRA to address particular changes I think is consistent with the draft NEI guide that

I reviewed this week on the risk significance determination for the Part 50 project, that you need to look at all scopes of the, all scope in terms of external, internal, level 1, level 2, for operating modes and all initiating events, either probabilistically or in some deterministic fashion.

And in areas where you do not have a probabilistic model for a particular function of an SSC that you need to default to maintaining the component as safety-significant in the absence of risk information that indicates otherwise. So that would imply that you need the largest scope PRA that addresses all the safety functions of SSCs to get the greatest benefit in terms of assessing the safety significance and the potential for changing the status of a component from safety-significant to non- or low-safety significant.

And lastly, I generally concur with the draft ANPR Appendix T in terms of the use of importance measures that's described in there by the staff and believe that there are no significant changes that I think are really needed to that. We've looked at the top of the prevention method that Bob's gonna talk about in a couple minutes, and we think that's an acceptable alternative to Fussell-Vesely and risk achievement worth.

But we don't see that it provides particular advantage over them, since we believe that the bottom-line

sensitivity analysis using the model as a requirement for ensuring that the changes you're making to the plant are acceptable in terms of the Delta CDF and Delta LERF requirements in Reg. Guide 1.174. That concludes my presentation.

DR. APOSTOLAKIS: Thank you very much, Tom. Mr. Grantum from South Texas Project joined us a little while ago. Maybe we can go ahead with you since Mr. White is going to present something that's very different. Now the agreement is that you will not repeat things that Tom has said.

DR. GRANTUM: I would hope to not do that, yes.

DR. APOSTOLAKIS: Because he only had three viewgraphs and it took us twenty-five minutes to go through them.

DR. GRANTUM: I've got four, but one of them's a cover sheet. I don't think it'll take us long for that.

DR. APOSTOLAKIS: Okay. So -- but even within the three that you have, I hope if there is any overlap that you skip that stuff.

DR. GRANTUM: In case anyone doesn't know me, I'm Rick Grantum from the South Texas Project. I do have some overlap and points -- what Mr. Hook just got through talking about. I basically tried to put together a whole list of what I perceived as impediments. And they fell basically in

to three categories for me: Regulatory impediments; what I called "cultural" impediments; and then PRA institutional impediments.

In regard to the regulatory impediments, one of the things that we see in here -- and I'll try not to cover too much of this that's been discussed -- but in regard, if you look down the list there, you can see quite a few items that I've put in here. Several of them are somewhat detailed and some are, somewhat more, broader based.

The regulatory quantitative limits. Realizing that there's been some information put in Reg. Guide 1.174, but it's in the implementation of these things. If one were to strictly look at Reg. Guide 1.174 and the thresholds that they've applied there, I could probably go and implement elimination of a ten-second diesel start, but I don't really think that that's going to be based strictly on quantitative limits at that point.

And that ties in to the next bullet, which talks about -- there's no differentiation between design basis events and then what I call operational basis events or events that are likely to occur in the station.

Many of the things or the figures and merits that were tied to it are -- the questions that we get from, coming from the staff, have to do with how are things going to ensure that they're still going to be operable and work

during all design basis events. And my response -- and this ties in somewhat to the third bullet here -- is that if one says that everything has to work perfectly within design basis events, and one says it's also going to do the same thing for the risk-informed events, then basically what we have here is PRA becomes an add-on at that point in time.

The RAIs are still in some cases structured to discuss, ensure that everything will be okay in design basis space, and also for the non-safety related risk-significant stuff. What else are you going to do in addition to that. And that generally tends to be somewhat of a theme that falls through here. So when I see those kinds of things, that's why I brought these three items up to the very front of here is because there isn't a differentiation between something that strictly is not important -- where is the line we're going to agree that something is not important versus something in design basis space -- we get locked up. And it's, I think it's a significant impediment to being able to move forward.

There's not really a path or a mechanism by which to change safety-related classifications using risk information to non-safety related classifications. And once again, that falls into the what's safety-related, what's associated with the design-basis event. It forever is, and you can't ever change it.

DR. APOSTOLAKIS: Okay, you can't use 1.174? You can't use 1.17 -- whatever -- 1.176?

DR. GRANTUM: Well you can use it, but my example about the ten-second diesel would be beautiful example of that. If you go look at the impact of that, associated with why diesel has to start in ten seconds, that's associated with the design basis event for double-ended guillotine break of the largest piping. The likelihood of that event happening, which would cause a diesel to need to start in ten seconds, is extremely, extremely low in those regards, but if you were to go and pursue a petition to eliminate that, the questions would then come forward as to how is that going to be able to ensure that it's still going to be able to work for design basis events.

Well obviously, with the analyses and the things out there that are structured for, you know, analyses under those conditions, well you can't do it. And there is no, there is no risk-informed method once that wall has been placed up there, so you have to --

DR. APOSTOLAKIS: So what are you -- are you saying then that the Staff should be pursuing Option 3? Are you familiar with Option 3?

DR. GRANTUM: Um hmm.

DR. APOSTOLAKIS: More vigorously?

DR. GRANTUM: I'm saying the staff is --

DR. APOSTOLAKIS: Because they can't violate the law.

DR. GRANTUM: That's true.

DR. APOSTOLAKIS: And if there is a design basis requirement out there, I mean tough luck. So how do we do it?

DR. GRANTUM: \Well, the way to go at this is to assume that you're going to use, produce a process to use risk information by which you can tailor that, or one has to go and look at the design basis events from a risk-informed point of view.

DR. APOSTOLAKIS: So Option 3 then would do that?

DR. GRANTUM: For design basis events, yeah, Option 3 would be the kind of treatment that one would have to go to at that point in time. You would decide that double-ended guillotine breaks are not the proper design basis event. And also, I'd like to make the point through that there could be a distinction between a design basis event -- an event by which you design, fabricate and erect nuclear components -- versus an operational basis event, which is an event by which you can maintain and test once the plant has been licensed to operate.

There could be a distinction drawn between those events right there, which could very well provide a distinction in being able to do that. So I think that's a,

something to consider, something to think about. Particularly with existing plants, I mean the design basis events -- if you think about it, we've sunk the costs into those, we've built those plants that certainly were not going to go and try to make big changes to RCS vessels or anything like that.

It's the operations and maintenance and testing of the things that a lot of the risk-informed applications are going towards right now. It's not trying to redesign RCS vessels or those types of things. So there could be a distinction made.

I'd like to skip down a little bit just to go through the next couple of ones here. I think there is a little bit of a lack of clarity in the sense of how qualitative versus quantitative approaches can be used. I'm not going to sit here and advocate that individuals who use strictly qualitative analyses should be discounted. What I am saying is that there should be -- there's a difference between a strictly qualitative approach and a qualitative and quantitative approach, and I believe that the stronger approaches certainly have the quantitative elements associated with it. But, if someone makes a good qualitative argument, they should be able to have something, even though it may be a minimal type of application.

If there aren't any other questions on the slide,

I'll jump to the next slide here. I think a lot of the things about the regulatory with the utilities have to do with the culture that we've lived with in the nuclear industry for decades. I am constantly reminded, as I visit other utilities and other organizations, of the lack of understanding of the complementary effects of blending deterministic and probabilistic information. There's really not a good understanding out there, I don't believe, in utility organizations and even in staff organizations with a regulator of what is the benefit of really doing that. And it seems like there's -- there isn't any really lack of training -- or there's a lack of training involved in trying to demonstrate how that is.

There's a reluctance to let go, even of the things that have, from the South Texas experience, safety-related components that are clearly non-risk significant, do not even enter the equation. There's still a reluctance to even let go of those things. And I think that even on a pilot basis, that's been difficult. And, you know, gentlemen, I would offer to you that that really inhibits and is an impediment to risk-informed regulation, because if we're not allowed to implement anything, then our opportunities for lessons learned, our opportunities for experiences to be gained are very limited, because we never get to try anything. So, I think that's a real impediment.

One of the things that continues to come out and come before us, also, is the belief that a safety-related component is much, much better than a non-safety related component. And I think that we probably need to go and ask ourselves that question seriously. Let's go do some studies about them. Let's just find out what it really means, in terms of reliability and availability. I really believe that that's one of the things that when you get over that little problem here, there would be a willingness to let go of things, because it's really not going to be much better and the marginal increases, if any at all, have minimal impacts on the risk.

The obvious item is the resistance to change, in terms of turf protection. And it's a term to use, but does, in fact, happens both in the utility organizations and it, also, happens in the regulator. And you can see it with the kinds of questions and the kinds of interrogatories that you get.

I'd like to bring this one up, because it's a pet peeve of mine, the quickness to declare victory. We did a risk-informed application and I asked questions, well, what did you do. Well, we changed the frequencies. You didn't change the scope? You didn't change -- all you did was change the frequency of the test? That sounds like an extremely marginal risk-informed application to me, that

does not allow the full implementation of risk information to come in. If it doesn't include a scope change, if it doesn't include a strategy change, which could include testing frequency changes, but other strategies, how you are, in fact, going to implement that, I don't really see it as a risk-informed victory, at that point in time, or even an application. Marginal, at best, and to declare victory that you've really done it is questionable by me.

I believe one of the cultural impediments that we have is due to a lack of the amount of PRA expertise that's out there. There's a willingness to try to demonstrate qualitative risk analyses, to some degree, and try to get the same benefit that you get from a group or an organization that's put together both qualitative and quantitative analyses. Although I can applaud the effort to look at it from a qualitative point of view as initially starting out, I don't believe that that is a justification to get the type of relief or adjustments that one should be able to get with quantitative approaches.

The misconception that PRA analyses are too expensive relative to the benefits, this is primarily a cultural impediment that is directed, in a sense, towards utilities. I hear it all the time, PRA is expensive. I've heard many times about STP's Cadillac PRA that we've spent a gazillion dollars on. I tend to discount that. STP's PRA

is a PRA that has been maintained and it's been involved in a process of continuous improvement. PRA analyses are inexpensive relative to the benefits that they can get, provided that the regulatory structure allows a risk-informed application to work.

Unproven technologies: another big one for the utilities is there are weaknesses in understanding of PRA at the management levels in some utility organizations, so you tend to have these discussions with those. One of the big areas that I think is going to need -- definitely going to need to be occurring in the future is the improvements in the formalization training and organization and the oversight of expert panels. Everyone is going to be cropping up with their own expert panel. The only place I know right now where there is a formalized discussion of this is in the ONM3 code case for -- in the ASME realm. But, we probably are going to need to take a look at expert panels, what are the expectations, what are the requirements, what are the training items and the oversight. I think this is one area that probably needs to be looked at in the near term.

And not to let myself go on this, I'm going to go ahead and indict my own discipline here -- severely here, because I do think there's elements in the PRA institutions, themselves, that we need to work on, ourselves. As Mr. Hook

mentioned, we have limited PRA practitioners. We've had delays in legitimizing the discipline with the ASME and the ANS standards. One of the big areas, though, that we are going to have to come up to grips with is resolving the probabilistic approaches with other institutional requirements: ASME code, IEEE, NFPA, special treatment requirements. These all have their own niche. It's all a new discipline that's got to be brought up on the learning curve of probabilistic risk assessment elements and you're going to have to have direct involvement of PRA practitioners, of which there are not very many direct involvement of PRA practitioners involved in performing risk-informed approaches for ASME and these other areas here. Definitely going to be a challenge for the PRA community to rise to that.

Risk ranking methods need further development and importance measures acknowledge need further development. Uncertainty analysis, yes, we need o be looking at those things.

One of the other areas is human and organizational analyses need to be looked at. We probably, in the PRA research area, need to try to take a look at how the humans, how the organization affects decision-making and how does that affect risk. There is a point of tangency there. There is a thread to be pulled there with that, of exactly

where it comes into play. We haven't really gotten to the point where we can really quantify those.

So, that represents the portion of this discussion that talked about impediments to risk-informed regulation.

MR. APOSTOLAKIS: Now, I have a couple of questions. The -- one of the things we discussed, before you came, with the staff was the practice of using quantitative results from PRAs and are you planning to go through this?

MR. GRANTOM: There have been some other questions about --

MR. APOSTOLAKIS: Only as needed.

MR. GRANTOM: -- importance measures and --

MR. APOSTOLAKIS: Only as needed.

MR. GRANTOM: -- this is going to be a quick brush through and this is primarily information for you, but I'm certainly not going to go through every bit of that, no.

MR. APOSTOLAKIS: Maybe you can answer my question using some of these view graphs.

MR. GRANTOM: Yeah, and that's what I plan to do, is just throw some slides in there.

MR. APOSTOLAKIS: So, the reliance -- the degree to which we rely -- or the expert panel relies on the quantitative input from the PRA, the ranking using importance measures, in their own judgment. And one of the

points we made was that very often, we are too willing to forgive inadequate methods or the use of inadequate methods, because we trust that the expert panel will take so much and that will remedy, perhaps, whatever weaknesses that are there.

Now, you and your colleagues at South Texas have gone out and announced to the world that you have categorized close to 23, 24,000 system structures and components and the general perception is that perhaps about 100 are in the PRA. So, the overwhelming majority really were not in the PRA. And you put them into four bins: highly safety significant, medium, low, and no safety significant. Can you give us one or two examples how the panel did this? How the organization did this? Obviously, you didn't use quantitative information, because simply you didn't have it, right?

MR. GRANTOM: Didn't have it, exactly.

MR. APOSTOLAKIS: Unless you had the other kind of quantitative. So, if you -- can you give us an example of a safety-related component that was downgraded in this new scheme and then the reverse?

MR. GRANTOM: Okay.

MR. APOSTOLAKIS: Because that's another thing that has impressed people, that you have come back and said, I think, that about 360 or so components that were not

safety related were found by the panel to be of high risk significance, which is a very important finding. An example of either case, I think --

MR. GRANTOM: Yes.

MR. APOSTOLAKIS: -- very quickly would help us understand that --

MR. GRANTOM: Yes.

MR. APOSTOLAKIS: -- they are all of quantitative analysis in these things and the kind of thinking process that the expert panel does.

MR. GRANTOM: If you would like, I'll take you through the qualitative portion of this, which is looking at components where we did not have importance measures. I can take you -- the package of information that was just passed around, if you go to this particular slide right here, this is a slide that we have shown at other presentations and I wanted to just be able to address this.

For the components that did have importance measures and for components that do not have importance measures, these same critical questions were asked across the board. So, in the example that Dr. Apostolakis poses, where we have no quantitative information, because the component is not included in the risk analyses, then we ask these five critical questions: one has to do with initiating events; the other one is asking a question of

whether it fails a risk significant system; is it used to mitigate accident or transients; is it specifically called out in emergency operating procedures; and is it a necessary for a shutdown or mode change. So, these questions are asked here for all of these components.

And the questions are asked, with respect to the components functions. One of the key things -- the first thing that occurs here is when we look at a system, we ask, here is component X, what functions does it do that supports the system. We've already ranked what -- all the functions that the system does. And we're not talking about safety-related functions or key missions, every function; everything from venting and draining, to providing pressure indication at a particular area. What is the functions that the systems do and what are the components that support those functions and then what are the failure modes.

So, when we come to a component, we're going to ask these questions right here: can this component cause an initiative event, fail a significant system, accident or transients. And this is done with a graded quality assurance working group, which is an expert panel structure of licensed operators, design engineering, system engineering, licensing, probabilistic risk assessment, quality individuals. We have a whole team of people that are looking at this, from multidisciplinary points of view,

to answer these questions.

MR. APOSTOLAKIS: The composition of the team changes, depending on the system?

MR. GRANTOM: Depending on the system, the system engineer for the given system always comes in and joins, at that point in time, and we do have other representation from system engineering that's there throughout each of it. But, we do want to retain the expertise of the system engineering.

So what they do, at that point in time, is they go through, in a sense, like an expert solicitation process, in which they go and everyone will have a discussion about it and they'll determine whether a component, no, it can't cause an initiating event; is there general consensus, everybody agrees this component can't do it. Or they may be very positive and they go and they'll rank these things, depending on their experience and their judgment about these things. And then, once they've assigned -- and this is done on a function by function basis. If the component performs more than one function, then this kind of thing is done for each function that it supports.

Then, there's a waiting system. As I indicated to you earlier, accidents, transients, EOPs are weighted higher. If it gets a response or some kind of a value that's associated with this and it has to do with accidents

or EOPs, it's weighted higher. If it's less than that or if it fails a risk significant system or an initiating event, it's still weighed, but it's weighted at a lower amount. And then those scores are tallied together to determine if it's within a zero to twenty range or, as you see in here, determines whether we consider it non-risk significant or highly risk significant. So, components that have multiple functions are generally going to be tended to be weighted higher. They're going to fall into the high and medium components that have minimal functions and the only thing that they do is support functions that are non-risk significant, are the ones that cascade into the non-risk significant region.

Now, what happens in a plant system is that when you look at the entire system, there are thousands of components that are what we call tag numbers, component locations, the physical components -- thousands of components that are associated with a system. Many of them are local indications. There are things that are attached to the wall. They are not part of the main process that occurs. They're not the main driver. They're not the pump. They're not the main valve. They're not in the main process stream. They're ancillary devices that are used to help maintain the system possibly or just for local indication to be able to monitor what the system is doing from a local

point of view. But, there are many, many, many of them, and a lot of it is instrumentation taps and those types of things, and those kind of things that count for the number of components that we see.

So, what you'll find is that the components that are high and medium are the pump, the valve, the check valve, the reg valve, the other things that are associated with making the system perform its key functions. But the other functions associated with venting and draining the system or a local indicator on the wall that kind of gives them some other information about certain aspects that may help them diagnose issues or problems, those are the things that fall into the non-risk significant region. Currently, they're still all safety related. Currently, they all get treated the same. And so that's why we see this big distinction here.

So getting to your question about an example of a component that's non-safety related, that was determined to be of high safety significance from our point of view, what you see here is -- and this is, in a sense, a -- this is a component -- I wanted to give you this example here. This is a component that is included in the risk analysis, okay.

MR. APOSTOLAKIS: It is?

MR. GRANTOM: Yes, this component here is included in the risk analysis, and I am going to explain this to you

here. What you see here, this is a copy of a spreadsheet. These are two basic events for a positive displacement pump, which is in a chemical volume and control system. The motor on this pump is a non-safety related component, okay. Normally, this positive displacement pump is only for hydrostatically testing the RCS after outages and those type of things, primarily what this pump does. That's what its main function is.

However, through the risk assessment, we've identified that it can really do some other things. It can provide an alterative seal -- RCP seal injection path, in the events of losses of off-site power or station blackouts, because it's powered from a diverse source, the tech support diesel generator. And it offers another success path, in order to buy time to recover electric power.

These elements that you see up here, these items here, are various sensitive studies that we do in the PRA risk ranking. The first sets of these things, the GNs, represent various maintenance states that we expect occur from a normal 12-week maintenance cycle. There's various -- the PMs are different types of trained combinations working, train A, B running; train A, C running -- we're at the retrain plant -- train B, C running; and the calculations of the PRA from there. And then these others represent other various sensitivity studies: no common cause, no operator

recovery action, changing the failure rates of components.

And what happens in here, from the PRA perspective, is you go across here and you can see that this component ranked out medium and low, for the most part, for failure to run, the basic event that says failure to run; but for failure to start, it ranked out high in a few of the sensitive studies. Therefore, the component went to high and it was recommended to the expert panel that this component, even though it's non-safety related, comes out as a high risk significant components and as an example of a component that was identified through this process, which calls about -- talks about that particular item there.

Now, the other example, where you want to talk about a safety-related component, which falls to low --

MR. APOSTOLAKIS: Yeah, you have a lot of here.

MR. GRANTOM: Yeah, I've got several of them here, so hold on.

MR. APOSTOLAKIS: Just one will suffice. Okay, pick one.

MR. GRANTOM: Yeah, let me pick one here. Okay, here's one on the safety related -- if you look at the second item, where it says "reactor coolant filter 1A," here's a safety-related component that's sitting here, that's got low safety significance that's associated with it. This is basically a filter that's associated here. If

you can see the description over there, the filter collects demineralized resin finds, in particular, it's larger than 25 megawatts; however, abundant filter available, also, bypass. So, there is redundancy and there's a bypass that's, also, associated, in the event that this failure -- this filter clogs.

Also, you have to look and associate it with what does this filter do. Well, this filters water that goes into the RCP seals. RCPs, in general, are non-safety related components to begin with; but this particular component is a safety-related item here and it's the filter, not necessarily the housing and the structure that supports the filter. So, here's an example of a component that when you go through this -- and when you see that it's risk ranked low on the outside, I do want you to keep in mind that it's gone through all of these deterministic questions that we asked a minute ago: can it cause an initiating event; does it fail a risk-significant system, no; does it -- accident, transient, EOPs.

The questions -- the answers to those questions for this filter were answered no or they were answered to the point that they were considered low in this deterministic region here. So, here's an example of a filter, okay, the filter can -- you know, obviously, you can postulate the filter clogs, but is the filter change out, in

and of itself, going to be an issue from a safety perspective or from that? And the answer to this question, with these kinds of components, is no. And you see thousands of these components that are like that, that are associated with these things. So -- and here's -- and I can go on for several other pages about this.

MR. APOSTOLAKIS: No, let's --

MR. GRANTOM: So --

MR. APOSTOLAKIS: I think that's sufficient.

MR. BARTON: How would you treat this filter differently?

MR. GRANTOM: Well, what might happen with this filter here that's treated low is that we might very well use some different practices or strategies on handling it. Obviously, we're going to replace the filter if it -- when it needs to be replaced; but whether it needs a full maintenance package, in order to be able to do this, might be able to be handled with a different maintenance approach, particularly if it's an easy filter change out and it's well within maintenance procedures to be able to do that. This can be something that can be handled possibly with tool pouch maintenance during an outage, if, in fact, you can replace it during an outage.

Also, the other aspect of this is if it's a safety-related filter that has some pedigree associated with

it, the question comes, can I buy the same filter -- the exact same filter from a non-safety related vendor, a vendor that would provide it from a non-safety related part that we could probably buy with a cheaper procurement. So, there's several questions that can be asked.

But, looking at this, one can develop a strategy for how you're going to maintain this component. We are still going to have to be able to repair it, if it gets clogged, which we'd have to be able to do; but the opportunity for a strategy change on these offers itself to be asked: can you purchase it non-safety related; can you do it with what we call tool pouch maintenance, which is minimal packaging. It basically says that the filter was clogged. We repaired the filter or we put a new filter in. It's not a full pedigreed package like we do on the other safety-related components. Currently, right now, it had the full package, and that offers an opportunity for us to restructure and streamline that process.

So with that, I would offer any other --

MR. APOSTOLAKIS: Thank you, very much, Rick. I think we should move on with Mr. White. John, do you follow?

MR. GRANTOM: Thank you, very much.

MR. APOSTOLAKIS: Thank you. You can stay there, because there may be more questions. Bob, I would suggest

that given the lateness of time --

DR. POWERS: Let's not penalize him.

MR. APOSTOLAKIS: No, we will not penalize him.

DR. POWERS: I think he's got an imaginative and new concept that we were not so familiar with.

MR. APOSTOLAKIS: But, I would like you to zero in on why you felt that you needed to talk about prevention analysis methodology. You know, you can use selectively your -- this is one place where the utility can actually pick and choose. Use whatever slides you have to use. Tell us why you felt that the importance measures were not adequate and very briefly describe what the essence of the approach is and then maybe you can tell us whether you have applied it to some real problems.

MR. WHITE: Okay.

MR. APOSTOLAKIS: Trying to cut down the amount of time, as much as we can.

MR. WHITE: I'm Bob White and I work at the Palisades Nuclear Plant. And I'm just going to go over importance measures, some of the issues that we have with importance measures -- they're not necessarily issues, but items to cover.

We agree that importance measures can be used to identify what is important, but we have a difficult time trying to determine what is not important by using these

important measures. It gives us half the story that we need. And it is an acceptable method tool, but it is not complete.

We believe that, if you go down to the bottom bullet here, that if you do a sensitivity study, some type of sensitivity study, it doesn't matter the method that you use to pick your safety-related components or significant components, as long as you can thoroughly test and understand why you're saying the other components are not significant. And that leads us into why we like to use this method called "Top Event Prevention," that I'll explain a little bit about.

First of all, I call it TEP for Top Event Prevention, and it provides the minimum combinations of events that are important in the PSA results. Essentially what it is, is the complement equation to the cut sets. The cut sets are core damage sequences. The Top Event Prevention goes through and it provides the complement of that. So what it says is, you have a group of components that if you concentrate on these components and to the extreme case, they become perfectly reliable, you will always prevent core damage, because you have no sequences then that have a failed component.

And what we'd like to do with this is, since we know we can't prevent all of the components, we may look at

what we call the level of prevention, which is similar to a defense in depth. If we pick a level of prevention of two, what we're saying is we'll prevent all the cut sets by two components, to have a level of defense in depth there. And what we do with these components is we put them in this category of safety significant. We go back, then, and we can test our model -- the logic models that we have for PSA and identify components that would have been truncated from the cut sets and identify if there are any other components that we want to put in this category.

MR. APOSTOLAKIS: So what you're really doing is you are looking at the success space --

MR. WHITE: Correct.

MR. APOSTOLAKIS: -- and you're saying -- well, we know what a minimal path set, similar to a minimal cut set, is the minimal combination of events, whose success guarantees a success of an event of interest. This is a minimal process. So, if I take one component out or fail it, then it doesn't work anymore.

MR. WHITE: That's right.

MR. APOSTOLAKIS: What is unusual about your approach is that you really don't work with a minimal process. You work with unions of minimal process. You don't take a single, because you just said, you know, you want the level of protection to be two.

MR. WHITE: Right. You can take --

MR. APOSTOLAKIS: Why do you feel you have to do that?

MR. WHITE: It helps us cover the defense in depth philosophy, having multiple diverse trains to perform a function.

MR. APOSTOLAKIS: But, isn't the defense in depth measures, aren't they already in the path sets?

MR. WHITE: Well, that only shows you that you have one success path.

MR. APOSTOLAKIS: You may have more than one.

MR. WHITE: Okay, you may have one more one --

MR. APOSTOLAKIS: Yeah.

MR. WHITE: -- but, you are only guaranteed to have one, if you take a level of prevention of one. If you take a component out of service for maintenance, you may have violated that prevention set, and so you may not have a guarantee success path for a certain sequence.

MR. APOSTOLAKIS: So what you're saying is that you want to have success paths that are not minimal, so you can afford to lose one of the elements and still succeed?

MR. BARTON: That's what he's saying.

MR. WHITE: Right.

MR. APOSTOLAKIS: That's really what you're saying.

MR. WHITE: Yes.

MR. SIELSEN: So, he can afford to be wrong.

MR. WHITE: So, we'll have -- right.

MR. APOSTOLAKIS: So, you're taking unions of minimal paths sets.

MR. WHITE: So, if you do a level of prevention --

MR. SIELSEN: What happens if you're wrong?

MR. WHITE: -- of two --

MR. APOSTOLAKIS: What's that?

MR. SIELSEN: What happens if you are wrong?

MR. WHITE: -- you have two success paths for each sequence. And you can take it to a level of prevent of three --

MR. APOSTOLAKIS: Right; sure, sure.

MR. WHITE: -- and go on from there.

MR. APOSTOLAKIS: But there is a fundamental difference, though, in my mind, between what you are doing and what the importance measures in the PRA do. You don't seem to look at the probabilities at all. You go back to the logic of the system.

MR. WHITE: That is correct. We take out the probability inputs, because it goes back and it tests the logic of the models and so it prevents -- if you have your logic model set up, this method will come back and tell you the success paths for those logic models.

MR. APOSTOLAKIS: You have used this?

MR. WHITE: Yes, we have.

MR. APOSTOLAKIS: You have done this? And you have the computer tools to implement it?

MR. WHITE: Yes, we do. This method was actually identified 25 years ago, not understood what the importance was, and then -- that was by Dick Worrell. And then about 10 years ago, Mr. Youngblood has identified, hey, this is -- this is of use to PSA; but the tools that we had were not available, because the equations are very large.

MR. APOSTOLAKIS: Again --

MR. WHITE: But today, the tools are there that we can use these.

MR. APOSTOLAKIS: But, isn't it a major contribution of PRA, the fact that it ranks accident sequences according to their probability of occurrence, so it makes risk management practical, possible? And you are sweeping that away. You are saying I'm not going to look at probability; I'm going back to the logic of the system. Aren't you paying a high price for that? I mean, are you using probabilities at all anywhere, later?

MR. WHITE: Yes, we are. It helps us grade the components that are in the prevention sets, as to what type of maintenance we need to do on those.

MR. APOSTOLAKIS: Okay, maybe we should let you go

ahead.

MR. WHITE: Yes. The four quadrant plot that you might be aware of. Once we come up with a prevention set and group the components, this is our -- we did the TEP methodology for our check valves at our plant, identified which ones should be significant, which ones aren't. And after we came up with our set of check valves that we feel are significant, we use importance measures to put them on this four quadrant plot. And what this does is it helps us identify, then, the contributions to core damage on our PSA models, so that we can look at what is in this upper quadrant here. We need to -- those are candidates to do more maintenance activities on, because they are very important.

Candidates that come over in the other upper left-hand quadrant, those, in that plot, don't contribute a lot to core damage frequency right now, but can, if you let them, degrade. So, those, we want to maintain them for practices that we have on those components.

Those in the lower left-hand quadrant, then, have minimal impact on core damage frequency and if you let them degrade, will not have significant impact on core damage. Those are candidates for reducing our maintenance. So, we use this graph to help us grade the maintenance activities we would perform on the significant set of components.

MR. APOSTOLAKIS: But what is the relation between TEP and this standard application of importance measures?

MR. WHITE: The only items on this graph here are those that come out of our prevention set that are in our significant category. Everything else that's not in the prevention set doesn't show up on here and those --

MR. APOSTOLAKIS: Let me see if I understand this. One of the arguments that is made in the paper I read is that the PRA, itself, does not pay attention to certain very reliable components, like pipes, you know, some structures and so on, which is a problem, also, with risk-informed science. And there was a reason for that, the paper argues; because we know how important these things are, we have made sure that their failure probability is very, very low. So, by going to this approach, TEP, you are not using the probabilities; you are looking at the logic of the system and you're saying, my goodness, of course the piping is important. It's way up there, right, so I put it in my TEP results. So, I -- it's on my right-hand side column there. But then you have no way of finding the importance measures to create your quadrants, because that, you know, is not in the PRA.

MR. WHITE: But this only includes those items that are in the PRA models right now.

MR. APOSTOLAKIS: So what do you do with the other

ones?

MR. WHITE: The other ones, we do processes similar to what Rick talked about. We go through an expert panel. We talk about its importance to initiating events, components that have -- that are significant, what are the functions that are performed by those processes not in the prevention sets, not in the PSA models.

MR. APOSTOLAKIS: So, my impression from reading the paper was that this approach would be extremely difficult -- extremely useful, if I were to design a new reactor --

MR. WHITE: Yes.

MR. APOSTOLAKIS: -- okay, where I have to determine, you know, what kind of reliabilities I would demand from certain components; or if I were to implement option two for special treatment requirements to such a degree that I'm relaxing now these special treatments so much, that I'm beginning to affect the basic assumptions of the PRA. In other words, what I thought was of very low probability of failure may cease to be such, because I'm relaxing a lot of things, in which case the current PRA is no good anymore, so I have to go back to something like the event analysis that you guys are doing. But for other, more routine applications, it seems to me you are, also, resorting back to the methods that the other guys are using.

MR. WHITE: Well, in the reg guide and the industry documents right now, we have to answer the question of defense in depth and I believe that going through the TEP methodology answers that question, how do you address defense in depth philosophy. So, we don't have to go back and look at other deterministic analyses to say, yeah, we still cover a large break LOCA, with concurrent loss of offsite power, because that's -- we're not going to change the safety grade classification of any components in our safety analysis for that.

MR. APOSTOLAKIS: So, it makes life easier in that respect?

MR. WHITE: Yes.

MR. APOSTOLAKIS: Although even with a PRA, you could --

MR. WHITE: So, if we have that modeled in our PSA, we can come back and say here's how we're covered for that scenario. So, here's what is minimally what we need in our set of components to cover all sequences.

MR. APOSTOLAKIS: Yeah. I think a great advantage that you have is that you can gain insights in your analysis that will be free of the assumptions that the PRA analyst have to make, in order to produce quantitative results.

MR. WHITE: From the probabilities.

MR. APOSTOLAKIS: Yes.

MR. WHITE: The bottom line question is always --

MR. BONACA: It's more like a PRA-aided deterministic approach, it seems to me.

MR. WHITE: Yes, this is a deterministic application.

MR. BONACA: And it is somewhat similar to use of FMEA to design, okay. So, it's -- okay.

MR. APOSTOLAKIS: So this would be, then, perhaps more appropriate be used in low power shutdown, during those operations?

MR. WHITE: No.

MR. APOSTOLAKIS: No?

MR. WHITE: One or two -- you made a point, in your meeting last October, about conservatives and having things that aren't in the PSA; then you include them and it changes the risk evaluation, the risk reports --

MR. APOSTOLAKIS: Yes.

MR. WHITE: -- measures of components. With a prevention set, your prevention set doesn't change, right. All you do is you add to it, when you add more things to your model. So, you can keep your same prevention set. To add more sequences -- you add seismic later, all you do is you add more to your prevention set, because your prevention set is there and that doesn't have to change.

MR. APOSTOLAKIS: So, in other words, if I do a

very conservative seismic analysis in my PRA --

MR. WHITE: Right.

MR. APOSTOLAKIS: -- that fact does not affect you, but it affects Russell-Vesely --

MR. WHITE: That's correct. So, it may affect what we do with the components that show up, but it won't affect which ones show up in the result.

The other thing about TEP that we, also, like at our company is when you come up with prevention sets, you have many of them. Depending on the size of the problem, we could have millions of prevention sets, and you need to pick one. And the way that we can pick one is by looking at what the application is we want to do. If we're looking at an IST application, we can take all the components that appear and all the prevention sets, put a cost value on those, and pick the cheapest prevention set and say this is our prevention set, because it cost the less to the utility and it satisfies the reg guides.

MR. APOSTOLAKIS: So, you are using -- what you're saying is that you are using -- your method allows you to use completely different criteria for ranking those prevention sets --

MR. WHITE: Yes.

MR. APOSTOLAKIS: -- than the usual criteria of how likely are they?

MR. WHITE: Right.

MR. APOSTOLAKIS: And you have found this to be very, very useful?

MR. WHITE: Yes, we have.

MR. APOSTOLAKIS: What else would you like to say, Mr. White?

MR. WHITE: Well, there is one thing that we want to bring up, is that the reg guides talk about overall change in core damage frequency, delta CDP and delta LERF values --

MR. APOSTOLAKIS: Right.

MR. WHITE: -- in the orders of 10 to the minus six, 10 to the minus five, and so forth. What we do with prevention sets is our sensitivity studies, we take our prevention set and everything that's not in the prevention set, we set to a failure probability of one, basically not crediting any component outside of our prevention set. When we get changes in core damage frequency that are greater than 10 to the minus six, that doesn't necessarily mean that's what the real core damage frequency is. We need some guidance on how do you -- what would be acceptable limits on bounding analysis like that. Right now, if we don't need a 10 to the minus six, we have to go back in and say, well, we know these components won't fail at a certain probability of one; they will fail at something less. And it's a lot of

work to go back and change every one of those non-prevention sets -- cut sets to some probability. We'd like some guidance on, if we have a bounding analysis, what can we expect, in terms of what would be acceptable to a regulator.

Now, we have some results here from some actual studies and if we look at this, the last column here talks about this change in core damage frequency that we have looked at, setting everything outside the prevention sets to a failure rate of one. You can see that most of them are less than two, which is equivalent to a raw value of two for all the components together, collectively. These don't meet the reg guides, though.

MR. WALLIS: What are the units of change in CDF?

MR. WHITE: This is your -- this is your multiple. This is basically a raw score.

MR. WALLIS: It's a factor. It's not --

MR. WHITE: It would be a lot of work to go back in and change all the individual components not in the prevention set to some level and --

MR. WALLIS: Well, that's probably within the uncertainty bound of CDF anyway.

DR. POWERS: Probably.

MR. WHITE: So what this does is it shows that a prevention set that we pick actually does have minimal core damage impact; that they really truly are the significant

components that affect our PSA.

MR. WALLIS: This could be called "keep it simple," find out what really matters and --

MR. WHITE: Yes.

MR. SEALE: Go fix the air valves.

MR. WALLIS: Well, there is some appeal in that philosophy.

MR. WHITE: And that's it, in a nutshell.

MR. APOSTOLAKIS: Thank you, very much. This was very useful to us.

MR. SEALE: Let me ask one -- it would be interesting, after you've had a chance to think about it a little bit more, to tell us if there are any other impedimenta, if you see them, in the present system or is there a 1.174 guidance that might be applicable to the kind of questions you raised here. That sort of thing might be useful.

Is would, also, be interesting to hear what the staff has to say. I understand they have --

MR. APOSTOLAKIS: Not today, unless they have something they want to say now.

MR. KING: No, it's the first time we've seen this.

MR. APOSTOLAKIS: Oh, okay.

MR. WALLIS: How long would it take the staff to

-- having seen it today, to evaluate whether they like it or not?

MR. HOLAHAN: We definitely don't know.

MR. APOSTOLAKIS: But, I think one of the messages here is that perhaps it is premature to give -- in the raw, to make them an integral part of the regulations, the way that they're changing things, because you never know, now --

MR. WHITE: Right.

MR. APOSTOLAKIS: -- somebody may come up with something else. You know, we have to phrase it in such a way that allows for other approaches.

MR. WHITE: Right. That's one of the impediments that I see going on in the industry, in risk importance measures, is the accepted methodology for identifying significant components. We don't want this methodology to be excluded from those kinds of documents.

MR. APOSTOLAKIS: Yes. Do you know of anybody else who is using this?

MR. WHITE: Yes, there are several utilities that have this.

MR. APOSTOLAKIS: Can you mention a few names?

MR. WHITE: Northern States Power, Clinton.

MR. APOSTOLAKIS: Okay, that's fine. Thank you, very much. There was one question that I want to raise to you guys: in calculating the importance measures for all,

my impression is, which checked with 1150 and a few other IPEs and it was confirmed, what the computer called -- that calculates it does is it takes one term in the PRA, sets it equal to one. For example, you know, it may include the failure of the valve to open, plus a couple of other things, it says, okay, what if this is one, okay. So, I will set the probability of failure to open equal to one and calculate my raw and everything, right? It doesn't go -- if you -- if I'm interested in the valve, though, I should worry about maybe it is a generator. I should worry about it failing to start, failure while you're running, and maybe other things. Does it take different terms to set them up?

DR. POWERS: And I intend to take it out of your time period that you have later this morning.

MR. APOSTOLAKIS: That's fine.

MR. WHITE: When it calculates a raw value and it sets failure to open of a valve, the other terms in the cut set that are there --

MR. APOSTOLAKIS: Right.

MR. WHITE: -- would be there for all the other failure modes. They are essentially taking those into account by setting one term.

MR. APOSTOLAKIS: At a time. Well, that makes --

MR. HOOK: There are, also, two ways to calculate raw: one is from the cut sets, where you set the basic

event to one and resolve the cut sets; the other is to resolve the model with that basic event set to Boolean true. In that case, all the other --

MR. APOSTOLAKIS: Yeah.

MR. HOOK: -- basic events that are under the orgate are set to true, so you don't double count.

MR. APOSTOLAKIS: Is that done routinely, though?

MR. HOOK: I don't -- in Santa Ofrey, we actually calculate our raws from the model, instead of from the cut sets.

MR. APOSTOLAKIS: Okay, thank you.

MR. WHITE: That's the way we do it at South Texas, we calculate it from the model. And, specifically, when you go into configuration risk management, when you're doing multiple components, you have to do it that way, to go and turn them off in the model, recalculate the model. It's a more accurate way to do it.

MR. APOSTOLAKIS: Right. Okay, thank you.

MR. HOLAHAN: I'd like to clarify one point.

MR. APOSTOLAKIS: Okay.

MR. HOLAHAN: That is, I think Tom and I have confessed that we haven't thought about this very much; but the staff, who have been reviewing or reviewed the Palisades check valve study, have, in fact, spent some time thinking about this and I understand at least some of these thoughts,

in fact, are reflected in the ANPR Appendix T discussion. But, I have to confess, for myself, I haven't thought about it very much.

MR. APOSTOLAKIS: Okay. I think we're done. Thank you, very much. This was very useful and back to you, Mr. Chairman.

DR. POWERS: I'm willing to recess until three minutes after 11:00.

[Recess.]

DR. POWERS: True to my promise, we are going to start at three minutes after the hour.

MR. WALLIS: Do we have a quorum?

DR. POWERS: I think we do.

MR. BOEHNERT: Yes, you do.

DR. POWERS: And I think we have sufficient number for a quorum. And we turn now to the issue of the final revision to Appendix K, the 10 CFR Part 50. I first have a request for a personal statement from Professor Uhrig.

MR. UHRIG: I just wanted to acknowledge that I have some research going on similar to some of the things that Herb Estrada is going to talk about. I just wanted to let this be known.

DR. POWERS: Okay, possible competition.

MR. BOEHNERT: Yeah, but you're not in conflict, Bob. We've gone through this before.

MR. UHRIG: Okay, but I want to point that out.

DR. POWERS: That's fine. With that introduction, I'll now turn to Professor Wallis and he can guide us through this particular topic.

MR. WALLIS: We should catch up on time with this topic. It does not involve PRAs or risk information.

[Laughter.]

MR. SEALE: Just thermal hydraulics.

MR. WALLIS: It concerns the assumption, which is required -- has been required to be made in the ECCS calculations, that the power level be taken to be two percent higher than it is thought to be, as a result of uncertainties in the power level, mostly as a result of measurement uncertainties, and as a result of the availability of further measurement devices, it seems possible to reduce to some certainty. And the staff believes that when they presented it to us last time, essentially endorsed their belief that with uncertainty is reduced and there are grounds for reducing the corresponding module in the regulations. This sounds like a very straightforward case.

We, also, asked them to look at whether or not there were ripple effects; if this were approved, were there other parts of the regulations where 102 percent might have been used for some other purpose. And we, also, cautioned

them that this was a very simple case where reduction in uncertainty could lead to reduction in -- and the connection was so obvious that it could be approved; but, in other cases, the connection not might be so obvious.

Mr. Donoghue, maybe we'll get to lunch on time.

MR. DONOGHUE: I'll try. Thank you. Good morning, I'm Joe Donoghue. I'm in the Reactor Systems Branch in NRR, and I am here to give you an update on where we stand on completing our efforts to revise part of Appendix K.

This is where I always give a summary of what we're doing, so I won't repeat that. I'll just give you a little bit of background, where our milestones that we've gone through so far. We've had briefings last year with the Thermo Hydraulics subcommittee and the full committee and then we had exchange of letters, which expressed those views. And we then went to the Federal Register and published the proposed rule in October and then completed the public comment period in December. We did receive some comments. Those are incorporated in the final rule package. And we are probably about two-thirds of the way through the concurrence process with the staff right now.

So, really, what I need to do is tell you what will change from what you've seen and heard before. And it is really just summed up in the -- what we say to address

the public comments. There were six responses to the proposed rule notice. Caldon, the vendor for a full meter NEI, and four licensees. All the responses were positive, in that they all supported the rule change. There were some requests for clarifications and some other issues raised within the comments and we have to address those in the final package. Three of the more significant ones I've listed here, under that second bullet.

What to do when a licensee finds that the uncertainty for power measurement is above two percent? We, basically, say that a licensee needs to take action to address that. We can get into that in detail, if you'd like.

Apparent requirement for upgrading instruments was addressing a perceived requirement in the statement of considerations in the proposed rule, that we were going to require some kind of a technical specification, a LCO have you, for an instrument that was going to be used to justify this change. And we do say -- we do clarify in the Federal Register notice for the final rule that that's not a hard requirement that we're going to impose on people.

The last point is -- it's been around awhile, 50.46, the ECCS rule, reportability requirements; specifically, what to put in the annual report. This was mentioned in the proposed rule notice, saying that if a

licensee did nothing more than change their ECCS analysis, in response to the rule -- the amended rule, that at the very least, we would need to know through the annual report. One of the comments took issue with that and we are putting some clarification into the final package, to say that this rule change does not affect the reportability requirements in the ECCS rule. Those still stand and we try to make it clear that the NRC needs to know when there are changes made to the -- to an existing ECCS analysis.

MR. WALLIS: You have very few slides, so I think it's fair to ask questions.

MR. DONOGHUE: Yes.

MR. WALLIS: This question about uncertainty above two percent is interesting and originally, we sort of assumed that uncertainties were going to be better than two percent. This two percent was a conservative business.

MR. DONOGHUE: Sure.

MR. WALLIS: But, then, you went to NEI and NEI essentially said if it turns out there are uncertainties above three percent, then they'd better reanalyze or they better incorporate this somehow in their paperwork.

MR. DONOGHUE: Right, and we don't have a problem with that.

MR. SIELSEN: And it might go the other way.

MR. WALLIS: Well, it's just interesting, that it

might -- it might not help them. This new rule might actually set them back a little bit, if they've got higher uncertainties.

MR. DONOGHUE: Well, it will help -- I think it helps, because people know more about their plant.

MR. WALLIS: But, it means they've been operating with an assumption of two percent, whereas really they should have been operating with maybe four or five percent, whatever the uncertainty really is.

MR. DONOGHUE: I understand. And there are two edges to that issue: one is when a plant has already implemented the change, has been operating for a while, for example, with a new instrument, and they find out that something has gone wrong with that instrument, there's something to be done; also, if they're in the midst of trying to figure out what the existing uncertainty is, what should be done. We didn't have an issue -- we didn't have a problem with the comments; we just wanted to be clear on where we stood and that's what we tried to say in the Federal Register notice.

MR. WALLIS: Now the second one is they don't need an upgraded instrument, unless they haven't got an accuracy, which is good enough for the present instrumentation and they want to implement this new -- this new flexibility.

MR. DONOGHUE: Right.

MR. WALLIS: So, they can just live with what they've got, as longs as it's accurate enough. But, it may be if they find out that it's inaccurate, they may go back and actually get a better instrument, rather than try to change their ECCS analysis.

MR. DONOGHUE: Certainly. They have either option to take.

MR. WALLIS: Now, sometimes -- I read your thing and I think it's straightforward. But, again, there's going to be an SRP or something. There's going to be some things in there, which clarifies what you mean by accuracy and you've got to clarify that the instruments got to have the right mean and you're going to have the mean, which is -- it says it's so many megawatts and it is so many megawatts. It's their best estimate of the mean. And then there's a distribution about the mean, which is statistical. It's one percent means within a 95 percent of probability or something.

MR. DONOGHUE: Well, in general, we -- there was a comment on whether or not -- well, they recommended that we institute some kind of guidance, that sort of thing.

MR. WALLIS: Yeah, I think you need definitely guidance. It's not clear what one percent or two percent means.

MR. DONOGHUE: Well, our response, at the moment,

is to say that we need to gain experience on what the different approaches might be out there that people want to take. There might not be just an instrumentation installation that could make the option available to people. It could be an analysis of the existing flow measurement systems. It could, also, be some other approach that we haven't even thought about.

We acknowledge that the guidance may be necessary. What we've said in the final Federal Register notice is that, as we gain experience on reviews, we'll assess whether or not we need to put those kind of things in writing for people to follow.

MR. WALLIS: Well, I think guidance is definitely necessary.

MR. DONOGHUE: Okay.

MR. WALLIS: You may even need to explain to us some day. Because, if you simply say two percent uncertainty, that's not specific enough for me to know what you mean.

MR. DONOGHUE: The way I understand it right now, the instrumentation that we looked at has some clear contributors to the uncertainties, and that was -- I won't call it simple, but it was laid out, so that we could follow it, we could ask questions, and we got to the point where we understood, we think, what the contributors to the

uncertainty were. And that's in the topical report that was reviewed. It's a document that we have.

Other approaches may have other contributors that we haven't thought about right now. And for us to put a laundry list of things for people to look at, based on the review we've done so far, wouldn't, I don't think -- I think it would be counterproductive.

MR. WALLIS: No, I wasn't looking for laundry lists. I was simply saying that if you said uncertainty is two percent, I don't know what that means. You have to put it in more rigorous statistical language for me, so that I know what you mean.

MR. CARUSO: Dr. Wallis, this is Ralph Caruso from Reactor Systems Branch. The way we've viewed this is that this is an unusual situation. This is the only instrument in the plant for which there is a regulation that specifies that you will use a particular uncertainty value. All the instruments in the plant, temperature, pressure, everything else has various uncertainties associated with it and the staff -- I'm saying this on belief, because I don't work in the I&C branch, but it is my belief that the staff already has guidance in place for how to handle instrument uncertainties, how to deal with them. And we would expect that this instrument now would just fall into the bin with the rest of the instruments.

MR. WALLIS: So, you could refer to some other guidance that's in -- that is somewhere in your bag of tricks?

MR. CARUSO: I believe so. I don't know that for a fact, because I'm not an I&C person.

MR. WALLIS: I'm just uncertain about it being equivocal, what is meant by uncertainty.

MR. CARUSO: That's what we would expect.

MR. DONOGHUE: I'll speak a little bit for the Instrumentation Branch, because I was familiar with the review on the LAFM. The topical report referred to some industry standards and in some of the -- at least the REI responses, there were involvement of some of the reg guides that had to deal with instrumentations. So, those are the things that I'm pretty sure Cliff Doutt, in the Instrumentation Branch, drew on as guidance.

DR. POWERS: Just for my own edification, if somebody happens to know what is the usual attribution of uncertainty in the temperature measurements.

MR. UHRIG: The best you can expect on a thermocouple is two degrees -- I'm sorry, two percent.

DR. POWERS: Which is about two degrees.

MR. UHRIG: Well, it depends on what temperature --

MR. WALLIS: Two percent of what?

MR. SIELSEN: Of the full range.

MR. UHRIG: Of the full range.

MR. WALLIS: When going back to absolute zero or --

MR. UHRIG: No, no, no.

MR. SIELSEN: For the range in the --

MR. BARTON: From zero to 500 degrees, you're talking about two percent.

MR. WALLIS: Over the range, okay.

DR. POWERS: That was roughly my understanding. I think I was a little more generous. In the temperature range that you're here with type Js and Ks, I thought it was about two degrees; and then when you got up a little higher, more as you approach the failure point, then it went to the two percent.

MR. WALLIS: So when you're doing calorimetry, you need to know flow rate and temperature, don't you?

MR. DONOGHUE: Correct.

MR. WALLIS: And you need to be pretty precise in your temperature measurements.

MR. DONOGHUE: It is a big contributor.

MR. WALLIS: Yeah, definitely.

MR. SIELSEN: Another perhaps simple question, this really doesn't authorize a change in power level. A reactor operator still operates at 100 percent power.

MR. DONOGHUE: Correct.

MR. SIELSEN: The net effect of this is to reanalyze under Appendix K and you end up with more margin on things like final acceptance criteria.

MR. DONOGHUE: That's one option they can use it for.

MR. SIELSEN: Okay.

MR. DONOGHUE: A power up-rate is another step.

MR. SIELSEN: That's right.

MR. DONOGHUE: It's a license amendment. It has to be reviewed by the staff.

MR. SIELSEN: And you could use this in conjunction with a submittal for a power uprate to claim enough margin to show that the power uprate was appropriate.

MR. DONOGHUE: Well, this and going through the other analysis for -- safety analysis for the plant --

MR. SIELSEN: Right.

MR. DONOGHUE: -- to show that you either need to reanalyze them, you don't need to reanalyze them, and why it's okay.

MR. SIELSEN: Yeah. But, this, in and of itself, does not change the power --

MR. DONOGHUE: No, it does not.

MR. SIELSEN: -- level of the plant.

MR. DONOGHUE: It does not. Okay, as I said, we

added some clarifications to the Federal Register notice and, as a result of the comments, none of the language in the proposed rule was changed. That's why we feel comfortable coming here today to say that, although we were not to the final rule stage or submitting it for publication as yet, we feel confident that what we've told you, what you've read so far is what you're going to see for a final rule.

Just to sum up, we had no adverse public comments to the rule. The final package will have public comments addressed. And based on that, we'd like to ask for the Committee's endorsement on the final rule. That concludes what I have to say. Any further questions?

MR. WALLIS: Well, I have just a few questions.

MR. DONOGHUE: Yes.

MR. WALLIS: The package is fatter than I thought it was going to be. That's not the question.

MR. SEALE: That's an observation.

MR. WALLIS: There are some statements -- "the change in the rule gives licensees the opportunity to use a reduced margin, if they determine that there is a sufficient benefit" is in here. Now, do they really have to determine a sufficient benefit? If they want to do it, they can use it. They can apply for it and they can say we're going to become better at accuracy here, we're going to use a reduced

margin. They don't have to justify it on the basis of some sort of benefit.

MR. DONOGHUE: That's correct. The staff is not going to see if it's --

MR. WALLIS: So, I don't know that you need --

MR. DONOGHUE: -- worth their while.

MR. WALLIS: -- to qualify. It just gives them an opportunity to use a reduced margin, if they can justify it.

MR. DONOGHUE: Right. The only requirement is to justify the --

MR. WALLIS: Okay. Because, you use "benefit" in some of these paragraphs and I'm not sure there's any obligation for the licensee to show any sort of benefit.

MR. DONOGHUE: No, no, there's no obligation. I think maybe that's just the kind of language that -- and I guess in a rulemaking package, we like to talk about why we're making a rule change to begin with --

MR. WALLIS: They might see --

MR. DONOGHUE: -- that's going to have benefits.

MR. WALLIS: -- some reason to do it, which is not in terms of a benefit that might be understandable, in terms of dollars directly.

MR. DONOGHUE: Correct. That's not a factor in our review at all.

MR. WALLIS: And I was, also, interested to see

that there's a fairly extensive discussion here of cost benefit analysis. Is that necessary?

MR. DONOGHUE: It's required.

MR. WALLIS: But, it seems to me that -- it seems very strange it should be required, because this isn't a straightforward thing.

MR. DONOGHUE: It's just a standard requirement for rulemaking packages. It's needed to put some thought into that.

MR. WALLIS: I find it interesting that -- okay, I'm even more intrigued that it should be even thought necessary with such a simple change.

MR. DONOGHUE: I can point out at least a dozen things like that.

[Laughter.]

MR. WERMIEL: It's the wisdom of the Congress. There are other examples, Dr. Wallis, of paper reduction and FACA and things like that, that all go into rulemaking packages that have no direct relationship to what we're doing.

MR. WALLIS: Well, I'm not sure you passed the paper reduction rule.

[Laughter.]

MR. WERMIEL: And I might agree with that.

MR. WALLIS: Then there's the question of clear

language requirements.

MR. WERMIEL: That's true.

MR. WALLIS: We won't get into that.

MR. WERMIEL: That is a requirement.

DR. POWERS: I am almost certain that they comply with both the requirements of those laws, which may, indeed, have some errors in their titles.

[Laughter.]

MR. WERMIEL: Maybe.

DR. POWERS: Or ambiguities in their titles.

MR. WERMIEL: Yes.

MR. WALLIS: So, I guess my questions are mostly -- well, not substantial, in terms of this seems to be the right thing to do. We told you that last time anyway.

MR. DONOGHUE: Yeah.

MR. WALLIS: Does the Committee have questions about this?

DR. POWERS: I guess the question that comes promptly to mind is: are there issues that you feel should be explicitly addressed in any letter we forward to the Commission? In other words, if you anticipate questions that would be useful to have comments from the ACRS in their letter.

MR. DONOGHUE: I guess the only thing is if you feel strongly about putting guidance in place, that if you

do say that, maybe tell us where you want us to -- we don't want to be very prescriptive in guidance. It doesn't need to be to the point where we're telling them how to do statistics or is it --

MR. WALLIS: No, no, no. I think that -- I think you have to point them -- I understood from the conversation that there are other places where there is guidance on I&C, uncertainty, and so on. All you have to do is have one sentence that --

MR. DONOGHUE: Okay.

MR. WALLIS: -- directs them to where to find that. Otherwise, if you simply have things like two percent margin, it's not immediately clear what that means. You can argue about the details of the statistics and so on, how you interpret it.

MR. DONOGHUE: Okay. But, otherwise, we've -- you know, we've had some comments from the industry on this and we think we've addressed them in the Federal Register notice. I don't think there's any major issue that we need to --

MR. WALLIS: Well, we've raised the question --

MR. DONOGHUE: -- force the Commission -- of the ripple effect on other things, like other limitations where they might be asked to assume 102 percent power for some other purpose. You did look into that, I understand? It's

mentioned somewhere in here, but I didn't -- It's mentioned in connection with the review we've done on the Comanche Peak power uprate, which was our first step to look at. This is basically taking the same approach that somebody would take to get a power uprate based on this rule change, where we ask questions about all the safety analyses and where there -- for example, one issue that was brought up in the ACRS letter was fuel performance limits.

MR. WALLIS: That's right.

MR. DONOGHUE: When it looked like we needed to take a closer look at some events based on that, we asked some questions, to make sure that any new analysis that had to be done, that it ensured that they met fuel performance limits. So, the existing requirements in the regulations requires certain safety margins for fuel and so forth aren't affected by this. The licensees still have to follow all of these. When we do a license review, we just make sure that they still do.

MR. UHRIG: But this up-rate would be no different than any other up-rate, as far as review is concerned, is it?

MR. DONOGHUE: Basically, right. You ask the same --

MR. UHRIG: Exactly the same.

MR. DONOGHUE: -- kind of questions; correct. In

the case, we had a Westinghouse plant and we asked a lot of questions, based on that generic topical report.

MR. UHRIG: Well, I mean, as far fuel is concerned.

MR. DONOGHUE: Right, right.

MR. UHRIG: Okay.

MR. DONOGHUE: Those limits don't change.

MR. UHRIG: That's right.

MR. DONOGHUE: The analysis for those limits don't change, either. It's make sure that whatever they have in place when we're done, the safety analysis that they're saying that the plant is based on are sufficient.

MR. KRESS: This is -- one conservatism was -- one conservatism in Appendix K that allow several others, one of which is the added 20 percent of the decay heat, which is far and above being conservative in this. It probably could be -- there probably could be a better estimate of the uncertainty in the decay heat number, if you didn't have that in there. But why is the two percent power conservatism any different from the other conservatisms, from the standpoint of allowing Appendix K analysis to get rid of those conservatisms and make use of the power up-rates or whatever they wanted to?

MR. DONOGHUE: Why change one and not --

MR. KRESS: Yeah, why change one and not even look

at all these others? It just seems a little strange to me.

MR. DONOGHUE: Well, we were being told that industry saw a potential benefit that they could use now. We didn't see any reason to prevent that from happening, based on having to do research on other parts of Appendix K to do a broad change. And this is something we've talked about in both the proposal and the final rule, where that was an option we had. We could have -- they could have elected to put this on a list of changes that we would have considered for all of Appendix K. And we realized that it would be a very resource intensive effort, it would be very time consuming, and the public, being the industry in this case, would have a long time to wait to get any benefit. So, this was, we've said, a not very risk significant change. It's -- and you said so yourself, compared to the other conservatisms in Appendix K, it's relatively small; so, we felt confident to be able to make it now -- make the change now.

MR. KRESS: I think it sort of leaves you wondering whether is something going to come down the line later.

MR. WERMIEL: Yes, Dr. Kress, this is Jared Wermiel, Chief of the Reactor Systems Branch, again. We do have an effort underway right now with -- in conjunction with research, to look at two other specific aspects of the

conservatisms in Appendix K, one of which is the decay heat assumption. We are, also -- we're, also, looking at other parts of it. But, Joe -- go ahead, Dr. Seale, I'm sorry.

MR. SEALE: You meter and sell operating power.

MR. WERMIEL: Right.

MR. SEALE: You don't sell decay heat.

MR. WERMIEL: That's true.

MR. SEALE: It's as simple as that.

MR. KRESS: You meter decay heat. You sell it in the arena of the power --

MR. SEALE: But, it's part of what you get when you measure flow rate and temperature.

MR. KRESS: You don't do that for decay heat.

MR. WALLIS: Yes, but I think the issue here is safety; that in order to make a safety analysis, if you're uncertain about flow rate, you add this two percent. It's pretty clear, when you are no longer uncertain, then you can reduce it. Some of the other uncertainties in LOCA analysis are not so easy in getting around, because of other uncertainties. And that's what I think we wrote in our letter, if you're going to try to broaden this reduction of uncertainties and tie it to margins, it may be more difficult to justify.

MR. DONOGHUE: Right.

MR. WERMIEL: To reiterate what Joe was saying,

the industry came to us and said this was something that they wanted and we just thought it was a good idea to pursue. Yes, we were reacting to an initiative that really began on the part of the industry. The initiative I just mentioned is really a staff initiated one, where we realized just exactly what you're saying. And ACRS, I'll admit, helped play out that it's about time we did start to think about other conservatisms in Appendix K that warrant change and that is what we're doing.

MR. KRESS: Thank you, Gerry.

MR. WALLIS: I still want a more rigorous answer to the question about whether this affects other regulations. And we wrote in our letter, because some of the members other than myself felt that there might be these things. And are we now sure that there is no concerns, so we don't -- do we need to just sort of state in our final letter that our concern with the affects on fuel is -- are flow limited rather than LOCA limited? Have they gone away?

MR. WERMIEL: As far as we know, Dr. Wallis, from our look, there is no other regulation where this change has an impact. There is in some reg guides an assumed power level and that does have to be changed. But, from a regulation -- standpoint of requirements, this is the only one that specifically addresses the power level of the plant. In other analyses -- or guidance for them, the power

level is a value that's assumed and it's established in some reg guides that do need to be revised. And I believe we say that in the statement of consideration. I think I remember reading those words somewhere in there.

MR. WALLIS: Yes, I read that, too. So, we can say in our letter that you've taken care of it?

MR. WERMIEL: Yeah, and more than that, our Office of the General Counsel has been helpful in helping us search out those areas, to make sure that the -- what we talk about in the package about conforming rule change, to make sure that that is consistent with the regulations. In other words, they're making sure that this change is consistent with the rest of Part 50 and doesn't, in any way, conflict with it or somehow negate other parts of the rules.

MR. BONACA: I would point out one thing: that comment regarding the affects of the power change and other issues, I raised an issue at a previous meeting, it was a concern with the piecemeal approach that we have had in the past and it seems to be continuing now. We discussed this morning the uncertainties, assuming the analysis in other analysis, the degrees Fahrenheit and 50 PSI, particularly in PWRs. Well, PWRs do not require to have those kind of assumptions made explicitly for uncertainties, because electric provides a different approach and the staff accepted it. So, now, you have a situation, where for PWR,

you're forcing the explicit treatment of uncertainties. For PWRs, they're implied that they're contained within the conservatisms in the calculation.

The point I tried to make at the time, Graham, was relating to this piecemeal approach to regulation. It seems to continue now. Now, we're removing the two percent off of the LOCA. And, you know, again, it's one change there and I don't have a problem with that. I have a problem with the piecemeal approach.

MR. WALLIS: Well, piecemeal -- one person's piecemeal is another person's sort of prudent steps one at a time.

MR. BONACA: No, I would like some consistency; that's all I spoke about. And I gave the example of the treatment of uncertainties between PRW and BRW for no good reason, except the two vendors chose different approaches. It's totally different, you know. In one case, you have strict requirements for something that is presently on uncertainty treatment and for the BRW, you don't. They're implied in the conservatism "of the calculation."

MR. WALLIS: Our piecemeal word got into the statement of considerations here. This is an attempt to rebut the piecemeal accusation in there. Do we need to say anything more about this in our letter?

MR. BONACA: I would not. We already made a

statement before.

MR. WALLIS: Have we gone too fast?

MR. BOEHNERT: Well, I think Mr. Herb Estrada is here and wants to make some comments on behalf of Caldon.

MR. WALLIS: Are we ready to invite him to speak? Any closing remarks from anybody or comments?

[No response.]

MR. WALLIS: Thank you, very much.

MR. DONOGHUE: Thank you.

MR. WALLIS: You can proceed.

MR. SEALE: We see you again.

MR. ESTRADA: Yes, I'm returning, but not for long.

MR. WALLIS: All I was going to say is good to see you, again. We appreciate your comments last time.

DR. POWERS: We appreciate you coming in the snow, Herbie.

MR. ESTRADA: Thank you.

MR. WALLIS: You can sit down, if you wish.

DR. POWERS: Yes, there's a chair there. There's a chair down. You can sit down and use that microphone.

MR. ESTRADA: Thank you. I appreciate that. I will be brief. My purpose is simply to reiterate my remarks of last time. I do believe, based on Caldon's experience in this field, that engineers skilled in the science of

measurement are not numerous in the utility industry. And so, I do believe that in the relatively near future, some guidance in the application of this rule is necessary. It's a little bit unusual for somebody on the industry side of the fence to be asking for that, but I do believe that absent such guidance, we can see very possibly some mistakes in the application of this rule, which won't be good for anyone.

I, also, wanted to comment that we did provide -- we didn't discuss it last time, but we did provide to the ACRS and to the staff some suggested guidelines that might be used in such guidance. I won't go over them in detail, but they do speak to some of the subjects that were discussed this morning. For example, a clear definition that 95 percent confidence levels are the appropriate measure of uncertainty and some suggested acceptability -- some suggestions as to the appropriate methodologies for combining uncertainties were suggested. There are several of them out there. In our topical report, we used one. There are others. They do things somewhat differently and you can get different answers. I'm not asking that the staff be prescriptive in this, but I think some consideration of that is appropriate.

And we, also, suggested several guidelines, which were along the lines of achieving, in the power measurement,

the same kinds of rigor that one achieves in the analysis of transients and accidents, themselves, namely that the analysis that demonstrates that, in fact, a precision of the power measurement has been improved be demonstrably complete, that the modeling uncertainties be bounded, and that the parameter uncertainties that go into the determination of the power, also, be bounded by the approach. And they can be made again available, but I believe the staff does have them.

That's all I had to say. But, I do believe that such guidance will be necessary, if this rule is to be applied responsibly. Thank you.

MR. WALLIS: I was going to say that was spoken like a member of the ACRS.

[Laughter.]

MR. WALLIS: Nice job.

MR. ESTRADA: I'm old enough.

[Laughter.]

MR. SHACK: It was clear, concise, and to the point.

MR. WALLIS: Any other --

MR. ESTRADA: Do you have any questions?

MR. WALLIS: -- questions or statements? Thank you, very much. I think we're finished with this issue.

DR. POWERS: Let me ask you, Graham, do you have

enough information from the members and whatnot, to prepare a draft letter, at some point?

MR. WALLIS: I think it will be a short one, if the members will allow it to be.

DR. POWERS: I think you need to say a few words about the guidance issue; but, yes, I agree with you that this will be a fairly pointed letter. If that concludes that topic, I will now turn -- I'm going to switch the order just a little bit and ask for the report on the ACRS/ACNW subcommittee.

MR. KRESS: Okay. The joint subcommittee did meet on January 13th and 14th, and the subject of the meeting was defense in depth, in general, and, specifically, how it might be used in the NMSS regulated activities and how they may -- how it may be related to the reactor use of defense in depth, if at all.

We did have the benefit, let's say, at the meeting, of presentations from three of the members. That would be Kress, Apostolakis, and Gary. And we, also, had presentations by three invited experts; that's Bob Budnitz, Bob Bernero, and Tom Murley. You guys probably all those names. And we had an NMSS consultant, Levinson, and we had the benefit of the staff's presentation. As you could probably guess by the cast of characters, it was a spirited, just lively discussion. It was -- it may be even

characterized as enlightening; I don't know.

DR. POWERS: That may go too far.

MR. KRESS: We did develop a draft letter on the subject and I hope, I don't know with our crowed schedule, to at least have you guys look at it and maybe read it in private and give us a little feedback, to see as to whether or not you have any really severe heartburn with what we said and what the draft consists of, at this time.

It has been gone over by George and by Gerrick and the other members of joint subcommittee, so it's kind of near a final form, but not altogether.

So, so if -- the letter itself makes a number of points, and maybe I'll point those out to you before you read it. One is that the Commissioner's definition of defense-in-depth in their white paper, which basically defines defense-in-depth as an allocation of risk between prevention and mitigation.

And you know, it doesn't say those words but that's basically what it means. We say that's a good if defense-in-depth no matter where you apply it, NMSS or reactors. But it's not a design tool definition, in Dana's words. There's guidance needed on this allocation in terms of how many compensatory measures and how good they have to be.

And in the letter, we also laid out a number of

what we'd call defense-in-depth principles that can be used to guide the application. And these principles -- maybe I'll just read a few of them. There's three of them. It's -- principle, defense-in-depth is a strategy to deal with uncertainty. We all know that. The other principles, "the degree to which you apply defense-in-depth ought to have been on the potential inherent hazard of the activity you're regulating. This goes directly to the NMSS stuff, where they have things that just aren't very hazardous, and so the question is how much defense-in-depth do you really need? It would all depend on that. And, how good and how many compensatory measures you put on is not really subject to technical resolution. It's a policy issue; it's a judgment. It's a matter of, you have to decide based on how you value those things.

And we made a couple of, I think they're pretty good recommendations. For the NMSS, they need to develop risk acceptance criteria, like we have in the reactor business, for each of the regulated activities. What is it we're trying to regulate to? What is our acceptance criteria? They don't really have a lot, all those yet, and they need them.

The other recommendation is that somebody needs to develop this guidance on how you really do arrive at allocating the risk reduction contribution from, from a list

of compensatory measures. So we also expanded on that need for guidance and said for the NMSS regulation of particularly Yucca Mountain, the repository -- but it would apply to other things too.

There was a suggestion written up in a little paper, discussion paper presented by John Gerrick on how to go about determining the risk contribution and the uncertainty associated with each compensatory measure in terms of preventive measures and mitigation measures. And he used as an example how you would apply it to Yucca Mountain. We thought that was a good way to go about quantifying with PRA, using PRA methods, quantifying the allocation that you already have for an existing design.

So we thought the pragmatic approach was to take existing designs for the -- which they have basically for all the regulated activities, including, including production facilities and other things, medical and so forth -- take this approach and actually apply it and look at what you got. Number one, it tells you, do you meet your risk acceptance criteria, and it tells how this risk reduction, contribution to reduction of risk is allocated among the various measures, and just take that and say, all right, is it good enough? Is this the right balance to have, and how would you make that judgment? Use expert opinion. And --

DR. UHRIG: Is that Gerrick paper available?

MR. KRESS: Hmm?

DR. UHRIG: Is that Gerrick paper available?

MR. KRESS: Yeah, we're going to append it to the letter.

DR. POWERS: Tom, one of -- an input to your meeting I think included someone who felt that a criteria had to exist for invoking defense-in-depth, that it was an expensive safety strategy. And he set down a set of conditions he thought had to prevail before you went to defense-in-depth type approaches. Was that totally rejected?

MR. KRESS: Not totally. We tried to incorporate that into the concept and defense-in-depth ought to depend on the inherent hazard, the extent of it.

We have yet to -- it was rejected to some extent because we felt like defense-in-depth was gonna be there regardless of what you called it and regardless of whether it's expensive or not. I mean, if you put it in there, it's worth the price of putting it in there. That's basically the concept.

DR. POWERS: I think that's going to be a stumbling block.

MR. KRESS: It may well be. It will be only because -- it may or may not be because the recommendation comes from one of the invited experts and we're not bound to

be held by any recommendation. We can reject it if we want to. And unless some members share their opinion and make a, make an issue of it, that may be an issue here.

DR. SEALE: No --

DR. POWERS: Do I have a copy of this draft letter?

MR. KRESS: No. I think it's supposed to be handed out to you --

DR. APOSTOLAKIS: So there is a letter?

MR. MARKLEY: I'll make copies.

MR. KRESS: There's this draft letter that you and I and Gerrick worked on, and I thought we had it available for the members to look at, give us -- you know, we, we can't afford the time to go over it in much detail, but the members can read it and then --

DR. POWERS: I mean, that's the approach we had for this joint letter is it's read for content and not for -- but we do leave open the opportunity to make additional comments, and it sounds like there probably will be.

MR. KRESS: It could be. Or you may suggest, in addition to the letter, that it might or might not get --

DR. APOSTOLAKIS: Suffocated.

MR. KRESS: -- incorporated. That's, it hasn't been --

DR. POWERS: I persist in worrying that

defense-in-depth sounds like such a wonderful thing that you want to apply it here and there. I don't think it does. I don't -- I think it does not belong in certain kinds of discussions and I think a, I will agree that it is arguable on Yucca Mountain and things like that. But when I come to the other kinds of things that NMSS covers, I just can't imagine why you would want to go to a defense-in-depth type of strategy.

MR. KRESS: Well, I think the Committee would agree with you on that. In fact it wasn't meant to say you're gonna have to apply it to all those sort of things. We think it's probably applicable to Yucca Mountain.

DR. POWERS: I mean, it's arguable there.

MR. KRESS: It's arguable there.

DR. POWERS: When it is applied, I grow uncomfortable with this statement -- which may have an element of truth to it -- that defense-in-depth is a method of dealing with uncertainties. But without some further discussion, it trivialized the issue, I think, and implies that perhaps we know more than we actually do.

DR. SEALE: Yeah.

DR. POWERS: Because one of the biggest uncertainties you're confronting with are the things that, through human ineptitude, have been left out of the models altogether. And so -- I'm not sure that comes across when

you say it's an attempt to deal with uncertainties.

DR. WALLIS: That's the biggest uncertainty of all.

DR. POWERS: Of course, but I'm not sure that that's transparent to everyone that --

DR. WALLIS: It's not necessarily ineptitude. It's human action.

MR. KRESS: I think, I think that is wrapped up in uncertainties and in terms of compensatory, a series of compensatory measures because what you do is you spread your risk out, and some of these compensatory measures are not going to be affected by this human error as much as others. That's why you do it, because you don't know how much it's going to do it, and that is a way of dealing with that kind of uncertainty.

DR. POWERS: It's an intriguing topic. And I'm sure we'll have more to say about that. I look forward to looking at the letter. We probably ought to reserve at least a few minutes to discuss it --

MR. KRESS: We probably ought to.

DR. POWERS: -- so we can get on with that. Let me now turn to the Subcommittee report from the Reliability and Probabilistic Risk Assessment Committee and their meeting on the 15th through the 16th.

DR. APOSTOLAKIS: Okay. We had a meeting, a

two-day meeting where the first day we discussed the activities of the former AEOD people. I don't know why we keep referring to them that way. What's your new, new name, Steve?

MR. MAYS: It's the Operating Experience Risk Analysis Branch.

DR. APOSTOLAKIS: Oh. Okay. The Operating Experience --

DR. POWERS: I think we keep referring them to the AEOD because we thought that they ought to be preserved.

[Laughter.]

DR. APOSTOLAKIS: We lost that battle.

DR. POWERS: Yeah, but we don't have to admit defeat.

[Laughter.]

DR. APOSTOLAKIS: So we had the usual suspects there, and one of them is here today. Patrick Baranowsky's not. Also other guys.

We discuss data sources, analysis tools like EPIX and the Reliability and Availability Data System. They also provided the results of the reliability studies for a number of systems. HPSE, Isolation Condenser, High-Pressure Injection and so on. The usual good stuff that this Committee appreciates.

We discussed the Accident Sequence Precursor

Program, the SPAR mode of development, and so on. I suggested that the common cause failure -- no. Was it, the common cause failure thing is kind of overwhelming, the methodology that those guys have developed, and that maybe we need something simpler, and that people can read and understand the approach. The Staff was negative when they were there, when I had a couple of phone calls that maybe you were not so negative after all. We'll see how that goes.

Maybe a review of state of the art -- as you know, I have expressed concerns in the past regarding the basic assumptions of the approach, which were established, as we said the other day, I mean starting with Carl Fleming's beta factor in 1976, that time frame. And then, you know, we have become a little more sophisticated, but the basic assumption of defining parameters like beta and gamma and so on are still there, and I thought that maybe after all, this experience we should re-evaluate the validity of these assumptions. So we'll see where that will go.

There were concerns expressed -- also we discussed the possibility of -- yes?

DR. POWERS: Give me some insight here. If I were to set all of the parameters in a typical PRA for a nuclear power plant, dealing with common cause failure, to zero -- say there's no such thing as a common cause failure.

DR. APOSTOLAKIS: Yeah.

DR. POWERS: -- there is no such thing as common cause failure. What kind of risk would I typically get?

DR. APOSTOLAKIS: Oh, you would get a much lower value. For example, I don't know about the ultimate risk, but for system unavailability, as I remember, when people naively used to do the so-called random independent failure analysis, they would get typically 10^-6 or lower. And we know now that the numbers, both analysis and the work that the operating experience branch has done, is about two orders among the difference or higher, if not greater sometimes. About two orders, I would say.

MR. MAYS: I think it depends on the complexity of the system.

DR. APOSTOLAKIS: It depends on the complexity, but definitely not 10^-6.

MR. MAYS: I think you don't find very many two-train systems running around with 10^-6 --

DR. APOSTOLAKIS: Exactly.

MR. MAYS: -- realistic experience on their probabilities.

DR. APOSTOLAKIS: So at that level, I would say you'd see about two order among the difference in the unavailability. That affects the core damage frequency.

DR. POWERS: I mean, I just don't know how widely

seen it is outside of the practitioner's community. How much of the PRA rest upon this technology, which is difficult at best to experimentally verify?

DR. APOSTOLAKIS: This particular model has an impact.

DR. POWERS: A true impact, and we had a struggle to distill out of a failure data something that gives us a warm feeling about this.

DR. APOSTOLAKIS: yeah, but also we have to give credit to people, because you really, if you think about it, what they're trying to do is, they're trying to model a class of failure, possible failure causes that are not modeled explicitly. This is really important. This is not the only place where we model dependencies.

I mean, we have fires, earthquakes, human errors during testing, and so on and so on. We do model a lot of things that are, that induce common cause failures explicitly, and then we stop and say, well, gee, we have seen so many other things happen in real life, and we can't very well start modeling each one explicitly. It's not worth the effort. So we create this class, and that creates all sort of conceptual problems. But at least it's a lower bound on the calculated unavailability; you don't see those ridiculous numbers anymore. This is really very important. It is very important.

I mean, yesterday, as I told you, or two days ago, we were looking, we went back to 1150 looking at importance measures. But the common cause failure trend was right there. I mean, if you went only with independent failure, the whole sequence would disappear. It was right there, and they tended to use lower beta factors than we would use today. But even so. Because you don't square anything. See, the random case -- you take lambda, lambda, how can you square it? In the common cause, you say no, now it's leaner. It's lambda times a beta. So you know, you're really raising the numbers significantly.

So, we'll see where that will go because, you know, in all fairness, this particular branch, you know, they don't have all the resources to do the work that's required of them. They have to develop a --

DR. WALLIS: The common cause could also be this human action.

DR. APOSTOLAKIS: Yeah. We modeled this separately, as I said.

DR. WALLIS: Oh, but that would be the most unnerving common cause, would be somebody misunderstands or foolishly does several things.

DR. POWERS: And those kinds of things are encountered, and you can actually go through the database and find them.

DR. APOSTOLAKIS: Yes. No the other thing -- by the way, there was a discussion of design and construction errors. And some of those, at lower levels, are included in this other category, when you have a big event, a big containment structure's resistance to very strong earthquakes. Well, you're not going to see that in the database. But some of them already in there.

Anyway, there were questions raised also about the public availability of raw data and the EPIX system. The raw data will be proprietary, therefore not available to the public, but the results of the studies will be available to the public.

Now Steve, I don't remember. Are the raw data available to you, to the Staff?

MR. MAYS: Yes.

DR. APOSTOLAKIS: Yes, okay.

DR. SHACK: I thought there was a cleansed version of the data that was gonna be available.

DR. APOSTOLAKIS: Then there was a discussion of that, and I don't remember --

MR. MAYS: The use of the data in the public is governed by the INPO and NRC Memorandum of Understanding, with respect to proprietary information. Basically, that instrument provides that we can produce the results of any of those analyses, and the data associated with it, so long

as it's not an explicit linking of particular events at particular plants at particular times. That would basically then replicate the database.

DR. POWERS: That would not be crucial?

MR. MAYS: And we have done that also in several system studies reports. If you remember the, for example, the RPS studies used NPRDS data. That fact that we had data records was there, but the reports also do not list in the report exactly which plant on which date had that particular thing. But the fact that we had, say, twenty events from NPRDS and has this nature, we can put that information. So there is mechanisms for putting scrubbed information about the data out in the public domain.

DR. POWERS: If I were a member of this public domain and I wanted to reproduce the analyses that you did, would I be able to do it from the data that are available?

MR. MAYS: You would be able to reconstruct and review all of the classifications and information that we had. What you would not be able to do is go back to the entire original database and determine whether or not you agreed that we had pulled everything out correctly.

DR. POWERS: Okay.

MR. MAYS: But however, we do send these reports to EPRI and INPO to see whether they agree that we have pulled the information out correctly. And we do send them

to the owners groups. And any time we would take a specific licensing action at any particular plant on the basis of that information, we're required by the MOU to go back and check with the plant to determine whether that information has been accurately representative. So there's those estimate --

DR. SHACK: So there is no "scrubbed" version of the database that a person can go and look at on his own.

MR. MAYS: There is no scrubbed version of the database itself in its totality. Correct.

DR. APOSTOLAKIS: Okay. Thank you, Steve.

The SPAR models -- there was a question by Bob Seale, what was the intended use by the Staff? And their answer was -- the reason I'm bringing it up is it has to do with some questions Dana has raised in the past. The Staff stated that these models were intended to assist senior reactor analysts in better analyzing risk for operating events and inspection planning. So presumably, these would be plant-specific, right?

MR. MAYS: That's correct.

DR. APOSTOLAKIS: And so we're not completely naked, in other words. We do have some capability as an agency.

DR. POWERS: No one accused you of being completely naked.

[Laughter.]

DR. APOSTOLAKIS: Offensively naked.

[Laughter.]

DR. POWERS: One accused you of being deficient, not naked.

DR. APOSTOLAKIS: I understand. I would rather be naked than deficient, though.

[Laughter.]

DR. WALLIS: But he could be both.

[Laughter.]

DR. APOSTOLAKIS: Having discussed this sufficiently, let's move on. We're still on the record.

[Laughter.]

DR. APOSTOLAKIS: The staff requested that they brief the ACRS during a future meeting, preferably the next one, which I don't think is feasible simply because there's too much to cover. And in particular, they would like to see a letter from us, perhaps commenting on the benefits of their continuing work, because now they're not AEOD anymore. Maybe a letter stating that this is still important and should be continuing, it would be in order. Okay. So this is the result of the first day.

The second day, real quick. We discussed risk-informing technical specifications. We had presentations by a member of the NRC staff and Ms. Nanette

Gilles is here to run the first part of the show. And we also have a presentation by the risk-informed -- the industry, presenting the work of the Risk-Informed Technical Specification Task Force.

There are six initiatives -- seven now? Okay, seven initiatives of this task force. And they're in the phase 1, which started last century. It's been going on for a year on and off.

DR. POWERS: Let me interrupt at this point. I'm gonna have to go and participate at another meeting.

DR. APOSTOLAKIS: Okay.

DR. POWERS: I'm going to turn the meeting over to you and rely upon you getting us back here at one o'clock.

DR. APOSTOLAKIS: Yeah. We need two, three minutes to finish this.

DR. POWERS: Sure.

DR. APOSTOLAKIS: Okay. So the initiatives include --

DR. POWERS: Via condios.

DR. APOSTOLAKIS: Defining --

DR. POWERS: -- and all that.

[Laughter.]

DR. APOSTOLAKIS: Defining hot shutdown as a preferred end state for technical specification actions, as opposed to cold shutdown; increase the time allowed to

enter, to take action when a surveillance is missed -- I'm just giving you a few examples; develop a risk-informed extension of current allowed outage times; optimize surveillance requirements; and so on. The plan that was given to us is -- by this past January, two of these would be completed. Is that, I don't know -- is that true, Nanette?

MS. GILLES: Two submitted.

DR. APOSTOLAKIS: Submitted?

MS. GILLES: Right.

DR. APOSTOLAKIS: Completed on their side, submitted to you.

MS. GILLES: Yes.

DR. APOSTOLAKIS: And then by, by February of next year, they plan to submit risk-informed AODs and risk-informed other actions. And finally, the whole project will be completed in the Year 2003, where the hope is that we will have fully risk-informed technical specifications.

We also had a presentation by Mr. James Riccio. You remember him? The lawyer from Public Citizen. And in fact, I -- he didn't come and present; he a conflict because there was Commission meeting. I think he has his priorities right. He went to that.

[Laughter.]

DR. APOSTOLAKIS: But I was asked to read the

letter, and I did. Among other things, he says that "Public Citizen opposes any further reduction in the technical specifications. The NRC's new and improved technical specifications were never intended to improve safety, only the economic viability of the nuclear industry by reducing the limiting conditions of operation by forty percent." So he clearly disagrees with the current appearance.

MS. GILLES: I might comment that the staff did contact Mr. Riccio following the meeting, and you know, offered our assistance in making any of the information available to him that he wasn't able to get to on his own.

DR. APOSTOLAKIS: Very good.

MS. GILLES: So we have done that.

DR. APOSTOLAKIS: Now, there was a recommendation, according to Mike, that full ACRS hold meetings to review each of the tech spec submittals, and I think we plan to do this. Am I leaving anything out? Mike?

MR. MARKLEY: It's just a future activities item. I don't think you missed anything, George. It's an industry initiative. The Staff's doing a lot in this area. It's probably going to be the busiest risk informed activity areas for the staff in the near future. I'd say four out of the seven items are probably going to fall in place sometime within the next year. They do have generic implications. They're not individual licenseed necessarily, but they

certainly will be sponsored by individuals. So it'll be a future activity item for the Committee to decide whether they want to have it for, within what context for future meetings.

DR. APOSTOLAKIS: In fact, I remember that somebody pointed out -- I think it was you, Mike -- that this is really a major effort.

MR. MARKLEY: Oh, yeah.

DR. APOSTOLAKIS: And it's added now to the other major efforts we're following, like risk-informing Part 50, right?

MR. MARKLEY: Exactly.

DR. APOSTOLAKIS: And this Committee -- well, we still have some leisure time. So we can start taking --

DR. BARTON: We haven't deleted lunch break yet.

DR. APOSTOLAKIS: We have not deleted lunch. And I think the order is only to sleep three hours a night. And Nanette, am I leaving anything out?

MS. GILLES: No, I don't believe so.

DR. APOSTOLAKIS: Okay. Well, any questions from the Committee?

[No Response.]

DR. APOSTOLAKIS: Thank you, very much. We will be back at one o'clock.

[Whereupon, at 12:06 p.m., the meeting was

concluded.]

REPORTER'S CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

NAME OF PROCEEDING: MEETING: 469TH ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

CASE NO:

PLACE OF PROCEEDING: 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.

Mark Mahoney
Official Reporter
Ann Riley & Associates, Ltd.

INTRODUCTORY STATEMENT BY THE ACRS CHAIRMAN

469TH MEETING - FEBRUARY 3-5, 2000

THE MEETING WILL NOW COME TO ORDER. THIS IS THE SECOND DAY OF THE 469TH MEETING OF THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS. DURING TODAY'S MEETING, THE COMMITTEE WILL CONSIDER THE FOLLOWING:

(1) IMPEDIMENTS TO THE INCREASED USE OF RISK-INFORMED REGULATION AND USE OF IMPORTANCE MEASURES IN RISK-INFORMING 10 CFR PART 50
(2) PROPOSED FINAL REVISION OF APPENDIX K TO 10 CFR PART 50
(3) REPORT OF THE RELIABILITY AND PROBABILISTIC RISK ASSESSMENT SUBCOMMITTEE
(4) REPORT OF THE ACRS/ACNW JOINT SUBCOMMITTEE
(5) NRC SAFETY RESEARCH PROGRAM REPORT TO THE COMMISSION
(6) RECONCILIATION OF ACRS COMMENTS AND RECOMMENDATIONS
(7) FUTURE ACRS ACTIVITIES
(8) REPORT OF THE PLANNING AND PROCEDURES SUBCOMMITTEE
(9) PROPOSED ACRS REPORTS

THIS MEETING IS BEING CONDUCTED IN ACCORDANCE WITH THE PROVISIONS OF THE FEDERAL ADVISORY COMMITTEE ACT.

MR. SAM DURAISWAMY IS THE DESIGNATED FEDERAL OFFICIAL FOR THE INITIAL PORTION OF THE MEETING.

WE HAVE RECEIVED NO WRITTEN STATEMENTS FROM MEMBERS OF THE PUBLIC REGARDING TODAY'S SESSIONS. WE HAVE RECEIVED A REQUEST FROM A REPRESENTATIVE OF CALDON INCORPORATED FOR TIME TO MAKE ORAL STATEMENTS REGARDING PROPOSED FINAL REVISION OF APPENDIX K TO 10 CFR PART 50. 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.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

January 24, 2000 (REVISED)

SCHEDULE AND OUTLINE FOR DISCUSSION
469TH ACRS MEETING
FEBRUARY 3-5, 2000

THURSDAY, FEBRUARY 3, 2000, CONFERENCE ROOM 2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND

1) 8:30 - 8:45 A.M. Opening Remarks by the ACRS Chairman (Open)
- 1.1) Opening statement (DAP/JTL/SD)
- 1.2) Items of current interest (DAP/NFD/SD)
- 1.3) Priorities for preparation of ACRS reports (DAP/JTL/SD)

2) 8:45 - 10:45 A.M. Technical Aspects Associated with the Revised Reactor Oversight Process and Related Matters (Open) (JJB/MVB/MTM)
- 2.1) Remarks by the Subcommittee Chairman
- 2.2) Briefing by and discussions with representatives of the NRC staff regarding the technical aspects associated with the revised reactor oversight process, including the updated significance determination process, technical adequacy of the current and proposed plant performance indicators, and related matters.

Representatives of the nuclear industry will provide their views, as appropriate.

10:45 - 11:00 A.M. ***BREAK***

3) 11:00 - 12:00 Noon Proposed Final Amendment to 10 CFR 50.72 and 50.73 (Open) (MVB/NFD)
- 3.1) Remarks by the Subcommittee Chairman
- 3.2) Briefing by and discussions with representatives of the NRC staff and the Nuclear Energy Institute (NEI) regarding the proposed final amendment to 10 CFR 50.72, "Immediate Notification Requirements for Operating Nuclear Power Reactors," and 50.73, "Licensee Event Report System."

12:00 - 1:00 P.M. ***LUNCH***

4) 1:00 - 2:30 P.M. Proposed Regulatory Guide and Associated NEI Document 96-07, "Guidelines for 10 CFR 50.59 Safety Evaluations" (Open) (JDS/JJB/MME)
- 4.1) Remarks by the Cognizant ACRS member

4.2) Briefing by and discussions with representatives of the NRC staff and NEI regarding the status of development of proposed Regulatory Guide, which endorses guidance in NEI 96-07 associated with the implementation of the revised 10 CFR 50.59 process.

2:30 - 2:45 P.M. ***BREAK***

5) 2:45 - 4:15 P.M. Proposed Revision of the Commission's Safety Goal Policy Statement for Reactors (Open) (TSK/GA/PAB)

5.1) Remarks by the Subcommittee Chairman

5.2) Briefing by and discussions with representatives of the NRC staff regarding proposed revision of the Commission's Safety Goal Policy Statement for reactors and related matters, including industry views.

Representatives of the nuclear industry will provide their views, as appropriate.

6) 4:15 - 5:15 P.M. Break and Preparation of Draft ACRS Reports
Cognizant ACRS members will prepare draft reports for consideration by the full Committee.

7) 5:15 - 7:15 P.M. Discussion of Proposed ACRS Reports (Open)
Discussion of proposed ACRS reports on:

7.1) Low-Power and Shutdown Operations Risk Insights Report (GA/MTM)

7.2) Technical Aspects Associated with the Revised Reactor Oversight Process (JJB/MVB/MTM)

7.3) Proposed Final Amendment to 10 CFR 50.72 and 50.73 (MVB/NFD)

7.4) License Renewal Process (MVB/RLS/NFD)

7.5) Response to Follow-up Questions Resulting from the ACRS Meeting with the Commission on November 4, 1999 (DAP/NFD/SD)

FRIDAY, FEBRUARY 4, 2000, CONFERENCE ROOM 2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND

8) 8:30 - 8:35 A.M. Opening Remarks by the ACRS Chairman (Open) (DAP/SD)

9) 8:35 - 10:30 A.M. Impediments to the Increased Use of Risk-Informed Regulation and Use of Importance Measures in Risk-Informing 10 CFR Part 50 (Open) (GA/TSK/AS)

9.1) Remarks by the Subcommittee Chairman

9.2) Briefing by and discussions with representatives of NEI as well as invited experts regarding impediments associated with the increased use of risk-informed regulation and use of importance measures in risk-informing 10 CFR Part 50, and related matters.

Representatives of the NRC staff will provide their views, as appropriate.

10:30 - 10:45 A.M. ***BREAK***

10) 10:45 - 11:30 A.M. Proposed Final Revision of Appendix K to 10 CFR Part 50 (Open) (GBW/PAB)

10.1) Remarks by the Subcommittee Chairman

10.2) Briefing by and discussion with representatives of the NRC staff regarding the proposed final revision of Appendix K, "ECCS Evaluation Models," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

Representatives of the nuclear industry will provide their views, as appropriate.

11) 11:30 - 11:45 A.M. Subcommittee Report (Open) (GA/MTM)
Report by the Chairman of the Reliability and Probabilistic Risk Assessment Subcommittee regarding matters discussed during the December 15-16, 1999 meeting.

Representatives of the NRC staff will provide their views, as appropriate.

12) 11:45 - 12:00 Noon Report of the Joint ACRS/ACNW Subcommittee (Open) (TSK/GA/MTM)
Report on matters discussed during the January 13-14, 2000 meeting of the Joint ACRS/ACNW Subcommittee.

12:00 - 1:00 P.M. ***LUNCH***

13) 1:00 - 3:00 P.M. NRC Safety Research Program Report to the Commission (Open) (GBW/MME)

13.1) Remarks by the Subcommittee Chairman

13.2) Discussion of the annual ACRS report to the Commission on the NRC Safety Research Program.

Representatives of the NRC staff will provide their views, as appropriate.

3:00 - 3:15 P.M. ***BREAK***

14) 3:15 - 3:30 P.M. Reconciliation of ACRS Comments and Recommendations (Open) (DAP, et al./SD, et al.)
Discussion of the response from the NRC Executive Director for Operations to comments and recommendations included in recent ACRS reports and letters.

15) 3:30 - 3:45 P.M. Future ACRS Activities (Open) (DAP/JTL/SD)
Discussion of the recommendations of the Planning and Procedures Subcommittee regarding items proposed for consideration by the full Committee.

16) 3:45 - 4:30 P.M. Report of the Planning and Procedures Subcommittee (Open) (DAP/JTL)
Report of the Planning and Procedures Subcommittee on matters related to the conduct of ACRS business.

17) 4:30 - 5:30 P.M. Break and Preparation of Draft ACRS Reports
Cognizant ACRS members will prepare draft reports for consideration by the full Committee.

18) 5:30 - 7:15 P.M. Discussion of Proposed ACRS Reports (Open)
Discussion of proposed ACRS reports on:

- 18.1) Impediments to the Increased Use of Risk-Informed Regulation and Use of Importance Measures in Risk-Informing 10 CFR Part 50 (GA/TSK/AS)
- 18.2) Technical Aspects Associated with the Revised Reactor Oversight Process (JJB/MVB/MTM)
- 18.3) NRC Safety Research Program (GBW/MME)
- 18.4) Response to Follow-up Questions Resulting from the ACRS Meeting with the Commission on November 4, 1999 (DAP/NFD/SD)
- 18.5) Low-Power and Shutdown Operations Risk Insights Report (GA/MTM)
- 18.6) Proposed Final Amendment to 10 CFR 50.72 and 50.73 (MVB/NFD)
- 18.7) Proposed Revision of the Commission's Safety Goal Policy Statement for Reactors (TSK/GA/PAB)
- 18.8) License Renewal Process (MVB/RLS/NFD)
- 18.9) Proposed Final Revision of Appendix K to 10 CFR Part 50 (GBW/PAB)

SATURDAY, FEBRUARY 5, 2000, CONFERENCE ROOM 2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND

19) 8:30 - 2:00 P.M. Discussion of Proposed ACRS Reports (Open)
(12:00-1:00 P.M. - LUNCH) Continue discussion of proposed ACRS reports listed under Item 18.

20) 2:00 - 2:30 P.M. Miscellaneous (Open) (DAP/JTL)
Discussion of matters related to the conduct of Committee activities and matters and specific issues that were not completed during previous meetings, as time and availability of information permit.

NOTE:

- **Presentation time should not exceed 50 percent of the total time allocated for a specific item. The remaining 50 percent of the time is reserved for discussion.**

- **Number of copies of the presentation materials to be provided to the ACRS - 35.**

APPENDIX K RULEMAKING

Final Rule Change
Revising the 102% Power Level Requirement

Briefing to the
Advisory Committee on Reactor Safeguards

February 4, 2000

Joe Donoghue, SRXB (301) 415-1131

Appendix K Revision

Background

- ACRS briefings on May 26 and July 14, 1999
- ACRS letter to EDO on July 22, 1999
- Staff response to ACRS on August 18, 1999
- Proposed rule change published for comment on October 1, 1999
- Public comment period ended December 15, 1999
- Concurrence process on final rule is underway

Appendix K Revision

Comments on Proposed Rule Change

- 6 responses - Caldon, NEI, and licensees
- All responses were positive
  - NRC actions when uncertainty is above 2%
  - Apparent requirement for upgraded instruments
  - §50.46 reportability of changes to ECCS analysis
- Clarifications added to Federal Register notice
  - Upgraded instrumentation not required
  - §50.46 reportability not affected
- Proposed rule change language not modified

Appendix K Revision

Conclusion

- No adverse public comments to proposed rule change
- Final rule change package will reflect public comments and will implement the proposed rule change
- Request ACRS endorsement on final rule change

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Risk-Informed Regulation - Challenges and Importance Measures

Presented to:
Advisory Committee on Reactor Safeguards

Presented by:
Tom King, RES
Gary Holahan, NRR
Marty Virgilio, NMSS

February 4, 2000

Risk-Informed Regulation: Key Elements

- Policy
- Strategy (road map)
- Informed, knowledgeable staff
- Decision making
- Tools
- Communication

Implementation

Element	Activities	Challenges
• Policy	– PRA Policy Statement	– development of safety goals for non-reactor activities
	– Reactor Safety Goal Policy	
	– SECY-99-100 (NMSS)	
		– voluntary vs mandatory (two different regulatory approaches)
• Strategy	– PRA Implementation Plan	– what should be RI?
	– Risk-informed Regulation Implementation Plan	– how much of the industry will utilize risk-informed approach?
• Informed, Knowledgeable Staff	– training	– staffing (level and capabilities)
	– SRA Program	– how much NRC prior review and approval is necessary?

Implementation (Cont'd)

Element	Activities	Challenges
• Decision-Making	– guidance documents (e.g. RG 1.174) – plant oversight + enforcement – risk-informing Part 50 – risk-informing non-reactor activities	– selective implementation – guidance for non-reactor activities
• Tools	– analytical tools – risk assessment methods – PRA standard – data bases	– lack of completeness of risk assessments – lack of standard – adequacy of tools and methods
• Communication	– pilot programs – stakeholder meetings – communications plan	– perception that risk-informed equals burden reduction

Role of Importance Measures in Decision-making

- Primary role of Importance Measures is to perform an initial identification of risk significant SSCs or groups of SSCs
- Risk significance is confirmed by sensitivity analyses and qualitative assessment
- Safety principle that only "small changes" in risk are allowed can be met by
  - calculating ΔCDF and ΔLERF, or
  - by showing that only SSCs of low significance are being addressed and the impact of the change on them is relatively small. This approach can allow a qualitative judgement that the change in risk is small.

Importance Measures

- The staff guidance on using importance measures is presented in Appendix A of Reg Guide 1.174, and Appendix C of the Standard Review Plan, Chapter 19.
  - input to the categorization of SSCs with respect to safety significance
- Issues related to the use of Importance Measures include:
  - Technical issues related to completeness of PRAs, truncation, treatment of implicitly modeled SSCs, common cause failures, etc.
  - Importance measures are typically evaluated for individual SSCs, whereas changes are typically at a programmatic level (groups of SSCs)
  - Importance measures do not translate simply to changes in risk metrics (CDF and LERF)

Importance Measures (Cont'd)

- The Staff's conclusions with respect to these issues can be summarized as follows:
  - "Most of the issues can be resolved by the use of sensitivity analyses or by appropriate quantification techniques"
  - "When performed and interpreted correctly, component-level importance measures can provide valuable input..."
  - "The criteria for categorization into low and high safety significance should be related to the acceptance criteria for changes in CDF and LERF"
  - "If component-level criteria are used they should be established taking into account that the allowable risk associated with the change should be based on simultaneous changes to all members in the category."

IMPEDIMENTS TO RISK INFORMED REGULATION

STP Nuclear Operating Company

Comments to ACRS

February 4, 2000

REGULATORY IMPEDIMENTS

- No regulatory quantitative limits for establishing the importance/non-importance of components
- No differentiation between design basis events and events that are likely to occur during plant life (i.e., design basis events vs. operational basis events)
- Due to some of the cultural impediments (noted below), resolution of some RAI inquiries may be difficult. Opportunities for gaining experience and lessons learned may be lost.
- No mechanism or path to change safety-related component classifications based on risk information
- Lack of clarity or criteria in the degree to which risk informed applications could be approved using only qualitative approaches versus those that use quantitative methods or both.
- No tangible and recognizable incentives for developing, approving, and implementing risk informed applications
- Lack of defined roles and responsibilities for organizations tasked with developing risk informed processes, up to and including approval, in accordance with Option 3 of the regulations identified for risk informing 10CFR50

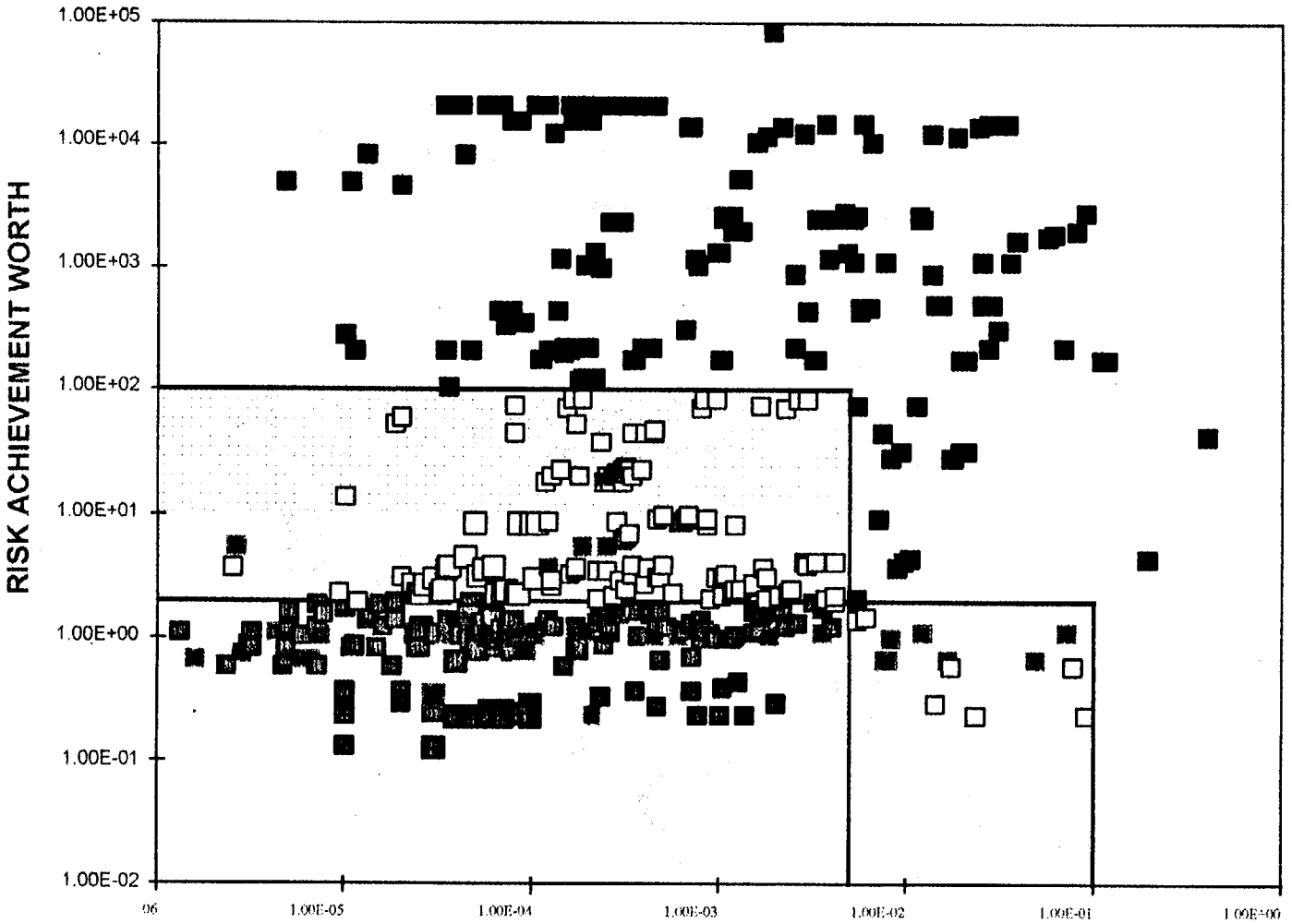
CULTURAL IMPEDIMENTS

- Lack of training that demonstrates the complementary effect of blending deterministic and probabilistic approaches in decision-making
- Reluctance to "let go" of selected activities on safety-related low or non-risk significant components even on a pilot basis
- Lack of data or other pertinent studies on the reliability/availability of safety-related components versus non safety-related components
- Resistance to change (turf protection) for both regulator and utilities
- Quickness to declare victory (i.e., implementation of a risk informed application) with a limited risk informed application (e.g., testing frequency changes without scope changes)
- Attempts to develop risk informed applications that are solely qualitative
- Misconception that PRA analyses are too expensive relative to the benefits
- Misconception that PRA analyses are unproven technology
- Weaknesses in the understanding of PRA at management levels in some utility organizations
- Need for improvements to and formalization of the training, organization, and oversight of plant expert panels

PRA INSTITUTIONAL IMPEDIMENTS

- Limited availability of PRA practitioners for both regulator and utilities
- Delays in legitimizing the PRA discipline (ASME/ANS standards)
- Resolving probabilistic approaches against institutional requirements (e.g., ASME Code, IEEE, NFPA, 10CFR50 Special Treatment requirements, etc.)
- Risk Ranking methods need further development
- PRA Importance Measures need further development
- PRA Uncertainty Analyses need further development
- Human and organizational analyses need further development

RISK RANKING OF ALL PSA BASIC EVENTS



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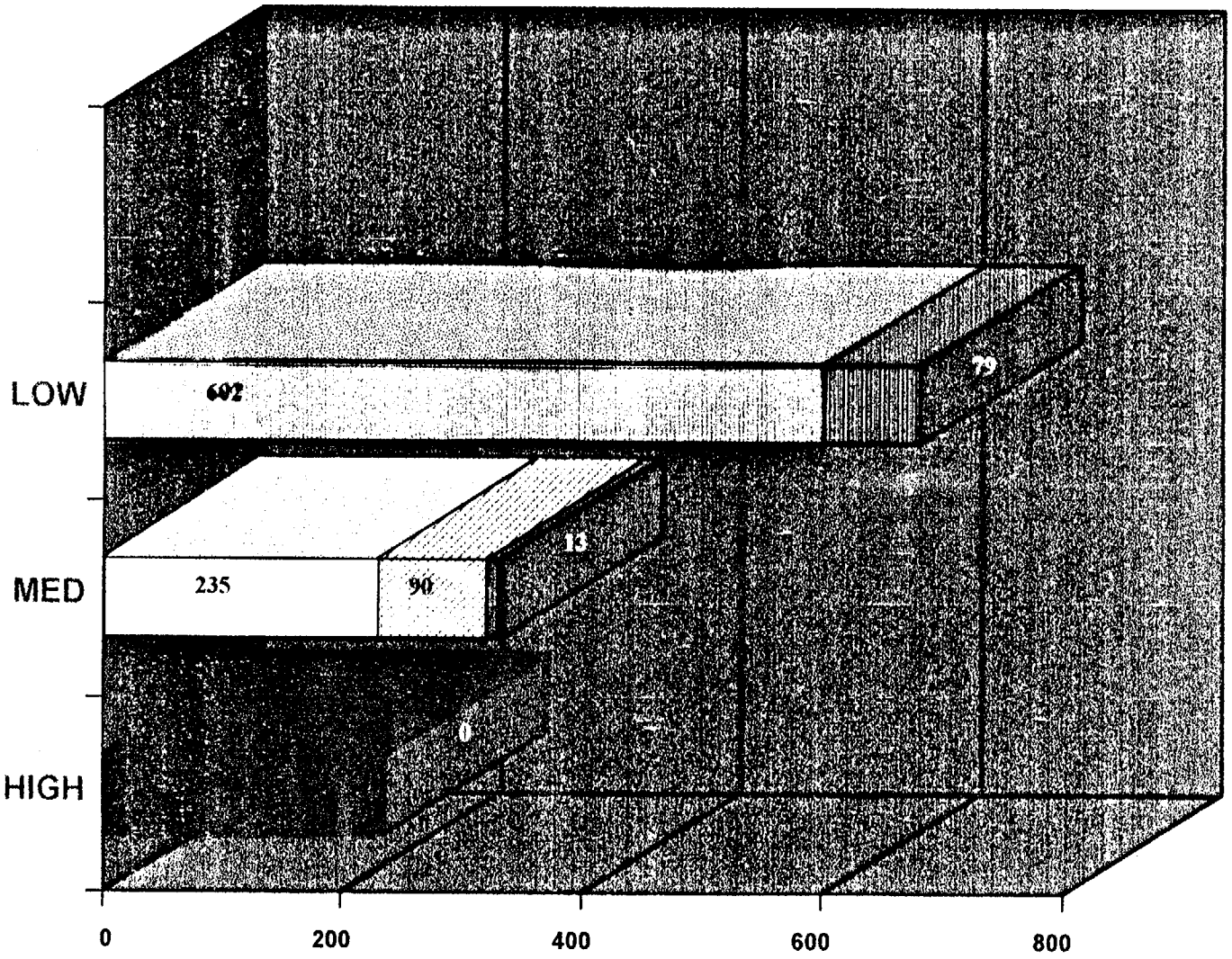
MED Basic QA — RAW>2.0 and <100 FV<0.005 **OR** RAW<2.0 and FV>0.005

LOW Basic QA — RAW>2 and FV<0.005

LOW MED HIGH — Non-Safety Related

Full + Basic (Critical Attributes Only) — RAW>10 and <100

TOTAL BASIC EVENTS RISK RANKING



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LOW □ **Basic** QA — RAW>2 and FV<0.005

LOW □ MED HIGH — Non-Safety Related

Full + Basic (Critical Attributes Only) — RAW>10 and <100

Risk Ranking Sensitivity Studies

Average

Description: Quantify the at-power nominal average operation PRA separately for Core Damage Frequency and Large Early Release Frequency.

Scheduled Maintenance

Description: Quantify the at-power nominal average operation PSA separately for each one of the scheduled-maintenance state types modeled under top event GENST in event tree PMET.

Purpose: Provides risk ranking with respect to equipment unavailability due to preventive maintenance activities.

Recovery

Description: Quantify available and appropriate risk models based on the removal of all operator recovery actions.

Purpose: Provides risk ranking with primary emphasis on equipment availability, reliability, and removes credit for human intervention.

Common Cause Failures

Description: Quantify available and appropriate risk models based on the removal of all common cause failure contributions.

Purpose: Provides focus of risk ranking based equipment combinations outside the scope of common cause failures.

Multi-System Effects of a Component Type

Description: For selected component types common to more than one system that are low risk and candidates for changes in QA requirements, vary the failure rates and requantify the models.

Purpose: To determine the impact of changes that affect more than one system.

Large Early Release Frequency

Description: Set split fraction ISS to one half it's normal value and reevaluate LERF.

Purpose: LERF is dominated by induced steam generator tube rupture, which is a highly uncertain phenomenon. This change considers the effect of reducing the assumed failure rate on risk ranking.

N1300 Total TAG/TPNS

Risk Ranking Sensitivity Studies (0PGP01-ZA-0304)

Avg. Model

	Level 1 Sensitivity Studies																				Level 2			
	Planned Maintenance States													Inc. Failure Rate									Comp	Final
UNIT 1 TAG/TPNS	GN1	GN2	GN3	GN4	GN5	GN6	GN7	GN8	GN9	GN10	PM1	PM2	PM3	MS2	MS5	MS10	NCC	REC	STP	LER	STPL2	Rank	Rank
2N121NPA102C	H	H	M-R	H	H	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M	M-R	M-R	T	H	H	H
2N121NTF101A	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	T	M-R	H	H
2N121TSI0011A	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	H	H	H	M-R	M-R	M-R	M	H	M-R	L	M-R	H	H
2N121TSI0011B	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	H	H	H	M-R	M-R	M-R	M	H	M-R	L	M-R	H	H
2N121TSI0011C	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	H	H	H	M-R	M-R	M-R	M	H	M-R	L	M-R	H	H
2N121TSI0012A	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	H	H	H	M-R	M-R	M-R	M	H	M-R	L	M-R	H	H
2N121TSI0012B	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	H	H	H	M-R	M-R	M-R	M	H	M-R	L	M-R	H	H
2N121TSI0012C	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	H	H	H	M-R	M-R	M-R	M	H	M-R	L	M-R	H	H
2N121TSI0013A	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	H	H	H	M-R	M-R	M-R	M	H	M-R	T	M-R	H	H
2N121TSI0013B	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	H	H	H	M-R	M-R	M-R	L	H	M-R	T	M-R	H	H
2N121TSI0013C	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	H	H	H	M-R	M-R	M-R	M	H	M-R	T	M-R	H	H
2N121TSI0014A	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	H	H	H	M-R	M-R	M-R	M	H	M-R	T	M-R	H	H
2N121TSI0014B	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	H	H	H	M-R	M-R	M-R	L	H	M-R	T	M-R	H	H
2N121TSI0014C	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	M-R	H	H	H	M-R	M-R	M-R	M	H	M-R	T	M-R	H	H
2N121TSI0104A	L	M	M	L	M	M	L	L	L	L	L	L	L	L	L	L	L	L	L	T	L	M	M
2N121TSI0104B	M	L	M	M	L	M	L	L	L	L	L	L	L	L	L	L	L	L	L	T	L	M	M
2N121TSI0104C	M	M	L	M	M	L	L	L	L	L	L	L	L	L	M	M	L	L	L	T	L	M	M
2N121TSI0206A	L	L	L	L	L	L	L	L	L	M	M	M	M	M	M	M	M	M	M	L	L	M	M
2N121TSI0206B	M	L	L	L	L	L	L	L	L	M	M	M	M	M	M	M	M	M	M	L	L	M	M
2N121TSI0206C	M	L	L	L	L	L	L	L	L	M	M	M	M	M	M	M	M	M	M	L	L	M	M
2N121TSI0207A	T	M	M	T	M	M	L	M	L	L	L	L	L	M	M	M	M	L	M	T	M	M	M
2N121TSI0207B	M	T	M	M	T	M	L	L	L	L	L	L	L	L	L	L	L	L	L	T	L	M	M
2N121TSI0207C	M	M	T	M	M	T	L	L	L	L	L	L	L	L	L	L	M	L	L	T	L	M	M
2N121XSI0001A	L	M	M	L	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	T	L	M	M
2N121XSI0001B	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	T	L	M	M
2N121XSI0001C	M	M	L	M	M	L	M	M	M	M	M	M	M	M	M	M	M	M	M	T	L	M	M
2N121XSI0002A	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	M	H	H	T	M-R	H	H
2N121XSI0002B	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	M	H	H	T	M-R	H	H
2N121XSI0002C	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	M	H	H	T	M-R	H	H
2N121XSI0004A	L	L	L	L	L	L	L	L	L	M	M	M	M	M	M	M	M	M	M	L	L	M	M
2N121XSI0004B	M	L	L	L	L	L	L	L	L	M	M	M	M	M	M	M	M	M	M	L	L	M	M
2N121XSI0004C	M	L	L	L	L	L	L	L	L	M	M	M	M	M	M	M	M	M	M	L	L	M	M

BEID	GN1	GN2	GN3	GN4	GN5	GN6	GN7	GN8	GN9	GN10	PM1	PM2	PM3	NCC	MS2	MS5	MS10	REC	STP	LER	STPL2	Final
CV_PMPS_FTR_X01A	M	M	M	M	M	M	L	L	L	L	L	L	L	M	M	L	L	L	L	L	L	M
CV_PMPS_FTS_X01A	H	H	M	H	H	H	L	L	L	L	L	L	L	M	M	L	L	L	L	L	L	H

DETERMINATIONS OF RISK

Five Critical Questions Addressed:

- **Inititating Event** - Does loss of function, in and of itself, directly cause an initiating event?
- **Fails Risk Significant System** - Does loss of function directly fail **another** risk significant system?
- **Accident/Transient** - Is function used to mitigate accidents or transients?
- **EOPs** - Is function specifically called out in EOPs and/or Emergency Response Procedures?
- **Shutdown/Mode Change** - Is loss of function safety significant for shutdown or mode change activities?

DETERMINATIONS OF RISK

Answers:

"0"	-	Negative Response
"1"	-	Positive response having insignificant impact and/or occurring very rarely
"2"	-	Positive response having minor impact and/or occurring infrequently
"3"	-	Positive response having low impact and/or occurring occasionally
"4"	-	Positive response having medium impact and/or occurring regularly
"5"	-	Positive response having high impact and/or occurring frequently

DETERMINATIONS OF RISK

Weighting Factors:

Accidents/Transients, EOPs	-	5
Fails Risk Sig. System	-	4
Initiating Event, Shutdown/Mode Change	-	3

Score Range	Risk
0 - 20	NRS
21 - 40	Low
41 - 70	Medium
71 - 100	High

SYS_ID	COMP_ID	COMP_DESC	FE_CLAS	_RISK_RA	DETERMINISTIC_INPUT	L_RISK_RANK
CV	2C091NPN053A	MECHANICAL PENETRATION|CVCS RC FILTER TO RHR PUMP	2		CONTAINMENT ISOLATION	LOW
CV	2R171NFR101A	REACTOR COOLANT FILTER 1A	2		FILTER COLLECTS CV AND BTRS DEMINERALIZER RESIN FINES AND PARTICULATES LARGER THAN 25 MICRONS. IN LETDOWN FLOWPATH. HOWEVER, REDUNDANT FILTER AVAILABLE. ALSO BYPASS LINE AVAILABLE	LOW
CV	2R171NFR101B	REACTOR COOLANT FILTER 1B	2		FILTER COLLECTS CV AND BTRS DEMINERALIZER RESIN FINES AND PARTICULATES LARGER THAN 25 MICRONS. IN LETDOWN FLOWPATH. HOWEVER, REDUNDANT FILTER AVAILABLE. ALSO BYPASS LINE AVAILABLE	LOW
CV	2R171NFR102A	SEAL INJECTION FILTER 1A	2	L	FILTER COLLECTS PARTICULATES THAT COULD BE HARMFUL TO THE RCP SEALS. REDUNDANT FILTER AVAILABLE	LOW
CV	2R171NFR102B	SEAL INJECTION FILTER 1B	2	L	FILTER COLLECTS PARTICULATES THAT COULD BE HARMFUL TO THE RCP SEALS. REDUNDANT FILTER AVAILABLE	LOW
CV	2R171NPD101A	SUCTION PULSATION DAMPER HTR PD101A	2		SUCTION STABILIZER FOR THE POSITIVE DISPLACEMENT CHARGING PUMP. ACTS TO MAINTAIN NPSH AT THE PUMP INLET TO PREVENT CAVITATION	LOW
CV	2R171NPD102A	PULSATION DAMPENER	2		ATTENUATES PRESSURE PULSATIONS AT THE DISCHARGE OF THE POSITIVE DISPLACEMENT CHARGING PUMP	LOW

SYS_ID	COMP_ID	COMP_DESC	FE_CLAS	_RISK_RA	DETERMINISTIC_INPUT	L_RISK_RA
CV	N1CVPA102A	CVCS POSITIVE DISPLACEMENT|CHARGING PUMP MOTOR|TPNS: 2R171NPA102A	7S	H	PRIMARILY USED FOR HYDROTESTING THE RCS. PROVIDES A MEANS FOR ADDING CHEMICALS TO THE RCS FOR pH AND OXYGEN CONTROL. PROVIDES SEAL INJECTION FLOW IF BOTH CCPs ARE INOPERABLE	HIGH
CV	N2CVPA202A	CVCS POSITIVE DISPLACEMENT|CHARGING PUMP MOTOR|TPNS: 2R172NPA202A	7S	H	PRIMARILY USED FOR HYDROTESTING THE RCS. PROVIDES A MEANS FOR ADDING CHEMICALS TO THE RCS FOR pH AND OXYGEN CONTROL. PROVIDES SEAL INJECTION FLOW IF BOTH CCPs ARE INOPERABLE	HIGH
RH	N1RHFY3860	RHR HEAT EXCHANGER 1A OUTLET VALVE FV-3860 CURRENT/PNEUMATIC CONVERTOR	7S		RHR HEAT EXCHANGER FLOW CONTROL: THE PNEUMATIC TRANSDUCER (FY) RECEIVES AN ANALOG ELECTRICAL SIGNAL FROM A HAND CONTROLLER IN THE CONTROL ROOM AND CONVERTS THE ELECTRICAL SIGNAL TO A PNEUMATIC SIGNAL TO PROVIDE FOR THE POSITIONING OF AN AIR OPERATEDBUTTER	HIGH
RH	N1RHFY3861	RHR HEAT EXCHANGER 1B OUTLET VALVE FV-3861 CURRENT/PNEUMATIC CONVERTOR	7S		RHR HEAT EXCHANGER FLOW CONTROL: THE PNEUMATIC TRANSDUCER (FY) RECEIVES AN ANALOG ELECTRICAL SIGNAL FROM A HAND CONTROLLER IN THE CONTROL ROOM AND CONVERTS THE ELECTRICAL SIGNAL TO A PNEUMATIC SIGNAL TO PROVIDE FOR THE POSITIONING OF AN AIR OPERATEDBUTTER	HIGH
RH	N1RHFY3862	RHR HEAT EXCHANGER 1C OUTLET VALVE FV-3862 CURRENT/PNEUMATIC CONVERTOR	7S		RHR HEAT EXCHANGER FLOW CONTROL: THE PNEUMATIC TRANSDUCER (FY) RECEIVES AN ANALOG ELECTRICAL SIGNAL FROM A HAND CONTROLLER IN THE CONTROL ROOM AND CONVERTS THE ELECTRICAL SIGNAL TO A PNEUMATIC SIGNAL TO PROVIDE FOR THE POSITIONING OF AN AIR OPERATEDBUTTER	HIGH
RH	N1RHHC0864	RHR HEAT EXCHANGER 1A CONTROL	7S		THE MANUAL CONTROL STATION PROVIDES REMOTE MANUAL CONTROL OF THE TRAIN A RHR HEAT EXCHANGER FLOW CONTROL VALVE FROM THE CONTROL ROOM OR THE AUX SHUTDOWN PANEL. THIS VALVE DOES NOT PERFORM A SAFETY FUNCTION. HOWEVER, THE VALVE IS NORMALLY OPEN AND FAILS OP	HIGH

Importance Measures (Issues/Alternatives)

- Importance measures can identify what is important, but do not necessarily identify what is not important.
- Importance measures are among a number of acceptable tools to get to an answer, but are not the answer themselves.
- Regardless of the methods used, sensitivity studies should be performed following classification of components into risk-significance categories to confirm the classification.
- Given these sensitivity studies, it does not matter how the classification was performed or whether importance measures were used. It only matters that the collection of components selected for special treatment are effective in managing risk.

Importance Measures (Alternatives/Sensitivity Studies)

Probabilistic

Given realistic estimates of changes in reliability for affected components, is the change in risk acceptable?

or

Given bounding assumptions for the reliability of affected components, is the risk acceptable?

Deterministic

Are there accident sequences dependent on low risk significant components for defense-in-depth?

Impedements to the Use of Risk-Informed Regulation

There continues to be significant uncertainty regarding what it costs and how long it takes to get approval for a Risk-Informed submittal

- Even post-pilot plant submittals have taken significant resources and have had to deal with generic issues

The PSA Quality issue requires significant effort as compared to technical details associated with a Risk-Informed submittal

There is significant effort needed to meet the detailed requirements for a Risk-Informed submittal from a quantitative standpoint

- The focus of current guidance seems to be on quantitative results as opposed to making decisions based on the insights generated from the quantitative results

CMS ENERGY

Risk-Informing 10CFR50

TopEvent Prevention (TEP)
A Deterministic Application of PSA

Advisory Committee on Reactor Safeguards
Bethesda, Md.
February 4, 2000

CMS ENERGY

Outline

- What is TEP and how does it work?
- Results of actual applications
- Implementation at CMS Energy
- Consistency with current Industry and NRC guidance

What Is Top Event Prevention Analysis (TEP)?

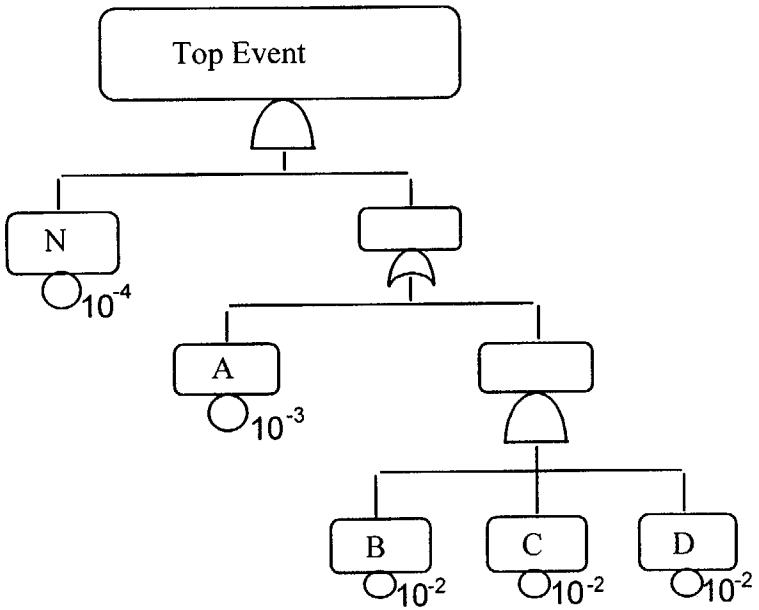
TEP is a deterministic application of your PRA

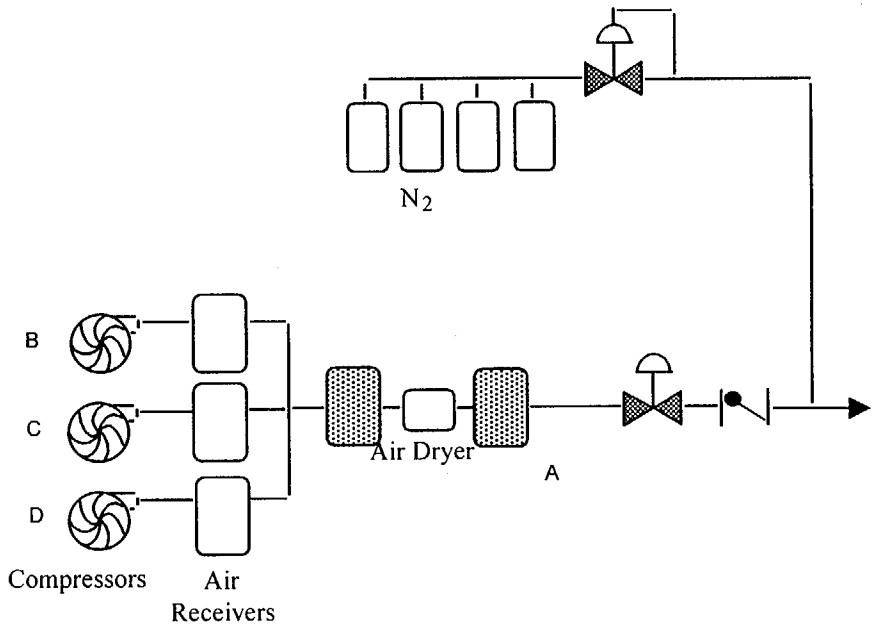
- Performs a detailed defense-in-depth review of your PRA
  - Cut set by cut set
- Identifies complete sets of success paths necessary to preclude the occurrence of the top event (i.e., CDF, LERF,etc.)
  - Evaluates the whole plant (all functions, all sequences, all components)
  - Assures consistency between risk-informed programs
- Addresses a number of limitations normally attributed to PSA methods
  - Combinatorial problems
  - Truncation

What is Top Event Prevention Analysis (TEP)?

- TEP identifies the ***minimum*** combinations of events important to the PRA results
    - It is this minimum set of components on which plant resources should be focused from a safety perspective (maintenance, testing, QA).
- TEP generates multiple ***options*** from which to choose
    - If the different options (or combinations of events) can be ranked against one another (such as by cost of maintenance, testing or QA), then the least cost optimal solution can be chosen to focus plant resources.

Top Event Prevention Analysis
Simple Example





10^{-7} N * A
10^{-10} N * B * C * D

	N	A	B	C	D
Fussell-Vesely	1.0	~1.0	10^{-3}	10^{-3}	10^{-3}
Risk Achievement Worth	10^4	10^3	1.1	1.1	1.1

Top Event

N * A +
N * B * C * D.

Prevention Sets
Level 2

(N*A) *
(N*B + N*C + N*D +
B*C + B*D + C*D).

Minimal Prevention Sets

N * A * B +
N * A * C +
N * A * D.

Top Event Prevention Analysis
Practical Example (Check Valve Testing)

Steps in the Process

- Build and solve model for core damage (> 80,000 cutsets)
  - 170 Check Valves modeled

- Prevention Level (2)
  - Credited Events (~2,000)
  - Excluded Events (~ 200)

- For each cutset, generate expression that represents prevention by 2 credited events

- Form Boolean product
  - Expand
  - Simplify (55,000 Prevention Sets)

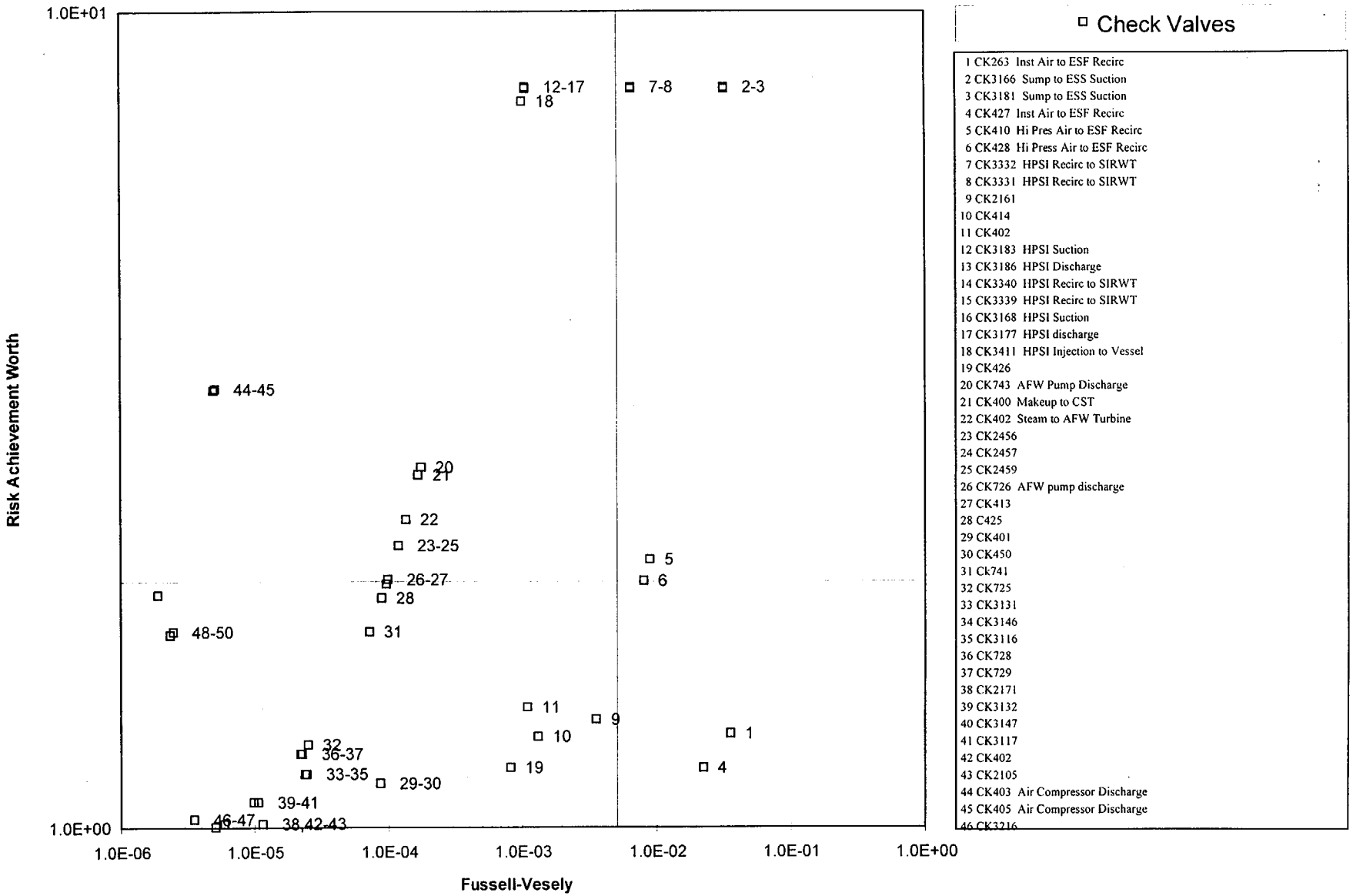
Top Event Prevention Analysis Practical Example (Check Valves)

Palisades PSA Check Valve Sensitivity Study

	Accident Class	Base Case	Prevention Set (1)	Importance Measures(2)
IA	Transient with failure of OTC injection	1.85E-05	1.94E-05	4.31E-04
IB	Transient with failure of OTC recirc	1.08E-05	1.98E-05	3.01E-03
II	Containment heat removal failure	1.31E-07	2.98E-07	6.55E-03
IIIA	LOCA at hi RX pressure with failure of injection	7.75E-06	9.38E-06	2.09E-04
IIIB	LOCA at hi rx pressure with failure of injection	6.88E-06	9.07E-06	1.53E-02
IIIC	LOCA at low rx press with failure of recirc	3.53E-07	5.13E-07	1.62E-04
IIID	LOCA at low rx pressure with failure of recirc	3.53E-07	5.13E-07	1.62E-04
IV	ATWS	4.35E-06	6.46E-06	1.46E-04
VB	Steam generator tube rupture	1.39E-06	1.87E-06	2.53E-04
		5.03E-05	6.69E-05	

Note (1) Select one prevention set and fail all check valves not in that prevention set

Check Valve Importance Measures



1 CK263 Inst Air to ESF Recirc
2 CK3166 Sump to ESS Suction
3 CK3181 Sump to ESS Suction
4 CK427 Inst Air to ESF Recirc
5 CK410 Hi Pres Air to ESF Recirc
6 CK428 Hi Press Air to ESF Recirc
7 CK3332 HPSI Recirc to SIRWT
8 CK3331 HPSI Recirc to SIRWT
9 CK2161
10 CK414
11 CK402
12 CK3183 HPSI Suction
13 CK3186 HPSI Discharge
14 CK3340 HPSI Recirc to SIRWT
15 CK3339 HPSI Recirc to SIRWT
16 CK3168 HPSI Suction
17 CK3177 HPSI discharge
18 CK3411 HPSI Injection to Vessel
19 CK426
20 CK743 AFW Pump Discharge
21 CK400 Makeup to CST
22 CK402 Steam to AFW Turbine
23 CK2456
24 CK2457
25 CK2459
26 CK726 AFW pump discharge
27 CK413
28 C425
29 CK401
30 CK450
31 Ck741
32 CK725
33 CK3131
34 CK3146
35 CK3116
36 CK728
37 CK729
38 CK2171
39 CK3132
40 CK3147
41 CK3117
42 CK402
43 CK2105
44 CK403 Air Compressor Discharge
45 CK405 Air Compressor Discharge
46 CK3216

Top Event Prevention Analysis
Summary of Other Applications

Analysis	# of Prevtn Sets	# of comp / plant	# of comp modelled in the PRA	# of comp in minimum prevention set	Change in CDF (Note 1)
BWR4 MOVs	21	~100	80	14	1.8
PWR MOVs	12	~200	80	26	1.9
MCCB (fail to trip)	7000	100-200	30[(2)]	2	1.1
PWR check valves	55,000	Hundreds	170	58	1.3
BWR4 AOVs	Millions	~1000	70	16	1.1
PWR AOVs	842	~1000	50	27	2.7
PWR Pumps	Millions	Dozens	36	16	1.7

Notes
(1) Change in CDF after all components not in the selected prevention are set to 1.0 (Failed)
(2) Super components added to model after cut sets were generated

Top Event Prevention Advantages

Addresses Combinatorial Problems

The combinations of events important to the PRA results are identified, not simply one event at a time.

Component importance is not masked by contributions from other sequences - e.g., conservative results from external events.

Component importance is not insensitive to multiple layers of redundancy.

Variables that are important in combination are identified explicitly and can be reviewed for common factors.

Addresses Truncation Issues

The cut sets that have been truncated from the original results can be tested.

Allows Presentation to Plant Staff/Expert Panel in Terms of the Plant Design

Explict identification of accident sequences for which a component is important.

Where a component is not considered important, what is being credited instead can be explicitly identified

Top Event Prevention Limitations

Limited Use of Probabilities

All credited components are treated equally, components within a prevention set are not ranked in any way

Completeness/Accuracy

Prevention sets are dependent on the completeness of the models and their accuracy with respect to the manner in which the plant will respond to accident and transient conditions.

Top Event Prevention Analysis
Consistency with Regulatory Guidance

- Elements of Regulatory Guide 1.174
  - ➢ Defense in depth

    TEP performs a defense in depth analysis for Core damage/Large early release
  - ➢ ΔCDF/ΔLERF low

    Demonstrate based on artificially high failure rates for low risk significant components (not a part of the prevention set)
  - ➢ Implement monitoring program

    Assign very relaxed performance criteria for low risk significant components (not a part of the prevention set)

Top Event Prevention Analysis

Would the ACRS and NRC staff consider
a risk-informed submittal based on TEP
as meeting the intent of

- R.G. 1.174
- R.G. 1.175 (IST)
- R.G. 1.176 (QA)
- R.G. 1.178 (ISI)
- The ANPR?

Top Event Prevention Analysis References

The theory behind the TEP methodology is presented in the paper

"Top Event Prevention in Complex Systems",
R. W. Youngblood and R.B. Worrell,
PVP-Vol. 296/SERA-Vol. 3, 1995.

Application of the TEP methodology is presented in a number of papers

"Using Top Event Prevention Analysis to Select a Safety-Significant Subset of Check Valves for Testing"
R.A. White(Palisades), R.B. Worrell and D.P. Blanchard
TopSafe '98, 1998

"Use of Top Event Prevention Analysis to Select a Safety-Significant Subset of Air-Operated Valves for Testing"
C.F. Nierode(Monticello), R.B. Worrell and D.P. Blanchard
PSAM 4, 1998

"Identification of Risk-Significant Circuit Breakers Using Top Event Prevention Analysis"
B.A. Brogan(Big Rock Point), R.B. Worrell and D.P. Blanchard
PSA '96, 1996

IMPEDIMENTS TO RISK-INFORMED REGULATION AND RISK IMPORTANCE MEASURES

Presented to
Advisory Committee on Reactor Safeguards

Presented by
Thomas G. Hook
Manager, Nuclear Safety Oversight
San Onofre Nuclear Generating Station

February 4, 2000

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IMPEDIMENTS TO RISK-INFORMED REGULATION

- Difficulty in quantifying costs and benefits
- Variations in PRA quality and scope
- Regulatory review process (e.g., RAIs and duration)
- Lack of PRA standards to establish quality
- PRA staffing inadequacies
- Current PRA focus on MRule and SDP
- Previous pilots marginally successful
- Insufficient credit for certification/Owners Group peer reviews

2

IMPORTANCE MEASURES

- RAW & Fussell-Vesely/RRW are acceptable for screening
- Importance measures that evaluate extrema (0,1) are acceptable only when augmented by sensitivity analyses
- Uncertainty analysis is underutilized by most licensees
- Sensitivity analyses should include model requantification with all impacted parameters (e.g., SSC reliability /availability, HRA, init event freq.) adjusted to bounding values
- Should consider SSC safety functions for all scopes, plant operating modes, and initiating events before reducing SSC quality requirements
- Generally concur with draft ANPR (Appendix T)

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