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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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RELIABILITY AND PROBABILISTIC RISK ASSESSMENT

(PRA) SUBCOMMITTEE

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TUESDAY, JUNE 2, 2009

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The Subcommittee convened in Room T2B3 in the Headquarters of the Nuclear Regulatory Commission, Two White Flint North, 11545 Rockville Pike, Rockville, Maryland, at 8:30 a.m., Dr George Apostolakis, Chair, presiding.

COMMITTEE MEMBERS PRESENT:

GEORGE E. APOSTOLAKIS, Chair

HAROLD B. RAY

SAID ABDEL-KHALIK

DENNIS C. BLEY

WILLIAM J. SHACK

JOHN W. STETKAR

MICHAEL T. RYAN

JOHN D. SIEBER

MARIO BONACA

NRC STAFF PRESENT:

YOIRA DIAZ SANABRIA, Designated Federal Official

GIRIJA SHUKLA

CHARLIE ADER

DON DUBE

BOB TJADER

HOSSEIN HAMZEHEE

MIKE CHEOK

ALSO PRESENT:

BIFF BRADLEY

RICK WACHOWIAK

EDWIN LYMAN

JIM CHAPMAN

KEN CANAVAN

GENE HUGHES

T-A-B-L-E O-F C-O-N-T-E-N-T-S

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

8:28 a.m.

CHAIR APOSTOLAKIS: On the record. This is the second day of the meeting of the Advisory Committee on Reactor Safeguards, Subcommittee on Reliability and Risk Assessment. I'm George Apostolakis, Chairman of the Subcommittee. Subcommittee members in attendance are Said Abdel-Khalik, Mario Bonaca, Harold Ray, Bill Shack, Jack Sieber, John Stetkar and Mike Ryan.

The purpose of this meeting is to discuss risk metrics for new light water reactor risk-informed applications. The Subcommittee will gather information, analyze relevant issues and facts and formulate, propose positions and actions as appropriate for deliberation by the full committee.

Ms. Yoira Diaz Sanabria is the Designated Federal Official for this meeting. The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the *Federal Register* on May 14, 2009. A transcript of the meeting is being kept and will be made available as stated in the *Federal Register* notice.

It is requested that speakers first

identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

We will now proceed with the meeting and I call upon Mr. Don Dube of the NRC staff to begin or maybe Don is not the person to begin.

MR. ADER: No, I'll start. I'll just make a few opening remarks.

CHAIR APOSTOLAKIS: Okay.

MR. ADER: My staff said I had to sit up here as opposed to sit at the side table and give Don some support.

When we met with you and the full committee and gave you kind of a heads-up, brief summary of what we're doing on risk insights you had asked us to come for this subcommittee so we could have a much more detailed discussion. We welcomed the opportunity to be here today to have the time to discuss some of the issues.

Before I turn it over to Don, I did want to mention that up front a lot of the presentation we really want to kind of revisit the policy and guidance framework that we're trying to use, the Commission policy statements, Commission SRMs, to help guide us in developing options, determining/evaluating options' pros and cons and I think it is important to kind of step back and refresh our memories on that framework so we can kind of understand where we're trying to go.

And with that, I'll turn it back over to Don.

MR. DUBE: Thank you, Charlie. Good morning. I'm Don Dube, Senior Technical Advisor in Division of Safety Systems and Risk Assessment in the Office of New Reactors. And as Charlie said, the purpose is to follow up on the discussions regarding the issues and options for the implementation of risk metrics for new light water reactor mainly risk-informed application, although there's a bit of a discussion perhaps on the reactor oversight process. But it's mainly on risk-informed applications at this point.

We're going to more or less recap some of the discussion from the April 8th full ACRS meeting. We'll mention the risk-informed initiatives. We want to start from a high level looking at Commission policy statements through SRMs.

MEMBER SHACK: Excuse me, Don. Just I would have thought ROP was almost the first order of business and I'm a little surprised. You think that that's taken care of.

MR. DUBE: No. The risk-informed initiatives are now. In fact, if you look at some of the proposed risk-informed applications, for example, risk-managed tech specs we almost have to have a draft SER early next year as opposed to the reactor oversight process which when is the first new reactor going to be operating. It's going to be what? Five, six years from now. So that's why.

MEMBER SHACK: Okay. Fair enough.

MR. ADER: When we started into this, Don had developed a white paper a year or so before the one we sent to the Committee and the sense was this was really an ROP issue and concern and we had plenty of time to deal with the ROP. We were focused on really certifying and doing the licensing for the new reactors and we would get to the ROPs a couple of years down the road. We did this.

As Don said, we have one application for risk-informed tech spec which really put the licensing change process at the forefront. So that's where we're focusing. We're in communications with our counterparts in NRR and ROP. They're starting to kind of formulate their thoughts on our ROP. But our focus right now is really the licensing piece.

MEMBER SHACK: Where is the application from?

MR. ADER: It's Mitsubishi, the design cert.

MR. DUBE: Right. Comanche Peak, in particular, Units 3 and 4. But there's interest in -- I'll mention that in a sec.

So with that, we'll discuss the current risk-informed framework, the implementation issues for new reactor. Based on stakeholder feedback, we did revise some of the options, deleted some of the less viable options if you will, took into account some comments from the ACRS, industry and other organizations within the NRC and then we've done a preliminary evaluation of the options against some high level objectives and that's way down the end of the presentation.

So specifically with regard to your question, Dr. Shack, in the near term we have risk-managed tech specs proposed. This includes risk-informed completion times. This is a tech spec initiative 4B and 5B. 5B is the surveillance frequency control program. These are -- Right now, there's South Texas Units 1 and 2 have risk-informed completion times and I believe there are several excellent plans, at least, one surveillance frequency control program. They're proposing both of these initiatives. Under the Mitsubishi Advanced Pressurized Water Reactor design certification, but more specifically in the Combined License Application for Comanche Peaks Units 3 and 4 have proposed this.

We've also had meetings, preliminary meetings, with Electric Power Research Institute on a research program on risk-informed in-service inspection of piping and this is not limited to just one design center. There are several design centers possibly interested and several applicants as well. So this piggybacks on currently implemented risk-informed ISI operating plants.

And then there's also been kind of mentioned several forums, although there is no application yet special treatment requirements under 50.69. So these are pretty imminent and that's what's driving us.

Our early review of these applications

raised questions about the appropriate metrics, specifically, acceptance guidelines for implemented of risk-informed initiatives for new reactors. And that is we use the current metrics in Reg. Guide 1.174, for example. Is that an adequate set or is an additional subset needed to be considered in view of the fact that the staff's reviewing license applications against a large release frequency metric which is one of the other things that we've mentioned.

CHAIR APOSTOLAKIS: So I'm intrigued by the statement "risk-informed initiative for new reactors." Can you elaborate a little bit on that? You mentioned Mitsubishi.

MR. DUBE: Yeah.

CHAIR APOSTOLAKIS: Are they the only one that are doing something about it?

MR. DUBE: I mentioned this. The only application as of right now for risk-information applications is Comanche Peak Units 3 and 4. But there is waiting on deck as soon as several applicants for new reactors get their combined license they've kind of mentioned within a very short period thereafter they will be coming in with risk-informed --

CHAIR APOSTOLAKIS: Which ones? Which risk-informed initiatives?

MR. DUBE: Oh, the same. Risk-informed completion time, surveillance frequency control program, possibly 50.69 and perhaps risk-informed --

CHAIR APOSTOLAKIS: Is anybody implementing 50.69, even an existing reactor?

MEMBER SIEBER: STP.

MR. DUBE: STP has sort of.

CHAIR APOSTOLAKIS: I'm sorry.

MR. DUBE: South Texas, Units 1 and 2.

CHAIR APOSTOLAKIS: Are they included?

MEMBER SIEBER: Yes.

MR. BRADLEY: It's an exemption.

MR. DUBE: Yes.

CHAIR APOSTOLAKIS: Say it again. What?

MR. BRADLEY: They implemented an exemption that's similar to 50.69.

CHAIR APOSTOLAKIS: But it's not 50.69.

MR. BRADLEY: No. As of right now, no plant is implementing 50.69.

CHAIR APOSTOLAKIS: This is Biff Bradley of NER.

MR. BRADLEY: Sorry.

CHAIR APOSTOLAKIS: You're not.

(Laughter.)

CHAIR APOSTOLAKIS: Okay.

MR. DUBE: Does that answer your questions so far?

CHAIR APOSTOLAKIS: Yes. It was a clarification kind of thing.

MR. DUBE: Yes.

CHAIR APOSTOLAKIS: Because all the design certification applications that we have been reviewing, I mean, nobody says anything about risk-informing anything. But you probably have more information.

MR. DUBE: Yes.

CHAIR APOSTOLAKIS: Except for Mitsubishi which I don't know.

MR. DUBE: Right.

MEMBER STETKAR: That wouldn't be in the design cert though. Right? It would always come at the COL.

CHAIR APOSTOLAKIS: Right.

MEMBER STETKAR: The sense that I've gotten is the priority is on getting the application approved and certified and they don't want to complicate. At least what I'm hearing informally is they don't want complicate their application with getting into some of the risk-informed information because it may take more time.

MR. TJADER: This is Bob Tjader from the Technical Specifications Branch of the NRO. The Mitsubishi design cert does have risk-informed completion times and surveillance frequency control program in their application. It's proposed, bracketed, as an option. So it is in their design cert and Comanche Peak is proposing to adopt that.

South Texas 3 and 4 which is adopting the ABWR is hoping to adopt or get their license as soon as they possibly can and they're not interested in complicating the effort with the risk-informed completion times and surveillance frequency control program which are not in the design cert of the ABWR which was created ten years ago. But South Texas 3 and 4 does intend to very shortly after they are licensed to come in with a license amendment to adopt these two initiatives.

CHAIR APOSTOLAKIS: It's unfortunate

that complication and risk-informed are in the same sentence all the time. I would expect that risk-informed --

MR. TJADER: Administrative complications.

CHAIR APOSTOLAKIS: -- would simplify things.

MR. TJADER: Administrative complications.

CHAIR APOSTOLAKIS: It can complicate things, but anyway I understand the spirit of your statement. Don, so far so good.

MR. DUBE: All right. Maybe we should quit now and we'll be ahead.

(Laughter.)

I'm going to walk through a little history. The relevant Commission policy statements, so we're starting at a very high level. We have the Severe Reactors Accidents Regarding Future Designs and Existing Plants, policy statement in '85, Regulation of Advanced Nuclear Power Plants in '86. There was another one in between and then the latest is 2008. The 2008 mainly added some information regarding security. But the bulk of what was said regarding expectation for advanced nuclear power plants really didn't change. And we're all familiar pretty much with the Commission Safety Goals which goes all the way back to '86. So these are kind of the high level statements and you'll see as we walk through there what the expectations are.

The '86 Safety Goals specify pretty much how safe is safe enough, the qualitative safety goals stating that regarding overall nuclear reactor safety. There's quantitative health objectives. And then sometimes not often included here, but specific interest was a general performance guideline for staff examination and I'll speak to that in a second because that's where this famous 10^{-6} large release frequency comes from.

In fact, here's the statement in quote from that policy statement. It says, "Consistent with the traditional defense-in-depth approach and the accident mitigation philosophy requiring reliable performance of containment systems, the overall mean frequency of a large release of radioactive materials to the environment from a reactor accident should be less than 1 to 1,000,000," which is 10^{-6}, "per year of reactor operation." So this is actually where the 10^{-6} comes from. Kind of sometimes forget and this actually doesn't even mention just new reactors. But in practice in the new reactor design certifications, this is where this 10^{-6} large release frequency comes from.

CHAIR APOSTOLAKIS: Now last time we were told that large release frequency means, the large release, means a release that causes at least one prompt fatality. That's not here.

MR. DUBE: We'll mention that in a few minutes.

CHAIR APOSTOLAKIS: That was an interpretation of the constitution.

MR. DUBE: That was one possible interpretation, but it's not a definition that the Commission ever officially approved.

CHAIR APOSTOLAKIS: Okay.

MR. ADER: The Commission asked staff to evaluate this. In a policy statement, they didn't define what a large release is. One of the Commissioners had commented that the Commission should have defined. So it was not defined at that point in time.

From roughly after the safety goal was

issued, there was a series of safety goal implementation papers and proposed various definitions of what a large release would be including an early fatality. Commission was looking to separate plant performance from siting. So they sent the staff back several times to develop a large release and in '93 staff recommended terminating the effort to define it. So there's never really been a large release definition that's been adopted.

MR. DUBE: Good.

MEMBER SHACK: Which makes a little difficult.

MR. DUBE: Very difficult.

MR. ADER: The other reason I'm sitting up here was because I was involved in some of that effort. So I have some rights.

CHAIR APOSTOLAKIS: Institutional memory, right?

MR. ADER: It's fading.

MR. DUBE: Here are several quotes regarding expectations taken from the '85 and '86 statements. I'm not going to read them through, but basically Commission expected new reactor designs to have enhanced safety, either inherent, passive or innovative means to perform those safety functions. At the last ACRS, remember industry followed up with their own quotes. I'll do them justice because I do come back and quote some additional statements from there which are kind of in conflict with this which is the reason that staff is in this little bit of a dilemma if you will. But this sets expectations that new reactors should enhance safety performance.

In SECY-90-016 the staff recommended if you have these expectations, should not the core frequency for new reactors be less than currently operating reactors, at least, on the order of 10^{-5}?

And we have this. Several slides ago I mentioned the large release frequency is at 10^{-6} and there's conditional containment failure probabilities, that's what CCFP is, should be less than approximately 0.1. That's kind of a nebulous statement. It's less than but approximately. Because if you read through some of the discussion, it's like you want to meet 0.1 to provide some separation of prevention capability with mitigation. But it's not going to -- You know, it's not a hard and fast number.

CHAIR APOSTOLAKIS: Go ahead.

MEMBER STETKAR: Do we know -- and you may get into this --

MR. DUBE: Sure.

MEMBER STETKAR: Do we know that CDF and CCFP and LRF are integrally related or is CCFP the conditional likelihood of any release of any size larger than design basis leakage, for example, small containment isolation failure.

MR. DUBE: And we talked about this at the last meeting. In practice, industry, all the design certifications so far and I'll show you their definitions released have used a CCFP equal to large release frequency divided by CDF. But again there's no --

MEMBER STETKAR: But do we know that that was the Commission's intent?

MR. DUBE: No. There's no definition of CCFP. It can be a release definition or it can really be a structural definition as well. But there is no definition.

MEMBER STETKAR: Okay. I was just curious because I didn't have that.

MR. DUBE: There is no -- You're not going to find a firm definition on that.

MEMBER STETKAR: Thank you.

MEMBER ABDEL-KHALIK: Now we're focusing on new reactors.

MR. DUBE: Right.

MEMBER ABDEL-KHALIK: So do we expect all applicants to a Level 3 PRA?

MR. DUBE: They're not required by the Part 52 rule.

MEMBER ABDEL-KHALIK: But if the applicants were to have a Level 3 PRA, why do we need surrogate metrics?

MR. DUBE: Most do have a Level 3 or something very close to a full Level 3, but they're not required to have the Level 3 by the Part 52 rule and the staff is not reviewing their Level 3 PRA if it does exist. We only stop at Level 2.

MEMBER ABDEL-KHALIK: But if you're going to set a limit on LRF that would require a Level 3.

MR. DUBE: Not necessarily. If you do a Level 2 --

MEMBER ABDEL-KHALIK: If you were to determine --

MR. DUBE: A Level 2 involves a certain

radioactive release, a certain magnitude, a certain timing, a certain containment failure mode, a certain release energy that which provides input to a Level 3, but one can -- In the containment event tree there's a containment event tree and there's a end state. One can define those end states to give you a large release without doing a Level 3.

MEMBER ABDEL-KHALIK: I'm just trying to ask the basic question. If we can avoid the use of surrogates altogether.

MR. DUBE: Well, except that large releases, I wouldn't call it a surrogate because it's right here in this Commission policy to use 10^{-6}. It's not a -- I don't see -- Surrogate usually means if you need this metric you'll be okay for some other higher level policy.

MEMBER ABDEL-KHALIK: Right, but --

MR. DUBE: I wouldn't consider this a surrogate. I would say this is --

MEMBER ABDEL-KHALIK: Ill-suited implicitly meeting the quantitative health objective goal.

MR. DUBE: Sure.

MEMBER ABDEL-KHALIK: Thank you.

MR. HAMZEHEE: And I think if I may, Don, number one it depends on the definition of large release frequency whether or not you need Level 3. That's step one.

MR. DUBE: Right.

MR. HAMZEHEE: Step two if you do Level 3 you have enough information so that you can easily understand and quantify LRF. But that does not mean that it's a surrogate. It just gives enough information to accurately measure LRF depending on the definition.

MR. ADER: One could with a Level 1, 2 and 3 calculate the individual risk with site characteristics and you wouldn't need any of the intermediate surrogates.

MEMBER ABDEL-KHALIK: That's what I'm talking about.

MR. DUBE: Right.

MR. ADER: History has been the safety goal has generally been the surrogates or simplification for convenience.

CHAIR APOSTOLAKIS: I think in answer to Said's question, why don't we just use the Level 3, there are two other reasons in addition to what you gentlemen have said. And the first reason is that if you want to evaluate any initiatives that people may propose the uncertainties at the Level 3 part are so large that you will not really see an appreciable change. But working with CDF and LERF so far allows you to see the difference. You know, if you change the testing frequency or something or 50.69. So that's one reason that it's easier to work with these methods.

And the second reason is defense-in-depth. You don't -- I mean the statement of CDF should be 10^{-4} and LFR or LERF should be less than something else is a statement of defense-in-depth. We are putting more emphasis on core damage prevention than containment failure and we don't want somebody to come and say, "I need the Level 3 quantitative health objectives because I have a core that will never melt."

MR. DUBE: Right.

CHAIR APOSTOLAKIS: In other words I meet everything because my CDF is $^{10-9}$. That violates defense-in-depth in the risk space.

MR. DUBE: Right.

CHAIR APOSTOLAKIS: And we want to spread the risk. So I think these are the two in addition to the definition that have made people go to these metrics.

For example, we had the fellow of the ACRS do some calculations some time ago. In fact, he cited I believe by NEI and maybe you do, Don, and he backtracked from -- he looked at the number of PRAs, primarily NUREG 1150, and he worked backwards. You know, what is the range of CDFs that one would tolerate and still meet the goals and it turned out it was significantly larger than 10^{-4}. You could still live with the 10^{-3} CDF and meet the goals and it was unanimous. I don't remember anybody objectively saying, "Defense-in-depth, guys. 10^{-4} is pretty good."

So there are a lot of hidden arguments here why everybody likes these and the industry did not object. They felt 10^{-4} is a good number and that's part of the answer to your question. In fact, we had one guy come here ten years ago and saying "The NRC has no business telling the industry what to do as long as the industry demonstrates that they meet the quantitative health objectives" and there was a unanimous cry "No."

(Laughter.)

Okay. Anymore on this? Don, can you?

MR. DUBE: Well, I was just going to say but the associated SRM the Commission said, "No."

(Laughter.)

They disapproved the use of CDF less than 10^{-5} and approved 10^{-4} which is kept the LRF to 10^{-6} and the CCFP of approximately 0.1. Now you take the 10^{-6} and divide by 10^{-4} you don't get 0.1.

CHAIR APOSTOLAKIS: That's correct.

MR. DUBE: So that already is another dilemma facing to some extent a little bit of an inconsistency.

CHAIR APOSTOLAKIS: But if you do it with LERF, then it's okay, right?

MR. DUBE: Right.

Now all of the design certificates are committed to meeting the Electric Power Research Institute's Advanced Light Water Utility Reactor Requirements document which does have a CDF goal of 10^{-5} or less, has the same large release of 10^{-6} but there's no CCFP if you look through your requirements document. So it's a little bit different, but the Commission told the staff, "No, you're not going to" -- They're not required to or the goal is not 10^{-5}. It's 10^{-4}. That's what the staff lives with as we're reviewing new designs and combined license applications.

And then in response to the staff recommendation on 10^{-5} and 10^{-6}, the Commission stated pretty explicitly -- this brings into some of the statements that NEI made at the last meeting and I want to emphasize here where this conflict is coming from -- the Commission strongly supports the use of information, experience gained and current generations for improving the safety of new designs, but the NRC should not adopt industry objectives as a basis for establishing new requirements. So we have this little bit of a conflict where expectations are that they're safer and review the designs against 10^{-6} large release frequency goal which is which is in the policy statement but not establish new requirements. So what does that mean?

MEMBER SHACK: But this thing all comes back to the definition of LRF. If you adopt the one early fatality definition, then LERF 10^{-5} and LRF 10^{-6}, they're roughly equivalent.

MEMBER SIEBER: Right.

MEMBER SHACK: So you've met it. But

you guys never could come up with a definition. Well, you're stuck with a hard place of any other definition you start to conflict with the health of the safety goals.

MR. DUBE: Right. I agree.

MR. ADER: To jump ahead a little bit, at the time, and there's kind of a time line there, in 1990 when the Commission was making these statements staff still had the large release under evaluation to see if we could come up with a definition. There was a belief at that time and a recognition that a 10^{-6} LRF was an order of magnitude more conservative in the safety goal, but there was an acceptance of that because they thought a plant performance goal would be a simplification. So it was close enough. The Commission said, "We're okay with an order of magnitude."

But staff pursued it and tried to develop a specific large release and part of the reason their recommendation to terminate is when you really come up with a specific one you're several orders of magnitude more conservative in the safety goal and the other guide that the Commission had given us back in that time frame was don't create a de facto new safety goal. So the staff was kind of in an over-constrained problem at the time which was one of the reasons of recommending terminating plus industry was using definitions that were acceptable to staff. So that the need to have one explicitly was less.

MEMBER SHACK: Yes. You knew what you could accept. You didn't know what you could require.

MR. ADER: So there was an evolution of large release in LERF around that time frame. But new reactors as Don said the reg guide standard review plan still have 10^{-6} LRF that we measure them against.

CHAIR APOSTOLAKIS: Without having a definition.

MR. ADER: Without having an explicit standardized definition. The definitions all of the applicants have used have been well within anything we probably would have come up with. So they've been acceptable and it hasn't been an issue.

MR. DUBE: Well, 15 slides down the road I'll show you the definitions for the five design certifications.

CHAIR APOSTOLAKIS: Okay.

MR. DUBE: And you'll see they're all over the map.

CHAIR APOSTOLAKIS: Well, it will be around 4:00 p.m.

MR. DUBE: Yes. No, we're doing well.

(Laughter.)

So Charlie talked about the second bullet. When we're reviewing in Office of New Reactors the new reactor applications they're expected to demonstrate how the design compares against the Commission's Goals. We have Reg. Guide 1.206 and then the Standard Review Plan 19.0 on PRA for new reactors and those are the guidance documents.

I showed this slide before which compared just for perspective core damage frequency in the upper left and the extent that one could come up with something called Large Release Frequency that's on the lower right. Now this is just for internal events.

And one can see these are current pressurized water reactors, boiling water reactors, the new LWRs with active systems. So those are basically the EPR, the APWR, the ABWR, whatever. And I think System 80 Plus is here, too.

CHAIR APOSTOLAKIS: So these are points estimates or whatever?

MR. DUBE: Yes, point estimate means, right.

MEMBER STETKAR: Don. I know that you've carefully shown that and mentioned that it's internal events only. If we're talking about the entire risk though from all of those facilities that you have there, the operating reactors plus the new reactors, I suspect if one was to do an actual full scope risk assessment for any of the new designs including risk assessments that are performed according to the quality standards that are available because the vast majority of those risk assessments aren't.

To include all external events and a full scope analysis of low power and shutdown modes, I suspect that those core damage frequencies and large release frequencies would increase substantially for the new reactor designs driven primarily by seismic events and perhaps incompleteness in the analyses that they performed already. Whereas, I wouldn't expect necessarily the current reactors to increase that same relative amount because they're already -- I don't want to say relatively high, but the contributions of seismic events on that scale would be toward the bottom end, for example, which would tend -- I mean, that practice if indeed the new reactors had a complete risk assessment would tend to reduce that apparent one to four orders of magnitude that seem to come out of this. Would that have any implication on kind of the concerns about what we're here to discuss?

MR. DUBE: It would lessen it, yes.

MEMBER STETKAR: Okay.

MR. DUBE: I've seen whatever's available. The fire is comparable. You don't get any risk from internal flooding so to speak. External flooding --

MEMBER STETKAR: That's self-explanatory.

MR. DUBE: So the only unknown there is seismic as you mentioned. Nobody has submitted a seismic PRA for design certification. They've all used margins analysis and eventually before fuel load since we know have a standard, ASME/ANS combined standard, which the staff has endorsed in

Reg. Guide 1.200 they will have a seismic PRA for fuel load. And you're right. That's going to narrow the gap quite a bit. How much I'm not sure, but I've seen back of the envelope calculation that's indicated that will narrow the gap.

So that helps in that regard, but if you look at all the risk-informed applications it's always a delta risk that we're evaluating against and a lot of these risk-managed tech specs, surveillance, control frequency program, seismic won't come into the equation whatsoever. So you'll still get very, very low delta risk that are driven by internal events and fire for the most part.

MEMBER STETKAR: That was one of the questions and we'll get into this a little bit more. Right perhaps? But if we're measuring delta risk -- Let's take a hypothetical example.

MR. DUBE: Sure.

MEMBER STETKAR: For new reactor where the internal events contribute 20 percent of the core damage frequency and seismic contributions 80 percent and it's true. If you make any change on something that affects only internal events the delta risk of that is going to be negligible.

MR. DUBE: Right.

MEMBER STETKAR: But on the other hand if that's actually the case, should we care? I mean, should we be regulating by being very, very concerned that we might make 20 percent of the risk, 20.5 percent of the risk, when indeed it's still a very, very small change to the overall risk if we understood what that risk is?

MR. DUBE: Right.

MEMBER STETKAR: That's why that perspective of what is the contribution from internal and external and where do the proposed changes affect that overall risk is I think a relative, an important, issue.

MR. DUBE: I would agree. That's why we're here.

MEMBER STETKAR: But I think the whole point is that we shouldn't be necessarily regulating based on changes to internal event at full power core damage frequency because that's the only thing that we have confidence that we can measure. Because indeed with the newer reactors, that might be a very, very small contribution to the total. So why should we regulate just on that?

MR. ADER: Those are the questions and let me reemphasize again, I mean, staff hasn't picked an option yet. We're trying to develop options and pros and cons. Those are the types of things we debate internal and we had one public meeting with stakeholders. We had really kind of an informational briefing for the committee. We have more time today to identify those types of issues that would play into our decision process on what's the right option from status quo, do nothing, to change the metrics.

MR. DUBE: That's a good perspective.

MEMBER STETKAR: Yes. We should go on with the presentation.

MR. DUBE: The other perspective would be it's like say, "Well, because I'm driven by seismic. Then should one have a license to do almost anything with internal events and with fire and so on and so forth" because seismic is always going to dominate.

MEMBER RAY: Yes, I was going to say that. There is some kind of a reasonableness feedback that has to take place within internal events themselves it seems to me like. In other words, you're trying to do all you can to reduce the risk even if it's only 20 percent of the total risk.

MEMBER STETKAR: My point is you'll never make that 20 percent zero and should you spend a lot of regulatory effort and a lot of resources on if you know, if you have confidence that what you're varying indeed is a small fraction of the total.

MEMBER RAY: Yes.

MEMBER STETKAR: You need that confidence. You need that. If indeed internal events were 99 percent of the total, it would be a completely different perspective.

MEMBER RAY: No, I guess I --

MEMBER STETKAR: It would be a completely different perspective.

MEMBER RAY: I'll leave it at this, but it just seems to me like if you can reduce it from 20.5 percent to 20 percent with a modest amount of effort that's worth doing.

MEMBER STETKAR: That presumption of "modest amount of effort" is really important.

CHAIR APOSTOLAKIS: That's an industry decision.

MEMBER STETKAR: It's an industry decision.

MEMBER RAY: I understand it. No, but he talked about regulatory effort and so on. I just -- I'm just echoing what he said which is you can't disregard trying to reasonably limit the risk in an area even though it's a small part of the total. You've got to look at it.

MEMBER SHACK: Well, I mean the other perspective that concerns me is also whether you consider say the 10^{-4} safety goal as a speed limit. You can't regulate them to go below that, but if they're at 10^{-6} do you allow, how high do you allow them to go and you know you can't regulate them to make that below. But everybody agrees that reducing the risk is a good thing and how much of that are you willing to give away it seems to me is one of the critical issues to be addressed here.

MEMBER ABDEL-KHALIK: But is it yours to give away?

MEMBER SHACK: Well, I think if your goal is 10^{-4} you can make the argument and some people have that that's a speed limit. You're okay as long as you're below that.

MEMBER ABDEL-KHALIK: So it is not yours to give away. It's the applicant's.

CHAIR APOSTOLAKIS: That has been a sore point.

MEMBER SHACK: That's a matter of discussion.

CHAIR APOSTOLAKIS: The margin. Who owns the margin? Mike.

MR. CHEOK: This is Mike Cheok from NRR. I think I'd like to caution the subcommittee. We are kind of focusing right now on the risk numbers. The PRA also provides insights not just to numbers and when they're talking about just like let's say in total risk and let's say they go in and Don Dube mentions the delta risk which is what we are focusing on when they're going up from a 10^{-8} base in total events, let's say, to 10^{-6} and you say that's relatively not that important when you compare the seismic, I think the agency and the NRC would like to know what's causing you to go up two orders of magnitude and what the insights are telling you because those two orders of magnitude are telling you quite a bit more than the numbers are telling you.

MEMBER STETKAR: I think that's absolutely correct. I agree with you totally. My whole point is that you need the full perspective of all of the contributors before you have that insight. Because obviously if you're changing that internal event number by two orders of magnitude and you had confidence that that was 99 percent of all of the risk your comfort level would be different than if you were changing it by two orders of magnitude from 0.1 percent to 1.0 percent of the risk.

CHAIR APOSTOLAKIS: Do you want to say something, Jack?

(No verbal response.)

Okay.

MR. DUBE: Very good. I won't do the large release frequency, but --

CHAIR APOSTOLAKIS: Hold on. So what is the message of this slide?

MR. ADER: The Commission's expectations for enhanced safety.

CHAIR APOSTOLAKIS: Okay. Without uncertainty analysis.

MR. DUBE: Correct.

CHAIR APOSTOLAKIS: Or without

operating experience.

MR. DUBE: Exactly.

CHAIR APOSTOLAKIS: Okay.

MR. DUBE: So for risk-informed initiatives --

CHAIR APOSTOLAKIS: If you go back to '76, '78, the first ANS PRA topical meeting in Newport Beach and you plot some of the numbers they have there for the current generation they would look like your new numbers and they would know what happened in the intervening 30 years. That's something also to bear in mind.

The typical unavailability of the safety system was 10^{-6}. It was. I was a young assistant professor.

MEMBER RAY: They never ran the plants.

(Laughter.)

CHAIR APOSTOLAKIS: I must admit there were no industry players there. It was all National Lab and academics.

Go ahead.

MR. DUBE: Thank you.

So in the realm of current regulatory guidance for operating plants 1.174 is, of course, kind of the umbrella reg. guide and then there are specific reg. guides for specific applications, risk-informed tech specs and risk-informed ISI and so on and so forth.

CHAIR APOSTOLAKIS: So all this discussion of the history which is very interesting by the way is to set up the stage for your options later.

MR. DUBE: Right.

CHAIR APOSTOLAKIS: Good.

MR. ADER: It's kind of the framework. We're trying to evaluate options.

MR. DUBE: Right.

CHAIR APOSTOLAKIS: I think it's a very nice exposition.

MR. DUBE: And the 1.174, a key principle is "when the change results in an increase in core damage or risk, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement." So when one looks at, a little bit later here, these kinds of graphs small was meant to be if it's up to, on the core damage frequency one, between 10^{-7} and 10^{-6} that's between one percent and ten percent, excuse me, a tenth of a percent and one percent of the surrogate goal of 10^{-4}.

That's very small and up to 10^{-5} is between one and ten percent in Region II and that has come to be known as small.

CHAIR APOSTOLAKIS: Let's go back to 14. Can you elaborate a little bit what the phrase "consistent with the intent of the Commission's Safety Goal Policy Statement" means? What does that mean? If we do anything because we wanted to be consistent with the intent?

MR. DUBE: Well, it means in a gross sense I would say it's been shown that if one meets 10^{-4} core damage frequency goal and 10^{-5} large early release frequency goal, then the quantitative health objectives can be met.

CHAIR APOSTOLAKIS: But it says "an intent." That's what confuses me. Is there a hidden message there that I don't see. If there is not -- I don't know.

MR. DUBE: I don't know if there's someone in the audience that knows the history a little bit behind it, but it's --

CHAIR APOSTOLAKIS: But I don't recall anybody saying that they were going to do this because this is consistent with the intent of the Commission's statement.

MEMBER SHACK: I think that's why it gets very black above 10^{-4}.

CHAIR APOSTOLAKIS: So the Commission said we should be black.

MEMBER SHACK: I think you don't go there unless there's a good reason. That's the way I interpret it.

CHAIR APOSTOLAKIS: So you mean that refers to the fact that these are goals.

MEMBER SHACK: Right.

MR. DUBE: Right.

CHAIR APOSTOLAKIS: And we really don't want to go above.

MEMBER SHACK: Right. If you have a goal, you know, you don't generally don't try to exceed it.

MR. DUBE: Right. Unless there's unusual circumstances.

MEMBER SHACK: Unless there's -- Yes.

CHAIR APOSTOLAKIS: But take it for a moment. The increases should be small and consistent. They are small.

MEMBER SHACK: They shouldn't take you above the goal.

CHAIR APOSTOLAKIS: So you're talking

about the cumulative now.

MEMBER SHACK: Yes.

CHAIR APOSTOLAKIS: Oh, your favorite subject. 1.174 is silent on the cumulative. So let's make that clear. Maybe that's a flaw in the regulatory guide.

(Off the record comments.)

MEMBER ABDEL-KHALIK: Small in this context is on an absolute basis, isn't it?

CHAIR APOSTOLAKIS: Absolutely, yes.

MR. ADER: George, I don't know if this helps. This was out of one of the Commission papers.

CHAIR APOSTOLAKIS: This is 17. Okay.

MR. ADER: It's small print.

MR. DUBE: Very small print.

MR. ADER: I mean there were two pieces. Small is one thing. You want to limit the changes to small.

CHAIR APOSTOLAKIS: Yes.

MR. ADER: And to the extent I can interpret "consistent with the intent," this kind of gave the background of why 1.174 was using LERF and CDF and it relates it back to meeting the safety goals, QHOs.

CHAIR APOSTOLAKIS: So it's the sentence before last.

MR. DUBE: Right.

CHAIR APOSTOLAKIS: That says, "Although work on defining a large release to be used with a frequency of 10^{-6} was thought, increased NRC management attention will be given to proposed changes that cause LERF to increase by more than one percent of the guideline value of 10^{-5}." And that ensures that the intent of the Commission's performance -- Well, it's not very clear to me, but at least there is some attempt to --

MR. ADER: We tried to go back and understand where the transition was from LRF to LERF and this is what we found in the development of one way to --

MR. DUBE: It's the closest that we could find in terms of something firm in terms policy that kind of connects the two.

CHAIR APOSTOLAKIS: Does it mean perhaps that the Commission stated the goal, but it wanted to discourage people from drifting towards a goal if they are better on the goal? That the intent was not to say everybody should be at 10^{-4}. I don't know. I mean we're speculating now.

MR. HAMZEHEE: You are.

CHAIR APOSTOLAKIS: What's that?

MR. HAMZEHEE: I said that you are.

CHAIR APOSTOLAKIS: I know. Okay.

MR. DUBE: Backing up, well, we talked about this. So back to Reg. Guide 1.174, it says that risk-assistance guidelines, there's a number of principles and I don't have a slide on that. But in terms of the risk aspect of it, the risk acceptance guidelines discuss the baseline risk metrics of CDF and large early release frequency and the delta CDF and delta LERF due to the change and we have those graphs that we've already showed.

CHAIR APOSTOLAKIS: But did I miss something now? All of a sudden, we're talking about LERF. How did we transition from LRF to LERF? Was it somewhere and I missed it?

MR. DUBE: No.

MEMBER SHACK: That's what he tried to give you.

CHAIR APOSTOLAKIS: So far until 14 you were talking about LRF. All we have is LRF.

MR. DUBE: Right.

CHAIR APOSTOLAKIS: All right.

MR. DUBE: We kind of skipped ahead. I think this was starting the transition.

MR. ADER: We were trying to go from -- We had the Commission's Policy Statements. They gave us guidance for new reactors. Then the operating reactors are operating in a risk-informed framework based on 1.174. So there's a little difference in the metrics and that's kind of how we got into this whole discussion and we're trying to give you a little bit of the history or the background that we could find on the development of 1.174.

MR. DUBE: It might have been logical to put slide 17 before slide 15.

CHAIR APOSTOLAKIS: That's okay.

MEMBER RAY: Old on a second. George, I've been thinking about what you said. The issue of cumulative, these are individual changes we're talking about here.

CHAIR APOSTOLAKIS: Yes, individual changes.

MEMBER RAY: I think as maybe part of the issue of intent and why the change needs to be a small part of the margin because you're not tracking the cumulative effect of multiple changes.

MR. DUBE: Well, they do, I mean.

CHAIR APOSTOLAKIS: In principle though, you could end up very close to the goal if you wait long enough.

MR. DUBE: See, in Region --

MEMBER RAY: I understand that.

CHAIR APOSTOLAKIS: Yes.

MEMBER RAY: I'm just trying to imagine what is the reason for the expression the way it is now.

CHAIR APOSTOLAKIS: Don.

MR. DUBE: Well, we're skipping ahead, but on slide 18 we do show that if a configuration or a proposed change places, I need a laser pointer --

CHAIR APOSTOLAKIS: That's good.

MR. DUBE: Places one in this Region III. These are very small changes. There's more flexibility with regard to the baseline. They are to track cumulative impacts.

CHAIR APOSTOLAKIS: Right.

MR. DUBE: And if one is in Region II.

MEMBER SIEBER: They still track it.

MR. DUBE: They still track it. These are --

CHAIR APOSTOLAKIS: But it doesn't say what to do with it.

MR. DUBE: Well --

MEMBER SHACK: It gets blacker.

MEMBER RAY: Yeah, and I guess I was thinking --

CHAIR APOSTOLAKIS: No, because this is for individual changes.

MR. DUBE: Right. The wording came from a period in which I don't think we were tracking cumulative.

CHAIR APOSTOLAKIS: I think we asked --

MEMBER SHACK: But your chances of an incremental change are getting smaller and smaller as it gets blacker and blacker.

CHAIR APOSTOLAKIS: That's correct. So the gradient changes. All right.

(Simultaneous conversations.)

CHAIR APOSTOLAKIS: Mike Cheok.

MR. CHEOK: I believe that when we were doing Reg. Guide 1.174 there was an intent to track cumulative changes. As a matter of fact, the companion document, Reg. Guide 1.174, was SRP Chapter 19 and the original version of the SRP had a table in there that actually would have the staff track all cumulative changes. After a while, the staff ran into some problems in the fact that licensees were making changes to the plans to improve the plans and to do in terms of maintenance plan changes and those kind of changes were not reported to the staff and so it got to be unwieldy for us to be tracking all of the different changes as we went along.

So basically what the staff ended up doing was to be cognizant of all changes that's going on and, for example, if you were going to do a QA change to a component, we would be very cognizant of the fact that if you also were testing it less in IST space on the same component that's the kind of cumulative changes we were looking at.

Also with the event of the PRA standards, it also says that you shall submit your latest PRA in with your changes that you submit. So in theory the latest PRA that you submit in would already account for the last change which you did. So that's how the staff ended up "tracking" cumulative changes.

MEMBER SIEBER: Is it not true though that when you make a change to the plant that establishes a new baseline CDF and LERF. So just by doing that you're tracking the changes.

MR. CHEOK: Correct.

MR. DUBE: Right.

MR. CHEOK: Absolutely.

MEMBER SIEBER: You keep moving toward Region I bit by bit as you make changes through the plant's lifetime.

MR. DUBE: That's a good point. Some would argue and some in the industry mentioned this at the last meeting though that in practice because generally speaking equipment performance has been improving. Their unreliability is getting lower. Unavailability is getting lower and plant improvements in fact may not have been creeping, but in fact continue to be coming down.

So some of the delta increases from risk-informed initiatives are giving you delta increases this small, a centimeter here on my finger. But plant improvements are giving you delta decreases of this magnitude and in effect those small incremental changes are being swamped by other improvements.

MR. CHEOK: Don makes a good point, I mean, with the ROP and MSBI licensees are learning what they would call manage risk which would be to make procedure changes and in some cases plant changes to get their baseline risk lower.

CHAIR APOSTOLAKIS: And I think from the beginning we all recognize that the deltas we calculate here are only part of the actual change in the risk. This is what we can quantify. But there are benefits, changes, that simply cannot be quantified. If you go to 50.69, for example, you don't know really what happens. What we do is do some sensitivity studies and show that even if the failure rate increased by a factor of five the delta would be acceptable. But we really don't know what it is and then when they improve operations I mean there is a negative delta if you want and we still don't quantify that. So this is just one indication of what is happening.

MR. HAMZEHEE: And I think, George, for the new reactors as you know there is a requirement under Part 52 that the COL licensees shall update their PRAs every few years. So you may not observe some of those intangible changes.

But over time as you get more operating experience and operating data, those PRA updates would reflect any real changes in your PRA baseline. So the process takes care of it.

CHAIR APOSTOLAKIS: Not only that, but we had the series of reports from Idaho a few years ago where one of them said that by looking at the actual data a general statement was that the frequency of initiating events had been overestimated by a factor of four.

MR. HAMZEHEE: That's correct.

MR. DUBE: Yes.

CHAIR APOSTOLAKIS: Now if you start doing thing like that, you are way beyond the deltas now. I mean a factor of four is pretty significant.

MEMBER SIEBER: But there are some controls on that. Otherwise, there's gamesmanship going on in the process and I guess I'm not clear on what controls there really are. But if I have a good year, that doesn't mean that I'm much better than the guy down the street because industry experience with the same kinds of equipment may generate a failure rate that's slightly less or --

MEMBER STETKAR: That's why you can't look year to year. You have to look --

MEMBER SIEBER: Yes.

MEMBER STETKAR: -- at a five year span or something like that.

MEMBER SIEBER: Well, two years is what it says and two years is a pretty short period of time.

CHAIR APOSTOLAKIS: I thought they looked at the longer period in Idaho.

MEMBER SIEBER: It takes more than two years for you to drive a plant into the --

MR. HAMZEHEE: And I think in addition under 1.174 you don't just look at the quantitative change. One of the other criteria is performance monitoring. So that would focus any licensee that makes any risk-informed change to monitor the performance because of that change. And if it goes to an unacceptable level, then they have to take some corrective actions.

CHAIR APOSTOLAKIS: But I think coming back to Jack's point, the group that is tracking actual unavailabilities at the NRC, the former AEOD, is producing those tables. I mean the trend is down for unavailabilities.

MEMBER SIEBER: Yes, and the ROP is the backstop because if you end up with poor performance indicators in certain critical functions the ROP is going to catch that.

CHAIR APOSTOLAKIS: But for PRA purposes I mean they are looking at the calculations and they say based on the last five years or whatever the trend is always downwards and this is due to --

MEMBER SIEBER: That's true. Well, you started out with assumed data and then as actual data was accumulated --

CHAIR APOSTOLAKIS: I mean the stats were improving. As Don said, things are better.

So what do we say about this slide?

MR. DUBE: So the basis here for 1.174 for the Risk-Acceptance Guidelines is that it increases small increments. The threshold was somewhere related to backfit regulatory analysis guidelines. In other words, if you go through a lot of the backfit analyses, 10^{-5} CDF change seems to be the threshold if you will where if delta CDF is above that sometimes it can be shown to be cost effective. But if delta CDF is below that if one were trying to implement, require, some kind of enhancement generally speaking it will not be cost beneficial.

MEMBER SHACK: See, I always pick the threshold as essentially a fraction of the safety goals. Your white paper had it as the backfit and I don't know. My mind always sort of, you know, it was a small fraction of the safety goal. I'm not sure that one's any better answer than the other.

MR. DUBE: Right.

MEMBER SHACK: But it might give you some insight to where you're going with an advanced reactor.

MR. DUBE: Well, if you took like 10^{-5} CDF and equate certain release and equate that to a certain man-rem and certain dollars per man-rem, you can't do anything. Any delta CDF less than that, you do the cost and benefits, it's going to be very hard for the staff to demonstrate cost effectiveness in terms of a requirement, in terms of new requirements.

MEMBER SHACK: But that's a backfit.

MR. DUBE: Yes.

MEMBER SHACK: The question is how much you're allowing them to go up.

MR. DUBE: Sure.

MEMBER SHACK: I'd relate that more to the safety goal and the fact that I don't want to --

MR. DUBE: That's a good point.

MEMBER SHACK: You know, we're working the ratchet the other way at this moment.

MR. DUBE: Right.

MR. ADER: I think some of that discussion from back in 1.174 is if you didn't want to allow a change you then turn around and backfit and cost beneficial backfit and then you'd allow it again and then you'd go back.

MEMBER SIEBER: Well, I don't want to get too far off the subject, but if you look at next generation reactors where you're using components where there is no failure history and the design may not even be there, you come up with a preliminary design and try to do a PRA on that. Does that have any meaning at all without actual components with operating history?

MR. DUBE: I don't know about my goal.

CHAIR APOSTOLAKIS: It does, but you have to be cognizant of the fact that you don't have operating experiences.

MR. DUBE: And then the final subbullet and I've got a rectangle here I guess is that the limits are based on absolute change, not these percent changes, was one of the options.

So, for operating reactors for core damage frequency, a 10^{-4} happens to be a surrogate for latent cancer fatalities in the quantitative health objectives, in other words, working the other way around. There was a number of analyses that have been done in separate papers and forums that show that a plant for reactor meets 10^{-4} per year and assuming conservative releases and conservative population densities and so on and so forth, it's a good likelihood that the latent cancer fatality risk quantitative health objectives will be met. And so in practice that's why CDF serves as a surrogate.

CHAIR APOSTOLAKIS: Because it must affect the prompt fatalities, too.

MR. DUBE: Yes, but that comes under LERF.

CHAIR APOSTOLAKIS: I keep hearing that, but I mean preventing core damage prevents everything.

MR. DUBE: You're right, but that's why

it's a two-step.

MR. HAMZEHEE: Defense-in-depth.

MR. ADER: It was usually the early fatalities --

CHAIR APOSTOLAKIS: When in doubt yes.

MR. ADER: -- QHOs the more restrictive that tended to --

CHAIR APOSTOLAKIS: It is more restrictive, correct. Yes.

MR. DUBE: And that's why the 10^{-5}-ish per year LERF goal ends up being a surrogate for prompt or early fatalities in the QHO.

CHAIR APOSTOLAKIS: So we still -- at least in my mind, I still don't know why we went to LERF rather than LRF. I mean this is a statement of fact.

MR. DUBE: Right.

CHAIR APOSTOLAKIS: But why? Is it easier to calculate LERF?

MR. DUBE: Yes.

CHAIR APOSTOLAKIS: Go ahead, Mike.

MR. CHEOK: When we were doing Reg. Guide 1.174, we did talk about LRF. But it was determined that it's a lot easier to define and to calculate LERF because we did not need a Level II or Level III PRA. Thereby we will eliminate some uncertainties from the calculation and BNL at that point came up with a new reg. that documented why LERF was good enough.

CHAIR APOSTOLAKIS: Now we can say that the reason we went to LERF is the calculation of convenience which is great.

MEMBER STETKAR: I was going to say essentially in my mind it's the difference between having a so-called Level I plus PRA which gives you fairly good confidence on LERF versus a Level II plus PRA which you'd need to have some confidence in LRF if you're defining LRF in terms of fatalities.

MR. DUBE: Right.

MEMBER STETKAR: And we just weren't there 10 years ago or 15 years ago.

MR. ADER: In reality, when you go back to some of the early staff proposed definitions of LRF, it was in a sense an LERF because it was a one fatality. There was a recognition that's an early release prior to evacuation. So some of the proposals were similar.

CHAIR APOSTOLAKIS: Tending that way.

MEMBER SHACK: We actually had a paper

from Rick Sherry on LERF, too.

CHAIR APOSTOLAKIS: I remember that. But he justified both at 10^{-4} and 10^{-5}.

MEMBER SHACK: Well, but he was arguing that LERF was sort of the right measure for the prompt fatality QHO and again early means early with respect to --

CHAIR APOSTOLAKIS: Evacuation.

MEMBER SHACK: -- evacuation and that was --

MR. DUBE: We've mentioned slide 17. Has everyone seen and understand this slide?

CHAIR APOSTOLAKIS: We see it now in our dreams.

(Off the record comments.)

MEMBER SHACK: Understand. That's a big word.

MR. DUBE: And it's a point to mention that in Reg. Guide 1.174 that the risk change being small was only one of five principles for making risk-informed decisions. The proposed change should meet the current requirements. That's the presumption of adequate protection unless it's specifically a proposed change.

CHAIR APOSTOLAKIS: Yes, to the

regulation.

MR. DUBE: Consistent with the defense-in-depth philosophy and there's a lengthy discussion on that. For example, containment failure should be considered under defense-in-depth when the change is being considered.

Maintain sufficient safety margins.

The fourth bullet is the risk one. Small.

And then the fifth bullet is monitor performance using performance measurement strategies. So risk is only one of the five principles in 1.174.

Here's a whole gambit. I mentioned earlier some of the programs and processes, everything from integrated leak rate testing, test interval extension, in-service testing, test specs, in-service inspection and 1.200 really is the staff's endorsement of the standards, PRA standards. 1.201 categorizes -- This is your 50.69 and then 50.65 "Maintenance Rule."

CHAIR APOSTOLAKIS: I have a question. I think I've said several times in the past that this Committee gets involved in the derivation, production, of these regulatory guides but very rarely gets feedback as to the implementation. So I would like to ask a question. How successful have all these initiatives been? Can someone from NRR perhaps explain.

(Off the record comments.)

And successful in the sense that they have been used widely by the industry and the staff feels very comfortable that the intent of all these things has been met and anything else you want to say.

MR. CHEOK: I believe it is a mixed bag in terms of how widely these initiatives have been used.

CHAIR APOSTOLAKIS: Right.

MR. CHEOK: Obviously, the ILRT initiative is widely used except I can't pronounce it. The IST initiative for some reason has not been widely adopted. I believe it's only been adopted by three licensees.

CHAIR APOSTOLAKIS: Do you know why?

MR. CHEOK: I don't know at this time, but I believe that it's not as cost beneficial as, for example, the ISI or the tech spec initiatives and at this point I think that a lot of it has to do with how much resources you put in compared to how much you can benefit from it.

And the text specs again it's quite a mixed bag. Within 1.177, there are several initiatives that are widely used. Some initiatives are not quite as widely used as others. I think right now though Initiatives 4B and 5B, those are the completion times and moving the surveillance intervals into owner-controlled programs. That's starting to pick up momentum, but for a time there it was also not quite as widely used as we thought it would be.

MR. TJADER: It was the text with Reg. Guide 1.177. That has been extensively used. The Initiatives 4A and 5A are just individual completion time extensions, just changing the completion time or changing the surveillance frequency just on a one-time basis and there is no variability after that. So that has been extensively used in the industry and applications come in and we've utilized that.

We've utilized 1.177 as a base for the eight initiatives that were in the process of developing. Many of the more simpler ones like missed surveillance frequency and mode transition ones which are adopted extensively now through the operating plants are pretty much the basis for those 1.177s.

Now 4B and 5B which are granting the licensees the flexibility to change risk-informed completion times and surveillance frequencies, those are sort of the cutting edge and they're just -- They're based upon 1.177. But they are just beginning to be implemented and adopted.

CHAIR APOSTOLAKIS: Mike, do you want to say anything else?

MR. CHEOK: I'll just continue down the list. 1.178 ISI is widely used. Obviously, 1.200 is the base document for PRA standards and it's used. 50.69 and Reg. Guide 1.201 at this point has not been widely adopted or used.

In a lot of what we hear from the industry is that PRA resources are finite and a lot of the PRA resources at this point are being used in applications such as NFPA 805 and in the wording of those resources there the other initiatives will lag behind a little bit.

CHAIR APOSTOLAKIS: But we spent so much time though coming up with 50.69 and we don't seem to get anything back in return. I mean, is it perhaps that we've posed too many conditions on the Risk 3 emphases.

MR. CHEOK: I think if you talked to the licensees that would be one reason they would give you for not using 50.69 that we have requirements for the Risk 3 that they do not feel commensurate with the risk significance.

MR. HAMZEHEE: Biff Bradley may want to say something from NEI because he has a --

(Laughter.)

CHAIR APOSTOLAKIS: Do you?

MR. BRADLEY: Sure. I am not going say I'm sorry though. Just a couple of observations. On 50.69, certainly we are desirous of getting some plants to pick that up. That's a major initiative.

All of the major risk initiatives, 50.69, 4B and 5B, rely on a 1.200 PRA that has to meet the standards and undergo potentially additional peer reviews. That is an intensive process. Most of the plants are getting there on an internal events, but that has basically put everything to a stop for the last couple of years while we get the PRA pedigree up to the point where we can do these applications.

So 4B, 5B, 50.69, hopefully we'll see

more. 50.69 is controversial and the Risk 3 treatment continues to be an issue even though we have a final rule and thought we had a final reg. guide. We still get very conflicting signals from NRC staff about Risk 3 treatment, enough to inject a lot of regulatory uncertainty into the process of going forward with 50.69.

But I think a lot of the inertia here is getting up to 1.200. Now, of course, the other thing is NFPA 805 has consumed the entire PRA infrastructure all by itself and that thing is like the elephant in the room and as long as we have that there that precludes us from having a lot of resources to put in these other areas. So those are probably the main reasons we're not getting a lot of pick on this.

CHAIR APOSTOLAKIS: So one of the main reasons is that the infrastructure is being built up, I mean, creating a good PRA which can be used in many applications. Right?

MR. BRADLEY: Certainly NFPA 805 if I was to point to one thing, you know, that is consuming all our resources particularly all by itself right now.

CHAIR APOSTOLAKIS: I think we're going

to have a subcommittee meeting on this 1.205. We agreed sometime in October. Maybe we should pick up some of these concerns and talk about them then.

Thank you. That was very good. Maybe we should have another subcommittee where you guys come back with actual applications of how you handled that because that's missing really. I mean, if you stop and think, this Committee is not really briefed on how these guides are actually being used. Once we approve something, that's it. It goes out of the room.

MR. HAMZEHEE: It's mainly because you guys are so busy.

CHAIR APOSTOLAKIS: We'll find the time.

PARTICIPANT (JB): Dr. Apostolakis, would you like to have a meeting with the staff on how the guys have been --

CHAIR APOSTOLAKIS: Yes, we'll do that. I didn't say when, but we'll do that because we're very busy.

PARTICIPANT (JB): Yes.

MR. DUBE: So this bring us to the issues before the staff and specifically the staff and Office of New Reactors. Use of the current risk metric goals, specifically LERF and those in Reg. Guide 1.174, could, and I'll use the word "could," result in risk-informed applications and amendments being evaluated against less restrictive criteria than those used for the licensing basis of new reactors and it's going to say specifically to 10^{-6} large release frequency because when the one says LERF and LRF are somewhat related, there is a safety evaluation report on all new design certifications as well as there will eventually be for the combined license saying the staff has reviewed against the Commission's 10^{-6} large release goal and so on and so forth. So they are being reviewed against the 10^{-6} and a staff conclusions is being made whether it adequately meets those goals and objectives.

And then second of all the current guidance could allow large relative changes to the core damage frequency and containment performance. We've talked about this. You know, if the baseline CDF is 10^{-8} for some internal event and a plant makes some changes or proposes a hardware change that goes from 10^{-8} to 2 or 3 times 10^{-8} I don't think the staff is going to be concerned about it given seismic is out there and some of the other contributors and given the uncertainties and given the orders of magnitude from the so-called speed limit.

But there are other perspectives that what if one weren't talking about factors of 1.5 and 2. What if one were talking about an order of magnitude or even more?

MEMBER ABDEL-KHALIK: Should one be concerned about large relative changes in the value of CDF or large relative changes in the margin?

MR. DUBE: Yes.

MR. HAMZEHEE: I think it should be both because they are somehow related.

MR. DUBE: Right.

MEMBER RAY: The margin, what do you mean by "the margin"?

MEMBER ABDEL-KHALIK: The difference between what the limit is and what the current value is.

MEMBER RAY: Well, I meant whether you're looking narrowly at a particular sequence, the margin for it, or the overall margin taking into account all risks.

MEMBER ABDEL-KHALIK: You have a specific application that would result in an increase in CDF.

MEMBER RAY: CDF.

MEMBER ABDEL-KHALIK: The current baseline CDF is X.

MEMBER RAY: Okay.

MEMBER ABDEL-KHALIK: Then you have a margin between that current value in 10^{-4}.

MEMBER RAY: You're not talking about a particular sequence.

MEMBER ABDEL-KHALIK: No.

MEMBER RAY: Okay.

MEMBER ABDEL-KHALIK: So it seems to me that one should be concerned about large relative changes in the margin rather than large relative changes in the absolute value.

MR. DUBE: Yes. I mean I think the staff considers that. We have this again.

MEMBER ABDEL-KHALIK: Yes.

MR. DUBE: And that's why Region III is treated differently than Region II.

CHAIR APOSTOLAKIS: Oh, but I think if I understand correctly what Said is saying, if you're on the horizontal axis at 10^{-5} or below, then you have much larger margin to the goal.

MR. DUBE: Sure.

CHAIR APOSTOLAKIS: So essentially what you're saying, Said, I think is that the lines that separate the regions should not be flat. They should be somehow inclined.

MEMBER ABDEL-KHALIK: Correct.

CHAIR APOSTOLAKIS: Which was an EPRI proposal at the time which the staff rejected. They didn't want to do that.

MEMBER ABDEL-KHALIK: Right.

CHAIR APOSTOLAKIS: I don't remember exactly the reason, but it was proposed. But for very low CDFs you should be allowing larger delta CDFs.

` MEMBER ABDEL-KHALIK: Right.

CHAIR APOSTOLAKIS: But I thought the issue of margin is also important because you have to bear in mind that PRAs do not quantify the thermohydraulic margin. That's not there. The acceptance criteria usually is conservative and all we're dealing with is the failure of components and systems and so on.

So I suspect the actual risk is lower than what we're calculating. In other words, if I do a thermohydraulic calculation for a LOCA and I do my thermohydraulic stuff whether I have a 100 degrees margin or a 300 degrees margin, the PRA does not reflect that.

Yes, sir.

MEMBER SIEBER: I have a question just for my own knowledge. Is it true that if the values of CDF and LERF as they become smaller and smaller that the uncertainties become larger and larger?

CHAIR APOSTOLAKIS: I would say yes as a general trend.

MEMBER SIEBER: So if you had a very small CDF and LERF the potential change in risk that you can get from a change in the plant could be substantial but still be pretty small. Right?

CHAIR APOSTOLAKIS: Could be, yes.

MEMBER SIEBER: Okay. If I look at the charts for the block diagrams for 1.174 if you have a very low CDF or LERF, the amount of change that you're allowed is very little; whereas, if you're in a risky state the amount of change you're allowed is little which to me I interpret as I'm allowed more change. Doesn't quite make sense to me.

CHAIR APOSTOLAKIS: I didn't quite follow that.

MEMBER SIEBER: Ir you say but that's the way it is, that's fine.

CHAIR APOSTOLAKIS: I can't say anything because I'm not sure I followed your argument, the last.

MEMBER SIEBER: If you look at slide 18 for Region III.

CHAIR APOSTOLAKIS: Yes.

MEMBER SIEBER: Very small changes are allowed in Region II only. Small changes are allowed.

CHAIR APOSTOLAKIS: Right.

MEMBER SIEBER: Which I presume that that's bigger changes than very small changes.

CHAIR APOSTOLAKIS: Yes.

MR. ADER: There is management attention that goes with the changes that are in a higher region. There would be more flexibility with very small changes as far as the review.

CHAIR APOSTOLAKIS: Jack, why don't you complete your argument?

MEMBER SIEBER: Pardon?

CHAIR APOSTOLAKIS: Complete your

argument.

MEMBER SIEBER: Well, I would think they would be reversed. I would think that you would allow small changes for Region III and very small changes for Region II because you're approaching --

MR. CHEOK: I believe there's a typo up there.

MEMBER STETKAR: On a percentage basis that's true, but on an absolute basis, it's not. It's the reverse.

MEMBER SIEBER: Okay.

MR. DUBE: This is not saying -- This is -- Yes.

MEMBER STETKAR: On a percentage basis.

MR. DUBE: It's not saying allowing very small changes. This is saying if the changes are very small changes.

(Simultaneous conversations.)

CHAIR APOSTOLAKIS: What did you say, Don?

MR. DUBE: Don't interpret that legion there on the upper right as being allowing a small change or allowing a very small -- This is saying if you're in Region III it is by definition a very small change.

MEMBER SIEBER: Well, but a change that you propose could have a significant risk component associated with it, but you would still be less risky than somebody in the higher level.

MR. DUBE: Right.

MEMBER SIEBER: I think maybe it's just the way the chart is drawn up.

MR. DUBE: Yes.

MEMBER SIEBER: As opposed to the way --

MR. DUBE: This is why this region is whiter and this region is gray and this region is dark. And there was some original proposals that had this, these kind of diagonal lines.

MEMBER SIEBER: So I need a densimeter. Okay. Thank you very much.

MR. DUBE: Okay.

MEMBER SIEBER: I appreciate it.

MR. DUBE: So we are -- Well, we mentioned this. Current guidelines could allow large relative changes to CDF and containment performance.

So again in the realm of new reactors, the issues are in the licensing world, how should acceptance guidelines for new reactor license applications or amendments proposing to implement risk-informed initiatives consider Commission's expectations. Remember one of the early policy statements.

Should one consider changes in CDF? Probably that's a straightforward. But should one continue with LERF or delta LERF?

CHAIR APOSTOLAKIS: I'm really confused. For licensing? Why does the delta come into the picture?

MR. DUBE: Well, if they're proposing a license amendment. They have a combined license.

CHAIR APOSTOLAKIS: Okay. You're right.

MR. DUBE: The new reactor is a combined license and they're starting up and before they load fuel, they come in with a risk-informed initiative, an amendment, before they even start up.

And then in the operations world, reactor oversight process thresholds rely on to a large extent on CDF, but really deltas, delta CDFs, conditional core damage probabilities, incremental conditional core damage probability, not too much LERF, but delta LERF. And so there's already ingrained if one looks at the reactor oversight process, I mean it goes everywhere. It's not just one document, but there's inspection manual chapters and management directives, the MSPI, the significance determination process, many, many different documents that rely on delta CDFs and delta LERFs.

MR. ADER: I think in the earlier presentation we had, and I don't think we did it here, we were trying to make a distinction because a decision could be made that the way we broke this down was in licensing you're allowing applicants to change their licensing basis on a permanent basis to implement a risk-informed initiative.

You may want to review those with one set of attributes under consideration. The operations part of it, the ROP piece and tech specs, outage time, is a temporary transient type of mode and how does the agency respond and where do they want to put their resources which is what a part of ROP was based on risk significance. So you could separate them.

You don't necessarily have to have the

same set of metrics and that was the question that we had in the earlier presentation that we're looking at. You could do different things for operation than you do for design changes that would tend to be permanent.

CHAIR APOSTOLAKIS: Good point.

MR. DUBE: And then on the third bullet, there's a whole host of other programs and processes. We don't sometimes give them attention, but there's everything from accident sequence precursor and the thresholds for reporting up through Congress and in some cases there's generic issues for MD6.4. There's regulatory analysis. There's non risk-informed license amendment requests and so on and so forth. There's a whole host of other programs and processes that really tied strongly to the CDF goal, the delta CDF, the LERF surrogate and delta LERFs.

As we mentioned our primary focus at this point is on the needs for licensing because of the risk-informed initiatives that have been proposed with license applications.

CHAIR APOSTOLAKIS: We are completing an hour and a half. So tell us where would be a good time to take a break.

MR. DUBE: I can do two or three more slides and then we can stop or I can stop right here.

CHAIR APOSTOLAKIS: You can stop right now?

MR. DUBE: Yes.

MR. ADER: This would probably be a good time because we've kind of gone through the background.

CHAIR APOSTOLAKIS: Okay.

MR. ADER: And the framework and we're starting to into --

MEMBER STETKAR: Let me just ask one quick one and it's for my own.

CHAIR APOSTOLAKIS: Wait.

MEMBER STETKAR: We have two minutes and this is kind of historical perspective only for myself and if it's a long, involved answer, I'm willing to discuss it in the hall. Historically, why has the reactor oversight process used -- We're talking about absolute measures of change versus relative measures of change. Why is the reactor oversight process also by and large use absolute measures of change? I would have thought that -- In the oversight process, I'm more interested in how day-to-day operations and maintenance of the plant is affecting my departures from a baseline risk and that would seem more of a relative type of interest, for example, than an absolute. Whereas, in the licensing, you know, changes to the licensing basis itself because it is a permanent change, I should be more interested in an absolute. Is there an historical context for that or?

MR. DUBE: I'm glad my colleague, Mike Cheok, is here.

MEMBER STETKAR: Only because it is one of the options. I was looking forward only because it's one of the options that seems to have been discarded. So I was curious about a bit of that history if it's short. If it's not short, that's fine.

MR. CHEOK: One of the tenants for the ROP was that it is transparent and easily understandable for all stakeholders and making it an absolute value where it's uniform for all different plans would make it more understandable, simpler and more transparent to all stakeholders as to -- In other words, if it's white finding, we are at a threshold of 10^{-6}. Should we change that to a different number for each different plant and I think it would be more uniform.

MEMBER STETKAR: So it's a pragmatic decision to try to keep everybody uniform rather than measure something on a plant-by-plant basis.

MR. CHEOK: That was one of the reasons.

CHAIR APOSTOLAKIS: But it seems to me that this is in conflict with the general spirit of the ROP which is to maintain the risk profile of the plant.

MR. CHEOK: Well, the ROP --

MEMBER STETKAR: That's my point that if I have a very, very good plant --

(Several conversations at once.)

MR. CHEOK: But the ROP also, you're right. I mean you have a good point and I will not argue that point. But the ROP also is a tool that we would use to align our inspection findings, you know, enforcement actions and so we are basically saying we will try to enforce at a certain level for certain risk framing.

MEMBER STETKAR: Thank you.

MR. HAMZEHEE: John, if you look at the operating plants, you realize that almost every plant monitors the risk profile on a daily basis for other purposes. So that is done. But from the regulatory perspective you have to have some thresholds, guidelines.

MEMBER STETKAR: I'm just interested in the regulatory -- the history of how we got there.

CHAIR APOSTOLAKIS: The maintenance rule, though, is based on the current risk profile that they proposed. So it's a mixed bag.

Jack.

MEMBER SIEBER: Yes. I think part of this is the public perspective. A citizen who lives in the vicinity of the plant is asking the question, "How risky is that place down the street" and in that term absolutes are more telling or answering that question than a relative change in the risk and part of the ROP is to respond to the public.

CHAIR APOSTOLAKIS: That's right. And on that happy note, we'll take 15 minutes. Off the record.

(Whereupon, a short recess was taken.)

CHAIR APOSTOLAKIS: On the record.

We're back in session.

Mr. Dube.

MR. DUBE: Again, just recapping what we've been talking about for the last five or ten minutes the fundamental issues are the current risk metric goals, the type of the currently operating reactors. They couldn't result in risk-informed applications being evaluated against, some would argue, a less restrictive criteria and the current guidance could allow large relative changes to containment performance.

For new reactors, should the principle -- these are rhetorical questions by the way --

(Laughter.)

CHAIR APOSTOLAKIS: Just in case we get an idea. Yes?

(Off the record comments.)

MR. DUBE: For new reactors, should the principle of "small increase" be based on relative or absolute delta CDF and delta LERF or delta LRF?

MEMBER ABDEL-KHALIK: There's a third option, of course, in that first question which is delta CDF margin or delta LERF margin or delta LRF margin.

MR. DUBE: Okay. Yes.

CHAIR APOSTOLAKIS: Of course, if you make it relative you probably would achieve the same thing because then it will be a percentage of where you are. I'm not saying -- It could. But you're right. At this point, we should have an open mind.

(Off the record discussions.)

Let me make a comment here and it may be jumping a little ahead. I read, of course, your document and the NEI document. Is there a -- I have the impression that the NEI document -- and, of course, they would have a chance to talk about it later. You focus more on the deltas, on the what do I do. I mean I have these regulations now that are based on changes.

The NEI white paper didn't do that as much anyway. I mean they focused more on the appropriateness of CDF and LERF. Is that your impression as well?

MR. DUBE: Yes.

CHAIR APOSTOLAKIS: So you guys are not really differing. You are addressing different issues.

MR. DUBE: Personally, I don't have a disagreement with anything said in the NEI white paper. But there were some things that they left out which doesn't help us on the staff because we still have this LRF goal that the staff's reviewing against and we can't just let it go away.

CHAIR APOSTOLAKIS: We'll have a discussion on this later.

MR. DUBE: Yes.

CHAIR APOSTOLAKIS: I just wanted to make sure that I understood the difference between the two documents. I mean you -- Well, you have that problem with LRF, but you could live with LERF, couldn't you?

MR. DUBE: Perhaps. Yes.

CHAIR APOSTOLAKIS: Thank you for that. If that's your answer, that's your answer.

MR. ADER: There's probably more than two related questions. One is the speed limit question Dr. Shack raised. You have the safety goal. Is that safe enough? And you have Commission's expectations. Plants will be safer. And we're reviewing them against those expectations.

Question we've kind of put on the table is which of those should be the speed limit if there should be a speed limit and then you have delta changes. How much of it a change would you like, would we want to allow without having some review process? At some level, changes are insignificant in absolute, but they may be significant in an relative. What they're telling you the insights are there.

CHAIR APOSTOLAKIS: I wish you guys wouldn't use the words "speed limit." Speed goal.

MR. DUBE: Right.

(Off the record comments.)

MEMBER SHACK: There is no uncertainty, George, because it's always on the mean. We've taken care of the uncertainty.

CHAIR APOSTOLAKIS: Yeah. Right.

(Laughter.)

We have done that. Right.

MR. DUBE: And the second part is should include an alternate or even additional delta LRF acceptance guideline from the reactors. That would be a significant change to Reg. Guide 1.174 and all the other documents, but that's certainly an option.

If we do come to this LRF though, we're going to be revisiting 1990s all over again because we would have to come up with a uniform definition of LRF.

CHAIR APOSTOLAKIS: But it is being used already though. So what are you proposing to do? If you -- you're going to go back, say, to AP1000 and look at it again from a different prospective. I mean you can't do that.

MR. DUBE: No, we can't undo this.

MR. ADER: There's not an uniform definition right now. They each have their own definitions.

CHAIR APOSTOLAKIS: I understand that. But my point is that it has already been used in a regulatory decision or more than one actually.

MEMBER SHACK: I think the answer would be though that any definition they would come with they would find out that everything they've approved is well more conservative.

CHAIR APOSTOLAKIS: Sure. That would be the other way. The definition, it would be defined in such a way.

MR. DUBE: I'm very confident of that.

CHAIR APOSTOLAKIS: Yes.

MEMBER ABDEL-KHALIK: I mean the fact that people have used different definition really bolsters the idea of using sort of criteria based on relative fractions of the margin of whatever measure people used.

MR. DUBE: That's a possibility.

(Off the record comments.)

MR. ADER: Don, back up one slide.

MR. HAMZEHEE: I just want to ask you a quick question if I may. Don, if you don't mind, I think I just want to make sure at least I'm clear. When you talk about margin, you're talking about the difference between plant CDF and the Commission's Safety Goal Limit. Is that what you're talking about?

MR. DUBE: Right.

MR. HAMZEHEE: Thanks.

MEMBER ABDEL-KHALIK: Right.

MR. ADER: Maybe it's not that subtle. It's kind of subtle in this slide. If we have an acceptance guideline like the CDF, LRF, LERF and 1.174, if we put a LERF and we put another graph there that had delta LERF where it was an acceptance guideline that was uniform that's where it would get us back into having then coming up with a common definition of LRF that everybody would buy into. One of the options we'll get into later is you deal with LRF based on individual applicant's definitions in a somewhat qualitative/quantitative way in 1.174 because you had all the other factors you look at. Then it wouldn't be as critical to have a uniform definition.

So this slide was saying if we put a limit there that we're going to judge everybody against we would get back into the whole process and the difficulty of coming up with an acceptable LRF definition. So that's a downside of some of the options.

MR. DUBE: But the LERF, L-E-R-F, is relatively uniformly defined. I mean they give examples of containment isolation failure or containment bypass for the PWRs and relatively uniformly applied across the fleet of plants.

MEMBER SHACK: Sure. What you're proposing is to put LRF up there and then let them propose a surrogate.

MR. ADER: No, if we did it in the context of the 1.174 charter where you had an acceptance criteria that would judge or an acceptance of 10^{-6} LERF and everything was judged against that, then I think you would be forced I believe to get into the same thing we did with LERF. You would want a definition in a reg. guide that was consistent across all of the applications.

One of the options is you deal with the applicant's definition of LRF when you have them evaluate changes and the impact on their LRF as they have defined it which we say all of those definitions would probably be less than what we have.

MEMBER SHACK: They'll have to go back and change their definition.

MR. ADER: That would be another difficulty, another part of the dilemma.

MR. DUBE: Which leads us into the five design certificates with combined license application. Some of these may not be the most current, but it's just by way of example.

The ABWR kind of lived up to some of the original intent of the Electric Power Research Institute's Utility Requirements document. They were using a dose-based definition of large release. It was 25 rem at 0.5 mile from the reactor.

CHAIR APOSTOLAKIS: But why? Is that

based on any government document?

MR. DUBE: It's a requirements document.

MR. HAMZEHEE: It's also based on an EPRI work that they published a report and they defined this as a 25 rem.

CHAIR APOSTOLAKIS: Well, that rings about 25 rem.

MR. ADER: Twenty-five rem is the Part 100.

CHAIR APOSTOLAKIS: Yes. That's what I'm saying. Is there any connection to --

MR. DUBE: That's the connection.

MR. ADER: I believe that was the connection they were proposing.

CHAIR APOSTOLAKIS: That's all.

MR. ADER: Was it would be Part 100 at surrogate site boundary and that would be a design objective.

CHAIR APOSTOLAKIS: And Part 100 also specifies half a mile?

MR. ADER: No.

MR. HAMZEHEE: No, I don't think so.

MR. ADER: But if you have guidance for a design of a plant, you don't know what the site's going to be. So that would decouple it from any specific site. You would say at a half a mile which is probably --

CHAIR APOSTOLAKIS: What does Part 100 say? I don't remember.

MR. DUBE: That's how you define the site.

MEMBER BLEY: The outside site boundary.

MR. ADER: But the plant that has a large site has ability to beat it much easier than a plant that has a very tight site boundary. Conclusionary boundary.

CHAIR APOSTOLAKIS: So is this -- Do you agree that this is much less than large?

(Off the record comments.)

Did you find it this way?

MR. DUBE: Well, if one goes back to one possible definition which was an early fatality which would require several hundred rem, yes.

MR. ADER: This is what current plants would need with containment, intact containment, with design based leakage. That's the exclusionary boundary dose limit. It has to be within two-hour dose.

MR. HAMZEHEE: And it's also very easy to measure compared to some other definitions. That's why it's attractive.

CHAIR APOSTOLAKIS: It's easy to measure.

MR. HAMZEHEE: Or understand at least. Calculate.

CHAIR APOSTOLAKIS: Calculate.

So what kind of PRA would be required to do this?

MR. DUBE: Level 2 gives you the release magnitude and timing and then you can do some chi/q calculations and put a person at a site.

PARTICIPANT: A 2-plus.

MR. HAMZEHEE: Ultimately, a Level 3 PRA would be ideal because that way you get a really good information. But absent of Level 3, then you can do Level 2-plus to get some inputs. So you can do it without a Level 3.

CHAIR APOSTOLAKIS: Which is the thing we are really trying to avoid, right? It's painful. Also it's a disease that will descend upon us if we do a Level 3 PRA. No?

MEMBER SHACK: Is that a rhetorical question?

MR. DUBE: Yes. So the AP1000 went with a containment failure modes definition which is basically all containment release failures except that intact containment and also the controlled release via containment venting constitute a large release. That's starting to get more like a LERF kind of a definition in the sense that if it's containment failure modes. Although there's no discussion here of timing of course. That's what distinguishes --

CHAIR APOSTOLAKIS: So why do you say that? Why do you say it's coming closer to LERF if there is no question?

MR. DUBE: The functional definition of L-E-R-F if you look in Reg. Guide 1.174 gives some ideas. It's induced steam generator tube rupture or containment bypass or containment isolation failure at the time of a core melt. So it's a containment failure mode definition.

One can take a Level 1.5 PRA and get an end state without having to do perhaps a full Level 2 or certainly not have to do a Level 3. So one could use, for example, the ASME/ANS combined

PRA standard and almost get an LRF without having to do a full Level 2 and on practice they do do a Level 2.

So we have a dose phase definition, a containment failure mode definition. ESBWR is non tech spec leakage. It's used to represent the sum of all release categories except for tech spec leakage where tech spec leakage represents -- Well, you can read it through.

For the ESBWR design certification nTSL, I suppose, non tech spec leakage is used as a bounding approximation for large release frequency. Its frequency is higher than LRF. So here, too, it's a conservative definition. I think it's fair to say that these are conservative and to some extent bounding and this is as well.

So now we're already up to three different definitions and completely different kinds of definitions.

MEMBER STETKAR: But isn't ESBWR pretty similar to AP1000 with the exception of the AP1000 controls?

MR. DUBE: Yes, somewhat similar.

MR. HAMZEHEE: One is B. One is P. That's the other difference.

MEMBER STETKAR: Functionally, they sound very similar.

MR. DUBE: Yes. This is a containment failure mode and this is a release category.

MEMBER STETKAR: So it's not necessarily unique definitions.

MR. DUBE: About 2.5.

MEMBER STETKAR: There are two pretty similar.

MR. DUBE: Yes. And APWR is a containment failure mode, but here they have actual failure mechanisms, specific failure modes. It includes containment bypass, containment isolation failure, energetic phenomena. They do include basemat melt through, overpressure and the energetic includes hydrogen combustion, ex-vessel, direct containment heating and rocket-mode and so on and so forth.

MEMBER STETKAR: But philosophically this also sounds to me like an AP1000 ESBWR.

MR. DUBE: Yes, it's a containment failure mode base.

MEMBER STETKAR: I'm just looking at differences. Do they include any containment isolation failure philosophically and they all three of them seem to.

MR. DUBE: That's right. There's a dose base, a containment failure modes base and EPR refers back to NUREG/CR-6595 and uses a release fraction of iodine, cesium or tellurium, 2.5, 3 percent and NUREG/CR-6595 did a series of calculations and did build upon previous NUREGs that show that with minimal evacuation 2.5 to 3 percent of these release fractions could potentially result in an early fatality. If there was some reasonable evacuation that percent could be as high as 10, 15, 20, 25 percent kind of a number. But to be conservative, the Emergency Protective Actions, these are the release fractions that could potentially give it early fatality. So this is a release fraction based definition.

There is at least three pretty different.

MEMBER SIEBER: There is a possibility if you tried to distinguish between LERF and LRF and for LERF you cannot take credit for an emergency plan, an evacuation plan; whereas LRF you can or cannot take credit for it. Is that a factor at all in the choosing between LRF and LERF is the effectiveness of the evacuation plan?

MR. ADER: The work we were doing before to define LRF we were really looking at a range of sites, a range of evacuation timing. So even then we were considering evacuation.

MEMBER SIEBER: Okay.

MR. ADER: We were trying not to be overly optimistic. We were trying not to be overly conservative.

MEMBER SIEBER: Yes. Some people won't move.

MR. ADER: Well, the calculations tend to have a small fraction that don't move. So they get thrown into the mix anyway. But what fraction doesn't move was part of the debate. You know, what's representative of meteorology, what's representative of population distribution, all of those things were factors that you kind of play with to figure out where you want to be back out of large release and where the Commission had the staff going it was trying to come up with a definition similar to the EPR to be an equivalent iodine, curies of iodine, or a fraction of the core. So evacuation played in both of them.

MEMBER SIEBER: It has. Is there a

difference in the way they're evacuation is treated between the two definitions of releases or are they treated basically the same way?

MR. ADER: Well, LERF defined in 1.174 doesn't get into the evacuation.

MEMBER SIEBER: Right. Because it's too quick.

MR. ADER: It's kind of a functional. It's early. It's a release that would be early before you could take effective evacuation. So it does in that sense.

MEMBER SIEBER: Okay. Thank you.

MR. HAMZEHEE: And also if you notice in the definitions that the new reactor designs have adopted, almost all of them define it in a way that LERF is a subset of it.

MEMBER SIEBER: Okay.

MEMBER STETKAR: But effectively the three new reactors that Don showed, the ABWR, APWR and AP1000 define a release.

MR. HAMZEHEE: Correct.

MEMBER STETKAR: And LERF and in fact LRF are both subsets of that release because they define any release of any size.

MR. HAMZEHEE: Correct.

MEMBER STETKAR: As I understand what you put up there.

MR. DUBE: That's right.

MEMBER STETKAR: So it could be a small containment isolation failure with a very extended release.

MR. DUBE: Right. That's a good point. Yes.

MEMBER STETKAR: But they just happen to be calling it LRF because numerically they can still meet the goal by giving it that name.

MR. DUBE: Exactly.

MR. HAMZEHEE: That's why they're all conservative.

MEMBER STETKAR: It's not really a --

MR. DUBE: I mean, we agree that they're conservative definitions. The problem is they're all orthogonal to each other.

MEMBER ABDEL-KHALIK: So with these three definitions, a power uprate would have no impact on this frequency.

MR. HAMZEHEE: On the CDF or --

MEMBER ABDEL-KHALIK: The way the large release frequency is defined by the AP1000 or the ESBWR or the EPWR.

MR. DUBE: Exactly right. By these broad definitions, you're probably right.

MEMBER ABDEL-KHALIK: Well, how good are these definitions then?

MEMBER SIEBER: Very good question.

MR. ADER: I mean, it would assume that in a power uprate that you're not reducing the margin to an unacceptable level and I'm talking thermohydraulic margin or you're not reducing operator, you know, time for operator actions. But everything else stays the same. The functional definition kind of wouldn't play.

MR. HAMZEHEE: You need to think about that. That's a definite application.

MR. DUBE: Yes, we have to think about that.

MR. HAMZEHEE: You know, you need to think about it more and look at the way they use these metrics for power uprate because CDF is more straightforward. But with respect to releases that becomes a little more complicated.

MR. ADER: Will the containment withstand the increased mass and energy? As long as you're not changing the likelihood of failure you're not significantly changing it.

MR. DUBE: Power uprate means more inventory, but you could be releasing a more absolute, but even the EPR has a relative.

MEMBER STETKAR: Right. You would see ABWR though. That's an absolute.

MR. DUBE: Perhaps. Good point. I'm not sure we could really measure it.

MEMBER STETKAR: In principle.

MR. DUBE: So the point of this last few minutes was to show the dilemma but also the problem of trying to retrofit a definition of large release. There will be some not so happy designers if one were to backfit a release definition.

At the April briefing, industry provided its perspective, its preference for status quo, that same treatment.

MEMBER ABDEL-KHALIK: I'm sorry. Back to the statement that you just made, but if the intuitive interpretation of these definitions that they are much more conservative than the way that you would define the large release frequency consistent with the 10^{-6} limit, why would they be unhappy if you were to --

MR. HAMZEHEE: Redefine it.

MEMBER ABDEL-KHALIK: -- redefine?

MR. DUBE: Well, I'll let them answer it, but my guess would be one is now going into the Level 2 PRA, the containment event trees, all of the roll-up of the end stages. It's not a trivial matter, but maybe Rick would like to --

MR. WACHOWIAK: Rick Wachowiak, GE Hitachi, designer and applicant. We would be delighted if we could define this and not have to use the overall bounding definition that you cited on there because we recognize that many of those release categories that we have would not be a large release. But because it's undefined, we just didn't know what to do with it at this stage and so a definition would be welcomed.

MEMBER ABDEL-KHALIK: Thank you.

MEMBER SHACK: A definition would look like this. One that looked like yours probably wouldn't be.

(Laughter.)

(Off the record comments.)

You all want to stand up and be the frontman for this one.

MR. ADER: And our focus has not been on going back in the design certification process and changing a definition. It's going forward and risk informed amendments are eventually ROP.

MEMBER ABDEL-KHALIK: But you can translate these definitions any way you want based on the current results of the PRAs.

MR. ADER: You say translate. I'm not --

MEMBER ABDEL-KHALIK: Translate them into other metrics that you might use.

MR. DUBE: It could be done.

So, back to this slide, we mentioned and I'll let them speak. I think this is a fair characterization. Preference for status quo. They did give a good historical derivation of LRF and LERF and demonstrated roughly the equivalence of 10^{-6} LRF with 10^{-5} per year, although I think the next slide shows you this counter-intuitiveness. These are Venn diagrams which I picked up in 5th grade I think.

The diagram on the left is our logically intuitiveness definition based on magnitude and timing. You think of all releases as a big set and the large release is a subset and a large early would a subset of that subset.

MEMBER SIEBER: Not true.

CHAIR APOSTOLAKIS: We agreed last time that's not true, right?

(Off the record discussion.)

MR. DUBE: On the right side based on what industry presented --

CHAIR APOSTOLAKIS: If I have to wait, this is not fun. This is an internal committee dispute. Go ahead.

(Laughter.)

MR. DUBE: Based on the evolution of LRF and LERF and what was used in the NUREG-1150 analysis, certainly the frequency in all releases stays the same. The LERF is a subset of that, but they're saying that there's only a fraction of all large early releases that result or a large fraction of all releases that result in a greater than one early fatality and that is actually a subset of LERF although there might be some that doesn't overlap. But I think that's the best way I can represent it.

And remember they were demonstrating that the conditional probability of one early fatality given a large early release frequency is a few percent or as much as an order of 10 percent. And that's just because of the way it was defined.

Now in the white paper where they said there was a ten percent conditional probability of LRF given LERF, that's true if one defines LRF as all releases resulting in one or more early fatalities. I don't think we've established and certainly the Commission has never stated that that is the definition of LRF. But if it were, then one could demonstrate an equivalence of 10^{-6} LRF with a 10^{-5} LERF. I think we could.

CHAIR APOSTOLAKIS: Is that something that even though the Commission has not defined it it's reasonable so we can just go ahead and keep this in mind or are you reluctant to subscribe to it? It sounds reasonable to me.

MEMBER RAY: But why?

CHAIR APOSTOLAKIS: What?

MEMBER RAY: Why does it sound reasonable to you? It doesn't to me right off.

CHAIR APOSTOLAKIS: Well, it seems to me that LERF can be calculated and has been calculated for a long time. People understand it and it's not tied to deaths. Right? The way it's done?

MEMBER SHACK: But the acceptance level

is. The acceptance level is designed to meet your prompt fatality.

MEMBER BLEY: But the underlying idea of when they defined LERF was that those were coming from the release categories that had the potential to produce deaths. It turns out they don't produce as many as one thought.

CHAIR APOSTOLAKIS: But it's not just the potential. I think John Stetkar explained it last time. LERF does not include probabilities of wind and other things that would lead to deaths, whereas LRF does. Is that correct what you said?

MEMBER STETKAR: Yes.

CHAIR APOSTOLAKIS: Yes, that's why it's lower because it includes more probabilities.

MEMBER BLEY: Somebody else said that.

CHAIR APOSTOLAKIS: Whatever. Okay.

MEMBER BLEY: It's only what's coming, where the other one when you have to calculate dose you have to --

CHAIR APOSTOLAKIS: Are you guys saying that this is not reasonable?

MEMBER BLEY: George, I think the only thing that isn't reasonable is what was proposed last time and it's kind of been in the writings would be to call that little thing LRF.

CHAIR APOSTOLAKIS: Which thing now? On the left or the right?

MEMBER BLEY: The frequency of greater than one fatality.

CHAIR APOSTOLAKIS: Right.

MEMBER BLEY: Because the language makes sense on the left.

MEMBER STETKAR: That's right.

MEMBER BLEY: Call that thing.

MEMBER STETKAR: Call it the frequency of greater than one or more fatalities.

MEMBER BLEY: Call it that. Don't call it LRF because that leads you to language problems.

MEMBER STETKAR: Don't call it a release frequency.

MEMBER SHACK: If you go back to the Commissions's policy statement, they had a QHO which is really the LERF. If they really meant the LRF to be equivalent to the QHO, why would they bring in the LERF? They had that as an extra thing. They had something in mind beyond the QHO. I don't know what they had in mind.

MR. ADER: LERF came here.

MEMBER SHACK: But the LERF we believe and we treat as a surrogate for the QHO, the prompt fatality, and it's $5(10^{-7})$. The LERF as they've defined it is $1(10^{-6})$. They're equivalent, you know, give or take a factor of two and this sort of thing is nothing. So to me they are equivalent if you're going to take that definition.

But then the question is why did the Commission bring up the LRF definition of 10^{-6}?

CHAIR APOSTOLAKIS: You're talking about the acceptability. I'm talking about the question why is the LERF greater than the LRF which appear to be inconsistent. But it seems to me the right-hand side diagram explains that. LERF includes releases that do not necessarily lead to deaths, whereas LRF does. It restricts itself to the releases that lead to death.

MEMBER RAY: Which includes site characteristics.

CHAIR APOSTOLAKIS: Exactly. Which makes sense then that the LRF is lower than the LERF. And I was happy understanding that. Now you tell me don't?

MEMBER RAY: No. You I thought were

saying is it okay to link LRF with one early fatality and you said it logical. And I said why is it logical.

CHAIR APOSTOLAKIS: No. That's not what I meant. I meant if you do that, then this makes sense.

MEMBER RAY: Yes. That's arbitrary to say LRF is constrained to things that result in --

CHAIR APOSTOLAKIS: I don't know how arbitrary it is. I mean why is it arbitrary?

MR. ADER: If I can go back.

CHAIR APOSTOLAKIS: Yes.

MR. ADER: The $1(10^{-6})$ LRF was I believe considered a surrogate that the Commission said staff has proposed or the Commission proposed and said go evaluate. There was a recognition at the time that it was probably an order of magnitude more conservative than a safety goal, but it would be a surrogate for the early fatality QHO. As we got into looking at a definition with the probability of wind directions and everything else, we realized that at 10^{-6} you're several orders of magnitude more conservative than a safety goal.

All of those were intended to be

surrogates for the early fatality QHO. LERF I think at 10^{-5} we've shown, a number of studies have shown, that's a pretty good representation of a surrogate for the QHO. LRF at the time of 10^{-6} was thought to be a surrogate for the QHO with a recognition that it's probably an order of magnitude more conservative.

MEMBER SHACK: Okay. Then you would argue the industry interpretation is a reasonable one for LRF then. It's really intended to be a surrogate just like LERF.

MR. ADER: I think that the LERF as it's used has been shown to be a reasonable surrogate for the safety goal.

MEMBER SHACK: And the LRF goal was intended to be a surrogate for the same safety goal. So therefore they're equivalent.

MR. ADER: They're different, but they were intended kind of for the same purpose.

MEMBER RAY: That's what you meant to say, I think.

MEMBER SHACK: Yes.

MEMBER RAY: Well, we should try and preserve this and think about it because it just seems to me that going back to what I understood

George to be saying which was the LRF being a surrogate for the QHO, why that's logical, it doesn't strike me right off the bat.

CHAIR APOSTOLAKIS: All I'm saying is that this interpretation of LRF explains a fact, the fact being that LERF is greater than LRF.

MEMBER RAY: Okay.

CHAIR APOSTOLAKIS: Which at first glance shouldn't be.

MEMBER RAY: Got it.

CHAIR APOSTOLAKIS: That's all I'm saying.

MEMBER ABDEL-KHALIK: In some writings.

CHAIR APOSTOLAKIS: I'm asking Done and Charlie. Should we go then ahead on the assumption that this is what is happening or do you still want to say but LRF is not defined, so I don't know? Because you do have the fact that LERF is greater. Somehow we've explained that.

MR. DUBE: Yes. I understand.

CHAIR APOSTOLAKIS: I mean clearly the lefthand side cannot be -- It's not true. Not cannot be. It's not true.

MEMBER RAY: We all agree on that.

CHAIR APOSTOLAKIS: So why can't we

agree on the right? I don't understand that. Can you explain that? Why do you disagree?

MEMBER SHACK: I don't. The question is is that the definition of LRF that you want to use.

CHAIR APOSTOLAKIS: Is there another definition that would explain the difference?

MEMBER SHACK: I don't have to explain any difference. I just want to know would that definition be the one we want to use. Do I want to use a definition that is a surrogate for the safety goal or do I want to something that's somewhat more conservative? And Charlie's telling me that they had originally intended to get one that's in the order of magnitude more conservative.

MR. ADER: They were willing to accept that.

MEMBER SHACK: They were willing to accept that.

MR. ADER: For simplification in a plant performance.

MEMBER SHACK: But you've achieved that now with LERF. You've achieved that goal.

MEMBER RAY: Well, but if you take away

early and you put in wind and the other considerations that cause LRF to be small, it's just another way of looking at accidents.

MEMBER SHACK: But the wind, all these come into the accepted. The 10^{-5} takes into account the meteorology. You know you define LERF in one way. Your acceptance value has to go off and look at --

MEMBER STETKAR: Not the way it's calculated in practice. The way LERF is calculated in practice is no --

MEMBER SHACK: But the acceptance value that you take.

MEMBER STETKAR: I don't care. The thing that you're looking at relative to that acceptance value has no information.

MEMBER SHACK: Sure. Right. Absolutely.

MEMBER STETKAR: So you can't infer what it has. It just has no information about wind.

MR. ADER: The calculations that people have done to say that that's a reasonable surrogate have taken it out to the Level 3 which factors in probability of the wind, wind direction and all of that.

MEMBER RAY: It just always seemed logical to me that you would look at early because of the reasons Jack was pursuing there having to do with you want to know how big the threat is early. And then you will also want to look at all of time if I can simplify it that way. So they don't seem necessarily to be in conflict.

CHAIR APOSTOLAKIS: Bill, what should I learn from this? What am I now?

MEMBER SHACK: If you accept the definition of LRF as one early fatality it looks like it does on the right.

CHAIR APOSTOLAKIS: And if I don't.

MEMBER SHACK: If you think of LERF and LRF as given amounts of a release then it looks like on the left.

MR. DUBE: That's right.

CHAIR APOSTOLAKIS: Which is inconsistent with --

MEMBER ABDEL-KHALIK: Calculated values.

CHAIR APOSTOLAKIS: -- the calculated values.

MEMBER SHACK: Not if you do the

calculation.

CHAIR APOSTOLAKIS: No.

MEMBER SHACK: I guarantee you that if you give me a given amount of release it look like it is on the left. If you ask me for an early fatality, it will look like it is on the right.

MR. DUBE: Exactly. That's right.

MEMBER SHACK: So what definition do you prefer?

MEMBER BLEY: And if you want to trace it back to origins, there was at least one piece of history I think Don left out of the presentation and that's back to the stuff Oakrin (phonetic) did on this Committee that set up safety goals in the first place and we might go back and see why that large release frequency was even put forward in the first place. And I think it was just to being a surrogate at that time.

CHAIR APOSTOLAKIS: You made the conditional statement regarding the lefthand side. How is that conditional statement consistent with the values that people are using?

MEMBER STETKAR: I think it's because there's a fundamental -- there are the frequentists who say, "I can calculate the frequency of releases greater than some magnitude." And those can occur at different times, but that's a frequency of a release and it's nice to talk about release frequencies because I'm using those two words.

In the second part, we're using the words "large release frequency" as not a large release frequency. All we're doing is calculating the frequency of deaths and if we call the little bubble to the right-hand side, frequency of death, and get away from this notion that it's a large release frequency, it all seems to make sense.

MEMBER BLEY: I don't think that the language that George refers to that we were shown last time is consistently used in calculations by people and all PRAs. I think that was -- it was certainly in 11.50 and then the reports that we were shown, but I don't think that's a consistently used calculation. Well, the calculation is always done, but it's not called large release frequency.

CHAIR APOSTOLAKIS: Jack.

MEMBER SIEBER: I think the one on the right requires a Level 3 PRA and is site specific. If I were selling or designing advanced reactors or modern reactors, I wouldn't be able to deal with the one on the right. I would have to deal with the one on the left because I don't know what site you're going to put it on. So I think it depends on the which definitions you use. It depends on whether it's dedicated to a certain site and then it's only a COL. Or it's dedicated to a DCE kind of situation where you use the one on the left and as long as we accept surrogates as representing some measure of fatalities, you know, that's --

MEMBER SHACK: Let me come back to the operational question.

MR. DUBE: That's a good -- If I can just finish up on that thought because again the Commission never officially endorsed large releases being that which causes one or more early fatalities. They kind of instructed the staff to come up with give me curies as a large release. We'll be happy with curies because that would be site independent.

PARTICIPANT: Right. That's like an LERF.

MEMBER SIEBER: Right, but that doesn't help you as far as calculating fatalities.

MR. DUBE: No. But it would be curies that might --

MR. ADER: That's where we were trying to back up from a representative site.

MEMBER SIEBER: Right.

MR. ADER: Because they wanted to divorce it from site. So what would be an equivalent curies that would be good enough for a large release or a fraction of the core --

MEMBER RAY: Is the time period implied by early different than that which is used in LRF?

MR. ADER: The calculations that were done back in trying to define an LRF was using evacuation timing. So that part of it was somewhat consistent.

MEMBER RAY: So they both were the same. The early doesn't really imply a different timeframe.

CHAIR APOSTOLAKIS: I thought it did. What?

MR. ADER: It was never defined. That was the problem. We never reached --

MEMBER RAY: Because the comment of two hours was mentioned awhile ago.

CHAIR APOSTOLAKIS: Well, no. It's

actually before effective evaluation.

MEMBER RAY: That's in the 10 CFR 100.

MR. ADER: The Part 100 is an EAB dose. A lot of times the first two hours is the more significant part, but it's just a Part 100 EAB dose.

MEMBER RAY: Because I thought we were distinguishing between early and all and not constrained by early here.

CHAIR APOSTOLAKIS: Maybe there's an obviously explanation which I don't see on the left. How can we have a 10^{-6} goal for LRF and 10^{-5} for LERF? That's what I don't understand.

MR. HAMZEHEE: George, you're right except if you believe that the intention was to keep the new reactors at the higher safety unless you agree with that.

CHAIR APOSTOLAKIS: The statements from the Commission we've been doing is independent of new or current.

MEMBER SIEBER: Yes.

CHAIR APOSTOLAKIS: So how can I -- If the picture on the left is the right one, how can the goal be different?

MR. ADER: They're not really

independent.

CHAIR APOSTOLAKIS: They're not really different.

MR. ADER: Because we never -- There was never an LRF definition that was endorsed.

CHAIR APOSTOLAKIS: But there is a definition there that is broader than LERF. The LERF is a subset. So for a subset we say 10^{-5} and for the bigger set we say 10^{-6}. If that is obvious, you guys, I'm going crazy.

(Several simultaneous comments.)

MEMBER STETKAR: Because latent containment overpressure failures are not concluded in LERF. If a late containment overpressure blow out the equipment hatch, for example, in an extreme case, it's not included today in what people publish as LERF.

MEMBER RAY: And is it an LRF?

MEMBER STETKAR: Well, it is certainly a large release. I don't know what the letters LRF mean. But a late containment overpressure failure that blows out the containment hatch would indeed be a large release, although late in time.

CHAIR APOSTOLAKIS: So is the lefthand side correct if I drop the F because you are dealing now with how each one is defined.

MEMBER SHACK: If you define the large release in terms of a given number of curies, then the one on the left is the proper way to look at it. You then find out that if you have a 10^{-6} versus a 10^{-5} it is much more restrictive.

MR. CHEOK: Can I offer an alternate here?

MEMBER SHACK: But let me ask my question just in a pure operational sense. You guys couldn't come up with a curie-based definition 15 years ago. You're not going to come up I don't think with a curie-based definition that isn't more restrictive than the QHOs today. So if you don't take the one early fatality definition, what definition -- Oh, this is the one that you're going to use with the floating definition. But then EPR guys are the smartest ones in the bunch.

MR. ADER: The definition we have right now are design specific. Each design has a definition that staff, at least the ones that have been certified, have found acceptable. The ones under review, I've not heard that we're finding them unacceptable. So there is no one definition and each designer has picked their own which we felt is reasonable.

Part of the discussion -- I want to go back to one of the original questions. We're reviewing them against a 10^{-6} LRF. They've picked the definition that we're reviewing them against. We're doing a lot of time and effort in a very systematic review of that design which we'll certify.

Then the question where we were struggling with is now you get into a risk-informed change process. Do you want -- How do we reconcile the current 1.174 which everybody's using with the metrics that we've reviewed them against? One of the questions is do we allow change process that would potentially be less restrictive than our acceptance. Those are some of the questions on the table.

We don't have an answer yet. We haven't picked an option. Actually, George said, "Don't come here with your proposed option. We want to help frame that." So even though some of us individually may have a preferred option, we have not collectively started moving forward and said, "Here's the option we're going forward with."

The type of discussion you're having on LERF versus LRF goes back to if we have an acceptance across the board we're going to get back into that dilemma of what do we want to define it as.

MR. CHEOK: One reason why we have this confusion and this discussion here is I think we are focused on the word "early" but we have to also realize that the definition of the word "large" is different. Even the definition of the word "release" is different. So I mean out of the four letters in the definition "frequency" is the only common thing in there. And so I think each one of us is correct depending on how you want to define LRF and the lessons learned here and I think Don had said this earlier if we do adopt LRF as a definition we do have to define it clearly and then I think the second part to that is we need to change and call it something different because LRF and LERF mean totally different things because the only thing common in there is frequency.

MEMBER STETKAR: And Don was careful to do that in the little bubble to the right. I don't see the letters "LRF."

MEMBER SIEBER: That's another set.

MEMBER ABDEL-KHALIK: Without a specific reference to a consequence like an early fatality, if you look at LERF the underlying logic for using that as a surrogate is that the relationship between that surrogate and the QHOs is independent of reactor design.

MR. DUBE: Reactor site.

MEMBER ABDEL-KHALIK: Reactor design.

MEMBER SIEBER: Design.

MR. HAMZEHEE: Well, not really.

MEMBER ABDEL-KHALIK: But the question is is that true and if it isn't true then this doesn't make sense.

MR. HAMZEHEE: Because large -- well. Because your large early release frequency in a sense depends on your CDF and your CDF depends on your design. So there is some relationship.

MEMBER SHACK: No. Your acceptance value depends on your source term and your meteorology. But you're sort of arguing that the source terms are roughly comparable when you use the same 10^{-5} and there are 11.50 source terms.

MEMBER ABDEL-KHALIK: Let me just ask a

question directly. Is the relationship between LERF and the QHOs independent of reactor design?

MEMBER SIEBER: Light water.

MR. HAMZEHEE: I don't think so.

MEMBER ABDEL-KHALIK: If that is the case, then why is that a good surrogate?

MR. ADER: The definition in 1.174 has containment failure which BWRs are going to have different failure modes than PWRs. Ice condensers are going to be different than potentially large drys. It's a functional definition which at some level is kind of designed independent because they all fit under it. But the actual failures are going to be very design dependent. I'm not sure that I'm fully getting to --

MEMBER STETKAR: That effects the F of LERF. It doesn't effect the LER of LERF.

MEMBER ABDEL-KHALIK: That's why I'm pushing to indicate that a frequency associated with a given consequence like the way LRF is being proposed to be defined makes a lot more sense because now it doesn't have to -- the relationship is fixed. You're defining it in terms of a given consequence.

MR. HAMZEHEE: But if you recall what

Don was saying earlier, most of the contributions to LERF come from things like containment bypass, steam generator tube rupture, things that are design specific. So those, and again John is right too, define what kind of frequencies you get. So with the LERF, the complete term, it depends on the design and the operations. So they are not designed independent.

MEMBER ABDEL-KHALIK: Right. So setting a limit that's the same for all designs doesn't make sense.

MR. ADER: In the 10^{-5} range, you're in the point that a release at 10^{-5} given the likelihood of meteorology, the probability of meteorology the math almost works out to be you're very close to the QHO somewhat independent of the release. I don't think it's going to be 100 percent independent, but the range is the work was done for 1150 type plants. The releases are not significant and they're going to vary. But the release from one design to another is not going to be significant enough to impact that basic math because you have generally the calculations are 16 windrose. The plumes that we're finding, I'm trying to remember back, didn't even really carry windrose. So you got --

PARTICIPANT: One-third.

MR. ADER: If you have a relatively uniform meteorology, the likelihood is an individual risk. The likelihood of that plume coming towards me as opposed to coming towards you, there's a certain probability that I'll have the dose as opposed to you which you should take that into consideration at 10^{-5} and you get pretty close to the QHO.

MR. HAMZEHEE: And then if you say why do we have the same criteria for all different designs, the answer is regardless of what you design we want to make sure you meet the qualitative/quantitative health objective. You should not exceed no matter what you do.

So you could come up with APWR, AP1000. You have to maintain your risk below the acceptable limits.

MEMBER ABDEL-KHALIK: That doesn't work if the relationship between these two parameters is not the same for -- is design dependent. You're imposing different limits on different designs depending on the relationship.

MEMBER BLEY: Said, I think the way

Charlie phrased it is pretty close to right which says they're reasonably design independent and that the particular failure modes in a design might be different, but you select the ones that give you the same kind of release to put them in the category of the LERF so that the relationship I suspect is pretty close to design independent.

MEMBER STETKAR: You know, it's the basic variability in the source term versus the -- The frequency is plant specific in your plant versus my plant even though they're precisely the same design because I operate differently than you do. That's the F part. The question is, the translation is, is there a substantial variability in the fundamental source term of those releases on a design specific basis. And, yes, there would be some variability, but I don't think that variability is large compared to the other sources of variability that we have that would effect the F part of that calculation, the frequency part of those releases.

MR. ADER: In the earlier slides and going back to the previous April presentation, Don had put up or we had put up the 1.174 risk metrics acceptance criteria. Industry pointed out that there's a lot more to 1.174 that talks about defense-in-depth and other considerations.

The containment failure part for defense-in-depth, the new reactors have quantified it in a way that some of the operating reactors they've gone a step further because they're required to have that. So we would still need to deal with their definition in a defense-in-depth point of view.

You know, we've certified a design where they've defined what large release. They've defined containment performance. We still need even -- If I don't have a quantitative definition, I think it would still be something the staff would want to look at in any risk-informed amendment process what would be the impact on the containment performance.

I had Don put this slide -- This was trying to put in context the discussion from industry slides. We had tried to put it further in the presentation because we didn't want to hung up on this that we're on.

(Laughter.)

Because depending on the options we pick, this may or may not become important what the definition is. If you pick status quo, then this is a nice discussion but it doesn't make a difference. If we pick an LRF metric, then we need to be pretty consistent if we have it as an acceptance criteria. We're still trying to --

MR. DUBE: Well, that's all background.

MR. ADER: Yes.

(Laughter.)

MR. ADER: Thanks, Don, for giving that away.

MR. DUBE: Okay. So what we thought we would do as a strawman is come up with evaluation criteria and these are for modified options going back to the fundamental policy statements, SRMs and guidance however conflicted they might be. Here are just four possible evaluation criteria. They're not necessarily weighted and one could view that, you know, take that into account.

Criterion one would be will the option provide reasonable assurance that the Commission's '86 Safety Goals will be maintained throughout plant life depending upon whatever approach one uses to risk factors for new reactors.

Criterion two would be will the option ensure consistency with the Commission's '85 and

'86 Policy Statements on expectations on enhanced safety for future and advanced reactor design.

Three kind of conflicts with two. Will the option be consistent with the SRMs on SECY-89-102 and -90-016 and I gave you some quotes from there in that no additional requirements would be imposed on new reactors? So it's kind of a little bit in conflict because they're almost mutually exclusive. Two says we won't expect enhanced safety, but three says but don't require it.

And four is something that the staff has to live to and do we need to continue living with this going forward with risk informed applications? Will implementation of the option be consistent with the staff's review against LRF Goal 10^{-6} per year for new reactors which we are reviewing against the SRM on SECY-90-016.

CHAIR APOSTOLAKIS: So if a new design comes for certification and the core damage frequency is $5(10^{-5})$ one can reasonably say, "Yes, you meet the goal, but you don't meet the expectation of enhanced safety." What you're saying is because of No. 3 the staff is not free to say, "We cannot certify." Is that correct?

MR. ADER: To qualify three a little

bit, it was the risk metrics that Commission and staff proposed. We wanted to use 10^{-5} and 10^{-6} to judge new reactors which were EPRI's goals. The Commission said, "No, stay with 10^{-4}, 10^{-6}, at that time, pretty much 10^{-6}. But if there is experience gained in certain areas, come back to the Commission and we can impose additional requirements on new reactors which they've done in severe accident. You know, there's core spreading, severe accident mitigation. So there is a number of features that the staff has proposed that's going to enhance the performance of new reactors to respond to severe accidents that they just were not necessarily judged against a safety goal type of metric or any other type of metric, so hydrogen control, response to ATWS, response to ISI.

CHAIR APOSTOLAKIS: But the $5(10^{-5})$ frequency for core damage would clearly not meet the expectation, would it?

MR. ADER: I think the staff would struggle if they had a new design that came in.

CHAIR APOSTOLAKIS: But you have no authority to say it's unacceptable because the expectation is not a regulation.

MR. ADER: The staff can propose additional features to the Commission and you would have to get -- I'm kind of speculating right now because I think all of the designs that we have --

CHAIR APOSTOLAKIS: Yes, all of them do.

MR. ADER: -- met the expectation and I wouldn't have any reason to think in the future somebody would want to come in with a design that didn't meet that expectation.

MR. DUBE: But since every design center, new design center, is committed to, that I'm aware of, more or less to the EPRI utility requirements document they're all pretty much committed to 10^{-5} more or less on CDF anyway. So in practice it's a moot point. They're going to meet 10^{-5} CDF.

CHAIR APOSTOLAKIS: So your earlier statement then, the two or three are conflicting is moot. De facto, there is no problem. Is that correct because they meet two?

MR. DUBE: Yes, they meet two.

MEMBER SHACK: But it influences how you decide to regulate them after you've accepted the design.

MR. ADER: Yes. These are not questions we're struggling with.

MEMBER SHACK: For the design certification, it's not a problem.

MR. DUBE: Right. It's not a problem with design.

MR. ADER: Yes. There are other issues we're struggling with, but these aren't the -- This is not the issue.

MEMBER ABDEL-KHALIK: Because they voluntarily met the 10^{-5} so that three is not operative.

CHAIR APOSTOLAKIS: Two.

MEMBER ABDEL-KHALIK: No, three.

CHAIR APOSTOLAKIS: They met two. They met the expectation.

MEMBER ABDEL-KHALIK: Right.

CHAIR APOSTOLAKIS: Yes.

MR. HAMZEHEE: But I think as was discussed earlier, the challenge becomes when one of these new reactor designs wants to apply for a risk-informed application. Then what? That's No. 1.

CHAIR APOSTOLAKIS: Yes.

MR. HAMZEHEE: No. 2, what about existing operating programs such as maintenance rule, ROP and those things when they try to apply them during the operations of their plants?

CHAIR APOSTOLAKIS: Yes. All right. Let's move on.

MR. DUBE: Okay. So we went back to look at the original set of options. Obviously, I mean Option 1 Status Quo remains which is apply the acceptance guidelines to both currently operating and new reactors to treat them the same.

1A is more or less the same except maybe let's not commit. Let's not make it a hard and fast commitment yet until we try this out on a few risk-informed applications. Get some lessons learned before we set anything in concrete in terms of reg. guides and all the whole set of programs and processes.

No one, no stakeholder that I've discussed thus far, had any liking for the relative risk changes. That is to say that a plant at 10^{-5} would be allowed a delta CDF of ten percent. But another plant with a CDF of $2(10^{-5})$ apply the same percentage allowance, but the absolute deltas would be different.

It requires a lot of things. It requires current and new reactors to have a firm foundation in terms of their existing large early release frequency and CDF. There's a lot of logistical administrative challenges with that and there's a lot of inherent disadvantages. I mean the disadvantages so outweigh the advantages and for the sake of at least reducing the number of options, more or less this option has been deleted.

MEMBER RAY: Now, does that then address the issue that you had on slide 21 that reads current guidance could allow large relative changes to CDF in containment performance?

MR. DUBE: Well, Option 3 still allows that to be addressed but instead of using a relative risk measure, it would use an absolute measure. But you don't have the logistics of knowing at any point in time what the baseline is and the baseline changes. So what happens? A decision made several years ago would be inconsistent with a decision made a couple years into the future because the baseline is continually changing.

MEMBER RAY: Yes. So an absolute could

amount to a large relative change. An absolute limit.

MR. DUBE: Right.

So Option 3 would be to reduce acceptance guidelines by -- we didn't hear anything more than one order of magnitude. So it would be lowered by one order of magnitude solely for new reactors.

MEMBER STETKAR: Don, this will come up this afternoon, but I might as well as you for your opinion. On No. 3, whenever I think of different criteria applied to currently operating reactors and new reactors I think of fixed site X which will now have both operating and new reactors and if I live a couple of miles down the road from site X how am I to interpret the NRC's oversight of those reactors in terms of my own well-being that for some reason I'm really being penalized because I happen to live near an old reactor site? I mean in that sense.

MR. DUBE: Do you mean as a member of the public?

MEMBER STETKAR: As a member of the public. I'm talking about public perception of the regulatory process. Now grant you, if I have a standalone green field site with a new reactor, perhaps it's different. But at a multi-reactor old versus new site, there seems to be some inconsistencies from a public perception standpoint if nothing else. Forget the logistics and how they're implied.

MR. DUBE: Both ways, you're right.

MEMBER BLEY: On the other hand, if you're going to plop another new plant on that site where you've already got old ones, the new one is not going to make a great change in the risk that you're facing. So if you present it in a reasonable way, I think it might --

MEMBER STETKAR: If you present it that way, that's right. It's acceptable. But if I'm really concerned about the old reactor, it seems to enhance my concern about the old reactor at that particular site where I live.

MEMBER SIEBER: The public will try to put them all in one category anyway.

MEMBER STETKAR: It depends on perspective.

MEMBER SIEBER: Yes.

MEMBER STETKAR: But it does raise this issue of different standards if you will.

MR. DUBE: Yes, there's a conflict.

MEMBER STETKAR: I was curious only because you're kind of presenting these in terms of feedback that you received from stakeholders because Option 3 is the first one that you presented that was different between new and current.

CHAIR APOSTOLAKIS: Who were your stakeholders?

MR. DUBE: Anybody how had commented to date.

CHAIR APOSTOLAKIS: Yes, and who are they? Was anybody from the public?

MR. DUBE: Comment on these?

CHAIR APOSTOLAKIS: Yes.

MR. DUBE: That's as far as I know.

MR. HAMZEHEE: Ask NEI. NEI may have some input.

(Off the record comment.)

CHAIR APOSTOLAKIS: Let me understand this better. How were stakeholder -- How did they become of this? You had a workshop or was it published or what?

MR. ADER: We had a public meeting.

CHAIR APOSTOLAKIS: Public meeting.

MEMBER RAY: So it was noticed.

CHAIR APOSTOLAKIS: So it was just you and the industry.

MR. ADER: It was primarily -- I think it was primarily the industry that showed up, but there was a public meeting. It was --

CHAIR APOSTOLAKIS: No, I understand it was public.

MR. DUBE: There was a paper to the Commission. There was presentation at the RIC. There was an open public meeting.

CHAIR APOSTOLAKIS: I'm not questioning your efforts to make it public. I know that you guys go out of your way. I'm just asking as a matter of fact that when you say stakeholders it was really the industry.

MR. DUBE: The ACRS and internal staff, right.

CHAIR APOSTOLAKIS: We are not stakeholders.

MEMBER ABDEL-KHALIK: Now, would the objections raised to Option 2 remain if it was converted to Option 2A which is converted to relative change in risk margin for new and current reactors? I think the biggest problem --

mR. DUBE: That would have the same logistical issues because it requires -- you have the goal of course.

MEMBER ABDEL-KHALIK: Right.

MR. DUBE: But the margin is always -- is an evolving, changing thing between the current baseline --

MEMBER ABDEL-KHALIK: And the goal.

MR. DUBE: -- and the goal.

MEMBER ABDEL-KHALIK: Right.

MR. DUBE: And it could be here today and we make a decision and that baseline could either be higher or lower which would give us a different decision.

MEMBER ABDEL-KHALIK: Right. But that's sort of --

MR. DUBE: And it could be an inconsistent decision. So relative have these logistical problems.

MEMBER ABDEL-KHALIK: Is it really?

MR. DUBE: And most utility staffs have not kept their LERF frequencies up to date. So what is their baseline LERFs?

MEMBER SHACK: Baseline is probably the biggest practical problem. I mean you have to believe the baseline number.

MEMBER ABDEL-KHALIK: Right. But that eliminates sort of the counter intuitive incentive that an applicant would inflate the baseline numbers in the first place. Right? Because if you go to relative change it would be advantageous to someone that their baseline values are higher than they really are.

MS. SPAIN: So, are you supporting not having Option 2?

MEMBER ABDEL-KHALIK: No. I'm supporting Option 2A which is converting to relative change in margin.

CHAIR APOSTOLAKIS: We have a comment from Dr. Lyman.

DR. LYMAN: I am sorry for intervening like this, but we haven't had the opportunity to comment. Well, first of all, the resources of the public right now, let's say, are considerably strained and I don't know too many who follow this issue as closely. I think that Option 2 was eliminated prematurely.

In our review, it's Option 1 that's the status quo that's the one that doesn't make any sense. In fact, if you pursue Option 1, then the entire approach of risk-informed changes to the licensing basis is not going to make any sense from the reactors. A new reactor with a core damage frequency of 10^{-7} could dismantle major safety systems and still meet the guidance. So we think that it's premature to eliminate the relative risk conversion Option 2.

But let's say you're now hearing from another stakeholder on this issue. Thank you for the opportunity.

CHAIR APOSTOLAKIS: Sir, let me ask very quickly. Have you had the chance to study all these proposals by the staff or is this the first time you've seen them today?

DR. LYMAN: No, I've read the white paper. This is the first time I've seen that the options have been modified. I read NEI's letter where partly they argue that it's actually -- One of NEI's arguments was the actual risk of the new reactors isn't as low as we've been telling everyone because once you put in external events, low power shutdown, uncertainties, they'll probably be as dangerous as the current generation. So it doesn't really matter. We might as well stick to the status quo which is a bizarre argument.

But I think the bottom line is that the intellectual framework here is flawed. I think that the accumulation of deferred decisions over the past 20 years is coming back to really harm you. The introduction of a large early release frequency and a large release frequency defining what a large release is is intellectually bankrupt and I think you're dealing with the consequences of that now.

I think that the second issue that we've had problems with is the inability to come to the terms with the fact that new reactors should be clearly safer and required to be safer than the current reactors. And the fact is that as they're coming in they do appear on paper to be safer than the current reactors and the public should get the benefit of that and that if changes are made that the relative risk increase should be small whether it's a CDF of 10^{-7} or a CDF of 10^{-5}.

I appreciate the opportunity to comment.

CHAIR APOSTOLAKIS: Thank you.

MR. DUBE: Thank you.

CHAIR APOSTOLAKIS: So is Option 2 back

in play? I see you writing there, Don.

MR. DUBE: Well, this means we have one more option. But it won't change the fact that Option 2 is more than new reactors. It would also be applied to current reactors. So it would be a backfitting against current reactors. That's how it was originally written anyway.

MEMBER BLEY: It need not be that way.

MR. DUBE: It need not be that way, right. But you still would have the fundamental issue of at any point in time one would have to have the official baseline CDF and the official baseline LRF, if that was the case, and we would still have the problem that a decision made in the future might be inconsistent with a decision made in the past.

CHAIR APOSTOLAKIS: But let me ask a question here.

MR. BRADLEY: Could I ask a quick question? I apologize, sir.

CHAIR APOSTOLAKIS: Sure. Yes.

MR. BRADLEY: Don, I was just -- can you explain why Option 3 out of all the options was explicitly called out as also applying to existing reactors because I was wondering why that option and that option alone was given that characterization? Option 3.

CHAIR APOSTOLAKIS: Option 3?

MEMBER STETKAR: I think you mean three of existing or new?

MR. BRADLEY: The one, the relative risk. I was just saying --

CHAIR APOSTOLAKIS: That's two.

MR. BRADLEY: Okay. I'm sorry. Two. I apologize. Two.

CHAIR APOSTOLAKIS: Yes. Okay.

MR. BRADLEY: I'm just trying to understand the thinking there.

MR. DUBE: No, I mean, it would be for the purposes of having consistency. Would one have absolute limits or absolute guidelines for current reactors and now all of a sudden shift philosophy and for all new reactors have just relative not absolute? It just seemed inconsistent. Do you know what I'm saying?

MR. BRADLEY: I understand what you're saying.

MR. ADER: I'm trying to remember. I think it was in part if you change 1.174 to be relative and you just make the change then you can apply it to both.

MR. DUBE: Right. These graphs rather than this be absolute deltas here (Indicating), these are absolutes, right?

CHAIR APOSTOLAKIS: Yes.

MR. DUBE: With the percentages. So obviously that would be applied to new and current operating reactors.

Now the challenge with --

MR. ADER: Or you create it one way for new reactors.

MR. DUBE: Right.

MR. ADER: That would be the two.

MR. DUBE: That's right. Or do you keep the existing absolute values for current reactors but then relative values for new reactors? So that would entail a whole new procedure or a whole new guideline, certainly a whole new chapter as opposed to having a consistent set of graphs here.

Does that answer your question?

MR. BRADLEY: Yes.

CHAIR APOSTOLAKIS: Don, if you go back to your slide 32.

MR. ADER: Each of these is a

subsequent slide that goes into each option in more detail.

CHAIR APOSTOLAKIS: I understand. But I'm just wondering. Are there -- Can we come up with a statement of principles that we really want to follow and formulate?

MEMBER SHACK: That was the previously slide.

MR. DUBE: That was 31.

MR. ADER: If there are other principles that ought to be added or taken off, that's part of why we're here.

CHAIR APOSTOLAKIS: Well, this is not what I have in mind. Like we said earlier that the intent of the ROP was to maintain the risk profile of the plant which was kind of inconsistent with the absolute changes. But at least we had a principle there.

Can we say here what that principle is? I mean, given a design all these changes and so on the principle would be to make small changes where small is to be defined to the present risk profile in which case you would formulate a set of options to do that or some other principle. And I think that the reason why I'm thinking that is Dr.

Lyman just said, "You come in here. You say this is your core damage frequency of 10^{-7}. Then you should preserve that." Don't come later with one of these options and start moving up because you still meet the goals.

So is it a principle to preserve this original risk profile or it is to preserve it but in addition do something else? What is the driver? I think most of your advantages and disadvantages here tend to be more oriented towards the practical implement of implementability of these things.

MR. ADER: Right. Could you go back to 14, slide 14?

CHAIR APOSTOLAKIS: Fourteen, okay. Maybe we have it there.

MR. ADER: The second bullet.

CHAIR APOSTOLAKIS: Let's look at 14.

MR. ADER: That's one of the principles of the current 1.174.

CHAIR APOSTOLAKIS: A key principle is when proposed changes ..." Yes, should be small. Yes.

MR. ADER: And it's consistent with the Commission's Safety Goal.

CHAIR APOSTOLAKIS: Right. So initially what he says is don't change it that much. I mean the current profile should be preserved.

MR. ADER: The question we have on the table that we're wrestling with is this the key principle or, as you stated, is we're reviewing them against a risk that is enhanced safety voluntarily -- I mean they've gone further. Is a key principle to maintain that risk or control changes in some fashion? That's kind of the question we're debating.

MEMBER RAY: But I think that it's true up until now and true in everything we've discussed so far that we assume a decoupling of the adequacy or the safety of the plant when it was built from the changes that are then made subsequently. This page 14 that you just looked at does small changes, okay, but not something that imagines as Don has been saying that you preserve this status and monitor it throughout the plant life always knowing what's left in the margin between the safety of the plant and some goal.

Every quarter I have an update, a

change of that. I know where I am at all times so that when I then make a change I can make a relative change rather than limiting myself to an absolute change. I think that's a different model, George.

CHAIR APOSTOLAKIS: But what is it that we are doing? I mean, what is the driving principle here?

MEMBER RAY: The driving principle I think would be to do what these words say.

CHAIR APOSTOLAKIS: Fourteen?

MEMBER RAY: Yes.

CHAIR APOSTOLAKIS: Yes.

MEMBER RAY: That is make small changes, looking at the change itself and recognizing it to be small as opposed to only making small additions to or reductions in the margin. We assume if I make a small change throughout the plant life that I will preserve the margin in essence. I believe that's an assumption of the regulatory process today.

CHAIR APOSTOLAKIS: But small compared to the existing profile.

MEMBER RAY: That's important. The right question which is how do you define small.

But I believe that's why I said earlier the word "intent" I think is meant to decouple some imaginary idea that I'm always able to measure and quantify the safety of a plant as I go along in time against the safety goal. I think that that's at least what I read into it.

CHAIR APOSTOLAKIS: Wait. Let me restate how I read it and see if you agree. I have a risk profile now that has been approved and whatever. And the Commission is saying, "Okay. Make some changes, but these changes should be small so that the risk profile that you have now is not affected significantly." Is that correct?

MEMBER RAY: Good.

CHAIR APOSTOLAKIS: And we want to have the same principle when we develop the six options or whatever. Is that the driving principle that you should preserve what you have now and all your changes should be small compared to that? Is that what we all are trying to reach?

MEMBER RAY: Rather than now, could I substitute the words "when the plant was in service"?

CHAIR APOSTOLAKIS: Fine. Fine.

MR. ADER: But then we need -- we're

struggling with reconciling that to the safety goal which says, "This is how safe is safe enough."

CHAIR APOSTOLAKIS: Why is that inconsistent, Charlie? It seems to me it is. Because when you licensed it at that time, you met with the goals and everything. So from now on, make sure that you don't deviate that much from it. Is that -- I think that was the spirit of 1.174.

MR. HAMZEHEE: Well, I think that is right. But however our regulatory basis is the Commission Safety Goal.

CHAIR APOSTOLAKIS: No. Come on. We can't bring that safety goal in every little thing. I mean we have met the goal. We have met them. Otherwise you probably wouldn't license them even though they're goals. But we all agree that they meet even the expectation, not just the goals. They meet all that stuff.

So the question now is you're down there and you want to give some flexibility to change the licensing basis or whatever. What is the principle that's driving you to do that? Of course, one ultimate principle is don't go beyond the goal. Yes. Sure. But it seems to me that everything we've been doing really and the intent of the Commission's approvals is to preserve that original profile as much as you can. For example, if you start removing systems, 1.174 will not allow it. But even if you did, you guys will say defense-in-depth. So you are really changing the profile significant if you do that.

But if that's the driver, I mean, should we compare or examine each one of these options with respect to that? Maybe all of them meet it. I don't know. But I would like to have this driver behind individual options and then look at the practical consequences which I think Don has done a great job listing.

MR. SHUKLA: Dr. Apostolakis, what you have said is also what Dr. Abdel-Khalik said before that the margin --

CHAIR APOSTOLAKIS: I didn't claim originality.

MR. SHUKLA: The margin would also be maintained the way you were saying.

CHAIR APOSTOLAKIS: That's another way of stating it.

MR. SHUKLA: Right.

CHAIR APOSTOLAKIS: That's another way of stating it.

MEMBER RAY: But you don't quantity it, right? You assume.

CHAIR APOSTOLAKIS: I think mine is a little more restricted though because I can imagine somebody playing games with a profile and the margin is still the same, but it has changed significantly and I think we are more restrictive. We really want the profile to stay essentially the same.

MR. HAMZEHEE: George, I think you're right. The primary objective is to be consistent and in compliance with the Commission's Safety Goal. That's the primary objective. Now then I think the challenge is how do we maintain risk profile within the existing rules and regulations.

CHAIR APOSTOLAKIS: Yes. I mean the goal I think is not an issue anymore. I mean they meet them. Everybody meets them.

MR. HAMZEHEE: Well, we have to make sure that happens.

MR. ADER: At some level, and I don't remember who was saying it, what level do you control the changes to maintain a risk profile that maybe is so far down that you're really not concerned that it goes up 25 percent or 30 or 40 percent. I think what we're looking for in one sense is what's our process to make sure -- we've done a deliberative review in approving it. What's their deliberative process in the changes?

CHAIR APOSTOLAKIS: Let me come back to the issue of absolute allowed delta CDF and delta LERF. I don't think that by saying this is absolute really you're conveying the real intent there. Indeed, there were absolute allowed changes. But they were developed in the context of the existing fleet at the time. So at delta CDF of 10^{-5} is indeed small compared to what we had at that time. It's not small if the new reactor has 10^{-7}.

So the absolute numbers did not come down from the mountain. They were developed knowing what we had at that time. So in that sense maybe they are relative.

I'm sorry. Yes.

MR. WACHOWIAK: This is Rick Wachowiak from GEH again and to continue on with kind of what you're talking about here, I just want to make sure when we're going, when we're looking, at these relative options and talking about maintaining the risk profile what we could end up with and not necessarily with the applications that are on the table now but in applications in the future, if we knew that we were going to lose flexibility by making the licensed plant safer we would have the incentive to choose to not add the additional safety features into the licensing basis and we would only license $5(10^{-5})$ or $5(10^{-6})$, whatever the barely acceptable number is and those things would be just taken off the table for the licensing basis and then we would just use in our own commercial terms where we could add a system later that makes it safer. Obviously, Reg. Guide 1.174 doesn't prohibit you from adding a system that makes the plant safer. Then we would have the flexibility to use that system the way that we would like to.

So I don't understand why after the fact we're going through and trying to say that things that the vendors did voluntarily as was mentioned earlier through the Utility Requirements document voluntarily to go an order of magnitude and plus more in some cases, arguable whether it includes everything, but more in some cases, and added that additional costs into the plants to in some cases gain a competitive margin and other cases to solve other technical problems that we ran into but then to lose the flexibility in the operation of the plant because we voluntarily chose to do that and that's what I find inconsistent with all of these options where we would consider a relative change.

CHAIR APOSTOLAKIS: So essentially what you're saying is that the idea of preserving the profile at the license time is not such a hot idea.

MR. WACHOWIAK: Well, we should know what we need to license is what I -- The regulation needs to be stable so that when we go in with an application we know what we're licensing and this thing that we're licensing is what we'll preserve and we'll include or not include that based on what we want to do with the plant later. But to not what we're actually licensing and then have it imposed later I think is unreasonable.

MEMBER ABDEL-KHALIK: Your concern will totally disappear if these fractional changes allowed are relative to the margin.

MR. WACHOWIAK: Were based on fractional changes to the margin. I agree with your statement and after hearing it just from this morning. So I'll think about it some more, but I think I agree.

CHAIR APOSTOLAKIS: Which I don't agree with.

MEMBER STETKAR: I'm not sure. If I take the inverse of increase which would be a reduction in the margin, why it's any different if I set a goal that you shall not decrease the margin by more than ten percent of the existing margin.

MEMBER ABDEL-KHALIK: Right. So a plant that starts out with a very low CDF would have a huge margin and therefore you're allowing them ten percent of a big number. As a plant that starts very close to 10^{-4}, you're allowing them a tiny fraction.

MEMBER RAY: Right.

MEMBER ABDEL-KHALIK: A tiny amount on an absolute basis.

MEMBER RAY: I would just as --

MEMBER STETKAR: That makes a lot of sense.

MEMBER RAY: You're going to end up imposing if you were to do that a new process on the life of the plant.

CHAIR APOSTOLAKIS: I think again, I'll repeat, don't take the 10^{-5} and 10^{-6} of 1.174 as absolute. I think that we're relative, relative to the existing profiles at the time. Okay. And the problem we're having now is that the existing profiles if we ever build a new plant will cover such a wide spectrum of CDFs that this 10^{-5} for delta CDF now is meaningless for some of these other designs.

But I wouldn't say that these are absolute. They are not. The safety goals are not absolute. If you tell the Commission tomorrow there is a miracle, the industry will build 1,000 reactors next week. Do you think they're going to stick to the 10^{-4}? No. That was at the time. They knew there were 100 plus units. Even if they become 200, it's not a big deal. So it's 10^{-4}.

If you increase it by an order of magnitude, I don't think this Committee should object. So all these numbers were relative to the existing fleet at the time. Let's not take them as absolute, given, you know. This is it.

So I think we should reevaluate all this stuff because of the new situation now. If the new reactors were in the same ball park, then there would be no problem. Right? 1.174.

MR. BRADLEY: I just wanted to make a quick comment. Yes. Thank you. If you go read 1.174 because there's quite a bit of discussion of how those absolutes were derived and it does discuss the safety goal, the margins to the goal, and it's not exactly I think, I stand corrected if I'm wrong, characterized the way you just did in writing in 1.174 if you read it.

CHAIR APOSTOLAKIS: I don't care what it says in writing.

(Laughter.)

It was done in the context of what we had. Okay. And that's what we had. So everybody was saying 10^{-4}. Sure. That's fine because immediately your mind goes to the existing PRAs and so on.

MEMBER STETKAR: George.

CHAIR APOSTOLAKIS: Yes.

MEMBER STETKAR: The only thing I caution you is be careful about not doing the same thing today with the perception that core damage frequencies are 10^{-6}. You know just don't.

CHAIR APOSTOLAKIS: I understand all that. All I'm saying is let's not look at these limits as being absolute. They were not absolute. They were done in the context of the times and the safety goals also. I just don't think that if we have 5,000 reactors at the time the Commission would still say 10^{-4}. I just don't believe that.

In fact, Commissioner Bradford I believe in the original policy statement had an appendix and he started doing calculations. "I have 100 reactors. They operate for 40 years. That's 4,000 years." And he came up with a 0.1 probability of -- Now if you had instead of 100 reactors 10,000 reactors, his calculation would have been very different and the Commission's results would have been very different. That's all I'm saying that all these numbers were done in a different time.

MR. ADER: That was part of the debate back when the safety goal was issued.

CHAIR APOSTOLAKIS: Yes, I know.

MR. ADER: Maybe in the interest of time, we ought to go to the individual options of pros and cons.

CHAIR APOSTOLAKIS: In the next five minutes?

MEMBER BLEY: Maybe after lunch.

CHAIR APOSTOLAKIS: Biff, we are late. I mean I hope you don't mind to take the stage at 2:00 p.m. or something.

MR. BRADLEY: No.

CHAIR APOSTOLAKIS: Dr. Lyman, do you want to make any more comments later? Do you want time or you will just jump up whenever it's appropriate because we have to have a discussion at some point. So that will be open to everyone. So nobody objects?

(No verbal response.)

I have already somebody voting.

(Laughter.)

So you are about to start the options.

MR. DUBE: Yes.

CHAIR APOSTOLAKIS: So maybe this is a good time to stop. 12:55 p.m. we're be back. Off the record.

(Whereupon, at 11:53 a.m., the above-entitled matter recessed to reconvene at 12:59 p.m. the same day.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(1:00 p.m.)

CHAIR APOSTOLAKIS: We are back in session.

Mr. Dube.

MR. DUBE: Okay. I heard earlier this morning that Option 2 in some form probably should continue to remain a viable option, perhaps even an Option 2-A, which would look at the relative change in the margin between the goals and baseline risk. Although, it wasn't clear to me that it was still logistically, or even practical to backfit relative risk change for the current fleet of reactors. Did anyone feel that that was within the scope of -

MEMBER RAY: To the contrary, I would argue that it's not.

MR. DUBE: Right. Good. Thank you.

And that -- now Option 3 had been just slightly revised. You'll see the word "one" in red, meaning that at first it said by one or more orders of magnitude, but I hadn't heard anybody suggesting more than one order of magnitude. I don't know if anyone has any opinion on this matter.

MEMBER SHACK: It's consistent with international URD, you know. It's a nice round number.

CHAIR APOSTOLAKIS: It should be a factor of 9.

MR. DUBE: Thanks.

Now, Option 4 was a combination of existing and new acceptance guidelines. I guess, in a sense, if we kept -- if one were to go with some form of Option 2 in the sense that we would be continuing to use absolute values for existing reactors and relative -- so, I guess 4 is kind of still subsumed into 2.

On Option 5, this is slightly modified. It would be to use -- it's kind of status quo, use existing acceptance guidelines for current and new reactors, and establish an LRF-based acceptance guidelines for new reactors. However, I added -- we added in red, "using a uniform definition of wide release", which is no easy task.

CHAIR APOSTOLAKIS: Would that help you

with the ROP?

MR. DUBE: Well, whether one would establish this for the ROP, I mean, you probably would defer that for the time being.

CHAIR APOSTOLAKIS: So you're focusing on -

MR. DUBE: Focusing on -

CHAIR APOSTOLAKIS: -- now.

MR. DUBE: -- licensing issues, yes. Changes to the licensing basis in the near future, or within a few years time frame.

MR. CHEOK: As we are discussing this, though, I think we need to keep in mind ROP operating issues has some tie-ins to this, so we have to keep that in mind also, as we discuss in licensing issues. I think while we are deciding what risk metric you're going to use for licensing actions, we need to be cognizant of the fact that the same risk metrics may or may not be applicable to operating reactors.

CHAIR APOSTOLAKIS: We can't put this aside, you mean.

MR. CHEOK: That's correct.

CHAIR APOSTOLAKIS: All right.

MR. DUBE: And 5A was kind of an

offshoot of Option 5, but rather than having a hard and fast acceptance guideline like we've seen earlier right here, do what's been done under the defense-in-depth in Reg Guide 1.174, which says as part of the change, also look at the impact of containment, but in a qualitative and no hard and fast acceptance -- no quantitative guidelines. 5A is sort of saying address large release frequency impact for new reactors, perhaps under the defense-in-depth principle in 1.174. And the Staff will have opportunity to review how the change in LRF might be impacting. But there would be no 10 to the minus 6, 10 to the minus 7 kind of step function. So, it's kind of a soft thing, but it would, at least -- well, you see under advantages, at least it would allow some review -- it acknowledges that Staff reviewed the applications against the LRF goal, allows Staff some opportunity to review the impact, but it would not be as formal as an actual acceptance guideline. It might be a draft.

MR. ADER: This may be a revision to 1.174 to be more explicit about how one would consider the LRF. And this is what I was going to earlier, that for each design you use their definition, is to have a discussion of what they need to do to address impacts on their definition with any proposed change.

MR. DUBE: And Option 6 was, "Assess reactors on a case-by-case basis". And I heard no one in favor of this. In fact, I heard everything against it.

The next three or four pages just go into advantages and disadvantages. It doesn't make sense for me to read through these. I can just kind of go by acceptance.

MEMBER RAY: Don, with reinstatement of Option 2, I would just observe that new plants will become old plants eventually, and we should hear from others who would be affected by this concept, that we would have a speedometer that we'd monitor all throughout the life of the plant.

MR. DUBE: Yes. Well, see, I don't know if it's a good thing, but under Part 52, new reactors licensed from here on in, are required to update and upgrade their PRA according to the standards that the NRC has endorsed for the remaining plant life.

MEMBER RAY: So, you've already got a speedometer. You've just got to pay attention to it when you're making changes.

MR. DUBE: Right.

MEMBER RAY: I mean, if that's the answer, then that's fine. I just know it's not true today.

MR. DUBE: They will be required to, on a periodic basis, and it's set in regulation, so that does distinguish new reactors from the current fleet.

The status quo is status quo. It's just new reactors will be treated the exact same way as current reactors, certainly in 1.174, changes to the licensing basis, and associated reg guides. And while I haven't explicitly listed it here, presumably reactor oversight process, as well.

CHAIR APOSTOLAKIS: So the principal disadvantage is the last bullet, isn't it?

MR. DUBE: Yes.

CHAIR APOSTOLAKIS: As we go on, maybe you want to highlight the principal advantage, and the principal disadvantage.

MR. DUBE: In some ways, the matrix that I have three or four slides down summarizes all of these against the evaluation criteria.

CHAIR APOSTOLAKIS: Okay.

MR. DUBE: It kind of comes out.

CHAIR APOSTOLAKIS: Yes.

MR. DUBE: I mean, the principal advantage is there's no more work to be done for anybody. The principal disadvantage is, if a new reactor has a baseline core damage frequency of 5 times 10 to the minus 7, just picking a number, between that and the 10 to the minus 4 goal, there's a lot of room for a large relative increase in terms of 10s of percents, maybe even 100s of percent.

On the other hand, I think some will argue, and I'm sure industry will say this later on, is that there are a number of safeguards or mechanisms in place, everything from the maintenance rule, the reactor oversight process, if nothing else, peer pressure that would preclude significant changes in a practical manner. But, certainly, there would not be any regulatory -- may not be a regulatory oversight, bad choice of terms, but any regulatory hooks into reviewing this against large changes.

I mean, Option 1A is very similar. The primary difference is that it allows for lessons learned to be factored into the process before we make a firm commitment to a particular -- and go through the whole process of changing all the regulatory guides, and all the regulatory documents, which would not be an easy matter by any means.

CHAIR APOSTOLAKIS: So, what would you do with the first few risk-informed applications? You would apply all the criteria to them and see which one is practical, or how do you see this experience coming about?

MR. DUBE: Well, in practice, I'm not sure. For example, hypothetically, if one of the new Combined License applicants comes in, they want to do risk-manage tech specs for A, and proposing using status quo, and then we might ask a larger number of requests for additional information than we might otherwise ask, and look at the impact and see if we feel comfortable, given the uncertainties, given that there's no operational experience, whether one would want to directly apply current guidance, or maybe have some margin of factors, margin of safety, if you will, that might not otherwise be -

CHAIR APOSTOLAKIS: Well, I can see

problems here. I mean, while you are attempting to learn more and see which option is good, an applicant will tell you look, I'm requesting this change, and let's go with the existing regulations. You have to make a decision, so you would have to make a decision using the existing regulations, which creates all sort of precedent. If you're uncomfortable, I mean, if the numbers there are 10 to the minus 7, that order of magnitude, it will be extremely uncomfortable, perhaps, but you will still have to make a decision.

MR. DUBE: Oh, we're not changing regulations by any means, but the regulatory guidance, what would apply.

CHAIR APOSTOLAKIS: Yes. But, I mean, they will tell you, I'm going with Regulatory Guide 1.174. We've been using it for 15 years, and I want you to make a decision based on that. You can't say, or maybe you can, but wait a minute. I'm learning here, so I really am not going to tell you anything. The industry will, I'm sure, object to that.

There is a practical problem, I think, with this. I appreciate that you want to learn from it, but at the same time, the guy who spends resources to prepare the application expects a decision. And it's legitimate to say I'm applying your existing regulatory guide.

MEMBER ABDEL-KHALIK: There's also a sort of -- a bigger implication. If you were to actually go this way, and approve a few applications based on the current Delta CDF and Delta LERF limits, and sort of the applicants who have these new reactors to go ahead with these changes, if they were very close to the limits of those deltas, you're pushing those plants into a new category that is much, much closer to the current plants, than they currently are. And, therefore, that sort of eliminates all of the other options on your list. You're sort of stuck with this.

CHAIR APOSTOLAKIS: In other words, it looks like there are serious doubts that this is a feasible option.

MEMBER ABDEL-KHALIK: Right. I mean, someone comes in, applies for this. You say okay, we're going to try it out. We'll approve it. They try it, and suddenly their CDF after implementing this change, instead of being 10 to the minus 8, it is now 10 to the minus 5.

MR. CHEOK: You see, the assumption is that we approve it after they say they'll apply it. I think -

(Off mic comments.)

MEMBER ABDEL-KHALIK: I'm just trying to conceptually explain the problem.

MR. CHEOK: Right. One advantage of this option here, would be to allow us to obtain the data that we say is not available for new reactors. And I think the other implication here is that potentially we could use the Reg Guide 1.174 guidance where we say we have increased management attention to areas where there's higher uncertainty, and we can apply that principle to the new reactors.

MR. DUBE: For example, on 50.69, South Texas Units 1 and 2 came in for a waiver. That's probably the best example of where they actually came in, we applied special categorization, special treatment before we actually had all of the guidance in the reg guides. It was kind of a one-off thing, and lessons were learned, and they were factored into them.

CHAIR APOSTOLAKIS: But that was a new

application. What if it is a change in -something 1.177 allows, for example. It meets Regulatory Guide 1.177, 1.174. It meets all of that stuff, but as Said said, you know, it really makes a big jump in the CDF, so that's something that is not in the existing regulatory guides. I mean, that's clearly a lesson learned, but at the same time, the applicant will say well, gee, I want a decision. I don't know, there may be a way around it, but you still, it seems to me, have problems with this.

MR. ADER: For the new reactors, there's going to be -- let me back up. For 1.174, operating reactors, staff experience based was filled. It was based on the history of the PRAs, the operating experience the plants had. The new ones, I would look at this as kind of a case-by-case but using the existing framework. It would be kind of a go-slow, and you'd be saying here that you think the existing framework is good enough, but we want to better understand some of the issues that may come out. And you may see something in there that you say well, on second thought, we want to go back and -

CHAIR APOSTOLAKIS: So, essentially,

then you're treating these applications as pilot applications, if you declare them as -

MR. DUBE: You could look at them that -

CHAIR APOSTOLAKIS: But the industry has to look at them that way, too.

MR. ADER: I think for new reactors, the first ones to come in, in a sense, are going to be pilots, because no matter what you do, you don't have the years of operating experience, which is going to be a question. How do you deal with that? But I think Biff's got the answer.

MR. BRADLEY: Yes. Since you mentioned the industry, I just want to say, I don't view that this is an insurmountable issue. We do this all the time with risk-informed applications. We pilot them, and the licensee goes through a more rigorous process, so I think the regulatory process wouldn't be a problem here, if we chose to go this option.

CHAIR APOSTOLAKIS: So, you would agree in advance that this would be a pilot.

MR. BRADLEY: Yes. Yes.

CHAIR APOSTOLAKIS: Well, then there is no problem.

MR. BRADLEY: Yes.

MEMBER ABDEL-KHALIK: I'm sure this would be easy for you, and would be good for the applicants, but I think in terms of preserving the risk profile, that plant that would take advantage of this can no longer maintain that risk profile.

CHAIR APOSTOLAKIS: Rick?

MR. WACHOWIAK: Yes. One of the other things I think we're maybe missing with this is that where we are in the certifications, and in the COLs now, for the most part, we're trying not to mix risk insights from the current plants in with these license applications. So, for example, we are not attempting to do anything with risk informed tech specs at GE at this point.

There are issues with that. We believe that our PRA has some gaps in it from the incompleteness associated with the DAC and other things in the design that haven't been done yet, so we can't quite get there. But, if we were at the point where we could have licensed this plant with risk-informed end states, and risk-informed surveillance intervals, and risk-informed out-of-service times, the CDF might be higher than what it is, given that we went with traditional tech specs. So, one of the reasons why we are trying to push the traditional PRA numbers down is so that later when we go back to do risk-informed tech specs, we're still meeting the Commission's statement that says that the new plants are supposed to be safer than the existing plants. Because if we go up by an order of magnitude, we're still an order of magnitude better than the other plants.

It's a large change, but it's still an order of magnitude better than the existing plants. And the reason we're not doing it now is because of quirks in the license process that don't allow us to do this particular application right now. So, if we had done the risk-informed tech specs at the time we made the application, a 10 to the minus 7 CDF would have been okay. But now, under these options, we might be trying to erect a barrier for us to include that sort of a risk-informed tech specs at a later time, because we started out with a lower baseline CDF.

So, I think part of when we were talking earlier about what should our overall objectives be, our overall objectives should include setting up a regulatory framework that is predictable, transparent, and encourages the plants to make the plant safer, and doesn't encourage them to avoid doing things to make the plant safer so that they can't do other more practical things later.

CHAIR APOSTOLAKIS: The way I understand what you just said is that we are -

MR. WACHOWIAK: I thought there might be a question.

CHAIR APOSTOLAKIS: Well, it's just a statement, see if you agree. That the numbers you're reporting now are very, very low, but, as a practical matter, you expect them to go up due to various reasons. But after they go up, they will still be low.

MR. WACHOWIAK: Yes.

CHAIR APOSTOLAKIS: So, if we say -- when we say we want to preserve the risk profile, you're saying but the risk profile you want to preserve is not what I have in my design certification application. It's something that will come later, after I implement certain changes, and possibly gain some experience, or whatever. And that profile will -- and more complete PRA, which I think is a legitimate argument. Although, then I'm thinking of Lyman's comment, the numbers you're reporting now, in other words, you, yourself are saying they're not real.

MR. WACHOWIAK: Right.

CHAIR APOSTOLAKIS: Because you are saying that.

MR. WACHOWIAK: And we've said that. We've said that it's -- we explained to the Staff, and to you, where we think it's incomplete. And we stated the purpose of the PRA was to obtain certification to show that the plant is safe enough. And it wasn't, necessarily, to do these things that we're contemplating right now.

MEMBER ABDEL-KHALIK: Again, your concerns would disappear if these deltas are based on margin.

MR. WACHOWIAK: Margin. I think -- like I said, I just heard this for a couple of hours now, so I'll think about it. It sounds reasonable. We've used that in other areas in addressing our certification in determining risk significance. Some things had to be determined based on the margin, and some things had to be determined based on delta from the baseline. It depends on the application. This sounds like one of those applications.

CHAIR APOSTOLAKIS: Biff? Oh, sorry.

MEMBER RAY: That's all right. I wanted to say that -- both of you guys, I guess, but Said especially, the idea about margin, you know, you've got to keep in mind that when a plant is licensed, it's licensed on some basis. That's a process that involves the public, and so on. To imagine that that margin to the safety goal can be used in the regulatory process without, essentially, reopening the licensing of the plant, I think is a questionable proposition. If you license a plant that's super safe, then the assumption is it's going to remain super safe throughout its life, not use up that "margin" at times when it's convenient to do so.

MR. HAMZEHEE: We don't say that you just change it. There's already a process in place, such as Reg Guide 1.174, that says once your design is approved, and you want to make changes to your licensing basis, then you've got to follow some process.

MEMBER RAY: I'm not questioning -

MR. HAMZEHEE: And you may or may not make it, so it goes through some review.

MEMBER RAY: Just hear me. Some review is what I'm talking about. It's not the same thing as re-licensing the plant. And if you're going to have that margin available for use during the plant life, then it just has to be really clear when you license the plant that that's the case, so nobody is later on surprised that you used up the margin. It's got to be clear that that margin is available for use. That's all I'm saying.

MR. WACHOWIAK: And I think the finding in the Chapter 19 of the SER will not state that the plant was licensed because the CDF was very low. It will say it was licensed because the CDF meets the Commission's goals.

MEMBER RAY: Well, we'll see. I've heard different spins put on that.

CHAIR APOSTOLAKIS: Let's hear from Biff.

MR. BRADLEY: I just want to respond to something that was said several minutes ago now, but there seems to be an idea that when you implement something like risk-informed tech specs, your CDF jumps up. And I heard one member mention something like going from 10 to the minus 8, to 10 to the minus 5. I just wanted to note, that's not reality.

We've implemented many, many of these tech spec changes across the fleet, and, one, there's sort of an artificial nature to the calculation you do to get that delta. It's based on some assumption of how many times you're going to get into the completion time. And, in reality, it allows you to focus your maintenance better, so that you may increase reliability on that and other systems, such that the net effect of all that is a risk -- is a positive decrease in risk. But the calculation you do for Reg Guide 177 makes you just assume taking that system in isolation that you've increased the unavailability, and it doesn't take into account anything else, including the idea that you're going to have to do that maintenance at shutdown; otherwise, you're also incurring some risk.

So, I just want to note that these things -- these deltas we talk about are not real. They're artificial deltas that are used as a shortcut to gauge sort of the bounding impact of the application. But when we look at what we've really implemented, and the effect it's had on the plants, we do not see -- I'm not aware of any plant where we had CDF go up, as a result of implementing these. So, I just wanted to note that, that it's a little bit of a, I think, a hypothetical concern that's being expressed here.

CHAIR APOSTOLAKIS: Back to Mr. Dube.

MR. DUBE: I heard some concerns with 1A, and perhaps this needs to be -- perhaps more directly implied that this may really be a pilot effort for the first few applications that uses the existing framework.

CHAIR APOSTOLAKIS: I think that -- yes. Okay. Option 2 deleted. Now, it's revised.

MR. DUBE: I have the advantages and disadvantages, but there were a lot of disadvantages.

(Laughter.)

MEMBER RAY: Don, Aren't you saying that in connection with applying it to existing -

MR. DUBE: Right.

MEMBER RAY: As compared with our earlier discussion.

MR. DUBE: I think if it's -- Option 2 is limited strictly to new reactors, and the fact that by Part 52, new reactors from time of fuel load to end of life, decommissioning, permanent shutdown, have to maintain their PRA up-to-date, and upgraded to meet evolving consensus standards. That's more viable than if we were trying to backfit this onto 104 plants that currently are in various states of updatedness, if there's such a word, and don't even have -- most of them don't have their Level 2 PRAs up-to-date. They did them once for IPE days back in the `90s, and have not been maintaining them, so perhaps Option 2, if it's just new reactors, are less unviable.

MEMBER STETKAR: Don, I know you don't want to talk -- I'll let you finish writing.

MR. DUBE: Yes.

MEMBER STETKAR: I know you're making some notes. I know you don't want to really talk about the reactor oversight process, but could you just mention -- I know in the pros and cons of Option 2, when you were considering Option 2, you must have thought about some of the downsides with respect to the reactor oversight process of that relative margin-type -

MR. DUBE: Oh, there's a lot of disadvantages, because -

MEMBER STETKAR: Could you mention a couple of them?

MR. DUBE: Well, for example, the -

MEMBER STETKAR: Recognizing the -

MR. DUBE: Sliding scale, currently operating reactor, a 2 times 10 to the minus 6, the CDF would be a white, and at a new reactor -

MEMBER STETKAR: Think of applying the relative scale -

MR. DUBE: Four times 10 to the minus 7 would be -- you could have an inconsistency where you could have Calvert Cliffs Unit 2 be a green, and a Calvert Cliffs Unit 3, hypothetically, be a white for the same change.

CHAIR APOSTOLAKIS: Well, again, it depends on your perspective. If you really want to preserve the profile, then why does it bother you? It's white. If, on the other hand, you have other things in mind, that should bother you. So, it really comes down to the principle of what you want to preserve, and what are you controlling.

MEMBER STETKAR: Well, I think in terms of public perception, because they publish this thing, and it's difficult to explain to the public why this unit is green, and why this unit is white. And both of those are equally acceptable.

CHAIR APOSTOLAKIS: But I can't develop a regulatory system that deals with complex technical matters with a guiding principle being that the average person in the public has to understand it. I mean, you do the best you can, but -

MR. ADER: Part of the ROP, I think is to put the agency's resources on those things that are risk-significant, and not put resources on things that are less risk-significant.

CHAIR APOSTOLAKIS: Right.

MR. ADER: Which is one of the principles for the current ROP. So, would you be putting resources on events that are less significant, or extensive resources that should be applied to -

CHAIR APOSTOLAKIS: Yes, but significance, again, comes down to what you want to preserve. It's significant because it changes the existing profile significantly, not because in absolute terms it's significant.

MR. ADER: I think that would go into

the insights you're trying to -- another piece of that process.

CHAIR APOSTOLAKIS: Sure.

MR. CHEOK: I think I would like to add two things to that, George, in terms of the ROP. One of the things we like to do in the ROP is when does the agency engage in a certain -- when a certain event happens? So, for example, when you have a new reactor that has a CDF of 10 to the minus 6, for example. That's a 10 to the minus 7. Under the existing scheme, it would still be a green, but for some new reactors that could be an order of magnitude increase. I think what that tells you is, what is it that's giving me the order of magnitude increase, as the agency can step back and not engage when you have a risk increase of a factor of 10. Does it tell me that full systems are non-functional at this point? I mean, in the current reactor space, to get up to 10 to the minus 6 space, you need to have one frame out of service, for the new reactors you could have a whole function, a whole system that is out of service. So, the insights are telling you different things for the different vintages of reactors. So, when do you want the agency to engage? I think, in this case, you might want to move -- have a sliding scale.

CHAIR APOSTOLAKIS: But the counter argument would be okay, I took a system out, but what do you care? It's still 10 to the minus 6. I'm still way below everybody else. So, from that point of view, you are not right. But from the point of view that there is a significant change from the existing risk profile, you're right.

MR. CHEOK: Right.

CHAIR APOSTOLAKIS: And I think that's the attitude that we will take in this.

MR. CHEOK: That's right. And the argument -- I mean, you can argue both ways for that. And you have to go back to the objectives and the premises of the ROP, and how we -

CHAIR APOSTOLAKIS: The change itself -

MR. CHEOK: -- define green, for example. I mean, green and white is defined as a level where you are within the operating band. Now, it's closing a whole system within your operating band. That's the question you have to ask yourself.

CHAIR APOSTOLAKIS: I think everybody

is speaking except the speaker.

MR. DUBE: No, that's fine.

CHAIR APOSTOLAKIS: Oh, it is, but we have to get moving here.

MR. DUBE: There's counter arguments -

CHAIR APOSTOLAKIS: Where are you now, 1A. Oh.

MR. DUBE: -- either way. And I think the white paper illustrates, too, for example, situations where on MD 8.3, which is the Staff's response to incidents with current reactors. There could be elevated investigation for a certain event; whereas, for some new reactors, if you look at the condition of core damage probability, it would be so low that it wouldn't even kick into investigation. So, there's some issues in the ROP, certainly.

So, I guess we're on to Option 3, which would be to lower the threshold by an order of magnitude strictly for new reactors.

MEMBER ABDEL-KHALIK: For the record, I'd like for you to add Option 2A, "Use relative changes in margin for new reactors."

MR. DUBE: Yes, I've got that. I don't have advantages and disadvantages yet. I have 2A.

MEMBER ABDEL-KHALIK: Thank you.

MR. DUBE: So, on the advantages, the principle one would be it acknowledges that new reactor CDFs and LERFs are significantly lower, and adjust the acceptance guidelines accordingly. It is consistent with the Commission's 85 and 86 policy statements, expectations.

The disadvantage is that it may be consistent with the underlying technical basis for the current absolute thresholds in 1.174. Some might argue it penalizes new reactors for having lower risk estimates, and talked about the ROP. Different ROP thresholds for currently operating and new reactors could cause public perception problems.

One other disadvantage that I didn't list here, and that is that all new reactors are not equal. I show that one in that graph right here. Well, this new reactor here is -- these two are really at the lower limit of some of the boilers. Grand Gulf, I believe, is in this. These two new reactor safeguards, in many regards really were like the current fleet, because they're really just evolutionary. They may have three or four signal trains, for example; whereas, some of the passive plants, perhaps, are one or two decades below that, so really not all new reactors are the same.

MEMBER STETKAR: But, Don, if you look at -- that's roughly a factor of 200 from the top black dot to the bottom blue dot. If I look at the operating reactors from the top left dot to the bottom red dot, I get almost a factor of 100, so there's a lot of variability in the existing reactors, also.

MR. DUBE: Right.

MEMBER STETKAR: And you're applying the same criteria to all of those. So, the variability over the new versus variability over the old is -

MR. DUBE: But my point would be using an order of magnitude lower the thresholds and applying it to these would be extremely restrictive.

MR. ADER: We set up a regime where -

MEMBER STETKAR: Well, but the existing threshold is more restrictive to the people who are at the top of the left-hand bar, also.

MR. ADER: We set up a regime where two comparable reactors, the low end of the operating, and the upper end of the new reactors. The operating one can do things that the new slightly safer one couldn't do, or you respond to them in different -- they have the similar event, but the safer reactor gets a higher color, a brighter color than the one down the road that is the old reactor. That's the regime -

MEMBER RAY: Well, but, remember these plants get sited at particular sites, and the sites have particular characteristics. If you're in Palo Verde, it's different than being in San Onofre. So, the fact that the reactors are different doesn't -- that's no the whole story. There are reasons why you would insist on one thing at one place, and you're willing to accept something else at another location.

MR. ADER: It's not as simple. I guess my point was it's not -- you set up things where you start -- if you don't think through, and you look at all the options, look at the pros and cons, you could set up a system where you end up doing things that then don't make sense after you -- down the road.

MEMBER RAY: I understand. I just wanted to add in that site location has something to do, ultimately, with the public risk you're talking about.

MR. DUBE: I mean, I don't have any plants, so this will be a little bit hypothetical. You've got Plant X, which is a currently operating reactor. It may have completion time for an aux feed water train, I'm just thinking of is 15 days. And it's sister plant, which is brand new, has a lower profile, lower CDF, would not have to keep a three-day allowed outage time, because you put an order of magnitude stricter threshold on what's acceptable. Would that make sense? No, I'm just trying to bring out the advantages and disadvantages, and that's one of the disadvantages. So, there is no solution.

Well, I won't dwell on Option 4. It was really a combination of -

MEMBER SHACK: Well, going back to Option 3 for a second, again. You've got that comment about the ROP. I mean, I'd still argue there's a difference between 1.174-type things, where you're making voluntary changes to your plant, and the ROP where you're talking about enforcement, and you must maintain safety. And it seemed to me that I would look at the ROP as basically, if it's safe enough, it's safe enough, whether it's old or new. If you want to make a change to your plant, then that comes down closer to this maintaining a risk profile kind of thing. You've brought a good plant in. You're going to keep it good, but in enforcement space, it would seem to me, a more absolute kind of thing, are you really threatening public safety? And, so, I think you could have an Option 3A.

MR. ADER: We had that question in the earlier -- the April presentation, do you separate ROP - do you separate the license -

MEMBER SHACK: Yes, I made the same comment then.

MR. ADER: Yes.

MEMBER SHACK: So I make it again.

MR. ADER: It's still valid. I'm glad you brought it back up, because we didn't emphasize it as much here, but we're not trying to, necessarily, it's both. It could be -

MR. DUBE: That's a good point. I thought I was going to reduce another option, but I just doubled it.

(Laughter.)

MEMBER SHACK: We give advice, but you

make decisions.

MR. DUBE: Skipping over Option 4, which is kind of a hybrid. Option 5 was pretty much unchanged, except one would establish an LRF-based acceptance guideline, new reactors using uniform definition. Well, 20 years ago we never came up with a definition of large release. I'm not sure how easy it would be to come in a timely enough fashion for some of our risk-informed applications. There's certainly a fair number of disadvantages.

MEMBER STETKAR: Don, you couldn't 20 years ago. How difficult do you think it would be today? I mean, we know more today than we knew 20 years ago, I hope, in practice. I mean, it's easy to say that we need to think about things, but if somebody really forced you within two weeks between the Agency and industry to come up with a working definition for what those three letters mean.

MR. DUBE: I wasn't supposed to say this, but the international community has come up with large release definitions, as you're aware of. In fact, the Finns, the actual POLUM, or whatever they call themselves, actually passed a law.

CHAIR APOSTOLAKIS: Where?

MR. DUBE: In Finland.

CHAIR APOSTOLAKIS: Oh.

MR. DUBE: Statutory law of what is a large release.

CHAIR APOSTOLAKIS: So they're using the large release, also?

MR. DUBE: They have a definition of large release.

CHAIR APOSTOLAKIS: And that's it? I mean, they're using it someplace?

MR. DUBE: Yes, for their current operating and new reactors.

MR. ADER: The difficulty 20 years ago, and potentially if you went down the same path, was coming up with a definition of a large release that was a surrogate for the early health effect at 10 to the minus 6 that wasn't so conservative was a factor of the safety goal. It was an over-constrained problem. Came out with a definition similar to LERF, it was a containment functional definition, probably any one of us could come up with a definition within a matter of -- we may not agree on what that definition would be.

MEMBER SHACK: Well, there's definitions up the wazoo. I mean, you've got -

(Simultaneous speech.)

MEMBER SHACK: As long as the Staff and the industry agree that this is the definition, and it - (Simultaneous speech.)

MEMBER SHACK: -- but it's not a new de facto safety goal, which becomes the difficulty.

CHAIR APOSTOLAKIS: Can you send the definition that the Finns adopted to us? Thank you. So, where are we now, go to 6, 5A?

MR. SHUKLA: Don, you also said UK and Canada has a definition.

MR. DUBE: Yes.

CHAIR APOSTOLAKIS: All right. Let's have that one, too.

MR. DUBE: 5A is a softer thing which would be status quo, which means we're going to have to keep the same acceptance guidelines for CDF and LERF, for new reactors, as the current reactors, but we would work into the defense-in-depth, that's probably the most relevant place, a requirement that the applicant for a license amendment would also address the impact on large release frequency for the new reactors. In much the same way, if you look on Reg Guide 1.174, there's a little -- there's a few sentences that says there under defense-in-depth that the impact of containment failure probability has to be addressed, but there's no firm -- there's no quantitative acceptance guidelines, but it does allow the Staff to review the potential impact on large release frequency. In so doing, we're not, necessarily -- it would not necessarily penalize safer plants in risk-informed applications.

There are disadvantages over time that could continue to allow large relative increase in CDF and LRD compared to the baseline, but some have mentioned that there are safeguards in place they feel. This one requires some minor changes to the regulatory guides, but putting a two-sentence footnote, or asterisk, or sentence directly in one subsection of Reg Guide 1.174, and all the corresponding acceptance guidelines would be trivial compared to trying to add a whole new graph just for new reactors, or make significant changes. So, it's kind of in-between.

MR. ADER: An option such as this could be implemented, could be expanded that where the 1.174 has a management attention region, you could maybe pick up a relative change, puts you into a management attention region. There's different ways to implement that. We're not spending a lot of time on the actual implementation details of an option until we figure out which direction we're going to go, so that some of these options can be blended. We're trying to put options there, kind of scan a range of what we think of as alternate approaches that we want to consider, and potentially raise to the Commission. I think some of these, we'll get to the point will need to go back to the Commission on what their intent, what their key principles are on some of this.

MR. DUBE: And we deleted Option 6, so we took a start at preliminary evaluation of the options. I'm sure not everyone would necessarily agree, but I think there's a strawman out there, too. If you go back to these four questions, which are the evaluation criteria, will the option provide reasonable assurance that the Commission's safety goals will be maintained, and then maintained throughout plant life, consistent with the expectation of enhanced safety by those policy statements. But, on the other hand, as I mentioned before, three and two are almost mutually exclusive to some degree, so it's almost impossible to satisfy both at the same time. Will no additional requirements be imposed? And four, will allow the Staff to review it against the 10 to minus 6 per year goal.

I think, regardless, that all of the options would maintain Commission's safety goal, reasonable assurance of that. It would be consistent with the Commission's expectations of enhanced safety? Well, I think three and five clearly will. Option 5A, which is we'll have a soft LRF that's in there in Reg Guide 1.174, one can argue well, it's -- you really don't have an acceptance guideline, so other than some judgment, would that allow some creep of LRF with time, perhaps. Option 1 and 1A, I think to a lesser extent -- the answer is yes, but probably to a lesser extent than Options 3 and 5. Here you're relying more on some of the inherent safeguards, maintenance rule, peer pressure, good practice, safety culture, and so forth, so you don't have a firm acceptance guideline.

On the other hand, would not add any additional requirements for new reactors in terms of de facto, stricter safety goals and so forth.

Clearly, Options 1 and 1A do. Option 3, no, because we're now saying plants have to meet an order of magnitude lower threshold. Option 5, if one argues that -- agrees with the industry's White Paper, that says LRF of 10 to minus 6 per year is equivalent to LERF 10 to minus 5 per year, then some way we're kind of not imposing new requirements, because we're just using -- we're just measuring delta LERF, instead of delta LRF, but they're almost equivalent, because one LRF is an order of magnitude lower than LERF. And then Option 5A, kind of to a lesser extent than 3. Would it be consistent with the Staff's review against LRF of 10 to the minus 6? Well, 1A is just status quo, so, clearly, I don't see how one can say yes. Option 3 would be yes, five is yes, and 5A is really yes, but perhaps to a lesser extent, because it's only a qualitative look at it. There's no numerical acceptance guideline.

MEMBER STETKAR: Don, just to make sure I get it straight. In Criteria 4 under 1 and 1A, you say no. But if I presume that LERF is one order of magnitude higher than LRF, as you've done under 5, then shouldn't that -- I mean, if it says yes under Option 5 across from 4 under the stipulation that LRF is one order of magnitude lower than LERF, then shouldn't -- well, you've answered that question.

(Laughter.)

MEMBER STETKAR: If I use that same implication, wouldn't that be yes under 1 and 1A?

MR. DUBE: Yes. I think you're right.

MR. WACHOWIAK: As a matter of fact, on our table it is a yes for that reason, on our version of the table.

MEMBER STETKAR: Okay. I just wanted to make sure that I understood what was going on in the matrix.

MR. ADER: It wouldn't be consistent with what the applicants have proposed, and what we -

MEMBER STETKAR: It wouldn't be consistent with the thing that the applicant is currently calling LRF. That's -

MR. DUBE: Right.

MEMBER STETKAR: But that's simply what they're currently calling LRF, because they don't know what else to do.

MR. DUBE: In spirit and intent, yes. But we would never be reviewing any changes in looking at the LRF, specifically, the delta LRF.

MEMBER STETKAR: But that would also be the case for Option 5. I mean, as long as you don't have a -

MR. DUBE: In Option 5 we have an explicit requirement on LRF acceptance guideline.

MEMBER STETKAR: Okay.

MR. DUBE: You mean 5A?

MEMBER STETKAR: Yes, 5A.

MR. DUBE: At least 5A, we're looking qualitatively. They're going to say -- they're going to come in with an application. They're going to say our delta CDF is such and such, our delta LERF is such and such, and we need these -- here we are in the acceptance -- and, oh, by the way, here's how impact LRF, so we would at least look at it. Option 1 we would never -- unless we did an RAI.

MEMBER STETKAR: You wouldn't look at that explicitly.

MR. DUBE: Right.

MR. ADER: And that would mean 5A you would look at it quantitatively, because they quantified their definition, so now you have a number you can benchmark it against, and at least ask the question, what's the impact on that number.

MEMBER STETKAR: As long as you track that definition differently for each -

MR. ADER: For each different design.

MEMBER STETKAR: -- for each different design.

MR. DUBE: That number was meant for certification -

MEMBER SHACK: Yes. You still have to come up with an acceptance criteria, and that seems a little -

MR. WACHOWIAK: The definition used in the DCDs were for certification, not for this. They should not be used for this purpose. They were intended to be bounding, and all-encompassing. They were not intended to be used as a delta for risk-informed applications, or for ROP.

MEMBER STETKAR: Essentially, what he's saying is the core damage frequency is low enough. They could define LRF the way they did, and still show whatever it means is less than 10 to the minus 6.

CHAIR APOSTOLAKIS: All right. There

is also a transcript.

MR. DUBE: Yes.

(Off the record comments.)

MR. DUBE: So, we've discussed the hierarchy of guidance for policy statements, mission papers, and associated SRMs, and even NUREGs. We have some preliminary evaluation criteria, modify your options, adding some and modifying some, did perform a preliminary assessment, plan to continue engaging stakeholders through public meetings through the summer. We've got this bullet here, take a position, develop a draft Commission paper with recommended options some time in the summer of 2009, but that will be a challenge. There will be additional discussions with ACRS, or perhaps a Commission paper late this year, early 2010. And that's it.

CHAIR APOSTOLAKIS: Any more questions? Remember, Don is going to stay around, so we'll have a general discussion later.

MEMBER SHACK: Can we see your backup slides? What did we miss?

(Laughter.)

CHAIR APOSTOLAKIS: That was a mistake.

MR. DUBE: It was just more of the history.

MEMBER SHACK: Oh, more of the history. Okay.

MR. DUBE: MD 9.02 in the SRM, SECY 94-05, SECY 95-138.

(Simultaneous speech.)

(Off the record comments.)

CHAIR APOSTOLAKIS: Mr. Bradley, and Mr. Canavan.

(Off the record comments.)

CHAIR APOSTOLAKIS: Would you remind the Subcommittee who you are?

MR. CHAPMAN: Yes, as soon as I figure out how to -

cHAIR APOSTOLAKIS: The other guy is going to start.

MR. CHAPMAN: Jim Chapman.

CHAIR APOSTOLAKIS: And your role in this?

MR. CHAPMAN: Support my colleagues.

MEMBER SHACK: Ken is going to get our attention. He's good at that. We've discovered that.

MR. CANAVAN: I think I just did.

CHAIR APOSTOLAKIS: You certainly did.

MR. CANAVAN: I'm all done with -

(Laughter.)

MR. CANAVAN: Ken Canavan with EPRI.

MR. BRADLEY: Both Ken and Jim are on a team we put together, and Doug True, also, who unfortunately couldn't be here today, but was here last time, maybe on the phone, I don't know. But they've all been involved in our rapid effort to try to address this issue in the NRC paper.

CHAIR APOSTOLAKIS: Mr. Wright works for you, Jim?

MR. CHAPMAN: Scientech, a business unit of Curtis Wright.

MEMBER SIEBER: It's Dr. Wright.

MR. BRADLEY: As in the Wright Brothers.

MR. CHAPMAN: As in the Wright Brothers.

CHAIR APOSTOLAKIS: Anybody else wants to comment? All right. Just mention the name. Wow!

(Off the record comments.)

CHAIR APOSTOLAKIS: Okay, Biff.

MEMBER SHACK: Curtiss Wright just

looks a little strange, but that's okay.

(Off the record comments.)

MR. BRADLEY: All right. I appreciate the opportunity to come back today and discuss this further. We did -- thanks to NRC Staff, we were able to get a copy of Don's slides late last week, but we only had a brief time to really digest everything. And this has been useful today. I think the Staff has made a lot of really good points in the discussion, many of which are the same ones we would have made, so this will probably be fairly brief.

I did want to note, our previous paper that you've discussed, it did talk about the LRF/LERF equivalency using the NUREG 1150 definition that we all recognize. There are other potential definitions. And that paper also discussed our belief that the actual values of the metrics were suitable for -- the existing methods were suitable for new plants, as well, so I was going to reiterate some of our rationale on that, as I go through that today.

We do have a new plant working group at NEI, and they're meeting later this week, a broader community that we'll be able to share this issue with. So, coming into this, before we got into Option 2A, and there was another one that came up, but two things we saw different in this version of the paper were Option 1A and Option 5A on the slide versus the original paper.

There was some discussion of Option 1A today, and I guess from the industry perspective, we believe that might be a reasonable path forward. We do, as I mentioned earlier, we have many cases where we've piloted risk-informed efforts, and then come up with a final regulatory guidance that applies to the rest of the plants, so there's nothing, in my opinion, unique, or any kind of regulatory process challenge with doing that, if we chose to do that.

5A we'll talk about a little more. I think that one, again, is something that might be workable from our perspective, and we'll speak to that briefly. A lot of today has been a reiteration of what was said at the last meeting, and in that spirit, I was just going to reiterate the things we said at the previous meeting, many of which have already come up today, so there's no point in dwelling on these.

I do believe that the existing 1.174

CLB change metrics are derived from, and consistent with, the safety goal. I know, George, you had a pretty lengthy discussion there about what was small then might not be small now. And it was all based on the CDFs at the time. I guess my take on it is a little bit different from reading the document, and I do believe there's a pretty strong tie there between 1.174 and the safety goals as discussed in the document. And it even discusses the fact that there's significant margin from the decision guidelines of 1.174.

CHAIR APOSTOLAKIS: If I may comment, I also said that the safety goals themselves were based also on what we knew at the time, so the whole thing, the whole structure.

MR. BRADLEY: True.

CHAIR APOSTOLAKIS: Yes. There's nothing absolute about it.

MR. BRADLEY: Right.

CHAIR APOSTOLAKIS: Anyway, keep going.

MR. BRADLEY: Yes. I mean, so far it hasn't been suggested we're going to revisit the safety goal policy statement.

CHAIR APOSTOLAKIS: No, it has not.

MR. BRADLEY: No. Okay. So, we talked

about -- I think Rick Wachowiak made some eloquent points about limiting plant operational flexibility due to the fact that you have a lower baseline CDF, seeming to be an unintended consequence here that doesn't seem logical. And, obviously, industry is always going to be interested in the inspection and enforcement aspects of this.

There's been some discussion here today that these two issues can be disentangled. I think Mike Cheok mentioned it's really not that simple. If you look at how we do this in operating plants, there is a general correspondence across the different applications, including the reactor oversight process, a significance determination process, and the CLB change process, which they all tend to use the same thresholds, and they all tend to be 1E minus 6 kind of CDF thresholds, which are believed to have that level where there is some correspondence to public health and safety. So, for instance, in the ROP, if they're below that, they're generally -- they're going to stay green. But above that, you show up as white or whatever on the matrix, and increasing regulatory oversight, et cetera.

So, there is a pretty significant tie. I think it would be a challenge just to totally separate these and say we can go forward with CLB now, and just worry about reactor oversight, and inspection and enforcement later. So, we have to be careful how we proceed with that.

I think we've already talked about the co-location issue. One thing we didn't talk about today, something we struggle with as we get better at PRA, we find cases where we start to get within uncertainty bands. It's especially true in things like fire. I'm sure you discussed this yesterday, but when we start getting down to very low numbers, the uncertainties do become larger in relation to the base number. And it makes decision making -- and we tend to gravitate toward making decisions at bright lines, 1E minus 6, 1E minus 7, whatever. That may not be the right way to do it, but that's the way it tends to get done in the regulatory world, so we start driving these values down, that problem is exacerbated. You may be basically dwarfed by uncertainty in trying to make a bright line decision across the threshold. We even see that today a lot in STP-type situations, where you may get arguments over HEP or a CFF value that can very easily trip you up above or below that line. And that would be a difficult -- made more difficult with these lower numbers.

We talked about today that the new plants want to do risk-informed applications. And it seems ironic that we would limit the ability of the advanced safer designs to use risk-informed applications that we've developed, so we certainly -- that would seem, to me, to be an undesirable consequence of lowering the metrics.

And then, finally, I did want to briefly reiterate, there is a requirement, I think it's actually in Part 50, but it's referenced in Part 52, that all Part 52 plants do have to meet Reg Guide 1.200 one year prior to fuel load. And that includes -- right now, Rev 2 is out. And that includes internal events, fire, and external events, which include seismic. A seismic risk was done through SMA for the DCDs, and so there will be that difference, certainly, in the imputed risk once seismic is quantified through an SPRA, so that there is truth to the fact that the number will be different, because of just the way it's been computed, because the SMA was done separately, and then prior to fuel load seismic will be quantified and become part of your baseline -- your computed baseline risk value.

It's also possible there will be further evolutions of 1.200 between now and that time. There's work underway for low-power shutdown. There's also a Level 2 standard that's somewhat pertinent to a lot of the discussion we've had today. ANS is working on a Level 2 for -- Part 52 does have that requirement. And, so, there probably needs to be some cross-pollination here with that effort, just a note.

So, these are the points we had made previously.

I did want to note that it seems -- I guess the question gets asked to us, what's the problem we're trying to solve? And the problem, as I understand it, and I think they are articulating in their paper and in their slides is the perception that these existing metrics would allow a plant to raise its baseline risk up by a significant amount, such that your 10 to the minus 7, or 6 internal events goes up, 10 to the minus 5.

I would just -- I believe that's really a perception, more than a reality, based on everything we've seen in the operating plants, and based on all the other factors that constrict your ability to do just that, that are built into the system. That has not been observed. I would just that note in operating plants, we've had 1.174 in effect for a number of years, which theoretically allow 10 to the minus 5 delta CDF. We've got plants out there right now in the low 10 to the minus 6s, they haven't gone out and increased their CDFs. We haven't seen that happening. And there's a lot of reasons for that.

One is, what we're talking about here are CLB license -- these are not things you do on your own. These are things you request NRC review and approval under the 1.174 process that has the five factors, and not just risk. And, routinely, you can have things that are not approved for the other reasons, be it DID, safety margins, what have you. So, it's not a carte blanche that says just because there's a value there of one minus five, that doesn't mean you can automatically get that. And we have not seen that -

MR. CHAPMAN: I think this is really key. I mean, there's absolutely no evidence to suggest a test, what we call 1 alpha, or Don and his team call 1 alpha, would allow significant changes, because it's a risk-informed process. It's not risk-based. And especially for these new plants, there are Part 52 requirements that address severe action mitigation systems, along with the other traditional licensing-basis process.

From my perspective, whether it's one, 1 alpha, 2, 3 alpha, 4, 5, 5 beta, whether it's called a pilot or not, there are pilots, because we're in search of a process that makes sense, both in the short-term, and, presumably, extended into the longer term. So, I'm not sure of the correct characterization, but simplistically, they're all pilots.

CHAIR APOSTOLAKIS: All, what do you mean by "all"?

MR. CHAPMAN: They're going to be testing any one of these options.

MR. CANAVAN: You don't have the final risk values for the sites you're speaking of, so until you have those final values, have some experience with the new systems, especially for passive systems that we have no experience with operations, to insinuate that we know the number now, is probably not accurate. So, we're -

CHAIR APOSTOLAKIS: If I want to test 1A, or implement it, and I know that the profile is not complete, as Biff just pointed out, how do I do that? I'm at a loss. I know that nobody in his right mind will come and ask me to approve something with a delta CDF close to 10 to the minus 5. I know that. So, essentially, then what am I doing? I'm relying on the other safeguards that I have, and on the goodwill of the applicant that will not ask for doubling the CDF, for example?

MR. BRADLEY: Well, you could always ask for it, but it would be summarily rejected, in my opinion, if you did. These are all subject to Staff review.

CHAIR APOSTOLAKIS: But I think as an applicant, you also have a problem, because you have no guidance what is acceptable. I mean, if your baseline says 10 to the minus 6, and you don't know whether, too, 10 to the minus 6 will be considered unacceptable, or would be, I mean, I don't know what you do.

MR. CANAVAN: Well, from purely out of process, and putting aside all Reg Guides, and all criteria, the way we would pilot it would be we'd perform the risk application given the information we have, calculate the delta CDFs, try and fill in the holes with either best estimates or bounding analysis. Bounding analysis that would dominate it would have to be analyzed further, so take a look at the seismic study for maybe a representative site where one of these new plants is going, et cetera. And we, basically, would create an application that replicates what we're trying to do here, and then see what Lessons Learned we get out of that. Like, for example, does the criteria for the DCD PRA, does it approach a limit, does it approach criteria that we would have thought to enforce?

CHAIR APOSTOLAKIS: So the candidate applications would be the ones that have been popular so far, tech specs, AODs. So, you would consider a number of those, ISI.

MR. BRADLEY: ISI would be a good one.

CHAIR APOSTOLAKIS: Yes, ISI. And you try something, and see where it will take you?

MR. CANAVAN: Right. See what Lessons Learned you can derive.

MR. CHAPMAN: But, in parallel, I mean,

I can't -- I'm not going to speak for the NRC, but from my perspective, I think my colleagues will agree, LRF needs to be dispositioned somehow. It needs to be - but it can't be a different LRF, in my opinion, for every plant. That doesn't make any sense. I'm not sure how the Staff would regulate that.

MEMBER RAY: Biff, if we should not be concerned about risk creep based on this, isn't that contrary to the argument that risk metrics, Option 3, would penalize new plants, because it would limit their operational ability to do things that would increase risk?

MR. BRADLEY: Well, yes, that's a good question. I mean, I think what -- and that sort of gets to my bullet here, that in reality, we keep talking about small changes, and 10 to the minus 5, but the only place NRC has ever granted a small change is when there's a managed known risk, and that's like for the Maintenance Rule A4, and for Tech Spec 4B, where you have to establish risk management controls. There is no other application where NRC has ever, in my memory, granted anything other than a very small change, which is a one order of magnitude smaller. So, actually, all the discussion we've had today about 10 to the minus 5s is really an order of magnitude less. And, I guess, if we lower -- if we say like, theoretically, we lowered everything by an order of magnitude, well, then you're going to have a very small change that's getting really small. And if we continue the process of really granting only very small changes, then I think you do start to run into a problem.

MR. CANAVAN: Harold, if I might take another stab at answering the same question. On paper, when you perform some of these risk calculations, on paper they demonstrate an increase. So, when I go to implement the Maintenance Rule, I throw in all the additional allowed outage time that I expect to experience as a result of doing on-line maintenance. When I do that, the risk number goes up by 20 percent. But then when I collect the data over time, it actually shows that the implementation of the Maintenance Rule results in a risk decrease of 50 percent. How did I go from plus 20 to minus 50? Well, the difference was the reliability of the system is improved, and reliability is much more important to the risk equation, than is the small amount of the additional unavailability. And you can show this over time. But when I come for the application, I say I'm going to do this risk thing, it's always shown in a positive way, because it tends to bound, it tends to include the extra unavailability, while it can't demonstrate that resulting reliability.

MEMBER RAY: Okay. Well, that may be very true, and a good example, but it's still anecdotal as compared with some fundamental change that you might make. I just wanted to ask for your take on it, because, I mean, at the end of the day, we are thinking about fundamental change possibilities, such as train removal. I took a -- had a hydrogen recombiner at one time, took it out of service, things like that, that are permanent changes.

MR. BRADLEY: Yes, when I talk about risk here, I'm talking about the real -- when you look at the updated PRAs, the real change. And the "deltas" that we calculate for these applications are rule-based, they're based on a set of assumptions. They are not predicting the real delta that you're going to get from implementing the application. They're sort of merely a bounding kind of calculation, that says in the extreme, this is the delta. But the problem is, if we lower all the limits, we still have that same set of rules.

MEMBER RAY: I grant you, in the world in which you've lowered the limits, then I can reconcile what you said on this with Option 3. Okay.

MR. BRADLEY: And then just a final thing, sort of key from the last meeting, every application has its own built-in checks and balances. I'll give you an example. I heard several people say under 4B, new plants could take systems out of service for long periods of time. You can't do that. You are limited -- I don't care what the risk is, 30 days maximum backstop for any system in 4B. So, I just wanted to mention that as we work through this, looking at it in theoretical space versus what really is in the details of the applications, it could get you to a different conclusion about the perception that you're going to raise, or diminish margin.

CHAIR APOSTOLAKIS: Even though you're listing disadvantages here, it seems to me that you do like 1A.

MR. BRADLEY: Yes.

CHAIR APOSTOLAKIS: If you had to pick one, Option 1A would be the candidate?

MR. BRADLEY: Well, I hesitate to give a -- we haven't had a full discussion.

CHAIR APOSTOLAKIS: I understand, but right now, given what you know now.

MR. BRADLEY: I think we could -- yes, 1A is something we could live with. I'll get in -- we have some further slides that will speak to that.

Just a couple of observations on Options 5 and 5A. I think everything has been said that needs to be said. Clearly, the big problem there is coming up with a definition of LRF that is both usable for operational decision making, and would somehow equate with the five different definitions that were used for licensing the different DCDs. So, that's definitely going to be a challenge, if we go that way. And, also, CCFP suffers from many of the same problems that LRF does. It's not defined, and it's subject to many different definitions. And that would also have to be part of that effort, if that was part -

CHAIR APOSTOLAKIS: Nobody seems to like CCFP.

MR. BRADLEY: 5A, that was new, and, actually, could conceivably be viable. The Staff believes that large release needs -- because it was considered in the DCD and the COL, needs to somehow be considered. I think 5A might be workable. It actually -- much of what's in the existing regulatory process already makes you qualitatively address long-term containment performance. Even though there's no metric there, you've got to speak to that, and address it, and NRC has to agree with that and on its effect on any application. So, I think 5A could be a viable path forward. You'd have to come up with a process that gets you to what's the set of questions or rules you follow to qualitatively address large release.

This was our take at the table, and some of these things got discussed already, I think. The red is places where we may have diverged from NRC's table. As we discussed when Don was presenting this, there are some interpretational issues here. But we believe that were you to pick the 1150 definition, as was discussed, you could have a yes across the board for Option 1, or 1A.

I think maybe the question of maintaining safety goals is only a partial question. You also have to ask are you establishing a more restrictive safety goal. And, if so, shouldn't you go back to that, the safety goal itself, if that's your intent. So, we added an Option 3, that yes, it maintains it, but it also actually makes it more restrictive.

I think any option other than 1 is going to have some new requirements, but that doesn't -- that would be a question of degree. And I think 5A might not really have substantial burdensome kind of new requirements, so that might be workable. So, anyway, this is our take on the NRC table.

MR. CHAPMAN: Staying on 2, Option 1, 1A. I mean, we already talked about this, but it says yes in conjunction with other aspects of Part 52. I mean, we can't lose sight of the fact that the PRA did not establish the expected safety levels, or the calculated safety levels in these new plants. It's a calculation that confirmed or informed design decisions and requirements in Part

52, such as station blackout, shutdown, seal LOCA performance, and a variety of topics that are explicitly addressed. And so, I mean, it's very much coupled, not just with the severe accident 50.59-type process in terms of monitoring changes to the plant, but fundamentally had to address deterministically issues that have evolved over the last 30 plus years. So it's -- you can't disconnect those two. It is a physical plant. Sorry.

MR. BRADLEY: And as you mentioned, we have Tier 1, Tier 2, and the enhanced 50.59-type process with severe change -- severe accident explicitly part of that process, so there are other aspects of Part 52 that would preserve the enhanced safety, irregardless of the risk.

MR. CHAPMAN: And I'm not sure we've communicated that well. We talked about that late last week.

MR. BRADLEY: So, I guess I can update this conclusion a little bit. Based on today's discussion, it sounds like there may be a potential Option 2A that involves looking at your -- bringing this down with relation to the goal, and then there's an Option 5A. Any of those could be viable. I think all this discussion has moved this in a direction of things that are worth looking at. So, 1, 1A, 2A, 5A I think are possible solutions here.

We do continue to be concerned with Option 3, that if you're going to establish lower metrics across the board, you really need to go back to the underlying policy and visit that, because that's what you're effectively changing by doing that. And then you've got the definitional issues for Option 5, and that's pretty much it.

Like I said, this was just a quick reaction based on one day we had to look at the NRC slides. But I think today's has been good, and we, obviously, look forward to participating in this as it goes forward. Ken, do you have anything more?

MR. CHAPMAN: Thanks for your time.

CHAIR APOSTOLAKIS: Well, we are scheduled to have some general discussion. And I don't know, I mean, are people willing to do that? I mean, people willing to participate. I think your -

MR. WACHOWIAK: I would love to participate.

CHAIR APOSTOLAKIS: If you gentlemen will stay around, and the Staff will stay here, maybe the members of the public, so I propose we take a break now, and we come back and go through that. So, 2:45.

(Whereupon, the proceedings went off the record at 2:25:41 p.m., and went back on the record at 2:49:28 p.m.)

CHAIR APOSTOLAKIS: I suggest we come back to session. This is supposed to be an open discussion with everyone, and I don't -

MR. WACHOWIAK: They asked me to sit by a permanent microphone.

CHAIR APOSTOLAKIS: Who is they?

MS. SANABRIA: Me.

CHAIR APOSTOLAKIS: Yes. Maybe we can -- we are done with the transcript? Yes, we don't need recording. This will be a freer discussion.

MR. WACHOWIAK: Thank you very much.

CHAIR APOSTOLAKIS: I would like to know who has -

(Whereupon, the proceedings went off the record at 2:50:10 p.m., and went back on the record at 2:54:02 p.m.)

MR. LYMAN: -- gross violation of the

current licensing basis, an entire train out of service for a very long period of time. I mean, you want to think about what your goals of inspection are. And you would want to calibrate this new system to make sure that you're capturing licensees where there's deficiencies of performance. I think you need to think about what you're trying to do. And, finally, with regard to public perception problems, I think don't underestimate the public's ability to understand distinctions between new and old plants, even if they're at the same site. I think there's a bigger public perception problem that's being sold on the basis that new plants are much safer, yet there's no restriction on the ability of licensees to degrade that safety significantly. And I think the public does and can understand that a plant that's been around for 40 years, and is being built now might not present the same risk profile. And it's not necessary, frankly -

(Background noise.)

MR. LYMAN: They might have two cars in their garage. Trying to go through David Lochbaum isn't - if they have a Volkswagen Beetle, they won't understand that you might want to set the safety standard using that car is different than a new car. So, I don't think that that's such a hard concept to get around, so having strict consistency between treatment of current generation and new plants is not necessarily a top level goal. And I did say -- I spoke at the Commission meeting in February on risk-informed regulation. I said then I didn't think risk-informed applications for new plants are appropriate at this point for other reasons, the fact that the PRA hasn't been -- or won't have been validated until significant operating experience is acquired, is one. But I think the fact that the framework also adds an additional inconsistency is another potent reason to not pursue that direction until there's considerable more experience with new reactor operation, and there's been time to work through some of these issues. Those are my remarks. Thank you.

MR. SHUKLA: Excuse me. I would like to introduce myself. My name is Girija Shukla. I'm with ACRS staff. We do need to record this part of the meeting because it was published in the Federal Register as an official meeting. So, please identify yourself and speak with clarity and volume. Thank you.

CHAIR APOSTOLAKIS: So, everything that Ed said has been recorded?

MR. SHUKLA: Yes. Yes.

MS. SANABRIA: Starting from the mid part of it.

(Off the record comments.)

CHAIR APOSTOLAKIS: What did you say, Yoira?

MS. SANABRIA: It's fine from mid part of what he -- when he started speaking, so we didn't record the entire part of it.

CHAIR APOSTOLAKIS: That's fine. That's fine. He will have opportunities to repeat the arguments. Maybe since we just heard this, anybody has a comment or a question for Ed?

MEMBER RAY: Well, I would just comment that I think the concern about the public's understanding of what is licensed at the time the plant is licensed is correct, that they understand a plant to be licensed on a certain basis, and have expectations that that will be the basis. That's why I said, if we're going to assume that there's a margin here that can be used, I wouldn't call it that it degrades safety, but if it can be used over time so that the plant over time is no longer what was licensed, that does raise an issue, in my mind, at least, in terms of the public's involvement and awareness of the licensing of the plant that can be addressed by saying look, this is the way it looks today, but over its life it may look like this other thing. So, it can be dealt with, if that's deemed necessary, but it would have to be addressed, I think.

MEMBER ABDEL-KHALIK: But isn't that the case today?

MEMBER RAY: Well, I don't know for sure. What I would say is that when you're talking about safer plants, and until we license a plant, Said, on that basis, this is hypothetical. Okay? But to the extent that it is purported in the process of licensing a plant that involves the public engagement that was just being talked about, and you characterize the plant that way, then I think there's an obligation to somehow preserve that characteristic of the plant, and not have it become something else. That's all.

MEMBER SHACK: Well, in 1.174, in a sense, the delta CDF of 10 to the minus 5 let's you use, in a sense, a tenth of the margin for the safety goal. I don't think that Said intended the whole margin was available. He was going to take some -

MEMBER RAY: I hadn't thought about it. But the way I think about it is, I mean, from the standpoint of somebody running the plant, is the plant was licensed with margin, and all I ever addressed myself to was the size of the changes that I made going along. I never attempted to recharacterize how that cumulative effect affected the plant. We're talking about something different in the future, and so I'm trying to think about it that way.

CHAIR APOSTOLAKIS: But let me come back to Ed. So, what you are -- I mean, if I understood you correctly, you would be comfortable with a different treatment of the new plants from the treatment of existing plants.

MR. LYMAN: Yes. Fundamentally, we don't agree with the Commission's policy statement, the new reactor policy statement. We think that every opportunity should be taken if we're building new generation nuclear plants that are going to be around for 60 or 80 years, to make that generation significantly safer, but that you don't need that principle to just recognize that if a new plant has significant safety advantages, you don't want the licensee to take advantage of that to be able to cut corners in a way that degrades that safety significantly. So, we don't -- I mean, obviously, we'd like the existing population of plants to be safe, and we don't see a problem with the next generation being built and held to a higher standard.

CHAIR APOSTOLAKIS: So, I guess the inconsistency in the regulatory system with having a set of rules for the new plants, and another set for the existing plants, you wouldn't raise an issue there.

MR. LYMAN: Well, I mean, there are so many -- one problem I'm seeing is there are so many different applications for this particular concept, and they, in some cases, may meet different objectives. So, I think it's going to be hard to come up with a uniform definition that's going to meet the objective -

(Coughing.)

MR. LYMAN: RFP versus ISI, allowed outage times. You may not be able to have a uniform of limitation. I think you want to focus on what the objectives are, and not get caught up in the numbers.

CHAIR APOSTOLAKIS: Now, I remember what Rick said earlier, though, that you guys are going to penalize me because I installed all these extra safety systems, and you're taking away some of my flexibility.

MR. WACHOWIAK: Extra non-safety systems are what are bringing the core damage frequencies down.

CHAIR APOSTOLAKIS: So, how do we respond to that?

MR. LYMAN: I don't see that as penalizing. If they didn't want to commit to the expensive building and maintaining the system so that they're operable throughout the life of the plant, then they shouldn't have them in the first place. You know, I just want to remind people that the -- I said it before, but the public is being told that the next generation of plants is going to be safer, and there's going to be a hearing on Calvert Cliffs 3, which lawyers have produced this concept that because the EPR is so safe that no one can publish and qualify for standing, because no one could possibly be harmed by this reactor. It turns out that ASLB rejected that argument, but that's the kind of thing that's being promulgated. And it just doesn't seem like a penalty, to me, for the licensee to carry through with maintaining the design -

CHAIR APOSTOLAKIS: So you're saying it's not a penalty because you have already reaped the benefit of being perceived as much safer than the existing reactors.

MR. WACHOWIAK: This is Rick Wachowiak. If that were in fact true, then I think we'd be in a completely different position here. And I understand that that one case was made there, but in the certifications, I don't think that there has been any advantage given to a plant that has a lower CDF versus one that simply meets the goals, or is as good as the better of the existing power plants. And I don't believe that the NRC was intending to license the plants based on that. And, basically, from the current prioritization of resources at the NRC, we do know that it was not based on which plants have the lowest core damage frequency. It was based on many, many other things other than that.

In this particular room, we had a conversation where one of the ACRS members made the comment about RCDF, that he couldn't confirm that it was 10 to the minus 8, but he could confirm that even if we did all the uncertainty, and everything else that could possibly be done to this PRA, all the scrutiny, it wouldn't take it above the safety goals; therefore, it's sufficient. So, I think the plants are being licensed based on meeting the goals, rather than being some number of orders of magnitude below the goals. Now, how they're sold in these other public hearings I can't attest to that, because I have no knowledge of that.

CHAIR APOSTOLAKIS: I think the comment was, Rick, that if all these uncertainties were removed, and we did a conservative calculation, that the design would still meet the expectation that it's well below the safety goal. There's a difference.

MR. WACHOWIAK: Okay. But once again, there's not going to be anything in our SER, I believe, that we get a license because the CDF is X.

MEMBER ABDEL-KHALIK: But there is a

benefit, though. I mean, if the ESBWR core damage frequency was an order of magnitude higher than the AP 1000, you wouldn't have had any customers.

MR. WACHOWIAK: I -- certainly, it could be speculated. I don't know that that's the case. It may have been two orders of magnitude cheaper, and then we'd have all their customers.

(Laughter.)

MR. WACHOWIAK: So, while that's a good point that could be debated, I'm not sure that we -- there are so many other factors that it would be hard to say. Certainly, though, what we're trying to do, or what we were trying to do with this, and what I want to make sure that we avoid harming in the future is setting up a framework, regulatory framework that works both for the license changes, and for the ROP, that allow us to fix some of the things that have been problems for the operating utilities currently. So, for example, the maintenance rule threshold, the things are based on essentially 10 to the minus 6 for performance criteria, is similar to the ROP and STP threshold. So, the monitoring and things that we do for the maintenance rule, typically, we have a hard time determining that there's going to be a problem until you've crossed the threshold into a regulatory problem, as well.

What we're looking at being able to do is by having the regulatory threshold remain the same, but in the maintenance rule application, this is one where delta from the baseline is the correct application, you would bring that down, so that your maintenance rule program can now be a predictor of when you have regulatory problems. And, therefore, you would end up investing your money not in fighting your green to white finding, but you would invest your money in fixing the equipment such that you won't reach the green/white threshold, which we think would be much safer, and much better for the public, and all the rest of the stakeholders.

So, I just -- I get worried when we start talking about how we have to move those lines down. The other thing, and I think Biff brought this up, is as you bring the threshold lower and lower, the uncertainty portion of what goes into calculating that number gets relatively -- on a relative basis gets higher and higher. And so many of -- at least in these STPs and other applications, especially in the risk-informed license change applications, the calculation of the uncertainty, and whether or not your value including uncertainty is above the threshold tends to be more governing. And, so, I worry that as we try to bring down thresholds for these, we get to a point where we can't calculate any sort of a acceptable out time.

The other thing is that there should be, I think, some area that -- some threshold below which we call negligible from a regulatory point of view. And I don't know what the right threshold is, but if we were just to extend -- if we were to extend that Reg Guide 1.174 to a Region 4 maybe below that, which was a 10 to the minus 7 delta, and it's already implied that that's a negligible delta, 10 to the minus 7, because the existing plants, if you had a CDF at 10 to the minus 4, and your operator gets some bad shrimp at lunch, that could be a delta 10 to the minus 7 event.

CHAIR APOSTOLAKIS: Well, that's not a permanent change to the licensing basis.

MR. WACHOWIAK: Oh, I jumped into ROP. I'm sorry.

(Laughter.)

MR. WACHOWIAK: But the thing is, it's already recognized that things that are that low are somewhat below the concern of having to go and invest resources -

CHAIR APOSTOLAKIS: But how would that help? It's unclear to me how that would help.

MR. WACHOWIAK: Well, it would help in certain -- in some cases where if we're talking about plants with a core damage frequency in the 10 to minus 7, 10 to minus 8 range, that they wanted to make a change in allowed outage times, or to take a non-safety system and not use it any more, or something like that, and got a delta CDF of 10 to the minus 7, that should be okay. I certainly don't see the public clamoring to say put ESBWRs instead of AP1000s in these places because there is a 10 to the minus 7 delta in CDF.

MR. CANAVAN: If I might make a quick takeoff on that just for a quick second. Most of the plants that I'm aware of, the new plants, are meeting the EPRI design requirements document. By definition, they're already safer. They're already in -- they're being designed an order of magnitude safer. Some people take the advantage and say I'm going to go ahead, and I'm going to go another order of magnitude safer. We need to be careful, I think, both from everybody's perspective, from the public's perspective, from the regulatory perspective that we don't disincentivize those people from going the next step, because if we say if you go to the next step, by the way, you don't get maintenance rule, and you get this really small change allowable, and you don't get to do anything else, those people are going to back away from that, and they're going to say okay, I'll tell you what. I'm going to go up to the minimum requirement, not do any more, and then I have even more flexibility. So, we want to incentivize the right behavior, so there's a split.

The way I sort of look at it is, we got an order of magnitude, we got a little bit more than that, because people chose to -- vendors chose to do that, to incorporate some operational flexibility. And maybe we don't want to give it all back back up to the threshold, but there might be some margin that we can allow operational flexibility.

One important thing to remember about

operations, by the way, is operations isn't a straight line. Operations and all these averages are composed of peaks and valleys. And if you look at some of these, you need a margin to operate. You don't operate at 100 percent, 0.000 percent power; nevertheless, not have anything ever out, not having any risk going up and down. These are composed of peaks and valleys, so there needs to be some margin to operate them. And when the core damage is lower, the peaks and valleys can be higher on a relative basis.

And the last comment was going to be just on the relativeness. I don't really like relative measures all the time. I like relative measures because at least not -- I mean, I like absolutes. Let me put it to you that way. Someone tells me I'm going to get 10 percent, 10 percent of what? What's the 10 percent of? It's a very small number. If I tell you I'm going to give you 10 percent of some dollar figure, you really don't care that you're getting 10 percent. What you care about is the dollar figure, because if it's a dollar, you're getting a dime. If it's a hundred thousand, you're getting $1,000. So, there's a role for relative, but there's also --

with relative you need to also know the absolute.

CHAIR APOSTOLAKIS: The dollar for a guy who makes half a million a year is not the same as a dollar for a guy who makes $25,000.

MR. CANAVAN: This is true, you need to know both. You need to know both, but, at the same time, you can't just say 5 percent. It has to be 5 percent of what, so the two go hand-in-hand, and I think both have a role to play. So, I don't think you can look at either in the absolute. You can't take just the absolute, but absolute risk, is absolute risk. Right? When we talk about 1E to the minus 6, it's 1E to the minus 6. So, if I talk about 10 percent of some number -

CHAIR APOSTOLAKIS: You're arguing against Dr. Abdel-Khalik's proposal to go with the relative, the margin.

MR. WACHOWIAK: Well, I liked the margin -- I actually liked the margin discussion. I need to think about it a little bit more along with Rick, because I did like the margin discussion. But I also do think that we defaulted to relative very quickly, and there seems to be some folks who like relative schemes in the absolute. I think relative schemes in the absolute don't provide enough information to make decisions.

CHAIR APOSTOLAKIS: I still think that using the word "absolute" is abusive. I don't think these things are absolute.

MR. CANAVAN: Yes. Fixed.

CHAIR APOSTOLAKIS: Charlie reminded me of when the goals were set, the Commissioners took one-tenth of 1 percent of other accident risks. But, again, why did they take one-tenth of 1 percent? If they had a thousand reactors operating, maybe they would have taken one-thousandth of 1 percent. They did have in mind the existing fleet, so it was relative in that sense.

MR. CANAVAN: Fixed might be a -- Rick can me a better word. I don't much care for absolute, either. Fixed might be better.

CHAIR APOSTOLAKIS: I mean, let's say that, as I said earlier, miracles happen, and all of a sudden everybody starts building nuclear reactors in the United States, and in three years we're going to have 500 plants more.

MR. CANAVAN: We'll revisit the threshold.

CHAIR APOSTOLAKIS: We'll revisit the same goals, with lightning speed.

MEMBER SHACK: We'll be too busy building plants.

(Off the record comments.)

MR. WACHOWIAK: So there was one other comment made on -- it was ROP space, again, but it was a plant getting into trouble because of some very -- a significant problem, that would be like a safety train out of service, or something like that. Typically, when plants - and this is anecdotal again, so granted, it's -- take it for what it is. If there is a significant degradation that would not just be a chance thing, like a component inside a containment that you can't observe more than once every two years, so that when you see that it's out of service, you have to assume that it was out of service for the two-year period that you didn't examine it. But, if it was really a systemic problem where the maintenance was bad, and the plant was not maintaining the equipment, I would expect that over a fairly short period of time they would get multiple hits in multiple systems, and it probably would trip a threshold even in one of the new plants using the existing fixed thing, because it would end up -- it would be a pervasive problem that just one instance wouldn't show up. And we don't want to get the false positives from things that you just can't observe. That's more of a passive plant thing, than an active plant thing. Passive plants tend to have inaccessible equipment, so random failures could look like a problem if you ratcheted down the thresholds.

MEMBER RAY: Could I go back to what you were saying, though. What puzzles me is, if you characterize the plant the way you did, then it doesn't seem be completing licensing, and it doesn't to me like there's this disincentive that you're talking about. In other words, you build a plant that's capable of being safer than what you license it to, and you then have the flexibility to operate it using this enhanced safety features, the way that you want to without violating the basis on which you license the plant. What is the concern? I'm missing the point here somehow.

MR. WACHOWIAK: There's a couple of different concerns. The concern in the license-based change is that right now we know that our PRA will not support risk-informed tech spec options that are available to the fleet, because of things like design acceptance criteria, which is -- it's a tool that the Commission has allowed for completing I&C designs, and other -- and human factors calculations later, after the certification is received. Because of things like that, and because of not being able to observe the as-built equipment, we don't have a PRA that meets the Reg Guide 1.200 threshold today. The Reg Guide, I believe, is being updated to address some of that, but today, so that you could gain entry to doing a Reg Guide 1.177 tech spec change. We can't do that now.

MEMBER RAY: Could you just stop there for a second?

MR. WACHOWIAK: Okay.

MEMBER RAY: I mean, I think that point, George, is one that I would like to understand more at some juncture, because it just seems as if you could make, I'll call them conservative, but generous assumptions about these unanswered parts of the design that would then later give you the flexibility that you wanted to have.

MR. WACHOWIAK: And that's what we've done right now, is for the operator actions, for example, we really only considered six operator actions that we know are going to be important, and that we put requirements that the HFE will be done for those. But all the rest of the operator actions in the plant, we've ignored in our baseline PRA.

MEMBER RAY: Okay. I don't know if that's an answer to my question or not. But, in any event, it just doesn't seem like this idea that somehow there's a disincentive created to make the plant as safe as possible, because then you lose operational flexibility. I don't understand how that works, but I don't want to take everybody's time here. I just want to make note of it, because it doesn't make a lot of sense to me.

MR. WACHOWIAK: See, where it will come into play is if we follow the rules and the Reg Guide for doing the tech spec change, as Biff and Ken said earlier, when you go in for that application, you only get to count the theoretical increase that's going to come from that tech spec change. You won't get to count any benefits that you might get out of actually doing the change. So, in our case, I would expect that that application would show the CDF going from a 10 to the minus 8 range, to a 10 to the minus 7 range on paper with just that change being considered.

MEMBER RAY: That sounds like a problem with how the change is calculated then.

MR. BRADLEY: It's not a problem. It is the system that we live in, where there is conservatism, and checks and balances built into the application. And when you calculate that delta, as I said earlier, it's not -- you're not calculating the real delta. You're calculating a hypothetical delta that only takes into account certain aspects. And that's -- you're not really -- when you go to say 10 to the minus 6 delta CDF, and you're not going to see your CDF go up.

MEMBER RAY: Okay. But aren't we back, Biff, to the problem created by option 3, which you guys didn't like. It's not inherent in Option 1, is it?

MR. BRADLEY: I don't understand.

MEMBER RAY: The problem in which you're -- it seems to me like you want to take credit for the enhanced safety, but you're concerned that if you do so, you will wind up not having the operational flexibility to the Commission's safety goals that you're looking for. The margin that Said is talking about here will be unavailable to you, and that's a disincentive to do the things that you're thinking -

MR. BRADLEY: I was thinking the disincentive was more along the line of having such small thresholds that every hiccup is going to end up in inspection space, or you're precluded from even applying for some of the tech specs. I mean, the rules are in place. The applications are done, so we'd have to go back and -- if you went back and redid everything for new plants, you might be able to solve that problem. But that, to me, is -

MR. WACHOWIAK: Okay. So, for example, what we did at this point was, we, in the certification, lowered the CDF enough so that when we go in to do this application, either after operating experience is gained, or whatever, we've determined that that's the right time, that the place that we get is still orders of magnitude below the existing plants, and it's an order of magnitude below the operating fleet; and, yet, it is well away from the goal. So, throwing that in to try -

MEMBER RAY: But listen to what you just said. You lowered the CDF enough -

MR. WACHOWIAK: By adding things to the design.

MEMBER RAY: Huh?

MR. WACHOWIAK: By adding things to the design.

MEMBER RAY: But, I mean, either that is a reflection of the design, or it's not.

MR. WACHOWIAK: What it is, is allowing us to make -- to do something with our technical specifications later than we would not necessarily be able to do as easily later.

MEMBER RAY: Fine.

MR. WACHOWIAK: If we could do it now, we would.

MEMBER RAY: No, now I don't -- that's exactly on my point. I'm sorry, George. I'll shut up.

CHAIR APOSTOLAKIS: Okay. Go ahead.

MEMBER RAY: Well, I mean, it allows you to do later something that you couldn't do now. We've got to talk about that.

MR. WACHOWIAK: And the reason we can't do that now is that it would be time prohibitive to combine a certification application along with a risk-informed application.

CHAIR APOSTOLAKIS: Because you don't have the risk profile that ultimately will pervade.

MR. WACHOWIAK: Yes.

CHAIR APOSTOLAKIS: Okay.

MR. WACHOWIAK: And there will be very - a lot of -

MEMBER RAY: You take it, George, because I think there's a -

CHAIR APOSTOLAKIS: I understand.

MEMBER RAY: Yes, go ahead.

CHAIR APOSTOLAKIS: I understand that. So, right now you're saying, and I think you're right, the risk profile that you have submitted is incomplete.

MR. WACHOWIAK: Right.

CHAIR APOSTOLAKIS: You don't have operating experience, you don't have your testing -

MR. WACHOWIAK: Design -

cHAIR APOSTOLAKIS: You have not included the probabilistic analysis of seismic.

MEMBER RAY: It's also lower.

CHAIR APOSTOLAKIS: It's much lower, and I think what Rick is saying is they made sure it was so low now that when you add these other things later, you will raise it, but you will still be comfortably below -

MEMBER RAY: Got it. Okay.

CHAIR APOSTOLAKIS: -- the expectation.

MEMBER RAY: That's a great insight that I didn't have.

CHAIR APOSTOLAKIS: That's what Rick is saying, and I think that's real.

MEMBER RAY: Well, but maybe it needs to be articulated.

CHAIR APOSTOLAKIS: But I think the -- I'm having difficulty tying that to the discussion today, because you would have to have a baseline risk profile in order to apply any of those options. So, nobody is forcing you to apply these to the design certification profile, which you are the first one to admit is not a real one. So, I don't know what the problem is here. But you don't seem to have a problem.

MR. CANAVAN: Well, I think -

CHAIR APOSTOLAKIS: I mean, nobody in his right mind would say they report a three 10 to the minus 8, therefore, they have to preserve that, because they are saying no, that's not the real number. So, I'm not sure what -- you disagree with this stuff?

MR. CANAVAN: Correct me if I get this wrong. So, the thought is, if you can pick your baseline CDF, which you sort of can do when you're designing, you want to incentivize people to get the lowest value starting possible, but if by getting the lowest value possible, you then go to, for example, a delta risk control mechanism, if they get to 1E to the minus 8, and their delta risk is 5 percent, they can't make a single change. So, they're incentivized to not go there.

MEMBER RAY: Now, wait a minute. When we build a plant, you make a cost-estimate, and depending on how good the cost-estimate is, you put a contingency on it. I mean, what you're talking about is the need for some allowance for things yet to be identified. That's what you're talking about. It's a risk contingency.

MR. CANAVAN: I am actually talking

about operational flexibility.

MEMBER RAY: I hear you, but what you're actually using as examples are allowances for things not yet identified or defined. And we all understand and agree with that. But why not simply do it the way you would in the cost-estimate, which is to say here's the estimated cost, and here's the allowance for contingency on top of that, and this is the final number.

MR. WACHOWIAK: Exactly. Which is why Chapter 19 of our DCD doesn't come to the conclusion that the core damage frequency is X. It says the core damage frequency is below the Commission's safety goals, 10 to the minus 4, and large release frequency is less than 10 to the minus 6.

MEMBER RAY: And if that's the way the project is presented, that it can go that high, which is what you're implying by that, and you can sell that, boy, that's the best way to go. But I'll bet you you're going to wind up selling it as a much safer plant.

MR. CANAVAN: But it is already designed one order of magnitude lower than the existing plants.

MEMBER RAY: I'm just telling you there's a communication problem here that I think you guys need to -- at least I'm beginning to understand, it's very easy to understand once you make it clear, like you started to do here. But it's as simple as saying there is a need for some allowance.

Now, in the cost-estimating world, you put a contingency allowance on there, and then you live with that. And what you're saying to me is no, no, I don't want to put an allowance on there for uncertainty and risk. What I want to do is say the sky is the limit, namely, the safety goal. And that's not going to fly, just to be real honest with you.

MR. WACHOWIAK: And -- which is why when we consider Option 1, it makes sense, because in Option 1 the sky isn't the safety limit of 10 to the minus 4, it's 10 to the minus 6.

MEMBER RAY: I'll think about that.

(Off the record comment.)

MEMBER RAY: Well, I know, Biff, that's right. We're having to sit here and not know what factor to put on the Staff review and approval. I agree with everything you said, but it still is vague.

MR. CANAVAN: I actually think in all the official quote documents, they're saying exactly what you're saying. I think that what happens is then somebody says well, what's the real CDF? And you say -- and if you answer that question, it comes up with well, right now it's 1E to the minus 8, but we expect it to go up, gets lost, and the 1E to the minus 8 gets quoted, so there's a communication issue.

CHAIR APOSTOLAKIS: For what, it's quoted for what?

MR. CANAVAN: It gets quoted.

CHAIR APOSTOLAKIS: It gets quoted, but it's not used in many risk-informed applications.

MR. CANAVAN: Right.

MEMBER BLEY: But the way Rick said, it's better, then it's going to go up.

CHAIR APOSTOLAKIS: Yes.

MEMBER BLEY: That's for the part of the design that exists. That's the answer. And there are things missing, and we know there are things missing.

CHAIR APOSTOLAKIS: I think it's important, again, to go back to the fundamental principle here. And it seems to me the fundamental principle in all these risk-informed changes is that the Staff or the Agency, the Agency wants to preserve the existing profile after all this stuff has happened, Rick. It isn't risk profile. Any deviation from that should be small. Now, you guys know that. You're not surprised, so when you talk about incentives to go as low as you can, first of all, there must be some benefit for you to want to do that, and I believe it's about, what Ed said, that you're selling the concept of the plant to the public, that it is much safer than existing reactors, so you have some benefit, maybe public opposition would not be the same, blah, blah, blah, blah. But then you know that eventually this profile working through the NRC cannot be changed dramatically, so you have to balance it yourself. But I don't see what the problem is. We are not taking any incentives away, it seems to me.

MR. CANAVAN: Definition of small. Is small 1E to the minus 8, delta 5 percent?

CHAIR APOSTOLAKIS: Again, they want to see the profile essentially preserved, so it's small compared to what you already have. So, small, 10 to the minus 5 is small for a particular reactor that we have now, but it's not small for a new design.

MR. CANAVAN: But is it compared to what you have, or is it compared to the AP 1000, or is it compared to new plants?

CHAIR APOSTOLAKIS: No, that's a good -- that's why I'm saying we need a principle. If AP 1000 comes in here, and after it's licensed and so has a certain profile of 10 to the minus 6, then 10 to the minus 5 is not small for them, because they don't want the profile to change dramatically.

MR. BRADLEY: But couldn't you make the same statement with regard to Grand Gulf? An operating plant loading E to the minus 6, CDF, certainly the public would want to see that preserved. Right?

CHAIR APOSTOLAKIS: Yes.

MR. BRADLEY: And has it been?

CHAIR APOSTOLAKIS: Well, they -

MR. BRADLEY: Has it gone up, or is it -

CHAIR APOSTOLAKIS: Even if the 1.174 says 10 to the minus 5, I don't think those guys will allow you to go -

(Simultaneous speech.)

MR. BRADLEY: Plants have been preserved under the existing system.

CHAIR APOSTOLAKIS: Yes.

MR. BRADLEY: Even though their baseline CDFs are smaller than the change -- the deltas that are allowed.

CHAIR APOSTOLAKIS: Yes.

MR. BRADLEY: So, what is the problem we're trying to solve?

MEMBER SIEBER: If the risk is -

(Simultaneous speech.)

CHAIR APOSTOLAKIS: What argument is that based on what I say? Naturally, one would conclude that even if you keep 1.174 the way it is, still if a plant has 10 to the minus 6, the change is going to be small.

MR. CANAVAN: Yes.

MR. BRADLEY: I mean, I haven't seen -

cHAIR APOSTOLAKIS: I can't argue with that.

MR. BRADLEY: I haven't seen any evidence that -

cHAIR APOSTOLAKIS: Nobody is going to

go with 10 to the minus 4. I mean, that's crazy. They will reject it outright.

MR. CANAVAN: Yes. Well, everybody is -- I guess I look at, George, what you said, and I do worry that if I was going to design the next generation of reactors, and I knew that I was going to be measured against my own risk profile when I was done, I would not put in the same effort to reduce that profile as low as I could possibly get it, than the next plant that got approved. Why would I -

CHAIR APOSTOLAKIS: If you look at the regulations of the last 40 years, that has always been the driver, it seems to me. I license you? No, if you want to make any change, I want to approve it, and I want to make sure it's small, regardless of whether you are in -

MR. CANAVAN: I agree with that.

CHAIR APOSTOLAKIS: -- probabilistic space, or deterministic space.

MR. CANAVAN: I agree with that. I just have a different definition.

CHAIR APOSTOLAKIS: But you knew that.

MR. CANAVAN: My small is not relative. It's more absolute. Small is 1E to the minus 6, then -

CHAIR APOSTOLAKIS: That's what I'm saying, that we have -

MR. CANAVAN: -- that might be small.

CHAIR APOSTOLAKIS: -- to go back to the principle of preserving the existing risk profile, even though risk may not have been quantified. Because if you look at the deterministic way of approving changes to the licensing basis, I think the philosophy is there.

MR. WACHOWIAK: But it's there based on degrading the margin. Can you do a 50.59, you see how much margin you lost. So, even with the lower CDF plants, I think if you look at it based on margin, it probably comes out okay.

MR. CANAVAN: That's why the margin -

MR. WACHOWIAK: And the numbers may not be that much different than what are in the current -- I think you can make that all work.

MEMBER SIEBER: But if your base risk -

CHAIR APOSTOLAKIS: Then the argument with the one you just brought up, I forgot the plant.

MR. BRADLEY: Grand Gulf.

CHAIR APOSTOLAKIS: Yes, I think it -

MEMBER ABDEL-KHALIK: I'm obviously a proponent of this idea, 2A, of fractions of the margin. But I also see that we can couple that with a below regulatory concern limit -

CHAIR APOSTOLAKIS: No.

MEMBER ABDEL-KHALIK: -- that is based on absolute -

(Simultaneous speech.)

MEMBER ABDEL-KHALIK: I mean, if you sort of implement this idea of a relative change based on changes in the margin, together with absolute changes, that we shouldn't be worried about at all, 10 to the minus 7 changes, regardless of where your starting point might be, I think that would make sense.

MEMBER SHACK: Your relative margin, if your safety goal is 10 to the minus 4, and you allow them 10 percent of the available margin, for all these plants we're talking about, you're back to Option 1 for all practical purposes.

MEMBER ABDEL-KHALIK: Right, because you're starting from -

(Simultaneous speech.)

CHAIR APOSTOLAKIS: I think that is

consistent with what I was saying, that you really don't want to change the profile too much. It depends on what percentage of the margin you allow.

MEMBER ABDEL-KHALIK: Right.

MR. CANAVAN: And the reason why the margins are so attractive is because there's two parts to a margin. One is the absolute portion, and the other one is the fraction. So, in that way it's looking at both.

CHAIR APOSTOLAKIS: I would -- no matter how you do it -

(Simultaneous speech.)

MR. CANAVAN: That's why the margins is appealing.

MR. WACHOWIAK: And we've learned from you guys that -

CHAIR APOSTOLAKIS: I think what Biff was arguing -

MR. WACHOWIAK: -- there's not going to be any decision on it today.

CHAIR APOSTOLAKIS: I think what Biff was arguing was that in practice this is what's happening. Regardless of what 1.174 says, in practice this is really what's happening.

MR. BRADLEY: Regulation isn't just about making plants less safe, raising CDFs. I wouldn't be doing this if that's what it was about.

CHAIR APOSTOLAKIS: So, it took us about half an hour, but we are -

MEMBER SIEBER: On the other hand -

CHAIR APOSTOLAKIS: I would like to -- I'm sorry. Yes, Jack?

MEMBER SIEBER: Margin does a lot of things, and one of them is that it controls and influences behavior. And if you have an artificial margin that says that the risk is higher than it actually is, it has an impact on the plant operating staff, and the way that you find improvements and so forth, such that I've got this extra margin. I don't have to do it. And you have to remember that piece of it, as well as the regulatory piece of it, and the public perception piece of it. Margin does a lot of things, and it does affect behavior of plant people.

CHAIR APOSTOLAKIS: By the way, Said, the reason why there was such a reaction when you said below regul -- there is a bad history there, and we don't use that word.

(Simultaneous speech.)

MR. BRADLEY: I think one challenge with the margin would be you have five DCDs with five different definitions of LRF. And you have to come up with a one-size -- you still have to deal with that.

CHAIR APOSTOLAKIS: Yes.

MR. BRADLEY: Even to define the -

cHAIR APOSTOLAKIS: Yes.

MR. WACHOWIAK: Plus you need a definition of large for LRF -

cHAIR APOSTOLAKIS: I would like to hear from other people, though. Does anyone else have -- Gene, please, identify yourself.

MR. HUGHES: Gene Hughes. I've got several different comments, and I'll try to keep them concise, because I only want to make one or two points. But, first, the ABWR DCD has in it a statement from the NRC in which the NRC communicates with the public. And in that statement, the SER, it says that the core damage frequency has been looked at, and based upon a review of that by the Staff, the Staff has concluded that it meets the safety goal. It also says that there are very low numbers quoted, but it points out that sometimes low numbers are a reflection of the diligence of the people that designed the plant, and did the work, and are not always to be taken as absolute values. So, I think that's communicated pretty effectively in the Staff Evaluation Report. It is communicated to the public, and I'm very concerned about the public awareness, as we all are, of what we do.

The second side is that we're talking here today about this margin, and how we might use it. But the reality is, there are people in enforcement and inspection who oversee what we do at the sites, and we don't simply go around and take systems out of service because we feel like it. In order to take a system out of service, you have to make a decision to do so, which requires under the maintenance rule that you look at the configuration risk, but in the NRC Inspection and Enforcement Manual, which I think is 9900. I've got the reference here, it states the reason people can voluntarily enter a limiting condition of operation, or an action time, is because of their belief that the actions they take will improve the reliability of the system. So, you can actually only do that if you have reason to believe the actions you're taking are consistent with the goal of improving the reliability. So, it's reflection of margin, but it's not something that can be done easily.

Now, the point that I would like to make, I don't think there's any inconsistency whatsoever in the NRC Commission saying that plants that are new should be safer, and saying that the 10 to the minus4 number should not be changed. What we're doing is we are chasing safety by looking for risk. That's what we do. We try to find risk. When we find it, we identify it, we put it on a piece of paper, we highlight it, we train to it, we're aware of it, and we make the risk go down. We don't always change the number and make the number go down. But through the standards and the effort we're putting in, it would not surprise me that a new plant that is demonstrably safer would actually have a core damage frequency calculated that isn't significantly different, because we're looking with a much finer eye to try to identify everything we can. And, in the process, I think we're even making it safer. So, I'm not sure that we really have a huge problem with the existing metrics, and I'm not sure that the numbers we're looking at in this discussion, which sound like they're absolute values, and absolute certainty, this plant is safer because it's got that number, that plant is less safe.

These plants, I think, have to be looked at in the context that they meet all the regulations, they have margin, they have everything demonstrated they need to have, and these numbers are calculated to reflect what that insight set consists of. So, when we look at these plants, and they are low core damage frequency, intermediate core damage frequency but well below the goal, the important thing is that we've done the look, we've identified it, we understand the uncertainty, and we're trying to manage it. And I think in that context, 1.174 has shown itself to be an effective way of looking at it, and considering it. The most important thing being that it's not just a number, it's defense-in-depth, it's margin, it's meeting the regulations. And when you make an application to change it, you have to address all of those things, and demonstrate to the NRC due diligence on your part to do the right thing in the right way.

So, I really think the fabric of safety has many threads in it, and we need to look at all of them, from enforcement, to inspection, to these applications and how they're looked at.

CHAIR APOSTOLAKIS: So, I take it you are supporting Option 1.

MR. HUGHES: Yes.

CHAIR APOSTOLAKIS: Okay.

(Laughter.)

CHAIR APOSTOLAKIS: Any other comments, not necessarily on this topic, on anything.

MEMBER RAY: Well, I would just observe that I think what Gene says is very apt, and his reference to how the NRC characterizes what they do in licensing a plant, but it doesn't make irrelevant what is also said about the plant by others in the process as it takes place.

CHAIR APOSTOLAKIS: Well, the Staff, I think, do agree that we have all these other considerations. I mean, they mentioned them several times today. It's not just a number.

Well, it looks like we're getting to the end of this open discussion. Before we adjourn, I would like to go around the table and ask the members if they have any comments on what they heard today, so I will thank the guests, and let's spend 10 minutes doing that. And then we'll adjourn. I don't think -- Professor Corradini, do you have anything to say?

MEMBER CORRADINI: I'm learning.

CHAIR APOSTOLAKIS: That's fine. Mr. Ray?

MEMBER RAY: I would just offer that I think this is very, very helpful, especially to me. I appreciate it. As I understand it, we began the day with some challenges that the Staff is working through, and look forward to the next increment of update, and what they propose. I think we have a role to play, but not yet, in this debate, so it's all -

CHAIR APOSTOLAKIS: Okay.

MEMBER RAY: Thank you. Said?

MEMBER ABDEL-KHALIK: I think most of the comments I wanted to make, I've already made, but I would urge both the Staff and industry to look at this new option of looking at the changes in terms of fractions of the margin.

CHAIR APOSTOLAKIS: Dennis?

MEMBER BLEY: Again, I would like to thank everybody. I think the walk through history this morning was very helpful in putting all this in great perspective. And I think you're on the right track, and these issues of level against the delta business the changes, it's been around for a long time, but it's still challenging every time you think about it. No advice.

CHAIR APOSTOLAKIS: Bill?

MEMBER SHACK: It's been a very helpful day. Again, I'm less convinced than I was this morning that I knew the right answer on this.

(Laughter.)

MEMBER SHACK: I suppose that's progress of sorts.

MR. WACHOWIAK: What was your answer this morning?

MEMBER SHACK: My answer this morning would have been Option 3 for 1.174, and business as usual for ROP. But I'm not sure that I buy that anymore, but onward.

CHAIR APOSTOLAKIS: John?

MEMBER STETKAR: And, again, thanks. The presentations were really good. The only thing I would add, and it's something that I asked earlier, I really think that it's time for people to define what is meant by those three letters, LRF. I think we have the opportunity to do that, and I think until we get some agreement between the Staff, industry, us, ACRS, and the Commission, we're only going to be extending this discussion, because three years from now we'll be back worrying about what that thing really means that we're now measuring the change in. So, I'd try to get some incentives to move that process forward.

CHAIR APOSTOLAKIS: Michael?

MEMBER RYAN: Yes, I'm like Professor Corradini, I'm learning today.

CHAIR APOSTOLAKIS: Jack?

MEMBER SIEBER: It sounds like John's option is Option 5, because that defines LRF.

MEMBER STETKAR: I came in with a preconceived notion also, but it was a different option. And everybody put it on the table, so I -

CHAIR APOSTOLAKIS: I'm sorry. What?

MEMBER SIEBER: The presentations today allow me to have a broader perspective than I had before I go there, so I appreciate all of the thought that's been going on in both the industry, and in NRO. I'm not prepared right now to pick an option, even though there's a couple that look more pleasing than others. And I appreciate the work that everyone has done. Thank you very much.

CHAIR APOSTOLAKIS: So, I'm pretty sure that if the Staff wanted advice from the members of the Subcommittee as to how to proceed, they got none.

(Laughter.)

CHAIR APOSTOLAKIS: So, you probably have to go back to the transcript.

MEMBER SHACK: I think we can all agree we need to define LRF.

CHAIR APOSTOLAKIS: We all agree with that, but I think the transcript will be much more helpful to you than the last five minutes. And I do think -- I mean, adding again, a clear statement up front of what the objective is, or the principle, or whatever will go a long way towards helping understand the intent of the options. The advantages and disadvantages you list are very helpful, but, as I said earlier, they are more oriented toward the implementation, what it means, rather than the fundamental principle being this, and here is how we're going to achieve that. But I echo, again, all the comments, that this has been extremely helpful to us, anyway. I don't if it was to you. To us, it was very helpful. We understand much better the issues, and this has been one of the better Subcommittee meetings, I think, certainly better than others.

(Off the record comments.)

CHAIR APOSTOLAKIS: Thank you very much, all, and we'll see -

MR. HAMZEHEE: I just had one question -

CHAIR APOSTOLAKIS: Yes, I'm sorry.

MR. HAMZEHEE: One question for George.

CHAIR APOSTOLAKIS: Of course.

MR. HAMZEHEE: So what's the plan of the ACRS Subcommittee on this subject?

CHAIR APOSTOLAKIS: Well, right now we -- obviously, we're going to brief the Full Committee Friday, and -

MEMBER SHACK: Enlighten them?

CHAIR APOSTOLAKIS: Huh?

MEMBER SHACK: Enlighten them.

CHAIR APOSTOLAKIS: And enlighten them, yes, so they will know more. And we are waiting until you guys come back -

MR. HAMZEHEE: Final recommendations.

CHAIR APOSTOLAKIS: Yes. I think Don had the schedule up there, something like in the fall of `09. Okay. So, I guess we'll leave it at that.

MR. ADER: Our tentative plan, and it changes as we get input, was try to take what we heard, the recommendation from the Committee on an option, take what we heard from here, update the pros and cons, update options, maybe add options, and then just start moving forward towards a recommendation and a decision. At some point, and I don't know when, we'd want to interact, have another public meeting to be able to explore and discuss, as we're kind of refining our direction, where we're going to go. And then we've just got to start writing down -

CHAIR APOSTOLAKIS: I will leave it up to you, Charlie and your colleagues. If you want to come to the Subcommittee again before you have a final decision, but you're almost there, and you want to try it out, feel free to do that. If you want to draft a semi-final document and then come, that's fine, too.

It's always better, it seems to me, to allow enough time for you to work on new stuff if you hear different views, than if you come with a final product and say this is it. So, it's really up to you. I mean, if you request an extra Subcommittee meeting, I think we would be very happy to accommodate, because this is a very important --

MR. ADER: And a lot of the discussion today was kind of a replay of what we've been doing internal, there were some new ideas, and new takes on some of the arguments. But a lot of that debate has been going on between various staff members, and as we get the ROP folks more involved, they'll be bringing in a different perspective, so it's an evolving discussion and process.

CHAIR APOSTOLAKIS: Thank you very much. And on that happy note, the meeting is adjourned.

(Whereupon, the proceedings went off the record at 3:52 p.m.)

Implementation of Risk Metrics for New Light-Water Reactor Risk-Informed Applications

Advisory Committee on Reactor Safeguards Subcommittee on Reliability and PRA

Donald A. Dube, NRC, Office of New Reactors (301) 415-1483

June 2, 2009

Meeting Purpose

Follow-up discussion of issues and options regarding the implementation of risk metrics for new light-water reactor risk-informed applications.

Agenda

- Risk-informed initiatives for new reactors
- High level goals and objectives for new reactors
- Current risk-informed framework
- New reactor implementation issues
- Revised options based on stakeholder feedback
- Preliminary evaluation of options

Risk-Informed Initiatives for New Reactors

- In the near term, risk-informed applications have been proposed:
  - Risk-Managed Technical Specifications
    - Risk-informed completion times
    - Surveillance frequency control program
- Longer term initiatives (post-COL) may include:
  - EPRI research program on risk-informed inservice inspection of piping
  - Special treatment requirements (10CFR50.69)

New Reactor Implementation Issues

- Review of these applications has raised questions regarding the appropriate risk metric acceptance guidelines for implementation of risk-informed initiatives for new reactors.

Relevant Commission Policy Statements

- Severe Reactor Accidents Regarding Future Designs and Existing Plants (1985)
- Regulation of Advanced Nuclear Power Plants (1986 & 2008)
- Commission Safety Goals (1986)

Commission’s Safety Goals (1986)

- Commission’s SAFETY GOALS specify how safe is safe enough
  - Qualitative safety goals
  - Quantitative health objectives
  - General performance guideline for staff examination

Commission's Safety Goals (cont.)

Proposed a General Performance Guideline for further staff evaluation:

"Consistent with the traditional defense-in-depth approach and the accident mitigation philosophy requiring reliable performance of containment systems, the overall mean frequency of a large release of radioactive materials to the environment from a reactor accident should be less than 1 in 1,000,000 per year of reactor operation."

Commission's Expectations for New Reactors

Severe Reactor Accidents Regarding Future Designs and Existing Plants (1985)

The Commission "fully expects that vendors engaged in designing new standard (or custom) plants will achieve a higher standard of severe accident safety performance than their prior designs."

Regulation of Advanced Nuclear Power Plants (1986)

"Furthermore, the Commission expects that advanced reactors will provide enhanced margins of safety and/or utilize simplified, inherent, passive, or other innovative means to accomplish their safety functions."

Risk Goals for New Reactors

- **SECY-90-016 Staff Recommendations**
  - CDF < 1 x 10^{-5} /yr
  - LRF < 1 x 10^{-6} /yr
  - CCFP less than approximately 0.1

- **In the associated SRM, the Commission disapproved the use of CDF <1 x 10^{-5} /yr and approved:**
  - CDF < 1 x 10^{-4} /yr
  - LRF < 1 x 10^{-6} /yr
  - CCFP less than approximately 0.1

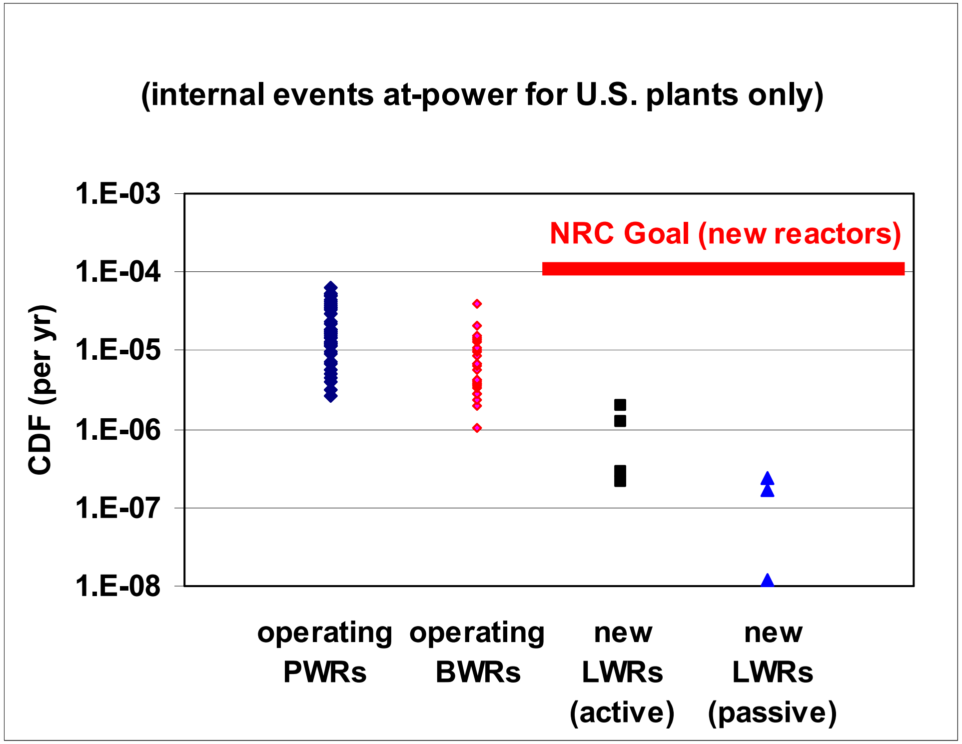
Risk Goals per SRM on SECY-90-016 (cont.)

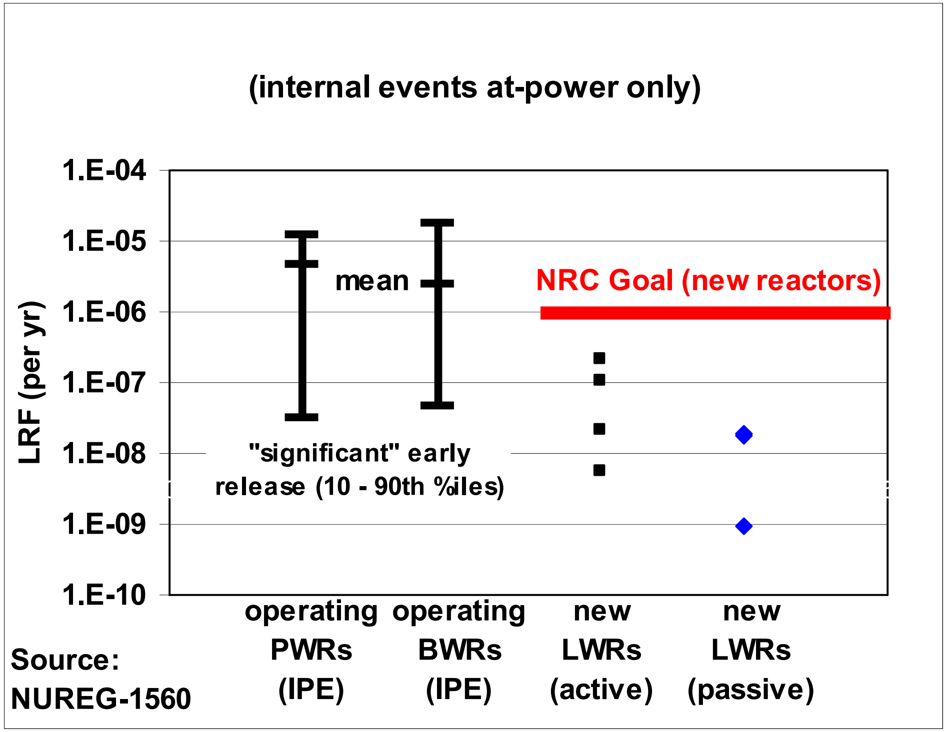
- **In response to staff recommendation on 10^{-5} /yr CDF and 10^{-6} /yr LRF goals, the Commission stated:**
  - **"Although the Commission strongly supports the use of the information and experience gained from the current generation of reactors as a basis for improving the safety performance of new designs, the NRC should not adopt industry objectives as a basis for establishing new requirements."**
- **At the time of SECY-90-016, staff was evaluating alternate definitions for a "large release," but that effort was subsequently terminated.**

Regulatory Guidance for New Reactors

- **New reactor applicants' PRAs are expected to demonstrate how the design compares against the Commission Goals for new reactors**
  - **RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)"**
  - **Standard Review Plan (SRP) Section 19.0, "Probabilistic Risk Assessment and Severe Accident Evaluation for New Reactors"**

CDF and LRF by Plant Type





Current Regulatory Guidance for Risk-Informed Initiatives

- **Regulatory guidance associated with risk-informed initiatives for currently operating reactors are based on Commission's Safety Goals (e.g., RG 1.174, 1.175, 1.177, 1.178, 1.201)**
- **A key principle of RG 1.174 is that "when proposed changes result in an increase in core damage frequency or risk, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement"**

Current Regulatory Guidance for Risk-Informed Initiatives (cont.)

- Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis"

- Risk-Acceptance Guidelines:
  - Baseline risk metrics of CDF and LERF

    AND
  - ΔCDF and ΔLERF due to change

- Basis:
  - Increases should be limited to small increments
  - CDF threshold related to backfit regulatory analysis guidelines
  - ΔCDF limit based on *absolute* change and set close to limit of resolution of PRA models

Risk Metrics for Operating Reactors

– **Core Damage Frequency (CDF) < 10^{-4} /yr**

  - **Surrogate for latent cancer fatalities in the Commission's quantitative health objective (QHO)**

– **Large Early Release Frequency (LERF) < 10^{-5} /yr**

  - **Surrogate for prompt fatalities in QHO**

Some Commission Papers Related to Risk-Informed Regulation

- **See SECY-97-077, SECY-97-221, SECY-97-287**
- **From SECY-97-287:**

"As described in SECY-97-077, dated April 8, 1997, the LERF guideline is derived from the Commission's Safety Goal Quantitative Health Objectives (QHOs) and provides a measure of accident mitigation and assurance that the QHOs are not exceeded. In effect, the guideline value for LERF is a surrogate for the Commission's QHO on early fatality risk. The Commission had also proposed in the Safety Goal Policy Statement a general performance guideline of 10^{-6} per reactor year for a large release of radioactive material to the environment. This guideline was proposed for staff evaluation and the results of the staff evaluation were reported in SECY-93-138, dated May 19, 1993. Although work on defining a large release to be used with a frequency of 10^{-6} per reactor year was stopped (as reported in SECY-93-138), increased NRC management attention will be given to proposed changes that cause LERF to increase by more than one percent of the guideline value of 10^{-5} per reactor year. This will help ensure that the intent of the Commission's general performance guideline is considered in the review of proposed risk-informed changes requiring NRC approval."

From RG 1.174

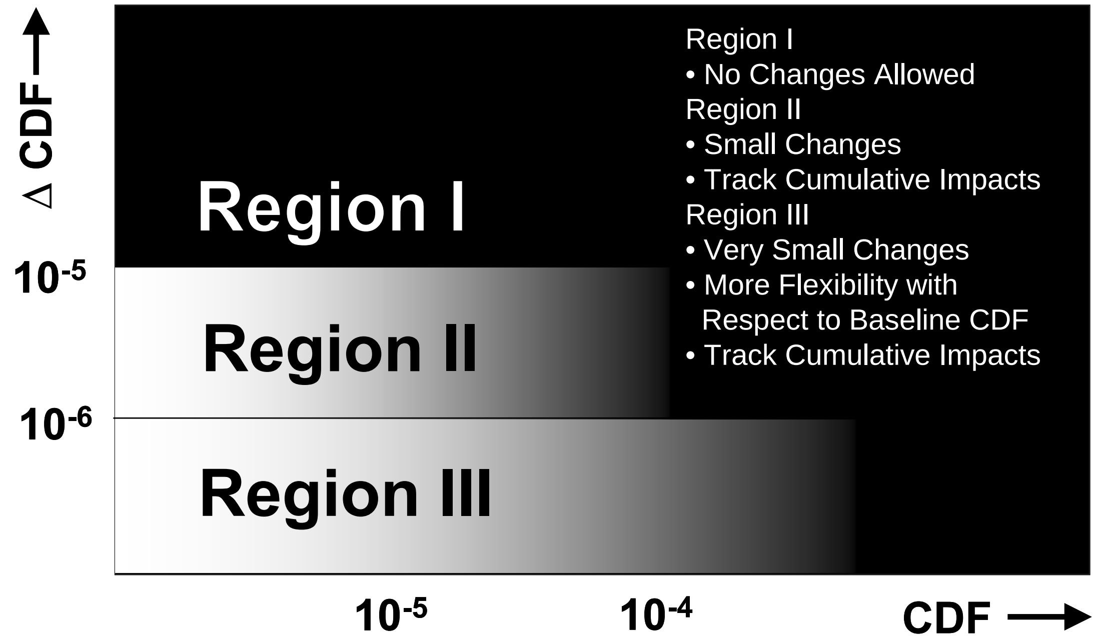


Figure 3. Acceptance Guidelines for Core Damage Frequency (CDF)

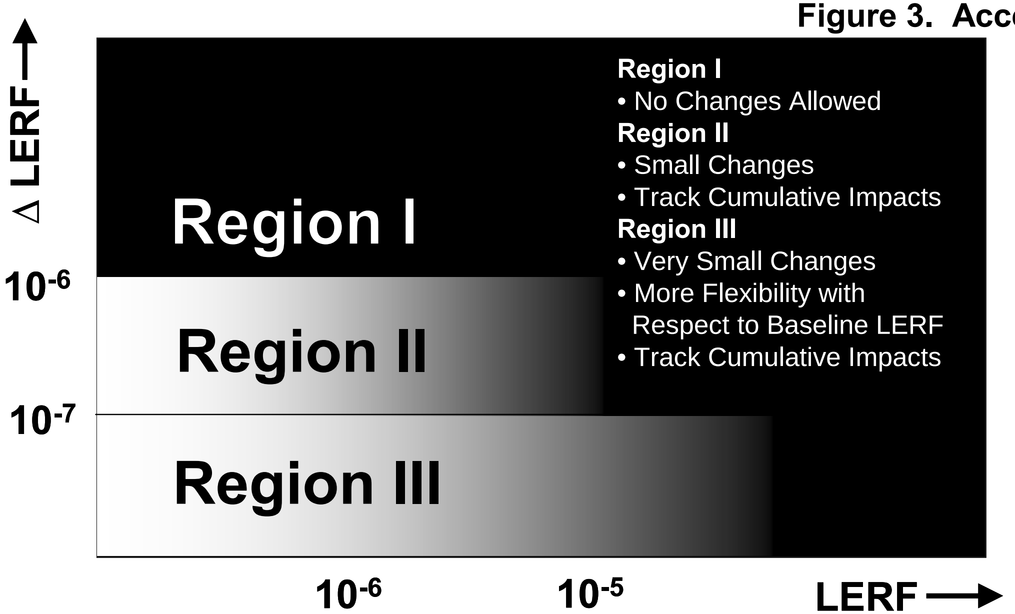


Figure 4. Acceptance Guidelines for Large Early Release Frequency (LERF)

From RG 1.174

- Five principles for making risk-informed decisions
  - The proposed change:
    - Meets current regulations (presumption of adequate protection)
    - Is consistent with the defense-in-depth philosophy
    - Maintains sufficient safety margins
    - Results in an increase in CDF or risk that is small and consistent with the intent of the Commission’s Safety Goal Policy Statement
    - Will be monitored using performance measurement strategies.

Regulatory Guidance (Cont.)

- Other programs, processes, and regulations:
  - Regulatory Guide 1.163, "Performance-Based Containment Leak-Test Program" (specifically, ILRT test interval extension)
  - Regulatory Guide 1.175, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Inservice Testing"
  - Regulatory Guide 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications"
  - Regulatory Guide 1.178, "An Approach for Plant-Specific Risk-Informed Decisionmaking for Inservice Inspection of Piping"
  - Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities"
  - Regulatory Guide 1.201, "Guidelines for Categorizing Structures, Systems, and Components in Nuclear Power Plants According to Their Safety Significance," 10CFR50.69
  - 10CFR50.65, "Maintenance Rule"

Fundamental Issues before the Staff

- Use of current numerical risk metric goals (e.g., LERF) could result in risk-informed applications/amendments being evaluated against less restrictive criteria than those used for the licensing basis of new reactors.

- Current guidance could allow large relative changes to CDF and containment performance.

Issues (cont.)

- Licensing:
  - How should acceptance guidelines for new reactor license applications or amendments proposing to implement risk-informed initiatives consider Commission's expectations:
    - CDF?
    - LRF?
- Operations:
  - Reactor Oversight Process thresholds rely on CDF, ΔCDF, conditional core damage probability (CCDP), incremental CCDP, LERF, ΔLERF, etc.
  - How should risk metrics for new reactor operations consider Commission's expectations?
- Other programs & processes (e.g., accident sequence precursor, Generic Issues per MD 6.4, Regulatory Analysis per NUREG/BR-0058, non-risk-informed license amendment requests, etc.)

➢ Focus on needs for licensing first

Issues (cont.)

- **For new reactors, should the principle of "small increase" be based on *relative* or *absolute* ΔCDF and ΔLERF or ΔLRF?**

- **Should RG 1.174 include an alternate or additional ΔLRF acceptance guideline for new reactors?**

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Issues (cont.)

If LRF is used as an acceptance guideline in risk-informed applications for new reactors, the issue of the lack of a uniform definition of LRF will likely need to be addressed.

LRF Definitions that Have Been Used in New Reactor PRAs

ABWR

No attempt was made to define the term “large release” but the following is considered to be “much less than large” and a surrogate for demonstrating that the large release goal is satisfied:

Whole-body dose greater than 0.25 Sv (25 rem) at 0.8 km (1/2 mile) from the reactor.

Source: ABWR SSAR, amendment 34, Section 19.6.7, p. 19.6-4

AP1000

All containment release/failure categories, except intact containment (IC) and controlled release via containment venting (CFV), constitute a large release.

Source: AP1000 PRA, rev. 8, Table 35-4, p. 35-24

LRF Definitions that Have Been Used in New Reactor PRAs (cont.)

ESBWR

The term “nTSL” is used to represent the sum of all release categories except for TSL, where TSL represents the condition in which the containment pressure boundary is intact and the only source term is that associated with the allowable leakage rate, as defined by the Technical Specifications. For the ESBWR design certification PRA, nTSL is used as a bounding approximation for large release frequency (LRF). Since nTSL captures all releases except for TSL, its frequency is higher than LRF.

Source: ESBWR PRA, NEDO-33201 Rev. 3, Section 8.2, p. 8.2-2

LRF Definitions that Have Been Used in New Reactor PRAs (cont.)

US-APWR

The large release is defined as any containment failure occurrence after the accident. The containment failure modes include containment bypass, containment isolation failure, containment failure due to energetic phenomena, basemat melt through, and containment overpressure failure. The energetic phenomena mean hydrogen combustion, in- or ex-vessel steam explosion, direct containment heating, and rocket-mode RV failure. The large release is also defined independently of the elapsed time from the onset of core damage.

Source: US-APWR DCD, Tier 2, rev. 0, Section 19.1.4.2.1, p. 19.1-49

LRF Definitions that Have Been Used in New Reactor PRAs (cont.)

U.S. EPR

The following guidance, adapted from Appendix A of NUREG/CR-6595, is used to determine whether the release associated with a given release category is "large":

Any predicted I, Cs, or Te release above approximately 2.5 to 3 percent is classified as "large release". The releases associated with all release categories with containment bypass, containment isolation failure, or containment failure at or before vessel failure are classified as "Large".

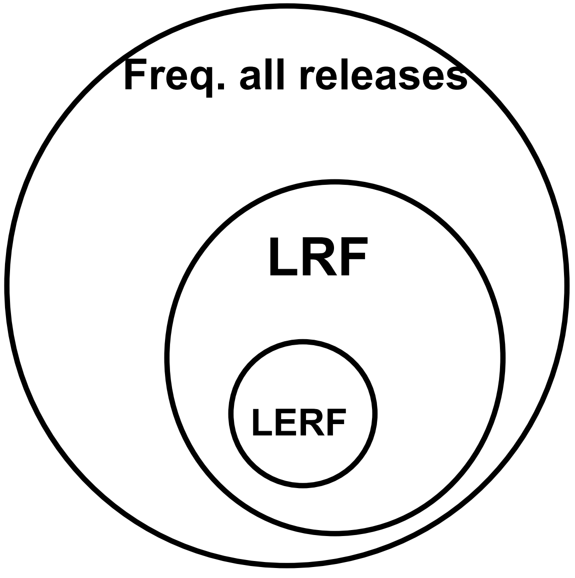
Source: U.S. EPR FSAR, rev. 0, p. 19.1-93

At the April 3, 2009 briefing, Industry provided its perspective

- Preference for *status quo* (same treatment for operating and new reactors)
- Historical derivation of LRF and LERF
- Equivalence of 10^{-6} /yr LRF and 10^{-5} /yr LERF

Perspective on LRF vs. LERF

Logically intuitive definition based on magnitude & timing



Based on evolution of LERF & LRF definitions and NUREG-1150 analysis

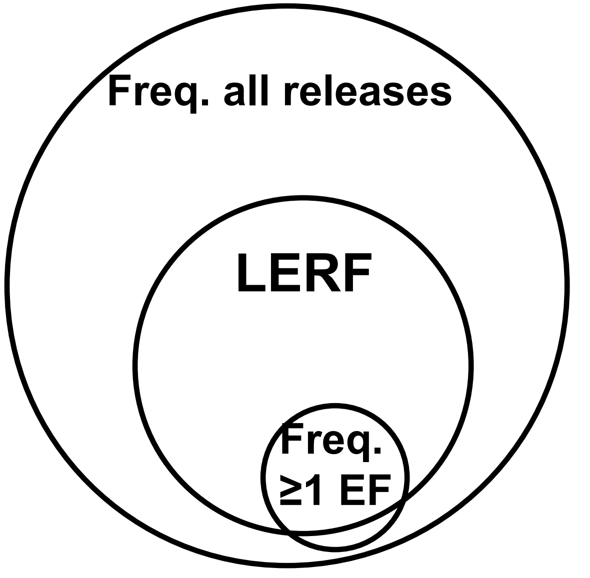


Table 3 of Industry's 3/27/09 white paper establishing ~ 10% conditional probability of LRF given LERF is true if one defines LRF as all releases resulting in 1 or more early fatalities.

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Evaluation Criteria for Modified Options

1. Will the option provide reasonable assurance that the Commission's 1986 Safety Goals will be maintained throughout plant life?
2. Will the option ensure consistency with the Commission's 1985 and 1986 Policy Statements on expectations of enhanced safety for future and advanced reactor designs?
3. Will the option be consistent with the SRMs on SECY-89-102 and SECY-90-016 in that no additional requirements would be imposed on new reactors?
4. Will implementation of the option be consistent with Staff's review against LRF Goal of 10^{-6} /yr for new reactors per the SRM on SECY-90-016?

Modified Options

- **Option 1 Status Quo:** Current acceptance guidelines in RG 1.174 (and associated regulatory guides) would also be applied to new reactors
- **Option 1a: Status Quo:** For first few risk-informed applications to derive lessons-learned
- ~~**Option 2 Convert to *Relative* Risk Changes:** New and current reactors~~
- **Option 3 Reduce Acceptance Guidelines for New Reactors:** Acceptance guidelines in RG 1.174 would be lowered by one order of magnitude solely for new reactors
- ~~**Option 4 Use a Combination of Existing and New Acceptance Guidelines**~~
- **Option 5 (Modified) Use Existing Acceptance Guidelines for Current and New Reactors (*Status Quo*), but Establish an LRF-Based Acceptance Guideline for New Reactors using a Uniform Definition of Large Release**
- **Option 5a: Similar to Option 5 except LRF Impact would be Addressed without an Acceptance Guideline**
- ~~**Option 6 Assess New Reactors on a Case-by-Case Basis**~~

Options in Detail

Option 1 Status Quo: Current acceptance guidelines in RG 1.174 (and associated regulatory guides) would also be applied to new reactors

<u>Advantages</u>

- Provides a consistent set of acceptance guidelines for both existing and new reactors.
- Consistent with the bases for RG 1.174 acceptance guidelines that are derived from Commission's 1986 Safety Goals.
- Would not impose additional requirements on new reactors.
- Acknowledges and gives credit to new reactors for lower risk estimates.

<u>Disadvantages</u>

- May not be consistent with Commission's 1985 & 1986 Policy Statements on expectations that new reactor designs will achieve a higher standard of severe accident safety performance.
- Could result in less restrictive change process than the Commission established for the review of new reactors.
- Option could allow large ***relative*** increases in CDF and LRF compared to the baseline CDF and LRF estimates for new reactor designs.

Options (cont.)

Option 1a Status Quo: Same as Option 1 except that it would be applied only to the first few risk-informed applications

<u>Advantages</u>

- Provides a consistent set of acceptance guidelines for both existing and new reactors.
- Consistent with the bases for RG 1.174 acceptance guidelines that are derived from Commission's 1986 Safety Goals.
- Would not impose additional requirements on new reactors.
- Acknowledges and gives credit to new reactors for lower risk estimates.
- Allows for lessons learned to be factored into the process.

<u>Disadvantages</u>

- May not be consistent with Commission's 1985 & 1986 Policy Statements on expectations that new reactor designs will achieve a higher standard of severe accident safety performance.
- Could result in less restrictive change process than the Commission established for the review of new reactors.
- Option could allow large ***relative*** increases in CDF and LRF compared to the baseline CDF and LRF estimates for new reactor designs.

Options (cont.)

[Option 2 Convert to *Relative* Risk Changes: New and current reactors]

deleted

Option 2 is deleted as the logistics of revising the acceptance guidelines to relative changes, retrofitting the change process to currently operating reactors, the bookkeeping associated with agreeing to and maintaining the official *baseline* risk profile, and other disadvantages far outweigh the advantages.

Options (cont.)

Option 3 Reduce Acceptance Guidelines for New Reactors: Acceptance guidelines in RG 1.174 (and associated regulatory guides) would be lowered by one order of magnitude solely for new reactors

Advantages

- Acknowledges that new reactor CDF and LERF estimates are significantly lower than existing reactors and adjusts acceptance guidelines accordingly.
- Consistent with Commission's 1985 & 1986 Policy Statements on expectations that new reactor designs will achieve a higher standard of severe accident safety performance.

Disadvantages

- May be inconsistent with the underlying technical basis for the current ***absolute*** thresholds in RG 1.174 in that more stringent requirements for changes are imposed.
- Penalizes new reactors for having lower risk estimates.
- Using different ROP thresholds for currently operating and new reactors could cause public perception problems.

Options (cont.)

[Option 4 Use a Combination of Existing and New Acceptance Guidelines]

deleted

For many of the reasons discussed under Option 2, Option 4 is deleted. The logistics of revising the acceptance guidelines to a combination of absolute and relative changes, retrofitting the change process to currently operating reactors, the bookkeeping associated with agreeing to and maintaining the official *baseline* risk profile, and other disadvantages far outweigh the advantages.

Options (cont.)

Option 5 Use Existing Acceptance Guidelines for Current and New Reactors (*Status Quo*), but Establish an LRF-Based Acceptance Guideline for New Reactors using Uniform Definition of LRF

Advantages

- **Consistent with the goals that the Commission established for the review of new reactors.**
- **Provides a consistent set of acceptance guidelines for both existing and new reactors with regard to ΔCDF.**
- **Consistent with Commission's 1985 & 1986 Policy Statements on expectations that new reactor designs will achieve a higher standard of severe accident safety performance.**

Disadvantages

- **Could allow large *relative* increases in CDF and LRF compared to baseline CDF and LRF estimates for new reactors.**
- **Definition of *large release* and possibly *CCFP* would need revision (previous effort to define large release was terminated as not practical or required, SECY-93-138).**
- **Depending on how LRF is defined, may be inconsistent with the Commission's 1986 Safety Goal policy.**
- **Requires significant changes to regulatory guides.**

Options (cont.)

Option 5a Same as Option 5 except that LRF Impact would be Addressed without an Acceptance Guideline

Advantages

- Consistent to a certain extent with the goals that the Commission established for the review of new reactors.
- Provides a consistent set of acceptance guidelines for both existing and new reactors with regard to ΔCDF and ΔLERF.
- Consistent to a certain extent with Commission's 1985 & 1986 Policy Statements on expectations that new reactor designs will achieve a higher standard of severe accident safety performance.
- It would not necessarily penalize safer plants in risk-informed applications.

Disadvantages

- Over time, could allow large *relative* increases in CDF and LRF compared to baseline CDF and LRF estimates for new reactors.
- Requires some minor changes to regulatory guides.

Options (cont.)

[Option 6 Assess New Reactors on a Case-by-Case Basis]

deleted

In view of the pending proposals for risk-informed applications at new reactors (e.g., RMTS, risk-informed ISI), Option 6 of deferring a decision regarding the implementation of risk metrics for licensing applications is deleted.

Preliminary Evaluation of Options

Criterion	Options 1 & 1a	Option 3	Option 5	Option 5a
1. Maintain Commission's Safety Goals?	YES	YES	YES	YES
2. Consistent with Commission's Expectation of Enhanced Safety?	**TO A LESSER EXTENT THAN OPTIONS 3 & 5**	YES	YES	**TO A CERTAIN EXTENT**
3. No Additional Requirements for New Reactors?	YES	NO	**YES, IF LRF=10^{-6}/YR EQUIVALENT TO LERF=10^{-5} /YR**	**TO A LESSER EXTENT THAN OPTIONS 1 & 1a**
4. Consistent with Staff's Review of LRF < 10^{-6} /yr ?	NO	YES	YES	**TO A LESSER EXTENT THAN OPTION 5**

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Summary

- Discussed hierarchy of guidance from Policy Statements to Commission Papers and associated SRMs
- Developed evaluation criteria for options
- Modified options based on stakeholder feedback
- Performed preliminary assessment of each option

Next Steps

- Continued engagement of stakeholders via public meetings (summer 2009)
- Staff to take a position and develop draft Commission Paper with recommended option(s) (summer 2009)
- Additional discussions with ACRS (fall 2009)
- Commission Paper (late 2009 / early 2010)

Risk Metrics for Operating New Reactors

ACRS PRASC

June 2, 2009

Biff Bradley - NEI

Ken Canavan – EPRI

Jim Chapman – Curtiss Wright

NUCLEAR ENERGY INSTITUTE

Background

- Industry white paper provided to staff and ACRS in April
  - Supports NRC Option 1
  - LRF/LERF equivalency (using NUREG 1150 LRF definition)
- NRC revised options slides made public late last week
  - Only limited opportunity for review
  - Will be vetted with NEI new plant working group
  - Initial feedback will be presented

NEI

New NRC Options

- Option 1A – Use existing metrics initially, pending further evaluation
  - Given complexity of issues, this is a reasonable proposal
- Option 5A – Use existing metrics plus large release, but without acceptance guideline
  - Further understanding of staff proposal needed
  - Efficacy would depend on details of large release evaluation process

Reiteration of industry concerns with Option 3

- Inconsistent with NRC policy statements
  - Safety goal policy statement
  - Advanced reactor policy statement
- New risk metrics would penalize new plants
  - Limit operational flexibility (maintenance rule, Tech Specs)
  - Subject plants to inspection and enforcement at levels not corresponding to public health and safety
- New risk metrics would create public perception problems
  - For example, co-located sites with different thresholds for enforcement actions

Reiteration of industry concerns with Option 3

- The proposed risk metrics values could be well within PRA uncertainty bands
- Proposed new risk metrics could truncate ability of new plants to use risk applications
  - Risk informed applications have led to increased safety
- Risk profiles for new reactors are not yet complete
  - Internal events, fire, external events (seismic) and possibly shutdown PRA will be required prior to fuel load

Industry Perspective on NRC "disadvantages" for Option 1, 1A

- Existing metrics of RG 1.174 also theoretically allow changes that could significantly increase operating plant CDFs on a relative basis
- Fundamental concern of "risk creep" has not been demonstrated in practice for operating plants
  - Licensing applications require NRC review and approval and are not carte blanch
  - Many regulatory constraints preclude erosion of risk margin
  - RG 1.174 is not risk based and changes are generally limited by other factors
  - Changes rarely granted outside "very small" range
  - Risk applications contain deterministic backstops, DID considerations, and monitoring requirements

NEI

Industry Perspective on NRC Options 5 and 5A

- Option 5 would require a LRF definition suitable for operational decisionmaking
  - This has not succeeded previously despite years of effort
  - Definition of CCFP is also difficult
- Option 5A would need further definition of large release evaluation process
  - We believe existing regulatory process elements effectively address this

NEI

Industry Evaluation of Options

Criterion	Options 1, 1A	Option 3	Option 5	Option 5A
1. Maintain commission's safety goals?	Yes	Yes, but more restrictive than safety goal	Yes	Yes
2. Consistent with Commission's expectation of enhanced safety?	Yes, in conjunction with other aspects of Part 52	Yes	Yes	Yes
3. No additional requirements for new reactors?	Yes	No (i.e. there would be new requirements)	No (i.e. there would be new requirements)	No (i.e. there would be new requirements)
4.Consistent with staff's review of LRF≤10E-6/Yr	Yes, if NUREG 1150 LR definition is used	Yes, more restrictive assuming LERF/LRF relation	Yes	Would depend on process

Conclusion

- Industry continues to support options 1, 1A
- Option 3 is de facto new safety goal and creates problems as noted
- Option 5 would require a LRF definition suitable for operational decisionmaking
- Option 5A would need further definition of large release evaluation process