[Briefing Charts]

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
OFFICE OF THE SECRETARY

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MEETING OF THE ADVISORY COMMITTEE
ON REACTOR SAFEGUARDS WITH THE
U.S. NUCLEAR REGULATORY COMMISSION

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PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Commissioner's Conference Room
11555 Rockville Pike
Rockville, Maryland
Friday, October 6, 2000

The Commission met in open session, pursuant to notice, at 9:30 a.m., the Honorable RICHARD A. MESERVE, Chairman of the Commission, presiding.

COMMISSIONERS PRESENT:

RICHARD A. MESERVE, Chairman of the Commission

GRETA J. DICUS, Member of the Commission

NILS J. DIAZ, Member of the Commission

EDWARD McGAFFIGAN, JR., Member of the Commission

JEFFREY S. MERRIFIELD, Member of the CommissionSTAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

DR. POWERS, Chairman of the ACRS

DR. APOSTOLAKIS, ACRS

DR. SHACK, ACRS

DR. BONACA, ACRS

DR. KRESS, ACRS

DR. WALLIS, ACRS

MR. GRAHAM LEITCH, ACRS

MS. ANNETTE VIETTI-COOK, SECY

MS. KAREN CYR, OGC

P R O C E E D I N G S

[9:30 a.m.]

CHAIRMAN MESERVE: Good morning.

On behalf of the Commission, I would like to welcome you to today's meeting with the Advisory Committee on Reactor Safeguards.

When we last met with the ACRS, which I think was in March, we discussed a number of issues related to the NRC's initiatives in risk-informing our approach to nuclear regulation.

After the meeting, the Commission requested the ACRS to address the process of selecting the regulations to be risk-informed.

In addition, I understand, over the past several months, the committee

has considered a number of
other issues, including the assessment of the quality of probabilistic risk
assessments, issues related to
spent fuel pool safety, and issues relating to more realistic thermal hydraulic
analytical procedures.

I'm pleased to welcome Dr. Dana Powers, the Chairman of the ACRS, and
other members, who will
address the ACRS perspectives on these issues.

Before we get started, however, I am pleased to announce the appointment
of Mr. Graham Leitch as
the newest member of the Advisory Committee on Reactor Safeguards.

Mr. Leitch brings to the committee a wide array of executive management
and technical experiences
in all phases of commercial power plant operations.

Mr. Leitch has more than 40 years of experience in power generation, of
which 25 have been involved
with nuclear power.

His education includes a Master of Science in mechanical engineering,
with an emphasis on nuclear
engineering, and he's held a Senior Reactor Operator's License at both the
Dresden and Limerick plants.

Mr. Leitch was, in part, responsible for the development of the Limerick
PRA and its application to
the design and, later, to the operation and maintenance of that plant.

Mr. Leitch's experience will certainly be an asset to the committee, and
on behalf of the
Commission, I very much welcome him.

I understand that there is a certain protocol associated with these
events that include the
presentation of a certificate to a new member.

DR. POWERS: This is the well-known first engineering test we apply to
our members, to find a way
to get this home without breaking it.

[Laughter.]

CHAIRMAN MESERVE: Mr. Leitch, allow me to present this certificate to
you.

We have a photographer who wants to take a picture, and I'm not sure how
he's going to do that.

Welcome, and congratulations.

Before I turn this over to Dr. Powers to get us started, let me see if
my colleagues have any
opening statements.

[No response.]

CHAIRMAN MESERVE: If not, Dr. Powers, you may proceed.

What I'd suggest is that we go through the two presentations on
risk-informing Part 50 and on PRA
quality and then have questions and then proceed on from there.

DR. POWERS: Thank you, Chairman Meserve.

We will be continuing our discussions from March, beginning with two discussions in the area of risk-informing the regulations.

Dr. Shack will discuss risk-informing 10 CFR Part 50 and a first application to the hydrogen control.

Professor Apostolakis will discuss quality of PRAs, which I think is an essential feature if we're going to have any practical application of risk information in the regulatory process.

At that point, we will switch to looking at some deterministic analysis, because deterministic analyses are, indeed, the heart of any PRA.

It is essential to have a good understanding of the phenomenology in order to do risk analysis.

One of the areas that it looks like it is feasible to do risk-informed regulation is in the area of decommissioning.

Dr. Kress will discuss the spent fuel pool fire safety, which seems to be the area of greatest risk posed during decommissioning.

We also see that, as we progress along, especially in the area of more realistic analyses of plant safety, that the issues of thermal hydraulics and the computer codes used for thermal hydraulic analysis are assuming greater importance, and Professor Wallis will discuss some of our observations about the thermal hydraulic tools that are available to the industry and the staff.

We do not have any plans to discuss license renewal, but we've included some material on the current status of our efforts in license renewal, both because it's a statutory responsibility of the advisory committee and we know many of the members have interest in the progress in those areas, and that material is included simply for your information.

We are prepared to discuss it if there are any questions.

Other than that, I propose we move directly into the area of risk-informing the regulations, and we will follow your strategy and just do the first two presentations and treat them as a group.

So, I'll turn to Dr. Shack.

DR. SHACK: Okay.

I'd like to discuss some of our recent activities on risk-informing Part 50.

We've met with the staff and stakeholders in subcommittee meetings in June and July and have had full committee meetings in July and September to discuss a number of topics, including NEI's recommendations for the prioritization of the regulations for assessment and

revision.

We've also discussed the staff's framework for risk-informing the technical requirements for the selection and prioritization of regulations to be assessed under option 3 and their first attempt to apply that framework to the risk-informed revisions to 10 CFR 50.44 concerning the combustible gas control systems.

We've also been briefed on the public comments on the advanced notice of proposed rulemaking for 10 CFR 50.69 and its associated Appendix T.

On this particular topic, we've discussed in a previous letter some of the technical considerations associated with the categorization of components, and we've had presentations from South Texas and Palisades, where they've applied two different methods towards the categorization of components into the Risk 1, Risk 2, Risk 3 kind of space.

We still have some technical concerns there. We believe that the staff and South Texas and Palisades have provided workable solutions to addressing that problem and that the categorization can be done.

There's a number of issues that were raised in the SECY associated with the public comments that we haven't addressed as a committee yet, so we don't have formal positions.

I would like to say just a few things about them.

One of them concerns the level of prescriptiveness in the so-called Appendix T, which describes the categorization process, and as I mentioned, we've seen two different categorization processes, one from South Texas and one from Palisades.

Both of them seem technically acceptable to us, and we believe that, however it's done in the rule, that there should be the freedom to choose alternate processes to proceed with the categorization.

We also have, in the past, expressed concern about ossifying technology by incorporating it into rules, but as I said, the committee really hasn't prepared a formal position on the prescriptiveness of Appendix T and whether it will be preferable to do that as a regulatory guide.

At the time of our meetings, the determination of appropriate treatments for the Risk 2 and 3 components was also still an evolving process, and so, we don't have an official committee position on that either.

We would note that we, you know, do believe that, if the categorization is robust, that Risk 3

components are not found to be risk-significant, that that is, in fact, the most important, and the rule should be written to recognize that, and it may be that there is a certain linkage, that the option 2 and option 3 are coupled here and that you will have to address more than 50.69 to proceed with option 2, but we believe that the risk information should be used.

In terms of the NEI recommendations for the prioritization of the regulations and recommendations, in our report on the NEI letter, we noted that input from industry was valuable -- again, they probably are the best judge of benefits in terms of reduced burden from regulation -- and that this should be considered by the staff in developing their priorities, but we believe that the selection of prioritization really should be based on a comprehensive assessment of the potential impact for changes.

The framework document that we've been considering, that the staff has been developing, includes consideration of defense in depth in terms of a balance between prevention and mitigation, treatment of uncertainties, an approach to a more consistent determination of what constitutes a adequate safety margin.

Since the document is still an evolving process, we have not yet completed our review on it, but we've agreed that the staff should proceed with the trial application of the framework to the development of risk-informed changes to regulations.

The first one was 10 CFR 50.44, and in our report on the proposed revision to 50.44, we agreed with the staff that there's little or no safety benefit associated with some of the requirements in 10 CFR 50.44 and these constitute unnecessary regulatory burden and recommended that the staff be directed to proceed with rulemaking on 50.44.

Because this was an example of how the framework was going to be used, we did suggest that there should be perhaps an expanded discussion of just how these considerations were used in the development.

We also had some internal discussions that, in some ways, this was perhaps not the most critical example of using risk information, since much of the understanding here was really a better understanding of the phenomenology, that once you understood what was important, you could see which portions of the regulations were relevant and which were irrelevant almost without a formal risk calculation.

So, it was almost a revision driven by a better understanding of the phenomenology rather than

formal risk considerations, although again, understanding the phenomenology does, in fact, tell you which portions are risk significant and which aren't.

Again, the results of the study that the staff did on 50.44 should help them disposition the petition for rulemaking on 50.44 that they've received.

We do plan in the future to continue our review of the proposed framework document, since we do feel that it's important to have a consistent process for considering these regulations and all the impacts -- again, we find that, every time we address these rules -- and that's one of the drawbacks of the approach we've taken in looking at a rule, is that there are linkages, and again, you do need, I think, a formal framework to consider all the linkages and impacts of these changes, and we haven't completed our assessment of the framework document but believe it's promising enough that the staff should continue to proceed with examining.

As I say, they've applied it to 50.44, and in considering, essentially, applications to the emergency core cooling system, which we will be reviewing in December, again, much of the emphasis there is, again, on a new definition of the large-break LOCA and how that may impact the emergency core cooling rule.

That completes what I wanted to say.

Again, in many of these, we're still in progress; we haven't yet developed formal committee positions. So, you may get some opinions from members of the committee but not a formal ACRS position.

DR. POWERS: Professor Apostolakis, do you want to go ahead?

DR. APOSTOLAKIS: Thank you.

Regarding PRA quality, we reviewed the ASME standard last July and the staff's SECY 00-0162 in September. This week, we discussed and reviewed the NEI certification process and the staff's views and comments on the ASME standard, as well as the recently-issued UCS report.

Some general observations before we come to actual recommendations:

We all know that PRA is a very ambitious undertaking. It attempts to model the whole plant, including all sorts of failures that are irrelevant to the particular metric of interest, and of course, the most complete PRA is a level 3 PRA that includes all modes of operation and has rigorous uncertainty and sensitivity analysis.

On the other hand, real life tells us that many, many regulatory decisions do not require such a

complete PRA, and the process as described in Regulatory Guide 1.174 recognizes this, and of course, the integrated decision-making process utilizes PRA as one of the inputs, along with other things such as defense-in-depth considerations and so on.

Given all this and, in particular, the ambition of PRA, we believe that it is very, very difficult to define a good enough PRA a priori for particular applications, and of course, the applications are of varied nature, and it's difficult to anticipate what the needs will be in the future.

Now, regarding the ASME standard, the committee concluded that it was not a traditional design to engineering standard or procedures guide, and this was not intended to be a criticism.

We don't think anybody can actually write anything like that, and the staff will need to make a case-by-case assessment of the adequacy of the PRA that is submitted in support of a particular petition.

The categories that the standard proposes should be delineated more clearly, and we are fond of uncertainties, so we'd like to see a better discussion of those, uncertainty quantification, not of uncertainties. We are not fond of uncertainties themselves.

The discussion of the categories, especially, there was a section in the standard where examples of regulatory applications of the various categories were listed.

We very quickly realized that you could not really claim that category X was sufficient for application Y. So, we suggested that this particular section be deleted, or at least that particular part of it.

And we were a little bit puzzled by the notion that one could submit supplementary analysis as needed for applications, and there was no guidance as to how these supplementary analyses were supposed to be performed.

Regarding the staff's positions as expressed in SECY 00-0162, we agreed with the staff that they should continue with the current process of reviewing PRAs, and we were happy to see that they also stated very clearly that the PRA must be judged in the context of the decision that the PRA supports.

The SECY had two attachments.

Attachment 1, PRA scope and technical attributes, was -- we found it to be a useful high-level tutorial exposition on PRA technical attributes. Of course, it's a standard in the traditional engineering sense.

But we were really impressed by Attachment 2, which had offered a collection of examples of risk-informed decisions and how risk information was utilized, and we recommended that the staff expand its collection of such examples and try to draw some conclusions so that we will have an input from real applications as to how risk information has been utilized, because this, as I said, a particularly thorny issue.

Now, how do we move forward?

We start with the truism that we should focus on points of agreement rather than disagreement.

However, here this is very true, because as you're aware, the last -- at least for the last year, there has been significant disagreement between the staff and the ASME group, and others, possibly, regarding the various proposals regarding categories or grades and so on, but if you really look at the various documents that these groups have published, there is agreement as to what I would call a baseline PRA could be.

If you look at Attachment 1 in the SECY, there are certain requirements that are listed. When you go to the ASME standard, very similar to what you see under categories 3 and even 2, and yesterday, we discussed the NEI certification process, grade 3.

So, all these seem to converge. I'm sure there will be some discussion about details, but we feel that, if we focus on these points of agreement and recognize that, if we have a baseline PRA that meets everybody's notion of what a baseline PRA will be -- and again, there will be some discussion about that but not as heated as the discussions we have seen -- then I think it will be -- the primary purpose of doing this, which is to expedite reviews and save the staff time so that the industry will get answers quickly to their petitions -- I think we will go a long way towards achieving this.

In fact, we can go beyond that.

The industry's position, as expressed to us, is that, sure, everybody would like to have a great PRA, but can we do something with what we have now?

Yesterday, we had a presentation by representatives of NEI, and we thought it was -- they described the process they went through, their peer review process for a particular PRA, and they ended up with a number of comments, and the comments were categorized as A, B, C, D, and S. "A" is something that you

really have to do to bring the PRA up to the current practice and then "B" was something that should be done but it's not urgent, and so on.

Now, if we take, say, an IPE that a licensee has and it goes through this process and you have the list of comments, then the licensee may ask, well, how can I use what I have right now?

Well, for a particular application, you may decide that the most important comments, "A" and "B", perhaps, do not really apply, so you can use what you have now. But for other applications, perhaps you should take care of comments of category "A" and then use your PRA.

In other words, you don't have to have a perfect PRA and respond to all the comments either way.

It seems to us that a combination of these things, the staff's views in a SECY document, the ASME category 2 and 3 requirements and the grade 3 requirements from NEI and this way of reviewing -- we're not necessarily saying that the certification process should be lifted and used as it is.

But the idea, as I just described, that seemed to be reasonable -- I think a combination of those can very quickly lead to some document that would be acceptable to all parties involved, so we'll make progress.

And then, at the same time, as we recommended, if the staff creates this collection of real examples and how PRAs have been used in the past, we will combine these experiences, and I'm pretty sure -- we are pretty sure that this will lead to something reasonable and the issue of quality of PRA will finally be resolved, and of course, this approach would have to be consistent with the requirements of Regulatory Guide 1.174, but I believe it will be, and I think this is the formal comments.

CHAIRMAN MESERVE: I'd like to thank you both.

Let me turn to my colleagues for questions. Let me do a round of questions, and then we'll proceed.

Dr. Diaz?

COMMISSIONER DIAZ: Thank you, Mr. Chairman.

Dr. Shack, you said something at the beginning that I would like you to amplify on it.

First, let me show my lack of understanding of the English language by bringing focus to the words "shall be," "should be", or "could be."

You stated that the risk analysis or risk information that leads to the categorization of, say, category 3 should be that -- and I'm going to use my words in here -- to determine, in fact, or to

establish what category it is.

Would you like to expand on whether you think that "shall be" -- whether it should be -- how far do you want to present to the Commission your views of whether we are ready to say, yes, we've done an analysis and we believe this is in category 3 and that should be what determines what requirements are for that structure, system, and component?

DR. SHACK: As a personal opinion --

COMMISSIONER DIAZ: We value your personal opinions.

DR. SHACK: -- I believe that we should develop a categorization process that is robust enough and conservative enough that, when we complete the categorization process, we believe the results.

COMMISSIONER DIAZ: And so it shall?

DR. SHACK: It shall.

COMMISSIONER DIAZ: All right. Thank you, sir. That's all I wanted to know.

Dr. Apostolakis, how do you propose to define a good enough PRA, since the issue keeps -- you know, you said it could be subjective.

Do you have any suggestions on, you know, what actual process finally the staff might have to end up with to say this is a good enough PRA?

DR. APOSTOLAKIS: I believe the practice will show us what's good enough PRA.

We have already made decisions using risk information, and wherever the risk information was not sufficient, we invoked other principles, as the regulatory guide requires, and I think, you know, the practitioners do have an idea as to what is a PRA that is up to the kind of state of the art, does not necessarily use the latest models, and doesn't have to.

So, that's why we are proposing this idea of, you know -- there seems to be agreement that you have to look at the initiating events, you have to have a reasonably complete set, you have to use plant-specific data, there are ways of doing this, widely used. Let's start with that. Let's have a baseline PRA.

Now, that doesn't mean everybody will have it right away, but in the certification process or something like that, we'll identify where you're doing a very good job, where you need to do more, where, you know, it would be nice to do better, and then use -- first of all, eventually you will have to respond to all the comments, but it turns out that there are certain applications where some deficiencies are

irrelevant, and we know that. We are already doing it.

If I want to worry about, say, extending the outage time of a particular piece of equipment, I don't know that I need to have a state-of-the-art seismic analysis, for example. Somebody might come up with a crazy example, but I think it's reasoned, really.

COMMISSIONER DIAZ: So, you're using a principle that, yes, the quality of the PRA should be proportional to the risk involved in the application.

DR. APOSTOLAKIS: Yeah. The part of the PRA that is being used for the application should be of good quality.

COMMISSIONER DIAZ: But proportional to whatever the --

DR. APOSTOLAKIS: And the scope, yeah, sure.

COMMISSIONER DIAZ: Then, you know, after you put all these things together, I believe the ACRS has recommended that the staff's review be applied.

Are we going to be able to determine how far should we go in this -- do you think, when this process is -- when we have the standard and the certification process and some, you know, review, that we'll be able to say this is what should be reviewed by the staff?

In other words, can we bound what the staff review is going to be?

DR. APOSTOLAKIS: I think that the staff review will always be required. The question is, how do you facilitate that?

I think if what we just discussed is in place and the staff does it one, two, three times, then this review will be very quick, but I don't see a situation where the staff -- where the licensee will come and say, well, this is -- the PRA information we're giving you is grade 3, therefore you should give him an answer tomorrow.

I don't think that can happen, but de facto, because it is grade 3, the staff review will be very quick. I think that is something to be expected.

COMMISSIONER DIAZ: All right. Thank you.

CHAIRMAN MESERVE: Commissioner McGaffigan.

COMMISSIONER McGAFFIGAN: On the quality of PRA, how do you get the public to buy into the notion that a PRA is good enough? How do you -- how much of this is going to have to be documented?

You talk about these reviews and categories A, B, C, whatever, comments -- does that all have to be in the docket, so that somebody who is an interested member of the public can understand the staff's thought processes, and why they thought that a PRA in this instance was good enough for the application, and how much of that has to be documented?

DR. APOSTOLAKIS: This is definitely a crucial issue, and we realized it this week when we were reviewing the UCS report that was issued last August, which relied a lot on IPE summaries, because those were publicly available.

The committee reached the conclusion that there must be a way -- we have to find a way that the public at large can have access to risk information that is being used in risk-informed decision-making.

The committee did not go as far as recommending that this information be docketed. The issue of ossification that Dr. Shack mentioned came up again in that context.

Do we have a recommendation how to do it? At this time, we do not.

However, we recognize this is a very crucial issue, that the public should have access to the information that is being used, and just by saying, you know, we have fault trees but we can't show them to you, that is not the right way to go.

COMMISSIONER McGAFFIGAN: The docketing -- once something is docketed here, it starts getting ossified?

DR. APOSTOLAKIS: Yes.

COMMISSIONER McGAFFIGAN: Is there no way that something can be put forward and not be a -- you know, locked in, you know, that people recognize that this is going to be changed, you know, as they respond to comments A, B, C, D categories, and this is a snapshot in time and we put it on the docket just to give you a snapshot as to -- I don't know what docketing means around here, but up in the Congress -- I'm looking at Commissioner Merrifield, you know, we get a document, and we realize it might not be the same document six months from now.

DR. APOSTOLAKIS: The impression right now, Commissioner, is that this is not the way it works. If we manage to change that and say that, yes, you can submit something now, put it in the docket, and then, you know, six months later, you can change it, I don't think that people perceive that as practical.

COMMISSIONER McGAFFIGAN: Maybe we can make a PRA exception for docketing.

I brought this up when we were -- we had Mr. Lochbaum before us last week --

DR. APOSTOLAKIS: Yes.

COMMISSIONER McGAFFIGAN: -- and it's clear that there's an awful lot of information out there, that there are less than wonderful PRAs out there.

You know, I think you all recognize that from some of the IPEs, but that

may be old and dated
information, the industry says we spent a lot of money, we have this peer
review process or peer review
processes, dominated, I guess, by the individual owners groups, there's been
improvement, but we don't --
no one knows quite how to make that -- last week, I think I got Mr. Lochbaum
invited in and out of a plant
when they're going to do one of these. He wanted to make sure he could get
out.

[Laughter.]

COMMISSIONER McGAFFIGAN: When they do one of these peer reviews, they
might well bring him along
and let him see that.

I believe our own staff should be going along. I guess we're going to
start doing that again, and
we did some early, and then I guess we lost touch with this process, but
there's got to be some way that
this becomes, you know, more transparent.

DR. APOSTOLAKIS: We agree with you.

COMMISSIONER McGAFFIGAN: How good a PRA do you need for option 2?

DR. APOSTOLAKIS: Excuse me?

COMMISSIONER McGAFFIGAN: For option 2, the categorization of systems --
does that have to be a
pretty darn good PRA or is it a medium-quality PRA, or what do you need?

DR. APOSTOLAKIS: Well, what you need is a grade 3, in my view, or at
least category 2 in the ASME
standard, but there may be a way out of it, and the way out is to rely, again,
on the expert panel that
will make conservative decisions.

Of course, any time you get away from a systematic, quantitative
approach, you are relying more on
subjective judgements of, you know, expert people, there is no question about
it, but expert judgement is
not as transparent as an analysis.

So, I don't want to say that it's an absolute must that you have to have
category 2 or a grade 3
PRA to do it, although in principle, that's what you should have, because of
this flexibility of being, you
know, conservative when you go to the expert panel.

DR. POWERS: I think it's fair to say that, in our discussions with the
certification process, one
of the things we thought was a necessary condition was a PRA that could capture
the dominant sequences in
the plant and identify the critical systems that led to that risk dominance,
and in examining their
categories, we had questions about whether the lower level of certification
could, in fact, capture those
things that would be essential for a categorization in option 2.

COMMISSIONER McGAFFIGAN: Just one last brief -- for the hydrogen

combustion example, option 3,
first example, what quality PRA do you need? Presumably it's a little lower
than what you need for option
2.

DR. APOSTOLAKIS: I think Dr. Shack said that it's mainly understanding
the phenomenology.

COMMISSIONER McGAFFIGAN: Right.

DR. APOSTOLAKIS: So, I'm not sure that the PRA really played --

COMMISSIONER McGAFFIGAN: -- much of a role at all.

DR. APOSTOLAKIS: Yeah.

COMMISSIONER McGAFFIGAN: The interesting thing is the place that's --
the thing that's driving
option -- PRA quality at the moment is option 2, which is nearer-term, in some
sense, than some of the more
distant option 3 stuff, and the first option 3 thing is straightforward from a
PRA.

Thank you.

CHAIRMAN MESERVE: Commissioner Merrifield?

COMMISSIONER MERRIFIELD: Thank you, Mr. Chairman.

First, I'd like to start off by thanking Dr. Shack for the time that he
and his staff took on a
recent tour that I had of Argonne National Laboratories.

The work that they are conducting for this agency, which amounts to
about $5 million a year, is of
significant value, and certainly wanted to publicly recognize that.

During our meeting last Friday regarding option 2, Mr. Beedle,
representing NEI, raised the
proposal of a risk-informed option for Part 54, and I was wondering if you had
any views on that proposal.

DR. SHACK: A personal view, I think it's appealing, myself, at least at
first glance.

You know, if we've decided these components are not risk-significant,
then I think the special
treatment requirements and the aging management programs are of less
significance, but I must confess that
I haven't thought through all the implications of that.

But in our own previous discussions of license renewal and how one would
begin to risk-inform it,
that seems to be one of the initial approaches that seems appealing and
straightforward once you've
convinced yourself that you -- if you can do the categorization for the
operating plant in the first 40
years, it doesn't seem that it can't be brought forward.

COMMISSIONER MERRIFIELD: Recognizing you haven't spent that much time
on it, one of the concerns
that was raised counter to that was that we have a license renewal process that
is functioning rather
smoothly right now, and I think there's concern among some that that may

complicate that process, and I didn't know whether you'd thought about that one at all or that might be further thought down the road.

DR. POWERS: There is a general belief that the license renewal process necessarily becomes risk-informed as the operating plants become risk-informed, so it's an inevitability in that direction, and I believe it's a compliment to the staff working that that they have developed the process they think they can accommodate that evolution.

Now, a more precipitant creation -- well, anytime you choose something precipitant, it's liable to cause delays in a smooth operation process, there's no question about that, but I think, with the experience that's coming along, that probably it would be possible to accommodate it.

COMMISSIONER MERRIFIELD: The next question I had regards -- you know, we did also discuss NEI's peer review process for their PRAs, and this is an issue that falls sort of under Dr. Shack and Dr. Apostolakis.

What is your thought on that? Do you have any thinking that ACRS may have a role in the interplay of that effort?

DR. APOSTOLAKIS: I don't know what you mean by the ACRS having a role, but --

COMMISSIONER MERRIFIELD: Well, as Commissioner McGaffigan talked about a little bit, there's a notion that NEI is doing this on their own.

There's discussion about whether David Lochbaum should or shouldn't be given an opportunity to view some of that process.

There's a thought that our staff should take a more significant role in reviewing that or at least keeping an eye on what's going on.

And so, following along that train of thought, is there some thinking that you, as the ACRS, as well, should have a view to that process to see whether it has the rigors that are appropriate.

DR. POWERS: I would just interject that, following our discussion, representatives from NEI invited the ACRS, any member that was interested in participating, on one of their review processes, to get a good look at it.

At the end of the meeting, I got together with that representative, and we looked at some schedules to look if it wouldn't be possible for one of us to attend that.

In that regard, I think the only way you can really understand all the nuances of this peer review

process -- and there are a lot, and I appreciate how difficult it is to write this down -- is actually to participate, and I think it would be a very edifying experience, enough so that I'm looking at the schedule myself.

DR. APOSTOLAKIS: I am less enthusiastic about learning much by visiting and attending, observing one particular review.

The quality of the review will depend a lot on who the reviewer is.

In yesterday's presentation, there was no doubt in my mind that the reviewer was very good, and also, as I said yesterday, you may have a Heisenberg effect here.

The fact that we are there observing may affect the process itself.

And I really would come back to what Commissioner McGaffigan said.

There has to be a way that these results should be accessible somehow.

Now, we don't know how to do that yet, but there has to be a way of finding out what comments were made, how the utility responded, and so on.

The application that was presented to us yesterday was very good, there's no question about it. The comments and everything they did was excellent.

I mean if the whole process is like that and we get convincing evidence that that's what it is, I'm all for it, but I have reviewed PRAs myself, and I know that, you know, sometimes things are done in a better way and other times.

There is, for example, this requirement in the NEI document that the peer reviewers should have so many years of experience, so many years of this, so many years of that.

Well, I know people who have been wrong for a long time.

[Laughter.]

DR. APOSTOLAKIS: So, the years of experience cannot be the only criterion.

So, there are details like that.

COMMISSIONER McGAFFIGAN: Al Gore and George Bush agree.

[Laughter.]

DR. APOSTOLAKIS: They have to be worked out.

COMMISSIONER MERRIFIELD: There are so many comments that could be made relative to that.

Let me make one final question, and I'll stop.

In the meeting that we had last Friday, the staff seemed to indicate that there have been some recent breakthroughs relative to the ASME PRA standard.

They didn't go into any level of detail about these breakthroughs, and so, I'm wondering if you all have been briefed on that process and whether you share the feeling that they are breakthroughs, or what is your general reaction to where that process is going?

DR. APOSTOLAKIS: Yes, we had a brief discussion yesterday.

The staff presented to us the recent developments, the information of the group, and the principles that they have.

It was very high-level, it seemed promising, but again, it will all depend on what comes next. But so far, I think it's fine. We think it's fine.

DR. POWERS: I think one of the things that they presented -- I don't know whether they presented you -- how much detail they presented you, but staff has formulated what they call the requirements that a PRA standard should meet in some well-articulated fashion. I think that's a tremendous step forward.

I think a lot of the floundering that was going on on formulating these standards -- because no one was exactly sure what the requirements would be -- if we have agreement on those, then I think progress will come fairly quickly here.

So, I see an enthusiasm now for a path forward on this.

COMMISSIONER MERRIFIELD: Thank you, Mr. Chairman.

CHAIRMAN MESERVE: Dr. Shack, I have a question on something that is touched upon the ACRS's July 20th letter, but you made only passing reference to it today, which was the 50.46 and Appendix K work.

You had a fair amount to say about that in the July 20th letter, and my question is really prompted by the intersection of two of our briefings today.

You had suggested that -- ACRS had suggested that if they go forward and risk-inform 50.46, that perhaps things like the double-ended guillotine break would not be the defining event that would drive the analysis, that there might be other sequences or events that would be more significant from a risk-informed basis, and I'm curious that -- and this has been offered -- 50.46 has been offered up as one that should be examined, because it is one that, if it were risk-informed, there might be significant or meaningful burden reductions that would be associated with risk-informing that rule.

My question arises, is that there's a later briefing that Dr. Wallis is going to give us about using best estimate codes for doing these sorts of analyses, which I would assume would get you in a similar place in that they -- presumably, best estimate codes would lead you to some increased margins that you would observe under existing procedures, and that, in itself, would give you an opportunity for relaxing the standards, and we're already doing that in that we're allowing that to go forward.

I'm just asking the question, is that if you're proceeding with the

effort to use best estimate codes, do you anticipate that there, in fact, will be significant burden reduction with going forward with trying to risk-inform 50.46?

That may be something that Dr. Wallis would like to comment on, as well.

DR. SHACK: Well, you know, in our July letter, we really were looking and assessing the NEI statement, that that was one of the leading ones to risk-inform, because we weren't quite so clear as to what the actual benefits would be, that NEI expected very large benefits from risk-informing 50.46.

We had no formal presentation on just where these benefits were coming from.

Part of our speculation was, you know, we weren't clear just where the benefit would come from.

The thought was that, in fact, changing the defining accident from a large-break LOCA would, in fact, make a substantial difference, but we really haven't explored that in detail yet.

DR. WALLIS: Well, 50.46 will be a much more substantial test than the last one we had of risk-informing regulations.

In terms of best estimate, there's a lot of overlap between the PRA issues and the other code issues, the thermal hydraulic code issues.

The question is, how good do things have to be in order to support a robust decision, and what are the uncertainties associated with that decision?

It's not clear that making a better analysis and understanding the uncertainties better and narrowing the uncertainties and so on will necessarily lead to reduction in margin; you have to do the analysis first.

CHAIRMAN MESERVE: Well, I don't mean to prejudge that, of course.

The simple-minded view --

DR. WALLIS: If you are trying to reduce margin, if there's a pressure to do so, then you have to be much more knowledgeable about how close you are to some limit.

DR. SHACK: I guess, in the simple-minded sense, you know, whether you calculate the insult by a conservative method or a best estimate method, it still makes a difference how big the insult is, and at the moment, we calculate the insult -- you have your choice of a conservative method or a best estimate method, but if, in fact, you decided that you really could reduce the insult and use the best estimate method, then you may get --

DR. POWERS: It seems to me the change that would be precipitated in

going to a more risk-informed approach to 50.46 -- first, I will reiterate, I don't think you can do 50.46 by itself.

You do need to go look at the general design criteria, that, in fact, changing 46 by itself will not change what the plant has to do one iota.

Second of all, once you do that, once you do say what's a more realistic design basis threat, it is not so much that you're reducing burden, but you're changing the focus of that burden from areas that may have very little risk significance to things that have a great deal of risk significance.

For instance, if your defining event becomes a station blackout, then you're paying attention to the station blackout things and not the integrity of piping or the ECCS systems.

I think that's going to be the advantage.

I think that whether one calculates a design basis event using a best estimate technology or a more conservative technology simply changes the ability to focus on the areas that have the greatest risk significance.

If there's burden reduction from that, that's a fallout that clever engineers are going to be able to find at the plant.

I don't think you find it through the regulatory process.

I think you find that through the design process.

CHAIRMAN MESERVE: Let me emphasize, I'm not suggesting it might not be useful to risk-inform 50.46.

I just asked the question about whether the foundation which has been presented to us is necessarily going to hold true.

Let me ask Dr. Apostolakis a very quick question, and this may reflect, again, a simple-minded view of the staff's aspirations which may not be accurate, but I think that the hope was that, to the extent we could have a robust PRA standard, that there then would be minimal need for the staff to invest its time in detailed investigation of the PRA whenever there was a licensing action that was premised on the PRA.

From the first part of your presentation, I got the sense that that's probably a impossible task and that one certainly would have to look at the quality of the PRA against the decision that's being made, and to a certain extent, you do have to get into the meat of it.

The end of your talk, you expressed some hope that, with the development of a consensus PRA standard, acceptable peer review process -- you later brought up the expert

panel -- maybe that this is all going to work out, but I think that the nugget I should draw from this is that the aspiration to be able to say, all right, this black box is satisfactory because it's met the standard and has gone through these various processes is going to be sufficient for relying on it -- that's a hopeless expectation.

DR. APOSTOLAKIS: No, I don't believe the staff will ever treat it as a black box, but if the licensee complies with the standard, an agreed-upon standard, then it will happen naturally that the review will be more expeditious, because the staff will start reading and say, well, gee, yeah, it makes sense, yes, we've seen this before, and it will happen by itself.

So, I probably gave you the wrong impression in the first part of the -- but there has to be a review, though. There has to be a review.

CHAIRMAN MESERVE: Commissioner Dicus.

COMMISSIONER DICUS: Okay.

To Dr. Shack, or to the whole committee, I've heard a few rumblings of late of some amount of concern on the part of the industry in going to risk-informing Part 50 and whether or not we might be moving too fast and whether the industry is backing off a little bit.

Have any of you picked up on anything along those lines?

Dr. Apostolakis is shaking his head yes.

DR. APOSTOLAKIS: Yeah, I've heard that.

COMMISSIONER DICUS: Yeah.

DR. APOSTOLAKIS: It's optional, is it not?

COMMISSIONER DICUS: It will be optional. I think that's the position we've taken.

DR. APOSTOLAKIS: They don't have to do it.

DR. SHACK: Well, we heard yesterday that 78 plants are going to apply for risk-informed ISI.

COMMISSIONER DICUS: That sounds good.

DR. SHACK: They're very enthusiastic.

DR. APOSTOLAKIS: But it confirms that it is optional.

COMMISSIONER DICUS: Okay. And to Dr. Apostolakis, we've been talking about -- Commissioner Merrifield and the Chairman -- bringing up the standard for PRAs.

Given the fact that ANS is working on it, ASME is working on it, NEI is working on it, everybody is working on it, will we get there?

DR. POWERS: Too many cooks spoiling the broth?

[Laughter.]

COMMISSIONER DICUS: Something along those lines.

DR. APOSTOLAKIS: The way we're going now, no.

COMMISSIONER DICUS: Okay.

DR. APOSTOLAKIS: If we keep trying to limit a priori what is needed for a decision, the risk information that is needed for a decision, no, we'll be debating this forever.

That's why we are recommending that let's forget about that and look at the baseline PRA, because I think there is a lot of agreement as to what constitutes a baseline PRA, and I think the certification process, with the categories of comments, offers a great way for the industry to utilize what they have now, what they will have next week, and what they will have a hear from now, to actually get some benefit from it.

COMMISSIONER DICUS: So, what do we do to get there, since we have all these other pathways ongoing? I mean what can the Commission do?

DR. POWERS: We saw from this task group that the ASME put together that they feel like they have to move to a smaller writing group, because they sense that, in their previous drafts, where they have disparate groups putting together and then they try to fuse it by compression, is breeding difficulties in people understanding it as a coherent whole.

So, it's clear that they have worried about the too many cooks spoiling the souffle a little bit, so it gets deflated.

So, they are looking for a little more compact writing group.

I'm not in a position to judge the insight, but it sounds very plausible to me that, having established a set of agreed-upon requirements, then a small writing group can put something together, then move to a larger group to help hone that coherent whole.

So, I guess I came away with an enthusiasm. Similarly, I think that they are paying more attention to that inventory of case studies that they have in setting up the requirements.

So, I guess, if I were to give you a recommendation, be patient.

[Laughter.]

COMMISSIONER DICUS: For how much longer?

DR. POWERS: This is not an easy tour, and I know that, when we did what's called the PRA procedures guide, that there was a great deal of gnashing of teeth and a large number of cooks working on that one.

It was a very difficult chore, but I think maybe they have -- I came aware sharing the staff's belief that there was a well-lit path forward here.

DR. APOSTOLAKIS: Another thing, Commissioner, that is important to mention is that sometimes you read a document from an organization and then you have a briefing by that

organization and they are two
different things.

I did read the NEI certification process. What I heard yesterday was not entirely consistent with what I read. For example, I heard things like, yeah, eventually we would like everyone to have a grade 3 PRA.

Well, that's not in the document. The document takes an entirely different approach, and I happen to agree with the presentation.

[Laughter.]

DR. APOSTOLAKIS: So, I'm glad we don't have to write a letter on that.

I think Dr. Powers is right regarding this new initiative to get a smaller group together and so on, but I still think that, if the group tries to define categories or grades in advance, they will never get anywhere. There is much more agreement as to what constitutes a decent baseline PRA, and I think the certification process offers a great way of identifying things you have to do to get there and things you can do right now to get the benefit of risk-informing your own regulations, the licensees.

DR. SHACK: I'd just add one comment.

I think there's a shift away from sort of -- you know, they're focusing now on identifying the quality of the PRA.

Some of the earlier discussions were too concerned with classifying what you could do with the PRA, and I think that there's likely to be much more agreement and a much less aggressive approach if you simply try to describe the quality of the PRA, and then, once you've done that, you can decide what you can do with that PRA and what you can't do with the PRA, rather than trying to determine a priori how good a PRA do I need to do this.

You know, you first assess the quality of the PRA and then decide what applications you can address with it and how you would apply it, and I think that will reduce the contention.

DR. APOSTOLAKIS: There was a second instance yesterday, by the way, where the written document was different from the presentation. It had to do with Mr. Lochbaum's presentation. What he presented was very different from what is in the report.

COMMISSIONER DICUS: Thank you.

COMMISSIONER MERRIFIELD: We find that quite frequently.

[Laughter.]

CHAIRMAN MESERVE: Well, why don't we proceed to the next subject?

DR. POWERS: I think we can turn now to the issue of spent fuel pool fire safety.

Dr. Kress?

DR. KRESS: All right.

We did review the spent fuel poor fire safety with respect to decommissioning plants. This was at your request. So, as usual, we did give it our best shot, which we would have done whether you requested it or not.

The purpose of this technical study that we reviewed was to -- for the staff to be able to use it as a technical basis to develop a rule.

This is to avoid having to deal with a number of exception requests, and the basic issue is, of course, as time goes by and the decay heat lessens, it's clear that the risk of the spent fuel in the pool decreases, and the question is how long do you have to wait before the risk is sufficiently low to be acceptable enough to relax the requirements, and the key words in that statement is, in my mind, acceptably low, just what does that mean.

The staff had basically two acceptance criteria for this.

First, they equated spent fuel fire, rightly so, to a LERF, because the spent fuel pools are all located outside of containment, and it would be a LERF if you had one.

The acceptance criteria they chose in this particular document was one that's in Reg. Guide 1.174. That's 10 to the minus 5 frequency per reactor year. And I'll have more to say about that in a little while.

The second criteria they used was, after how long do you have to wait before the risk is basically nonexistence, it's negligible?

That would be a time in which the decay heat is insufficient to overcome the heat losses at a temperature that the clad -- zirconium clad cannot ignite, and the temperature they used for that was 1,555-degree Kelvin.

The ACRS had problems with both of these acceptance criteria.

The major concern, I think, was with the Reg. Guide 1.174 acceptance criteria.

As you know, that was based on being a surrogate for prompt fatalities that you get when the core undergoes a core melt accident, but that's in a steam environment, and the source term you get from a steam environment core melt accident can be quite different than the source term you get from an air environment, and there's some evidence for this. It's not definitive in the sense that you get real quantitative rates,

but there's a lot of evidence that an air oxidation environment does two things to you.

Number one, it tends to volatilize a lot of the non-volatile elements that you don't get in the steam environment. These are things like, particularly, ruthenium, but it can be other elements -- lanthanum, molybdenum, barium, strontium even -- and the evidence is that you release much more of those than you do in a steam-related environment, and in fact, you may get quantitative release of the ruthenium.

Another phenomenon occurs under air oxidation conditions. We call it decrepitation.

Because of the different oxide states that the fuel can exist in, the grains tend to go to different oxide levels as they become oxidized, and these different states of oxidation are incompatible with each other in the grain structure, and the grains tend to just flake off, and these very small particulates can be airborne and carried away with the natural convection forces.

The thing about these very small grains of fuel is that they carry with them their load of fission products, no matter what the volatility is, and they carry with them the actinides.

So, these can have significant health consequences, and basically, it wasn't included in the risk analyses that were made.

The other major concern with the ignition temperature for the time at which the risk become negligible is that it's based on tests with basically fresh clad. It's known very well that clad that resides in the core over the refueling period gets highly hydrided, and metal hydrides, zirc hydrides reside in the surface layer and in the depth of the zirconium.

If you've had any experience with metal hydrides, you know, in a moist environment, you can take small particles of it and throw it in the air and it will self-ignite. It's very, very combustible, and the question is, if you actually do these tests with hydrided clad, would the ignition temperature be as high as 1,555-degree K? That's a very high temperature.

We think it would be lower. That's based on -- partly, on our part, on speculation, partly on things we know about metal hydrides, but there haven't been any definitive tests, and we think that more information is needed to decide that.

Our conclusions, based on the review and these concerns we have, is that with the air oxidation

environment, you would get equivalent releases of the volatiles -- that's the cesium, the iodine, the tellurium and the xenon and krypton, but you're likely to get much more releases of the non-volatiles, particularly ruthenium, and possibly significant releases of actinides.

The significance of that is that some of these actinides and non-volatiles have relatively long half-lives and are biologically very effective, as effective as iodine, and that, for example, if you were to assume that you released 100 percent of the inventory of the ruthenium, as opposed to just the source term that exists, that people use for steam environments, then the prompt fatalities would have increased by 100-fold over what the study had.

In addition, the latent cancers would have increased by fourfold, and land contamination would have -- the dose equivalent would have doubled.

So, it can be very significant, and what that does is put into question the LERF acceptance criteria that's in 1.174 for application to these accidents.

It no longer becomes a surrogate for the prompt fatalities. It has to be lower.

How much lower?

We need a better phenomenological study that includes these releases and does a prompt fatality and land contamination and latent cancer level 3-type analysis to get a new surrogate for the prompt fatalities and these other objectives based on the proper physics, and we also think more information is needed on the ignition temperature to pin down the actual time at which you can assume the risk is negligible and you can relax the requirements a great deal.

So, basically, that's the story.

CHAIRMAN MESERVE: Thank you very much.

DR. WALLIS: I'm going to talk about thermal hydraulic codes.

I have five transparencies, and the first four of them -- what I've tried to do is to describe the situation enough so that it's informative and then to have a bottom line at the end of the slide. Somehow, in the preparation of what was sent to you, the highlighting of the bottom line disappeared, but I think it's going to be pretty clear what is the bottom line.

And then the fifth slide has some of the observations that we have made in looking at codes recently, followed what would be a set of bottom lines or recommendations.

So, the first transparency that you have gives some very brief background on thermal hydraulic codes.

They are the major tools for figuring out what happens in an accident.

We don't do experiments with reactors, so we have to rely on these things, and that obviously makes them important.

The predictions of these codes are not tested on full-scale systems.

Again, we don't do experiments with reactors, unless you count TMI as an experiment, and therefore, it's very important that the verification and assessment be done right, so that there's some confidence in the predictions of these codes.

Long ago, in the days of Appendix K, the way that uncertainty was handled was to require very conservative predictions of margins, and they were picked with some sort of judgement that they were big enough that we could make proper decisions without worrying about the uncertainties of these codes, and then there was what I think is the enlightened amendment in 1988 which said, well, this extreme conservatism probably isn't the right way to do things, let's be realistic, and so, let's have codes which are realistic -- in other words, they don't make conservative assumptions.

But in that case, we have to know how good they are. So, we have to make some attempt to emphasize the uncertainty in these codes.

The term "best estimate" is probably best not used, because there's nothing particularly "best" about the estimates in these codes.

Well, that wasn't used very much, although it was a good idea, until the Commission moved in the direction of risk-informing regulation, and I think, perhaps, also, industry realized that, by being realistic, there might be some benefit, doing away with lots of these conservatisms.

So, the reason that we're interested in codes today is essentially because risk-informed regulation requires a better understanding of how good they have to be and what's the criteria for their acceptability. That's the bottom line.

There is an interest in the codes because of the move toward risk-informed regulation, and also, what's happening in terms of industry's actions, applying for upgrades, changes in the regulations, narrowing of margins, there's a need for the Commission to understand better how narrow those margins are.

Essentially, there's a risk associated with the code giving the wrong answer.

So, what is happening today? We'll move on to the second slide.

The industry is submitting codes, and three of them I've listed in your documentation, and the

staff, simultaneously to reviewing these codes, has been developing a reg. guide and a standard review plan in order to structure the review of these codes and make that process efficient and effective.

The ACRS has been involved in all of the above. We have had submissions from -- we have had presentations from industry. We have read great piles of documents. We've read thousands of equations and so on.

And along the way, the staff has listened to our discussions with industry, we've had presentations from the staff, we've interacted with the staff, and so, the ACRS has had, I think, quite an influence, and the point we're at now is the reg. guide and the standard review plan are either out there for public comment or they soon will be, I'm not quite sure, but they've reached that point, and our view is that they deserve to have reached that point, that a lot of work has gone into them and they are good.

The key question, of course, is are the codes good enough to support the decisions to be made, and that sounds like a simple statement, but when you look at the implications, you have to be very careful that you go into the details, and the other point which ACRS would like to emphasize is the public confidence side of this.

These codes and the documentation, although proprietary, get out in the public domain and people make presentations at conferences and so on, and if it appears that shortcuts have been taken, assumptions made which might not be justified or something, then this gets out there, and don't underestimate the need for confidence in the technically knowledgeable community.

Now, what are these codes? They've been around a long time, 30 or 40 years, essentially. This goes back to the ossification comment made earlier, that somebody made an assumption, in order to get on with things 30 years ago, it's still there.

One reason it's still there is because the NRC blessed it, and reversing that sort of regulatory history and doing something better is difficult.

But you know, codes and computers have evolved immensely, the most dynamic sector of the economy and technology.

So, one might expect some changes over the years.

These codes are essentially designed for nuclear applications. They're not commercial or academic.

What I mean by that is that they're not something which is routinely used by industry across the

board, subjected to investigation by students and professors and tested, and therefore, it's got a great broad base of technical support and verification.

It's very much a nuclear thing, and because of the complexity of the phenomena, the codes contain all sorts of assumptions, idealizations, best-shot estimates, choices by users, and so on. The user effect is one of the things to worry about. Different people using the same code get different answers.

But they've evolved. They're a useful engineering tool, and up to now, they've been good enough, but it's hard to figure out just why they've evolved the way they have and why decisions were made, and so, if you go back and examine them, that's not so each to check why they are good enough and why they're the way they are.

So, the bottom line of this slide is that they work, they're engineering tools, but they're not like stress analysis of beams or something. They're not something which is routine, which you just put in the equations and it works, and that leads on to the next transparency or the continuation of the same transparency.

For some accidents, it doesn't matter very much. Small-break LOCA, you have a pot of water boiling, it's mostly steam, at later stages coming out of a hole. There's a very simple phenomena. It doesn't matter too much to get the details right.

But for some phenomena, you do have to get the details right, and some of the codes can be way off if you look at the details.

So, there's always a bit of uncertainty, particularly if you apply them to a new situation.

So, they have to be assessed for every application. You cannot give a blanket approval to a code. You have to look at its use and see if it's good enough for that purpose and make extensive checks to see what happens if another assumption is made, if some different correlation is used, and so on.

You have to do a lot of checks of the robustness of the predictions versus what goes into the code, and the bottom line here that the Commission, I think, should probably recognize already is that what's key to all this, because of the judgements needed in making these decisions, is the knowledge, experience of the staff.

So, the staff needs your support, and you need to be sure that you have staff who are really

knowledgeable about these things.

And also thoroughness is a feature here. They have to be thorough in their review, because it's not trivial to make these assessments.

What are some of our observations in what we've seen in the last couple of years?

Some of the code documentation is poor.

A simple example: Equations should not appear before the ACRS which have obvious typos in them. They've been reviewed by numerous people, and this gives not the right impression.

Physical basis for analytical models is often incomplete.

We get codes submitted where an analysis is made for a straight pipe, long straight pipe, and there's no connection made between that and the real geometry of a reactor in the documentation, and we have to go through a presentation for that to come through.

Now, it surely should be better to start with saying we're analyzing a reactor, it has these various shapes, and this is how we go about analyzing those shapes, and there's a disconnect if the only analysis presented is for a straight pipe.

The assessment: Assessment often consists of rather qualitative assessment, looking at some figures showing a curve that goes through or close to some data.

With the more realistic approach, it would be much better to say this experiment validates this aspect of this code in this way and enables us to get an understanding of how good it is and what the uncertainties are.

So, our view is that the assessment needs to be more focused, and by the way, all these observations, I think, are shared by the staff.

Methods for calculating uncertainties: There's a great deal of advance since the early days in terms of putting uncertainties into the code so the code itself can tell you how uncertain the predictions are, and we believe some progress could be made in that direction.

Our view, as I've said before, is that not only should the documentation be considered as acceptable by the industry, but it should be acceptable to someone looking in from outside, like an ACRS member or a consultant, for instance, or someone who just happens to get hold of that or happens to read a report on which it's based.

Think of the graduate student. Graduate students should be impressed by what he or she sees.

So, to reiterate, risk-informed regulation is going to need a more quantitative evaluation of these

uncertainties in the code and what their consequences might be, and this isn't necessarily bad.

It may be that some of these issues can be resolved pretty quickly by showing that results are insensitive to assumptions.

We are concerned about the database for assessment being preserved.

Experiments were done in the past; not many experiments are done now or likely to be done in the future, and yet, because of the uncertainties in the physics, the codes must be tested against reality. So, the database that's there must not be lost, and in some cases, it may need to be expanded.

We're concerned about experts. There are three kinds of experts.

Experts in industry: Some of the teams in industry working on these codes are rather slim, rather few people, and the expertise that was there in the heyday of code development is no longer there.

We're also concerned about the staff maintaining enough experts, and the third kind of expert is the expert who is out there who can be put on an expert panel.

Unless the field is active, the people who did the work 30 or 40 years ago won't be around to be on these expert panels.

Now, what's the conclusions, then, of this part of my talk?

We recommend -- we strongly recommend that the staff should run the vendor codes themselves. It's not enough to just look at the curve presented by industry. You don't know what went into it, what assumptions were made, what's the effect of making a different assumption, doing something differently.

It's very inefficient to use the RAI process, the request for additional information, where a staff member has a suspicion that some variable might be important, has to go back and persuade industry to run some new test to some new code and then look and see whether what comes back is good enough or not.

The staff should be able to run the codes, try things out, and maybe that will satisfy them in a much more efficient and quicker way than the process of going back to industry.

We also believe the staff should maintain its own in-house code competence and have its own code, and the reason is that how a code performs depends on so many things, including the basic structure of that code, that there needs to be an independent code which the staff really understands which can be run in order to do some independent checks, and this is the way that things are found out.

Otherwise, they just have to use judgement and try things, and this can

be done quicker.

Nowadays, computer codes run so quickly, there's no reason the staff shouldn't have codes, even at the desk-top level eventually, where they can run a lot of experiments with codes and satisfy themselves that the decisions they going to make are robust.

It was mentioned in connection with another issue earlier that the processes in use by the NRC should encourage the improvement of codes, there shouldn't be this ossification, and we are looking into that. There are mechanisms for improving codes, but it doesn't seem to be easy enough for that to happen.

And the final point, eventually there will be a new generation of codes.

If you look at what's happened in computational fluid dynamics, heat transfer out there in the world, there's been an explosion of companies developing codes not for nuclear purposes, being used all over the place by industries, and running million-node computations rather than hundred-node computations of single-phase flows.

So, eventually, something better is going to come along, and the NRC better be ready for it.

CHAIRMAN MESERVE: Thank you both.

Commissioner McGaffigan.

COMMISSIONER McGAFFIGAN: Listening to your presentation, Dr. Wallis, these codes that are before us, where there are obvious errors in the equations, etcetera -- how soon will they be endorsed?

I mean how much do they have to fix things before you would advise the staff that this is now in a position that you could endorse it as a realistic code for regulatory application?

DR. WALLIS: I can't predict time. They have to essentially give us enough confidence that they know what they're doing and the results are robust.

COMMISSIONER McGAFFIGAN: Have they chosen to engage you at that level?

DR. WALLIS: It's been sometimes a little difficult. I would have liked to have seen more enthusiasm, saying yes, we'll go away and fix it, and we'll be back next week, and that would be possible, but it hasn't happened.

COMMISSIONER McGAFFIGAN: These are all proprietary codes.

DR. WALLIS: That is one of the problems, I think.

COMMISSIONER McGAFFIGAN: So, this is one of the times where the staff really, with you guys but not much other help, has to plow through this.

DR. WALLIS: That's right.

COMMISSIONER McGAFFIGAN: Is there any help in Europe? Are these codes also used and presented to

European regulators?

DR. WALLIS: Well, the NRC ones are.

COMMISSIONER McGAFFIGAN: But the ones that are currently before us, the EPRI codes or whatever --

DR. WALLIS: Yes, we sometimes pick up some evaluation. In fact, there are publications where they've been tested against certain data, yes.

But in terms of digging into the individual equations, we've found we had to do it, and we've been rather surprised that it doesn't seem to have been done before. The ACRS should not have to do that.

COMMISSIONER McGAFFIGAN: Right. But you are.

Dr. Kress, you talk about the possibility that the LERF goal has to be significantly lower than 10 to the minus 5. I think your words were "much lower." Is 10 to the minus 6 much lower? What number is much lower for purposes of this application?

DR. KRESS: Well, there's two interesting aspects to that.

Number one, the 10 to the minus 5 value is the summation of all sequences contributions, and here we're dealing with a set of sequences.

Now, what fraction of that 10 to the minus 5 do you want to give to a set of sequences? You don't give the whole 10 to the minus 5.

So that's item number one. You automatically ought to reduce it to some level.

COMMISSIONER McGAFFIGAN: Aren't we talking about -- in a normal plant, we've got all sorts of things that can go wrong, and here, all we have left is the spent fuel pool.

DR. KRESS: We're talking about its contribution to this whole 10 to the minus 5.

If you want the whole plant to have a 10 to the minus 5 --

COMMISSIONER McGAFFIGAN: There is no rest of the plant there, as I understand it. We're talking about a shut-down plant.

DR. KRESS: I'm sorry. In that case, you're right.

COMMISSIONER McGAFFIGAN: Right.

DR. KRESS: But I failed to mention that this is not just a decommissioning problem. You have the spent fuel pool there during the operating plant.

COMMISSIONER McGAFFIGAN: Right. I understand.

DR. KRESS: Okay.

So, you know, you need to deal with that issue for the operating plants but not for the decommissioned plants, you're right. You could take the whole 10 to the minus 5.

I really don't know how low it's going to be, and that's one of the things we've asked the staff to

-- they need to come up with a value for that, and if I looked at just the ruthenium releases and if it were 100 percent, it would be two orders of magnitude lower than that to be a prompt fatalities surrogate, two orders of magnitude, and that's for the ruthenium, but it's for 100 percent.

That doesn't include the possibility that actinides might get released by the decrepitation process, because I have no idea how much that is or how much that contributes to the release.

So, it's a question of I don't think we have enough information yet. We only use what information is out there.

COMMISSIONER McGAFFIGAN: This whole accident -- I mean we're not talking about difficult fault trees or anything in this instance.

DR. KRESS: It's a relatively simple PRA.

COMMISSIONER McGAFFIGAN: It's seismic, right?

DR. KRESS: Yeah, seismic.

COMMISSIONER McGAFFIGAN: Seismic event, catastrophic failure of the pool, all the water drains out.

So, if I can prove to you, even if it's two orders of magnitude, that my earthquake probability is less than 10 to the minus 7 per year, then I'm still in good shape. Is that right?

DR. KRESS: I think you would have to assume that, yes. You have very little defense-in-depth, and you have to ask what's the uncertainty in that calculation, but I think that's the only out that you have, really. You either have to continue with the full amount of protection that you have -- you can't relax the requirements -- or you have to get to a state where you're relying completely on prevention, as opposed to mitigation.

COMMISSIONER McGAFFIGAN: I'll quit in a second.

There are some profound issues here, because what you could be saying is that we, for some of the previous licensees, backed off on some of these requirements too soon.

DR. KRESS: Yeah. I didn't say that, but it would be nice to go back and revisit the exemptions that we have. Time is a wonderful thing here.

But you want to be sure that, if more exemption requests come in, that the technical basis for granting those is good. So, that would be a reason for going back and revisiting what we did before.

DR. POWERS: I think it's important that we not mislead about the state of understanding of the phenomenology, though.

We understand the phenomenology from laboratory-scale experiments and some experiments that have been done in Canada.

Professor Diaz chuckles because he knows that, when you take laboratory experiments and add them together to make an integrated facility, some things go a little different, don't they, Professor Diaz?

That's what we're asking the staff to do, to take into account the information that's been gathered in the studies in Canada and, more recently, in Europe and to address those in an integrated accident analysis fashion and, from that, give us a source term, because if we just use the laboratory source terms, you can get some horrific numbers, but we wouldn't do that in any accident analysis.

It's only revealing some phenomena that needs to be included.

DR. KRESS: That's a good statement of what we meant.

CHAIRMAN MESERVE: Commissioner Merrifield.

COMMISSIONER MERRIFIELD: Thank you, Mr. Chairman.

Mr. Kress, I want to go back to your presentation. You struck a number of areas where you had concerns about where the staff was coming from and could be interpreted as the staff is not being conservative enough.

On the other hand, in the letter that you report that the ACRS sent to the Commission April 13th, you talked about a concern relative to the conservative treatment of seismic issues, which takes us the other way, and this was one sentences or two sentences but a very important point in there, and you talked about how risk-informed decision-making regarding spent fuel pool fire issues should use realistic analyses, including the uncertainty assessment.

So, let me see if we can -- was it an attempt to sort of balance things here, and although it was only one sentence in a long letter, was your intention for that to take a larger role, and if so, what kind of response have you gotten from the staff on this issue, and where do you think we're going at this point on this and any other issues?

DR. KRESS: First, with respect to the balance, yes, I perhaps didn't do as good a job with my view-graphs in providing that balance, but we did think the seismic risk part of the thing was a bounding conservative one and that, by fine-tuning that, you can gain a lot.

I don't know if you can get to the two orders of magnitude, and I don't know if you need to get down that far, but that, to me, is a way out of this particular problem, if you

can show that the seismic
risk is much -- the seismic frequency driving this risk is much lower than the
bounding calculations that
were done.

So, that would be one thing, and what was the second part of your
question?

COMMISSIONER MERRIFIELD: Has the staff gotten back to you about their
progress?

DR. KRESS: We do have a subcommittee meeting scheduled.

We haven't heard back from them as to what they've done with respect to
our comments or how they've
re-analyzed this risk.

We just haven't heard.

They have been very responsive to our questions, and they certainly
understand our concerns, but we
haven't heard back from them yet. So, I don't know what the status of that is.

COMMISSIONER MERRIFIELD: All right. Well, I appreciate that.

DR. KRESS: We're quite anxious to find out what they've done since
then, and in our October
subcommittee meeting, we'll find out.

COMMISSIONER MERRIFIELD: I appreciate the clarification on those
concerns. I was struck, having
read the slides, if we had a member of the public who was video-streaming.

DR. KRESS: I'm very glad you brought that out, because that balance
does need to be there.

COMMISSIONER MERRIFIELD: Okay. Thank you.

Dr. Wallis, on the issue of -- I want to go to your slide 54.

These are rather damning accusations about our codes, and I know you had
some observations about
some things, some generic things that we can be doing to get better, so to
speak, but as a regulator, I'm
somewhat curious as to how to address in a more specific way the observations
you're making on page --
slide 54 to understand where we need to go. I didn't quite get there with some
of the generic suggestions
you were making.

DR. WALLIS: Well, I think you have to support the staff in their
attempts to require adequate
quality in these areas.

You're asking what you can do.

COMMISSIONER MERRIFIELD: Support the staff how?

DR. WALLIS: Well, if the staff requires certain level of documentation,
then -- or if they need
more people in order to do this work, then maybe in some way you can help them
there.

If you make it clear to them that you're behind them in the need to
assure quality in these areas,
then I think that that would help them.

COMMISSIONER MERRIFIELD: Well, it may be worth some further reflection

on your part if the committee has some specific recommendations for actions that the Commission can take to reach these goals.

DR. WALLIS: Personally, I'm surprised that the ACRS should have to notice these things, and it's even more surprising if the Commission has to get down to the documentation in the code. So, really, it's more a question of helping the people whose job it is to make sure that it's done right.

COMMISSIONER MERRIFIELD: The point I'm trying to make is you've made some very specific observation about the quality of the codes, and we, as the Commission, confronted with that concern, had to figure out how to act, and simply saying support the staff is not going to get us there.

So, I don't want to go over that anymore. I think it would be worthwhile for you to go back to the ACRS and think about if you have any specific issues that you want to talk to.

DR. KRESS: One comment about that.

The reg. guide and standard review plan that we've seen, that's out for public comment, maybe, is a very good step to resolving some of these issues. We think those are very good insofar as you can support the staff in those two areas.

COMMISSIONER McGAFFIGAN: It does strike me that the burden is on the licensee, that we don't need to put a lot of burdens on the staff, the burden is on the licensee. We're not going to approve these codes for use as realistic codes until they get the equations right and they fix all these problems.

The word should go out from this meeting that there's a standard that's going to be applied and it's going to be a standard that's maybe not super-high, maybe not the profession standard, but it's going to be -- these codes have to pass some sort of muster and that's what we pay the staff to do.

The unfortunate thing in this case is that it's a proprietary thing, so they don't get any help from anyone else, and maybe the thought that Dr. Wallis and others could help us with is how to bring other people, other eyes.

DR. WALLIS: I think if it were not proprietary, if it were in the public domain, then you'd find these things wouldn't be there.

COMMISSIONER McGAFFIGAN: Because graduate students and everybody would be working on it, perfecting them.

COMMISSIONER MERRIFIELD: My only concern is, you know, they're valuable

observations, it's just a
matter of what do we as a Commission go from here, and maybe we need to direct the staff to do something or
ask the staff to come back to us with something.

DR. POWERS: One of the areas to be aware of is I think the staff makes a heroic effort to overcome
poor documentation and physical basis, and I think we're very excited about the way they go about acquiring
the codes and exercising them and learning the code themselves to overcome these things, but it takes time,
and I think it's important not to set unrealistic expectations for the time it takes the staff to do things
like this, and I think we're going to see this in not only the area of applying realistic analyses for
design basis analysis, but I think it will come to the fore in certification of new reactor designs, that
when we're setting our schedules recognize that thermal hydraulics is going to be a big time consumer.

COMMISSIONER MERRIFIELD: Mr. Chairman, I want to get one last question in, and this is of a
different nature, and I want to direct it to Dr. Powers.

In the slides -- and you didn't, obviously, have as much time as you might have wanted -- you talk
about some of the near-term activities in the ACRS, and you mention in your report to the Commission
activities that you have underway relative to the NRC's research program.

As you and I have discussed in the past, I believe that previous ACRS reviews would have been more
beneficial to the Commission had they not only focused on research that we should be doing but also on
research that we are doing that is not really necessary given its limited value.

Could you describe where you are in the current review you have underway and give us any
significant insights you've gained so far?

DR. POWERS: Yeah.

We are just now initiating our work on reporting to the Commission on the safety research program
that the agency has in place.

Commissioner Merrifield and I have had discussions on where the research report would be of most
use, and in fact, we will report in two aspects: the status and review of the need and progress for the
ongoing research program, most of which has been initiated as a result of user needs, and the longer-term
confirmatory or anticipatory research that we think would assist the Commission in the efficient and
effective execution of its mission.

Your particular request of me is a particular item in our objectives for

that research report. So,
we are going to try to address that.

Our meeting with the staff to discuss the ongoing research programs and future work, plans and
research, is to be held on November the 1st.

We are now reviewing the write-ups on the existing research programs.

I am happy to tell you that one of the observations that comes immediately from this is to see that
there's been growth in the research in the probabilistic sciences. At the same time, I see some of the
historical research that's been done for a very long time in the agency -- I see reductions in that taking
place.

So, I think that we're seeing a research program that's more closely directed toward the
Commission's objectives than I have seen during my tenure on this committee.

Those are the insights I would feel comfortable giving you right away.

I hope to have a lot more after our report gets drafted, but your particular interests on what
would be useful for you is clearly being addressed in this research report, and similarly, I appeal to all
the commissioners, if there are particular topics that you'd like to see us address in the research report,
communicate those to us so we can factor it in.

Now is a particularly good time, since we're right on the beginning of the effort to produce a
report.

COMMISSIONER MERRIFIELD: I appreciate that update.

One final note: Although you and I had discussed that, it's not a self-serving interest. I think
that's information that's helpful to the entirety of the Commission.

Obviously we have an obligation under the law to do the best that we can and determine what are the
appropriate fiscal priorities of this agency, and I am certain, at least for me -- and I'm sure others can
speak for themselves, but I think as we review our budget process for the next cycle, certainly that will
be useful information.

DR. POWERS: I will comment that we have gotten some good help and suggestions from Commissioner
Diaz in this regard on the kinds of research programs that would be helpful in this area.

I might just go on, since you gave me the lead-in, to talk about some of our near-term future
activities at the ACRS.

CHAIRMAN MESERVE: Why don't we finish the good conversation with these two, and then we'll come
back to that.

We're all awaiting with interest the report that you're doing on the research.

Dr. Wallis, I want to make sure that I appreciate the significance that you intended to convey to us about the code.

As I understood your charts, they went way beyond documentation.

In slide 52, you indicate the codes are not based on, you said, quote, "mature, secure science."

In slide 54, you say the methods for calculating uncertainties are, quote, "primitive and not comprehensive," and of course, as you know, the calculation of uncertainties is required on the use of realistic codes.

And then you say, on slide 55, that the database for code assessment, quote, "must be preserved and, in some cases, expanded," and I would take the word "expanded" to mean that there may not be data available to provide for validation of code -- these codes in some circumstances.

The reaction I have to those words is that there are absolutely fundamental problems with these codes that are ones that are very serious and are ones that would cause us and our staff to hesitate to rely on them for the purposes that licensees might offer them.

DR. WALLIS: Can I address the science one? There are engineering methods which work, and they're used all the time, and the results are seen around you in things that work.

The understanding on which they are based is not what I would call science. It's not a secure science where you actually know that you can solve equations and get the answer.

But by doing suitable experiments, putting in suitable approximations and so on, engineers have developed a way of developing technologies, and that's what happened here.

It's not a damning -- it's just the way it is. It's not an accusation. That's the way it is. Just think about medicine.

Some things you just learn by experience and you build up knowledge, but it's not something you predict for fundamentals, yet it works.

So, maybe I gave the wrong impression. I just wanted to clarify that.

That's the nature of the beast.

What you have to learn there is, therefore, you cannot say we'll just use the code and predict things. That's why you have to do experiments.

The uncertainties -- yes, uncertainties are investigated now by varying some parameters, seeing what effect they have on the answer, doing sort of response services and so on, and trying to estimate

uncertainties, but there are other sources of uncertainty having to do with the basic structure of the code and so on, and with computer techniques we have today, uncertainty estimation can be put into the code, and we believe that's probably an area where work needs to be done, and it may not be that difficult, but what we see is more primitive than what we see can be done.

CHAIRMAN MESERVE: Am I correct that, on the database, that you feel that the database is, in some sense, inadequate?

DR. WALLIS: If you want to build some new reactor and some geometry which has not been tested before, then you would probably have to do an experiment.

CHAIRMAN MESERVE: You, in slide 56, have said that you think the regulatory processes should encourage code improvements, and when you discussed that, you talked about this ossification process, that once we improve the use of a code, that then that becomes something that's then used forever after and nobody changes it.

Do you have any specific suggestion for us about how to deal with that problem?

DR. WALLIS: Well, I think, first of all, you would probably have to give a lead and say we think that this is not -- this is acceptable or not acceptable, but we think this we should develop and keep abreast of science and technology.

I don't know. I'm mystified. I don't know enough about how the system works. I just sort of observe this happening.

DR. POWERS: One of the things that struck me is we really honestly need a 50.59 for code update. That is, a blessed code, one use for regulatory analysis, it should surely be possible to put in an upgraded heat transfer correlation in the code without having to go through a full re-evaluation of the code.

There should be -- trust me, I hate to use this word -- some minimal or even negligible change that could be made, but you do find things in these codes that are remarkable to you.

You see correlations that you know were invented before you were born, and they've been replaced now by much more sophisticated things in the literature, much more -- bigger database supporting them, and you say, well, gee, why didn't they do it, and it just builds upon the foundation of knowledge that we've always had.

It surely doesn't require a full-blown re-certification of the code, but it does, and so, I think we need to think in terms of something like a 50.59 for computer codes.

CHAIRMAN MESERVE: Dr. Kress, I just have one question for you, and it's really to follow up on a conversation you've had on the spent fuel pool risk.

I appreciate that the most significant sequence arises from a seismic event that causes a drain-down, and you said the way out of that is to look at the risk of there being such an event, being probably an important way to deal with it.

But I think you then have the problem of predicting the likelihood of very rare events, and my understanding is that EPRI and Livermore have made such estimates and they differ significantly from each other, at least an order of magnitude difference, and I just raise the question -- and maybe George has a few on this, as well -- about how you deal with that problem, when you have this inherent problem of predicting the probability of an extremely rare event, and how do you decide which one is right.

DR. KRESS: It's a very good question, and you're right, the Livermore curves for the seismic were about a factor of 10 different than the EPRI.

Both of these are based on expert opinion, and I think you'll have to go into how you put together expert opinion and somehow combine the two curves, and I think George probably can speak to this a lot better than I can, if you'd like to, George.

DR. APOSTOLAKIS: Yeah. There was near paralysis in that field in the 1980s, because we had two separate sets of curves for seismicity, and the Commission and DOE and EPRI cosponsored a committee, of which I was a member, to look at the situation and see whether there could be some reconciliation, and very quickly, the committee realized that a major driver for the difference was the way the expert judgement was processed.

There is no question that you have to rely on expert opinion, because the evidence is kind of weak for the eastern part of the United States, and Livermore was a little bit at a disadvantage, which is an understatement, because they were directed to give equal weight to the experts, and there was an expert in California who really drove the results.

My interactions at the time with the community of experts working the field was that that expert's views were considered outside the mainstream, and Livermore itself admitted it, but they had to give equal

weight.

EPRI, of course, was not under such constraints, being a private organization. That doesn't mean that what they did is the right thing, but at least they didn't have that constraint.

So, the impression that I got from all this exercise was that the difference was a little bit artificial due to the constraints that Livermore had, that had come from Washington, and the rationale was how can a Federal agency like the NRC go to a public hearing room and say that they gave different weights to the different experts, and first of all, that's the wrong thing to say, because you don't give weights to experts, you give weights to the views.

I mean the expert can be right sometimes and wrong some other times, and that, I think, takes away a lot of the emotional content upon this.

We recommended that, you know, an approach be developed -- in fact, we proposed an approach to evaluating seismicity curves. I don't think that that has been done, although I may be wrong, but that was the essence of the difference.

Now, when we say 10 to the minus 6 or 7 -- and you mentioned, Commissioner McGaffigan, 10 to the minus 7 -- there will be some large uncertainties associated with that, and I don't know how much they will help in resolving this particular issue, but the bottom line is that it was really a difference that was due primarily to instructions how to process the expert judgements.

DR. KRESS: Based on that, I think if you had to choose between the two curves for this particular study, I think I would choose the EPRI one, because I think it's more realistic.

CHAIRMAN MESERVE: Commissioner Dicus.

COMMISSIONER DICUS: Thank you.

I can be very brief, because the Chairman was nice enough to ask my question of Dr. Kress, so I don't have one for Dr. Kress, but I would mention, Dr. Wallis, you've made some recommendations of things that the staff or the NRC should do, the staff should do.

Have you considered what the resource implications are? Has the ACRS considered what the resource implications are?

DR. WALLIS: I think all I could say is that the staff seems to be fairly extended in terms of doing what they need to do with the people they have, but I'm not in a position to make recommendations about resources. I think that's something that is part of the bigger picture.

Maybe when we look at the
-- when we write our research report, we'll pick that one up.

COMMISSIONER DICUS: Okay. Thank you.

CHAIRMAN MESERVE: Commissioner Diaz.

COMMISSIONER DIAZ: Let me start with, I think, a statement that I hope is a valid statement.

The Nuclear Regulatory Commission needs to have adequate tools with which to discharge its functions. However, those tools are never going to be right at what the science is at that moment.

There will always be a difference, and the issue is, is the difference acceptable as a method to establish what safety is?

We all know that there is always another little thing in the scientific area, another little phenomenon, another thing that we would like to know, and I think universities and graduate students are the right way to address that.

However, we deal with the issue of determining safety, and I can tell you that, if the new phenomena is in the fourth significant figure, it really doesn't bother me.

If it's in the third significant figure, it might not bother me, and it might be occasions in which, in the first significant figure, it might not bother me, because I know we don't know any better, than the transients, the dynamics of the issue would actually change what the results are.

Therefore, when we get to this conclusion, how can we improve our regulatory tools in a manner that can perform our function fully knowing that the science and the graduate students might know better, and so, it is in this difference where we need to actually get good recommendations from the ACRS.

In the issue of spent fuel, Dr. Kress and I think -- and Dr. Powers already addressed it.

We have two fundamental things that are really coming at each other and maybe fighting, maybe complementing each other.

One is the phenomenology. It's the way that we deal with the physics and the chemistry and the metallurgy. And the other one is how risk-informed is coming to say you don't need to go farther than this, and I think it is in this maybe dichotomy that we expect to have a better set of regulatory tools.

It is a combination of these two things.

We cannot have bad phenomenology, and we should not have bad PRA, because then we're not being able to make those things.

So, it is in the convergence of these two things that we are, and I do

get concerned when I see statements that might be, Dr. Wallis, scientifically correct but, you know, might not be well interpreted when they are put in this context, and I think what Commissioner Merrifield asked is a very good thing.

We need to really put this in the proper context, because if not, they might be interpreted as the fact that we don't have the proper regulatory tools.

We might not have the most scientific regulatory tools, but they have been adequate. Can they be better? Yes. Do we know how much better they need to be? Well, that's what we look to you guys for, how much better they need to be to perform the regulatory function.

I don't think anybody doubts that, you know, there are issues that have not been considered. Maybe they don't need to be considered in regulatory space. Maybe they need to be considered in thermal hydraulics space.

That was my statement. I think I took care of Dr. Kress in there.

The issue of the spent fuel pools, I believe, you know, has to address not only what the lab phenomenology tells, but in essence, there are challenges that have been made, and it is important that we bound them within appropriate regulatory tools, including energy content, time, methods of cooling, degradation due to the metallurgy, and I think that effort should be done. It should be done not on the fourth significant figure but maybe two significant figures might be adequate.

Do you have a comment on that?

DR. KRESS: No, I fully agree with that.

COMMISSIONER DIAZ: Thank you.

DR. WALLIS: May I say I agree entirely with what you said, and it may well be that, for some purposes, a simpler analysis is perfectly adequate. It's just that we need to know that.

COMMISSIONER DIAZ: That's where the question of bounding becomes very important to the Commission.

The Commission needs to know, you know, how far do we need to establish, you know, our inquiries, and how far does the staff need to go, because you know, there are two things in thermal hydraulics.

We have a five-year thermal hydraulic plan that the Commission, with the recommendation of the ACRS, you know, embarked on it, and we are almost four years or three-and-a-half years on that.

That dealt with doing two things: taking the codes and making them user-friendly, getting a

computation or architecture that was capable of delivering, you know, for our staff, and anybody that wanted to use it, you know, reasonable answers.

We did not say this has to be the state of the art but reasonable answers.

But at the same time, we ask that the phenomenology be reviewed to make sure there were no glaring errors, that there were no issues that were going to come and haunt us, and I hope that is being achieved.

Thermal hydraulics keeps coming up, because I think it is something the Commission wanted.

Parallel to that, not completely separate but parallel to that is what are the tools that the licensees use, and what criteria do we use?

Do we want them to be completely scientifically correct, or do we want them to provide us with a baseline analysis that allows us to do our job, and I will tend to the later unless proven that they are not scientifically correct.

DR. WALLIS: I think the problem we had with the science was not perhaps the one you had.

The problem we had is at a very fundamental level, which an equation is written down, at a very fundamental level, not in the details.

That has to give us assurance that the people know what they're doing. That's the issue. It's not a question of getting all the details right.

The details very often don't matter, and we're not looking for scientific correctness in the details, but at least the exposition of what's the basis of what they're doing should give us confidence that they know what they're doing.

COMMISSIONER DIAZ: Let me tell you what my concern is.

My concern is, for example, on the spent fuel pool, we start drawing radiological consequences from a first cut at an issue that has not been fully analyzed, and it can cause concern and un-intended consequences.

I think we need to be technically correct, we need to know to what level we want to take it, what approximation is important.

You know, I keep hearing these issues of uncertainties.

Well, the smaller the number, the less significant the effect is, the larger the uncertainty is.

So, we might find uncertainties being as large as the actual number, and that doesn't bother me, because the number is not significant in itself.

I think we need to be able to put this in a proper perspective, and I personally look to the ACRS

for leadership in this area, to bound it, not to make statements that could be construed that spent fuel pools could have much larger consequences when we don't know.

However, to point out that the area needs to be further analyzed, that we need to obtain, you know, additional analysis that will go from the lab to an actual comprehensive, integrated look at both the physics and the PRA. I think that is very appropriate, and I think I have run out of time, and therefore, since you already have agreed with me, I'm going to end on that point.

[Laughter.]

CHAIRMAN MESERVE: Thank you very much.

We have run out of time, and so, I'd like to apologize to Dr. Bonaca.

We have the benefit of your slides, and I know that your presentation was really to give us a status report on the number of activities the ACRS has underway in the license renewal area.

DR. BONACA: That's correct.

CHAIRMAN MESERVE: Our suggestion that we not do that does not reflect anything with regard to the importance we view this activity.

In fact, it is the center of our activities, and we await the future opportunity to deal with you on the substance of this work as we go forward.

Dr. Powers, do you have any closing comments?

DR. POWERS: I think I have provided you a slide that indicates that there are some initiatives that we've undertaken, both the research report -- we're going to set the Executive Director of Operation on the resolution of a different professional opinion on steam generator tube integrity.

One of the more interesting things that we're beginning to look at is we're looking at a lot of changes in the way nuclear power plants run in this country. We're looking at life extension, we're looking at power upgrades, we're looking at high burn-up fuel.

All of those things are being looked in a fair amount of isolation, one from the other.

One of the areas that the ACRS is going to start looking in is are there synergisms among these various activities that we're taking on that could lead to erosion of margins that we might not anticipate based on looking at them individually.

This is an activity that we have had one of our senior fellows looking at, and it is raised independently in the course of looking at the license renewal, and we hope to be able to report to you on that sometime in the future.

CHAIRMAN MESERVE: We very much look forward to that.

With that, I'd like to thank you all for a very helpful meeting.

I know that you're all very hard-working, and we get a lot of benefit from the work that you do perform.

So, on behalf of the Commission, I'd like to thank you very much.

COMMISSIONER MERRIFIELD: Mr. Chairman, before you sign us off, just one quick comment to circle back.

I thought Commissioner Diaz made some very helpful comments.

The last point I want to make -- and I said this the last time we had one of these meetings, and I think it's especially underscored by the fact we're video-streaming now.

I think we have to be very careful about the slides we use, if there's an intention to have a balance in the presentation, that the slides reflect those.

In addition, this is certainly not just an academic exercise.

We have significant issues that are pointed out by the ACRS, and I think the Commission takes these very seriously.

We, as a Commission, obviously have to deal with the practicalities of making decisions based on that, and so, if there are significant issues that are underscored, and there were some here, particularly by Dr. Wallis, I think it's important to be able to focus on real solutions that we can use to effectuate the problems that ACRS has pointed out.

Thank you, Mr. Chairman.

CHAIRMAN MESERVE: With that, we're adjourned.

[Whereupon, at 11:45 a.m., the meeting was adjourned.]