Official Transcript of Proceedings ACRST-3168

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards

PROCESS USING ADAMS
TEMPLATE: ACRS/ACNW-005

Docket Number: (not applicable)

Location: Rockville, Maryland

Date: Thursday, September 6, 2001

Work Order No.: NRC-004

Pages 304-491

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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

485TH ACRS MEETING

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THURSDAY

SEPTEMBER 6, 2001

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ROCKVILLE, MARYLAND

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The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., Dr. George E. Apostolakis, Chairman, presiding.

PRESENT:

DR. GEORGE E. APOSTOLAKIS, Chairman
DR. MARIO V. BONACA, Vice Chairman
DR. F. PETER FORD, Member
DR. DANA A. POWERS, Member
DR. STEPHEN L. ROSEN, Member
DR. WILLIAM J. SHACK, Member
DR. THOMAS S. KRESS, Member at Large
DR. JOHN D. SIEBER, Member
DR. GRAHAM B. WALLIS, Member

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MICHAEL T. MARKLEY, ACRS

NRC STAFF:

RALPH LANDRY

TONY ULSES

RALPH CARUSO

SUDHAMAY BASU

PRESENTERS:

JENS ANDERSEN, General Electric

FRAN BOLGER, General Electric

I-N-D-E-X

AGENDA ITEM	PAGE
Opening Remarks by ACRS Chairman	306
Peer Review of PRA Certification Process . . . Presentation by Mr. Markley	309
Meeting with NRC Commissioner Merrifield . . .	330
TRACG Best-Estimate Thermal-Hydraulic Code . . Presentation by Dr. Wallis and Mr. Landry	381
Proposed Final Revision to Regulatory . . . . . Guide 1.78 Presentation by Jens Andersen and Fran Bolger	427
Proposed Final Revision to Regulatory . . . . . Guide 1.78, Main Control Room Habitability During a Postulated Hazardous Chemical Release	456

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

(8:31 a.m.)

CHAIRMAN APOSTOLAKIS: The meeting will now come to order. This is the second day of the 485th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting the committee will consider the following; a report by ACRS Senior Staff Engineer regarding peer review of the PRA certification process; the TRACG best-estimate thermal-hydraulic code, and proposed final revision to Regulatory Guide 1.78, Main Control Room Habitability During a Postulated Hazardous Chemical Release; and proposed ACRS reports.

In addition, the committee will meet with NRC Commissioner Merrifield to discuss items of mutual interest. A portion of this meeting may be closed to discuss General Electric proprietary information applicable to the TRACG thermal hydraulic code.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Mr. Sam Duraiswamy is the Designated Federal Official for the initial portion of the meeting.

We have received no written comments or

requests for time to make oral statements from members of the public regarding today's session. A transcript of portions of the meeting is being kept, and it is requested that the speakers use one of the microphones, identify themselves, and speak with sufficient clarity and volume so that they can be readily heard.

One item of interest is that this is the 300th ACRS meeting for our own Paul Boehnert. He started working here -- I mean, the first ACRS meeting he attended was on September 11th, 1975. That was the 185th meeting.

And we have a little treasure here. We have a picture of the staff engineers and the ACRS members from October 7th, 1977, and there is a young man here dressed very '70s, with a big tie and mustache. So I think the members will enjoy having a look at it, and I will pass it around. So we congratulate Paul and his dedication.

(Applause.)

DR. APOSTOLAKIS: And for the way your taste in clothes has evolved.

(Laughter.)

DR. APOSTOLAKIS: Okay. So we are passing around that picture. Our first session today deals with a peer review of the certification process for PRAs.

Mr. Michael Markley, our senior staff engineer, attended the North Anna Power Station peer review that was conducted by the Westinghouse Owners Group, last July and he will report on that today. Mike.

MR. MARKLEY: Good morning. Thank you for the opportunity to present my observations here. I do want to qualify that these are my observations, and they don't represent the views of the ACRS or the NRC, and the first few slides are really mostly just reviewing what the process grading and significance determination will cover.

The latter ones are really the majority of my observations. So if you would prefer I breeze through these early ones, I can. The ACRS last reviewed the NEI 00-02 in October 2000.

It was an information briefing, and they pretty much laid out what they were planning to do. This evolved out of the Boiling Water Reactor Owners Group certification process.

All licensees are performing it, and most of these are being conducted by the owners groups, and in this particular case, the Westinghouse Owner Group did the Dominion one.

As you may recall, during that briefing, talked about where they would like to see the PRA certified, and that was to a Grade 3 level. The Grade 1 is really essentially pretty much a point of departure with the IPEs, and so that really is -- they would expect most all of these to meet that level.

The Grade 2 would be risk ranking of the capability of doing SSCs, and so forth, and that they would be a combination of probablistic and deterministic insights.

Grade 3, which is where I think the majority of the Dominion observations were, and I think you will also note that if you read in the materials that there were a number of contingency findings there, and for the license to meet that Grade 3 certification, they would have to satisfy those contingencies to do so.

And Grade 4 is a little bit further than where they are today for most licensees, and that would be that the PRA itself would be useable, and not necessarily with the compliment of deterministic as we normally see them.

DR. APOSTOLAKIS: So Grade 3 then would seem to be a good goal?

MR. MARKLEY: That is the target mark today. And for the levels of significance for the facts and observations, as they had findings, they would document them on a fact and observation sheet, and provide them to the licensee, with level of significance.

And, for example, if it was extremely important and they had to satisfy it to meet the grade today, then it would be given an "A" then. Most findings typically would fall in the Category B of significance, where it could be accommodated during the next updated PRA.

MR. ROSEN: Mike, on that slide, why do you have a contingent item for grade assignment on both A and B? I thought that was just B?

MR. MARKLEY: Well, A would be contingent also. They are both contingent.

MR. ROSEN: Okay.

MR. MARKLEY: According to a NEI 00-02 process. I mean, it is just the way it is. For them to receive a grade, if they were given -- they can be given a Grade 3 with no contingencies, or a Grade 3 with an A or a B. That is kind of the way it fell together.

DR. KRESS: How many members of this peer review are there?

MR. MARKLEY: There were -- on this particular one, there were -- let's see -- seven. I will get into that a little bit as we go. The level of significance -- and these really -- there were very few observations that fell into these categories, with C, B, and desirable to maintain flexibility, but not likely to affect the results or conclusions.

And D, B, and editorial, are minor changes. And the S, B, and superior treatment, there were a fair number of items that were observed and brought to the attention of the licensee as being exceptional, or very well done.

The one thing that I would point to is that the information that I had when I departed were the licensee's exit -- you know, turnover -- from the Westinghouse Owners Group.

So they have gone back and forth since that time, and some of these contingencies have gone away, I'm sure, but they are still offering more information, and doing follow-up actions between then and the time that the report came out.

DR. KRESS: That S is an interesting level. Why did they feel it necessary to do that?

MR. MARKLEY: Well, this is part of the

NEI 00-02 process, but I think if this is a model for other licensees --

DR. KRESS: So it is a model for other licensees to look at and say, hey, maybe we ought to use that treatment?

MR. MARKLEY: Well, one of the things that I think is interesting here is that each owners group is going through and doing these. About half of the Westinghouse Owners Group had done them, and they still had the other half yet to do.

And there is a fair amount of organizational learning that is going on through that. They have identified things that were good practices, or even parts of the procedure that were useful and that they may want to consider in a possible revision to 00-02, and that's not really on the table just yet.

But each owners group will have its own little population of notes and lessons learned, I think, at the end of this in going through the PRAs with their licensees. So I think the S is useful in that respect.

MR. ROSEN: And it is an analog to what info does with good practices.

MR. MARKLEY: Right.

MR. ROSEN: And finding things that are

exceptional.

MR. MARKLEY: And one of the benefits, I think, of North Anna that they have certainly derived is that Surry is very similar to North Anna. There are clearly site specific differences, but for the most part the core of the PRA is very similar to Surry.

And Surry has been probably one of the most examined PRAs in the country. It has been through a 1150, a 1400, a 6144 for low power shutdown, and they serve --

DR. POWERS: And every time they do it, they find something new about the plant.

MR. MARKLEY: Right. So in that respect, I think the peer review team had a little bit more difficult challenge in finding opportunities for improvement. This was a fairly mature PRA as compared to many of the others that would be out there.

Surry is also going to be a pilot for the Option 2 Part 50 stuff. So, I mean, their participation in pilots I think has clearly benefited their PRAs in many ways.

I think that in looking at the peer review team itself, clearly because the PRA was more mature, the findings were more sparse, as compared to a plant that may not have had as long a history in developing their PRA and the talent.

They just added another person during that time period who used to be the head of the PRA group from San Onofre. So it is continuing to evolve there. This particular team was really fairly talent laden.

Some of the people that you have had presenting before the ACRS half a dozen times or better, they had 25 years of nuclear experience on average, and 17 years of PRA experience on average, which is really quite substantial compared to the industry on average.

The team members demonstrated a healthy team interest, and this was one of the more important things to me, is that they were really demonstrating a questioning attitude, and looking hard through the PRA, and trying to find vulnerabilities, observations, insights, opportunities for improvement.

There was really no apparent rush to certify the PRA. They did have a very challenging time schedule to do it within a week, and when you recognize that there are presentations for the licensee to bring the peer review team up to speed with where they are, and what they have done.

They had to do a self-assessment before

the team was scheduled to come there, and so some of those items, they had to tell them what we have done in response to the self-assessment, and what have we done in response to what was done at Surry, because Surry was one of the earliest NEI 00-02 evaluations.

And so looking at that, you know, there were a fair amount of methodical things they had to get through. And then three days to really dig into the PRA, and then you have the exit on Friday.

So a week is really a fairly challenging period of time to dig through the multiple volumes of a PRA.

MR. ROSEN: But, Mike, isn't there some prior work for the team?

MR. MARKLEY: Sure.

MR. ROSEN: The team does some homework before it ever gets there?

MR. MARKLEY: That's true. Yes, they do have the benefit of a lot of prior information. It is an extensive structure sampling, but it is a sample.

DR. APOSTOLAKIS: But very few PRAs though have been reviewed line by line.

MR. MARKLEY: No, I don't think --

DR. APOSTOLAKIS: It is very difficult. I mean, you are expending a lot of resources trying to do that.

MR. MARKLEY: Right.

DR. APOSTOLAKIS: The one that comes to mind is the review that Sandia did Zion and Indian Point, where they really went over it with excruciating detail. But it is very difficult to do that.

I think experienced reviewers can look at things on a sampling basis and say something.

DR. POWERS: I guess the question is how do we know that the sampling is adequate?

DR. APOSTOLAKIS: Well, again, it depends a lot on the reviewers.

MR. MARKLEY: I think that is what you are going to have though, is that there is going to be some variability in the population and the experience of the teams they will be sampling.

But I think the strength of this particular one was the talent of the team, and they brought a lot of experience to the table.

DR. APOSTOLAKIS: In my experience, if you take an accident sequence, and you really try to understand it, and you go all the way down to the data that they used, you get a very good idea as to whether the PRA is a good one or not.

DR. POWERS: How many fields do we have that say, oh, we are going to sample. I guess that is good enough. I mean, every place I can think of where you sample, they go to elaborate efforts to say how do we know that the sampling is going to be indicative of what the whole looks like.

DR. APOSTOLAKIS: I don't think this is sampling in the sense of asking people what they think. It doesn't have to be a random sample. I think it is up to the reviewers to -- well, what it says is that they did not review the whole thing from cover to cover.

But I don't think it was a random sample, where somebody says --

DR. POWERS: Well, how do you go about picking a sequence to look at? You say, gee, I will look at the risk dominance sequence. Well, that is the one that the PRA producer has probably spent the most time on.

And so it is most likely to be done well, and so maybe you don't want to pick that one. You want to pick one of the less dominant ones.

DR. APOSTOLAKIS: Well, that was just missed. Some of these guys might do that. I don't know what they did.

MR. ROSEN: Well, I think there is more to it than that. I think these people talk to each other. There are a fairly small number of PRA professionals in the industry, and there is a lot of communication between them.

So they know what the issues are, and the modeling issues, and the development issues within each other's PRAs. And a team like this, whose names I looked at, which was really a very superior team, probably comes with a pretty good idea of where to drill down, and to look for problems.

MR. MARKLEY: They did, and they found problems in some of the top level events that had common themes and trickle down effects. So if you were looking at each one of these areas, there were things that if they found a weakness in one area, it affected other areas, too, and that is not surprising.

But the NRC has the same dilemma, I think, if you are talking about what is an adequate sample. I mean, our inspections are a sample, and that's the nature of it. You are trying to find something, and to see whether that is representative of another problem, or to look deeper in a particular area.

During the consensus session, I think there was a healthy debate, and in looking at each one of the sub-elements within the particular categories and elements to evaluate each one, and then to have it rolled up into an overall rating.

And which items would be level of significance A, or B, and in most cases the licensee was not present. They did not have an opportunity to offer counter-arguments for that debate.

They would present them at the end of the day or meet with them early in the morning to discuss what the preliminary conclusions were. And at that point in time, in addition to the fact and observation sheets, new information would have come to light.

And then they would adjust things a little bit, but for the most part the consensus determined their own independent conclusions, and then shared with the licensee.

And as I said, even after the exit, I am sure that things are still being discussed back and forth as more information is shared.

DR. APOSTOLAKIS: What do you mean by there is no follow-up procedure?

MR. MARKLEY: There is no recertification. For example, if someone wanted to take their PRA from an overall Grade 3 to an overall Grade 4, there is really no follow-up procedure.

Or if they wanted to take something from an individual element from a Grade 2 to a Grade 3, there is really no planned NEI procedure to go back out and recertify these, and to give them a higher pedigree.

DR. APOSTOLAKIS: How about making sure that they actually did what they were asked to do? I mean, there were some comments, and is there a feedback mechanism there?

MR. MARKLEY: As far as follow-up, I mean, it is really part of the closeout of the report. I am not aware of any follow-up evaluations to verify that what was agreed to be done is actually done.

DR. APOSTOLAKIS: And that is related to what you said down here.

MR. MARKLEY: Right.

DR. APOSTOLAKIS: Because if they do it, then presumably they get the higher grade.

MR. MARKLEY: Right.

MR. ROSEN: You mean, Mike, there is not even a letter from the licensee to the NEI staff that says here are the things that the PRA peer review found, and here is what we did about them, and thank you very much?

MR. MARKLEY: It would seem to me --

MR. ROSEN: That is not a recertification. It is just a statement by the licensee that they did what was expected. I mean, that is sort of halfway between sending another team out to check like INPO does.

INPO, when they make comments and recommendations, they come out and take a look the next time. Well, maybe even before the next evaluation.

MR. MARKLEY: Well, I would not suggest that they don't maybe reconsider the information. If the licensee offers new information, it seems to me that that would be reasonable, and I cannot tell you what will happen following the actual on-site visit.

I know that they plan to issue the report within a few weeks, and clearly the licensee offers additional information, which may affect contingent or overall grades.

But as far as where it ends up after they issue the report, and where the licensee responds back, I can't explain how that is translated into an outcome.

And I think grading is really part of the process, but in most respects I think the licensee would agree, and the owners group would also, that the real value is in the suggestions for improvement to the PRA.

And what the licensee actually does with to make enhancements subject to that, and grading is part of it, but the benefit is really in the insights and the information, and how they can use that to improve things and to make changes.

And they clearly identified a number of useful recommendations, and how those get translated into actions. And incompleteness will still exist, and there is variability in the use of plant specific data from licensee to licensee, and how it is considered here.

There is variability in how uncertainly and other things are considered. But it does represent progress, and that's why I think it would be very advantageous if there was a follow-up type procedure for them to go back, and that once a licensee feels like they have made sufficient progress in an area, it would be useful I think for them to request another visit of that type.

I don't see any reason why that couldn't occur independently of an individually planned or a broad industry wide initiative to do a baseline peer review of all the PRAs.

I think it would be worthwhile for ACRS members to attend. I can't say in particular what -- if you weren't going to go for the whole week, what days might be the best days to go, because clearly there are going to be peaks and valleys in the findings and the conclusions, and how that all gets wrapped up.

And it would always be worthwhile to go to an exit meeting, but that process of when the major findings are derived, and how they get resolved, that's hard to tell, and that would vary from certification to certification, and how complete they had done their self-assessment, and what had been done out of that.

DR. KRESS: Is the one week a fixed amount of time, or --

MR. MARKLEY: That is the way it is now, or at least that is the way the Westinghouse Owners Group is doing it. I can't tell you what the others are doing.

DR. KRESS: It doesn't depend on how many findings they are coming up with?

DR. APOSTOLAKIS: No, because they don't resolve them on site.

MR. MARKLEY: Right.

DR. KRESS: But I was thinking along Dana's lines; how do you know when you go to get another sample, and it is like inspection. If I found some things, I would want to look further.

MR. MARKLEY: Right.

DR. KRESS: And that is the way that I would decide whether my sample was good or not.

DR. APOSTOLAKIS: My understanding is that they don't find those things when they are there.

DR. KRESS: Oh.

DR. APOSTOLAKIS: They read stuff before they go, right?

DR. KRESS: They just come in with their findings.

DR. APOSTOLAKIS: Well, as you discuss things, you may find out things, but it's not as if you go in cold and you start looking and you say, oh, I found this.

MR. MARKLEY: It is very much like an ACRS meeting. They have the information before the meeting, and they have the meeting itself, and the same with inspection.

DR. APOSTOLAKIS: So they read everything, all the documents, very well?

MR. MARKLEY: Well, we can't assure that

all the members did, George, but we presume that they have done some.

MR. ROSEN: Well, I have watched members of these teams prepare to go off to another site, and there is a lot of dialogue in addition to the stacks of material.

A guy calls up and asks questions about material that he has received,and has a dialogue with the PRA people at the site that is going to be reviewed.

DR. APOSTOLAKIS: And what is -- I mean, let's not forget what is the value of this? I mean, they are not asking us to bless anything, right?

MR. MARKLEY: No.

DR. APOSTOLAKIS: It is just something that industry does to make sure that they good PRAs. But if a licensee comes before the NRC requesting something, using this PRA then, the staff will have to be reviewed.

And if the PRA has gone through this, then presumably that review will be facilitated.

MR. MARKLEY: I think it is very worthwhile. To me, there are very few downsizes in going through and evaluating opportunities to improve the PRA.

DR. APOSTOLAKIS: Yes.

MR. MARKLEY: It is voluntary, but I do think it could do a lot to help the NRC in achieving its strategic goals of maintaining safety and enhancing public confidence, and reducing unnecessary regulatory burden, and increasing effectiveness and efficiency.

It certainly will help the decision making process if they offer this kind of information in their submittals.

MR. ROSEN: Well, the staff can always ask have you gone through peer certification, and if the answer is yes, then what did they find.

MR. MARKLEY: Right.

MR. ROSEN: And then you can get a good handle on it, and then the staff can even ask what did you do with those findings.

DR. APOSTOLAKIS: Only if they are relevant to the particular issue at hand.

MR. ROSEN: Sure.

DR. APOSTOLAKIS: And we are not looking at the big picture here.

MR. MARKLEY: Well, I think it should help the NRC processes in a number of ways; and in licensing, clearly as the precedents are made, in terms of regulatory initiatives, once something has been approved, then there should be an easier track for other similar requests to be approved in a more timely manner, with less review.

And in terms of inspection, I think it could help the ROP implementation in a number of ways. I think it would be very worthwhile for the NRC staff, whether they are the project managers, or the senior reactor analysts, or the resident inspectors, to attend these.

I think there is a huge benefit in understanding more about the PRA, and I think they would learn a lot by attending the certification process.

As far as future ACRS review, we did have David Lochbaum attend this, and certainly the NRC staff has attended some other PRC certifications. I am not aware of which ones in particular. I did become aware of one this morning.

But I think the appropriate time for the ACRS to look at it again would really be after the owners groups had completed their initial reviews, and when you can kind of sit back and say what did we learn.

You know, what -- well, the Westinghouse

Owners Group, for example, was using the sub-tier criteria, which is not part of NEI 00-02. It was subject criteria that had been developed by the BWR owners group.

But they found it very useful in evaluating the sub-elements within each of the PRA overall elements. So how those things fit into lessons learned, and whether those things could be combined into a improved NEI 00-02, I think would be very useful at that point in time.

And that would also be a good time to hear from people like David Lochbaum, and other concerned citizen groups who have attended these and have observations as well.

I think in the lessons learned, you know, what kind of follow-up actions. You have asked questions on what are the licensees doing, or how does the Commission verify what has been done. I think that is a very important issue.

And then how have these things been translated into regulatory initiatives, and been useful, and made the NRC more effective, efficient, and how it provides more confidence, the pillars of the NRC strategic plan.

It also provides some additional

perspective as we look at more issues related to PRA quality. The revisions, 1.174, and the ANS and the AMSE standards, and things like that.

DR. APOSTOLAKIS: Good. That's it?

MR. MARKLEY: Yes.

DR. APOSTOLAKIS: Any questions for Mike? If not, thank you very much, Mike. Commissioner Merrifield is here.

COMMISSIONER MERRIFIELD: Good morning.

DR. APOSTOLAKIS: Do we need the projector?

COMMISSIONER MERRIFIELD: No, I don't have slides.

DR. APOSTOLAKIS: Well, welcome, Commissioner. We are very pleased that you are here, and so we can talk really about items of mutual interest, and without further ado, the floor is yours.

COMMISSIONER MERRIFIELD: Well, thank you very much, Mr. Chairman. I appreciate the kind invitation that the ACRS has extended to me to come and share with you some of my own views about what is going on here at the Agency, within the industry, and at many of the plants and facilities that I have had the opportunity to visit during the almost 3 years now that I have been on the Commission.

Up front, I would want to say and issue my appreciation for the strong level of cooperation that we have had between the Commission and the ACRS. I think it has been a good dialogue during the time that I have been here.

Obviously, we have had a series of a very well qualified and helpful Chairman, and I know that you will continue what is a proud tradition in that regard.

I am, for example, very pleased with the work done by Dana Powers on the research report, and I will be going into that in greater detail a little later on in my presentation.

And it has also been a pleasure to get to know and work with a number of the members at ACRS. For example, I had a very positive visit to Argonne National Labs, hosted by Dr. Shack, and saw a lot of the very important research work that was being conducted by Argonne in the research area, on issues such as steam generators and otherwise.

So I look forward to a continued dialogue in that respect. Today, I am going to try to give my presentation in a fairly high level -- and not get into the technical details of a lot of it.

That is after all an appropriate role

being a Commissioner, and certainly that is the level that I want to present today. To underscore what is the obvious, what I am going to talk about today represents my own opinions, and not those of the Commission, although I would hope that in many respects the Commission would concur with those, but they are in fact my own views.

The first thing that I want to talk about a little bit is my insights from some of the activities that I have had over the last 3 years. I have had the pleasure and the opportunity at this point to visit 83 of the 103 operating nuclear power plants in the United States.

I also in the visits that I have had to over a dozen foreign countries have seen in excess of two dozen reactors outside the United States, and I am also taking the time to visit a variety of other facilities for which our agency regulates.

I have been to, for example, 7 of the 9 fuel facilities that we regulate, and a number of research reactors, and research facilities -- Argonne National Labs, and otherwise -- to get a better understanding and appreciation for the myriad of issues that our agency has grappled with.

In terms of the plants themselves, and the state of the industry, I have said in many public fora that I believe that the state of the industry right now is the strongest that it has been in the last 20 years.

The material condition and operating performance of the plants that I have been to I think is reflective of that increased performance and operating experience of the industry. And that involves a variety of different factors.

Work planning, for example. When you look at the outage time, the on-line time of the reactors, and you look at the amount of maintenance that is going on on-line, obviously there is a great deal of care being undertaken by the owners and operators of the units to make sure that they are operating at the highest levels of safety and performance.

And that is indeed I think an improvement over where the reactors were 20 years ago and 10 years ago, or 5 years ago. Increasingly, there is a greater reliance in corrective action programs to make sure that items that are identified by the staff, and hopefully by their staff and not by our staff, get into that corrective action program in a timely way so that it can be addressed, and keep that plant at the highest operating and safety performance.

Frequently, I think licensees have a better recognition and understanding of the need for appropriate asset management. As there are a greater number of licensees that are making the choice to increase the term of their license from 40 to 60 years, a recognition that the portions of the plant -- the material condition of the plant, the steam generators, the secondary side -- have to be maintained in an appropriate program to keep that resource operating at the highest operational and safety levels.

As you go around the reactors, you see that there are shorter refueling outages. Now, obviously some have always questioned this as to whether is that the right place for safety.

I think what you see associated with those shorter refueling outages is a lot better planning, a lot better understanding by the licensees of the work that needs to be accomplished, and how that is to be timed in such a manner as to take the most effective utilization of manpower resources.

For me, I think the key indicator of how those outages are progressing is the extent to which there are operational difficulties coming out of the outage. Do you have downpowers soon after those outages have occurred.

In years past, I think you saw a lot more of that, and certainly in today's operations, I see that that is decreasing significantly, and I think that is the right way to go.

It means that they are planning better, and it means that they are doing what is necessary to maintain the safety of that plant.

License renewal. I want to go into a little greater detail about license renewal, but I think the top level item that I would want to mention in my visits and in the discussions that I have had with the utility executives over the last 3 years, I think there is an expectation among the utilities, and I think it should be an expectation among this Commission, that virtually all of the units that we are currently regulating, all 103 operating units, will most likely seek a 20 year life extension.

And so I think we need to plan for that eventuality. We have had an increasing amount of attention -- and I will go into this in a little greater detail later, but we have had an increasing amount of attention regarding risk-informed regulation.

We have put a lot of effort into the risk-informed maintenance rule, and we are currently grappling with 50.44 and 50.46. I think there is a mixed bag out there.

There are some licensees -- South Texas, San Onofre, Fort Calhoun, there are a group of licensees who I think have a high degree of commitment to utilizing a risk-informed regulatory framework, and are very encouraging of the efforts of the agency to go down that road.

In reality, I think that there are a larger number of licensees, and I think an uncertain number to that extent, who have a lot of doubts about that, about whether they want to put in the time and expenses necessary to go with a risk informed Part 50.

There are many who are comfortable with the current form of Part 50, and have no real stake in seeing an option. Given that, I think we need to appropriately judge and continue to interact with NEI from a budgetary and management standpoint to make sure that the resources that we are dedicating toward risk-informed and Part 50 are appropriately balanced given the amount of interaction and interest on the part of industry.

We have a lot of challenges as an agency before us. I am going to go into some of the further ones that we have coming ahead. But the commitment toward a risk-informed Part 50 is going to mean a lot of money.

It is going to mean a lot of resources from both an FTE and a dollar standpoint, and we have to have some understanding down the road that there is a value that is going to be derived from that, because after all we do impose our fees on licensees.

And if we are spending a lot of money on areas at the end of the day that may not be fully realized and fully utilized by those licensees, you certainly have to make sure that we question appropriately the dollars that we spend.

Human capital. I am going to go into a little greater detail in that later on, but we have talked -- those of us in the Commission and outside of the Commission -- about the challenges that we face as an agency in an aging work force.

Those very same challenges are evident at the plants. They are evident in perhaps some different ways, and manifest themselves in a different group of individuals, but they are challenges shared throughout the industry, and one that I think we should need to maintain vigilance and a look at.

When I visit the plants, one of the first things that I -- and in fact the first thing that I do, is to meet with our resident inspectors, and I have had the pleasure of meeting probably in excess of a hundred of our residents over the course of the last few years.

I frequently -- and some people smirk at this, but I consider or refer to them as our sentinels of safety. They are our front line individuals out there identifying potential problems at the plant, or verifying that in fact things are working appropriately.

I believe that the group as a whole, the resident inspectors that we have, are very well trained, and very capable, and very outstanding good people. They are people who I believe the Commission, and that we all, can be proud of.

We have asked a lot of our resident inspectors over the last few years in moving towards the new reactor oversight program. Early on -- you know, 2-1/2 years or so -- when I was meeting with the resident inspectors at that point, there were a lot of concerns.

They had a lot of questions about the direction that we were moving with the new reactor oversight process. What I have found more recent is a group of inspectors who have embraced that program, and believe that it does in fact improve our ability to identify and address safety issues at the plant, and judge whether there is declining performance in individual facilities.

And I think that there is a greater level of confidence in those inspectors that we are doing the right thing, and I think that is positive. I think there is a much higher degree of uniformity, from top to bottom, within the Commission, and support for the new reactor oversight program.

One of the things that I think has been a concern, but I think that I have been hearing from both the inspectors and the licensees, are issues that sometimes fall out of our inspection program, and we have a very disciplined manner in which we go about inspecting the plants.

And we have asked our inspectors to be more disciplined in the way that they do it. Obviously, any individual walking through the plant, be it a Commissioner, a member of the street, or one of our inspectors, might see some things that may trouble them, or may raise an issue or a question.

It is clear to me that the licensees, and it is clear to me that our inspectors, are comfortable in engaging those issues, even when they are not within the parameters of our inspection program.

The positive thing that I think has changed from where we were before is the recognition that we need to allow in our inspectors, and that the Commission needs to allow the licensee to appropriately put that in the framework of the corrective action program.

For too long in the past, we would have inspectors who would identify a problem at the plant, and they would drive the licensee towards resolving that issue, irrespective from a risk standpoint where it fell on the corrective action program.

And I think that we have a much more sensitive notion now that we can bring these issues to the licensee, and leave the licensee with a challenge and the opportunity to place that in the appropriate area under the corrective action program, and deal with that in a timely and appropriate fashion.

Feedback from licensees. At the end of the day, I always meet with the top level management of the licensee. The reason I do that is that I want to get some feedback from them on how we are doing, and I want to give them some candid feedback in terms of how I think they are doing.

Some things that have come out of those meetings I think is a uniform recognition that the new reactor oversight process is working. There are some concerns that I have heard in a variety of plants.

Security, and the OSRE program, and that has something which has a lot of notoriety, and certainly has the attention of me and I think the other members of the Commission, and it is something that we are looking at.

We have the SPAR program that we are rolling out, and there are a lot of questions that go along with that, but one that we will continue to vigorously pursue over the next few years.

Fire protection. In our new oversight framework, do we have a program that appropriately judges fire protection, and that is a question, and I will discuss that a little bit further later on.

Finally, the conduct of investigations. We have a discrimination task force right now looking at harassment and intimidation issues. This is an issue which clearly raises the concern of plant personnel.

I have talked to line staff, and folks who are the welders and the pipe fitters, and the electricians, who raise concerns to me. I have talked to the plant management who has concerns.

There is a litany of folks who believe that we may have a better way of doing it, and that is clearly one, again, that I think the Commission is going to continue to take a look at.

During the last two years one of the things that I have tried to do in my plant visits is have an all hands meeting, and try to meet with a group of personnel at the plant to give them some idea of what the Commission is all about, and what we do in my own personal interactions.

Those meetings have ranged from 100 to 150 people, and up to about a thousand people that I met with at the Beaver Valley site. The reason that I do that is simple. For many of the individuals at the plant, the only people that they have an interaction with at the plant are our resident inspectors.

And those are very positive from our perspective, and so I think it is useful for those licensees, and the individual members of those utilities, to have a greater understanding of the context for which the NRC has, and the role that we have and that Congress has given us in the cradle-to-grave regulation of nuclear materials and nuclear safety.

I leave them with a message. It is typical at many of the plants that I challenge them to make sure that they are not complacent. One of the biggest fears that I -- well, not fears, but concerns that I have -- is that although we have I think a very high level of performance right now, we need to make sure that we and our licensees do not fall into the trap of thinking that we can't continue to move forward.

I think we need to and we need to keep our focus on that. Another issue that I frequently discuss is the issue of insularity. As we have more and more plants coming under the umbrella of licensees, there is the ongoing concern that a utility with many, many sites, may consider that all of the best practices, all of the best knowledge, fall within that group of units, and that is clearly not the case.

Each licensee I think brings something to the table, and I encourage all of our licensees to peer review, and to go out to other plants, and to go internationally to see how other people do their work to make sure that they continue to be top performers.

Latent problems. Clearly, we all need to be vigilant that while we are -- that we can say that we are doing a good job right now, but there may be issues that we failed to identify 20 years ago that may still be there.

And so it is those latent issues that may come back to bite us, and so again I challenge the individuals at those plants to be vigilant to those issues, and not merely to look at the report and say, yes, five years ago we checked that out and it was fine. It may be that that check may not have uncovered what is really a safety significant issue.

License renewal. I think a lot of credit should be given to our staff about the thorough disciplined and timely manner in which we have gone about pursuing the license renewal program. Clearly, this is an effort which has some of the highest scrutiny among Members of Congress.

Overall, obviously we have worked our way through six units so far. Currently, we have applications affecting a total of 14 units. And as I have mentioned, I believe virtually all plants will seek license renewal down the road.

We have made a lot of progress in the timeliness of the way in which we have been conducting those reviews, going from what we thought was going to be 36 months, and to actually coming in at around 25 months with Calvert and Oconee, and with ANO, we were able to bring that mark down to 17 months.

Well, why has that happened? I think there is a myriad of reasons for that. Part of the credit goes to ACRS. I think there is a comfort level within the Commission that this group is taking the time and vigilance to make sure that those license renewals are thoroughly vetted so we can have the comfort that when we issue that, that we have the technical basis and foundation upon which to make our claims that that will be safe for an additional 20 years.

I think some credit goes to the fact that the quality of license applications has improved. To their credit, I think the members of NEI recognize that we need not keep repeating the same issues, and that the NRC has a series of questions that are asked relative to the initial units that there ought to be a clear identification in the follow-on applications addressing those issues as well.

At the end of the day, presumably the number of questions that we need to ask on any license application may be reduced because the licensees have taken the time to make sure that many of the questions are answered up front.

Now, obviously there will be a continuing need for vigilance, and there will be issues that will emerge. But I think we do have a greater discipline on the part of our licensees in that respect.

On the part of our staff,I think the Generic Aging Lessons learned, and the Standard Review Plan, will also go a long way to having a program which is more regularized, and more disciplined, and will bring with it process efficiencies that will presumably allow us to review these renewal applications in the kind of timely manner that we have adjudged for ourself.

Now, will we ever be able to meet a six month deadline for license renewals? I for one am not putting that litmus test on our staff. At the end of the day, the important thing is that we conduct the reviews in a thorough manner, in a disciplined manner, so that we can make the assertion that we believe the extension of a license for 20 years will be safe.

What that is going to mean I think for this group is that the license renewal process should not become routine. I don't think there is an expectation on my part -- and I have never heard of anyone who would say otherwise -- that the ACRS should merely be rubber-stamping what is going on with the staff.

I think there is an expectation that you will do a thorough review, and you can and should, if appropriate, identify issues which the staff has failed to resolve.

For this agency to maintain the level of public confidence that we want, we need to have that important element of the ACRS review. So, I would commit to you my own belief that it is important for you to continue the level of review that you have.

The next topic that I want to address is the issue of power uprates. Currently, we have 12 power uprates under review, and within July alone we have approved five power uprates on the nature of around 1.4 percent.

The staff estimates are that we may have 44 power uprate applications within the next five years, several of which obviously would be GE boiling water reactors seeking extended uprates in the nature of 15 to 20 percent.

And we also have information that Westinghouse may be considering uprates in that range, 10 to 20 percent, for the Westinghouse and CE plants. That is a lot of work for the agency, and there is a lot of expectation on the part of all of our stakeholders, and the public, that we review those in a thorough manner, again to make sure that we feel confident in the work that we are doing.

Now, as it relates to small power uprates, the 1.4 percent range, I have discussed with a number of people -- and I think I may have mentioned to one or two members of this group -- that my concern that we were spending as much time on 1.4 percent uprates as we were on 5 to 7 percent uprates.

From a risk-informed standpoint, it is hard to understand or justify an equal amount of time. So I think that in that particular area that there are indeed process improvements that can be made.

On the other end of the spectrum are the obviously extended power uprates. When we have licensees coming in seeking uprates in that range, 15 to 20 percent, I think there is a strong expectation on my part that the work of the ACRS in reviewing what the staff is doing has got to be very thorough and technically sound.

Our staff has to have a solid basis for making an approval, or recommending an approval, of uprates of that magnitude. I think the Commission has that expectation, and I have that expectation, and I would expect other members of the Commission would as well, and certainly I think the public does.

Those are -- well, obviously those have a significant level of concern. I think that I have identified some of the numbers that we have right now. What is that reflective of? Well, when you go out and you visit the plants and you meet with the licensees, is clearly reflective of the nature of the power market right now.

What licensees will say is that one of the most efficient methods from a cost benefit standpoint of generating new power is to provide power uprates at the existing fleet of plants. Dollar for dollar on a kilowatt basis, that is some of the most cost effective ways of doing it.

And that is all well and good, but to the extent that we can feel comfortable about doing that that it is safe, that's fine. But as we go down this road, I think we do need to be vigilant in terms of making sure that we are having a sound, technically appropriate evaluation of that.

And ACRS obviously is a key component. And the final mention I would say on this topic is that it is going to take a lot of effort. And in terms of all the other demands that we have coming towards the Commission, we, the Commission, are going to have to evaluate the resources that we put into it.

With all of the topical reviews coming in, GE is the one that we are pursuing right now, and Westinghouse, if it indeed pursues the programs for the Westinghouse, the CE plants, that is a lot of work to be done, and a lot of challenges for all of us, and those will have to keep on top of.

The new reactor oversight process -- and I have talked a little bit about this already, but I do think that this is an area in which the Commission as a whole, the staff, can take a lot of pride in a lot of very positive work.

Now, what we felt very confident for a long time in the process that we used to inspect and determine the level of safety at these plants, obviously there were a lot of questions about that.

And ultimately that led us towards a more risk-informed reactor oversight process. One of the things that I have noted to many people is that I think that this new process, with the performance indicators in the more risk-informed inspection program, is more readily accessible to members of the public, because it allows more timely access to the performance indicators through our website.

And I think the average members of the public who live around the plants, and work around the plants, are interested in plant performance, have a tool available to them now where they can make comparisons of how one reactor is operating relative to another.

And I think it gives more information available to our stakeholders to allow them to make their own choices, and to make their own reviews. And one of the things that you see is a lot of the members of the press picking up on this.

When I and the Commissioners get a stack of clips every week of the newspapers around the country who are reporting on us, and frequently now you see reports tracking the NRC website that include that reference to it, and I think that is a good thing.

One of the sidelights, and certainly going into the process wasn't something that we necessarily expected, but I think one of the side benefits of our new inspection program and the performance indicators is that we have had increased public confidence that we were in fact keeping on top of these plants.

Now, some of that may be that the public is just more informed about what we were doing as a regulator, but I think that it is a more objective, predictable, consistent, and transparent methodology that the public can use to assess that information.

The other part of the new inspection oversight program that I think is important is the emphasis on the licensee corrective action program. As I mentioned before, the fact is that we had at some points in the past inspectors who were driving the licensee towards giving end points, which were not necessarily from the standpoint of the risks associated with the plant, weren't necessarily the right place to be.

It may have been a personal interest of an individual inspector. With the framework and discipline that we have in the new inspection program, I think it allows us the ability to say to our stakeholders, be it Congress, or be it members of the public, to State Legislators, or to others, that we have a disciplined framework that we can apply to all of the plants.

And that we can give a greater level of assurance that the same level of safety oversight is being given, and that when we put our imprint that we believe that the plant is operating safely, that we have a greater basis upon which we can make that claim.

By allowing items to be identified, and

allowing those to go into a licensee's corrective action program, I think that again allows the licensee go manage the plant in the most appropriate fashion.

We are identifying areas where there are concerns, and they are putting those from a risk perspective in the right portion of their action plan, and making those things happen. I think that is good for the licensee, and I think that is good for us, and I think that is good for the public as a whole.

Are we in the perfect place yet, and I think the answer to that question is no. I think that the new reactor inspection oversight program is a work in progress. I think it is going to continue to evolve.

Clearly, there are areas that we are focusing on for continued improvement. Safety system unavailability. There are some disconnects between the way in which we evaluate that, and the way that WANO evaluates that, for example, and that has been a concern amongst some licensees.

I know that the staff is engaging with the utilities to see if we can resolve some of those issues, and I look forward to reviewing where the staff is going on that matter.

Unplanned power changes. There are many

licensees who have come to me and who have said that we are concerned about that particular indicator because in the current marketplace there may be an economic reason for on a weekend taking a piece of equipment down for a time to work on it, which from a risk standpoint makes a lot of sense.

But the way in which our performance indicators are picking that up might not necessarily be in concert with that, and I think that continued dialogue on that issue on the staff's part is a good thing.

The significance determination process has been one that I think has challenged a lot of people. It has been more timely and time consuming than in fact we had thought. It has been rather cumbersome, and it has been something that there has been some growing pains on.

One thing that I think is positive is the fact that we will be completing I think later this month the SDP notebooks that will be available on a plant-specific basis.

I think that is going to make it easier for our resident inspectors to deal with these things in a timely manner, and obviously for the other inspectors, be they in regions or at headquarters, that will do it as well.

But again continued focus on that I think is going to be something that the staff is going to have to work on. There are specific SDP concerns that have been raised relative to security, fire safety, ALARA, and these are areas in which arguably we didn't have the degree of scrutiny in our old inspection program that had been brought out.

And so I think that is a positive thing if we are looking, for example, a lot more at fire protection and ALARA than we used to. How we deal with those -- and they are a little trickier to deal with than the SDP program -- the staff is going to continue to have to work on that.

And again as I say, it is something that I am looking forward to getting what the staff's suggestions are. One of the issues that has been raised about the new program is the issue of no-color findings.

We go in and we find a no-color finding, and that is not necessarily transparent to the public what we mean by that, and I think we need to have a continuing dialogue both within and outside of the agency about how we can better define and justify no color findings.

I mentioned how our resident inspectors are sharing their insights with licensing management. I think that is a positive thing. I think that both the licensees think that is good, and I think our inspectors feel comfortable that they can do that.

We need to make sure that we are doing that in a balanced manner, and not going too far out. But I think right now we are about where we ought to be.

There is some issues coming down the line, and I don't have any answers to necessarily define an opinion on them, but research, for example, is looking on the issue of risk-based performance indicators. I look forward to those recommendations.

I don't have a specific opinion one way or the other, but obviously there are concerns about going down a risk-based road, and we need to deal with that carefully and appropriately.

New plants. This is an obviously -- well, there is a possibility for a staggering amount of work before the Commission and before the ACRS. I think that the earliest thing that we will obviously see is the issue of early site permits, and something that we may see in this fiscal year and the next fiscal year, and testing out that portion of Part 52.

Pebble-bed modular reactor. There is a lot of discussion about that. Everyone has a lot of interest in that, and certainly Exelon has been spending a lot of time on it. There are a significant amount of challenges. They are a non-water reactor.

There are obviously the technology which is out there, and that the Germans have done a lot of work on, and the Chinese have an operating pebble-bed reactor, which I did have the opportunity to visit.

But there are things associated with that reactor that we don't have necessarily the right level of comfort with right now. There are different types of fuels, and significant use of graphite are in the reactor itself.

Braydon cycle turbines and the effects that that may have on operations of the unit, and what type of confinement/containment structure that may have, and a lot of policy issues go along with that particular design which may be a challenge.

The AP1000, obviously there is a lot of work that Westinghouse may bring before us in that regard, and in their efforts, and in one which I believe we will have to deal with in a timely manner.

Some which are out there, but certainly knocking on the door, is the General Atomics reactor, and Westinghouse's IRIS reactor, International Reactor, Isolated and Secure, Innovative and Secure, and regulatory infrastructure programs associated with these types of new reactors.

There is a lot of work out there, and are we where we need to be? No, I don't think so, and the reason for my feeling on that is a little work that I had done.

Last December, I put out a COMM which was adopted by the Commission, asking for the EDO and the staff to assess where are we relative to our resource capabilities on reviewing new reactors. Do we have the right people and do we have the right dollars, and do we know what we need to do from a research and a regulatory standpoint in regards to those.

Our response from the staff is due on that in September. I would expect that we will have a much more detailed understanding of the level of the staff expertise that we have out there, and what our existing regulatory infrastructure is, and how it relates to those innovative reactor designs, and where we need to go.

My hope is that that staff paper will give the Commission a better understanding of the challenges before us, and additional resources that we may need.

Now, how does this relate to the budget? This is something that the Commission has had to spend a lot of time worrying about. Congress for its part in this fiscal year decided that in the fiscal year that we are in, decided to give us some additional money, $10 million.

There are questions obviously on how we are going to spend that. Is that the right amount of money, or is that not the right amount of money. I think the Commission has had a difficult balancing act.

Part of it is dealing with very high expectations. There are a lot of possibles out there, and things that we may see. That is balanced against making sure that we have a staff that is capable, but not a staff that overspends itself, either in terms of not having sufficient resources, or getting out too far ahead of where our licensees are going.

And so I think the Commission in its effort has tried to make sure that we are the right size. I am very concerned about an over expectation of our getting too many things. That we may plan for far more orders, and far more designs, and that far more or many more licensing actions than may materialize.

And so I think we need to deal with this carefully. I think that we need to have an ongoing dialogue with our licensees, and with NEI to make sure that -- and with Congress, to make sure that we are asking for the resources that we need to do the work that we have and no more.

There are some issues out there that remain as challenges. Programmatic ITAAC. This is something that I think that we are going to have to grapple with, and before we see reactor orders, I think we are going to have to resolve that.

I think the staff now is working with NEI to try to bridge some differences that we have and see where we go.

Early site permits. Clearly, we need to understand if we are in the right place relative to Part 52, and our staff readiness to deal with those early site permits, and those questions need to be asked, and certainly will.

How will we deal with the regulatory infrastructure for non-light water reactors. We clearly are not there yet, and if we had an application for a pebble-bed reactor, along with some of the time lines that have been thrown out there, we would have to detail an exemption space in certain issues, and fill in as we go, in terms of a regulatory infrastructure, utilizing what we have available to us right now.

Finally, construction inspection. Now, that may come sooner rather than later. I had a chance to go out and visit WMP1 out at Hanford, and although that facility has not been in an active construction status since 1983 or so.

When you walk through it, because of the nature of the high desert atmosphere out there, and it almost looks as if construction stopped two months ago. In some of the welds and large-bore piping, they are very, very clean.

The work put together by that licensee to make sure that they understood and they had the quality assurance documentation in place, such that it could be picked up by another contractor down the line, was readily apparent.

We may see that come forward. I don't know. That is a licensing choice, and that is something that they are currently evaluating. There is a lot of news right now about what TVA may do relative to Browns Ferry One or other sites.

Who knows. Who knows. But it may involve us having to sooner rather than later think about how we go about construction inspection. There are a lot of issues that ACRS is clearly going to have to grapple with.

And having a role in licensing and design certification is clear. That is clearly a foremost role of this group. Review of new plant designs. ACRS has had a long and starred position in that respect, and will continue to as we have if we do in fact have reactor designs.

Fuel issues dealing with the pebble-bed, and the differences in that fuel is something that we are going to have to take a look at, and certainly we will depend on your analysis to provide us the technical basis there as well.

The development of regulatory infrastructure in non-light water reactors. We need to make sure that we have the appropriate licensing basis to make sure that we have the confidence so that we can tell the public that we are doing it right, and we need your help in making sure that we get there.

Continued review of the NRC's research program. I am going to go into a little bit more detail there, but clearly that is an ongoing role, not only in terms of the statute, but in terms of the expectation on my part of this group.

Finally, risk-informed, performance based regulations, an ongoing issue, and one which will clearly play into the area of new plant orders and new plant designs if they materialize.

Risk-informed regulation. I think all of us, and I know I certainly say, that this is a double-edged sword, and I think everyone has to realize that. I think licensees have to recognize that as we pursue a risk-informed path that may mean that there may be increased regulation to reactors.

On the part of our staff, it may mean that as we go through this that there may be areas that we have to reduce unnecessary burden. It goes both ways. I think that the staff did a positive job, in terms of working through the South Texas exemptions relative to special treatment requirements.

We have obviously work in front of us relative to Option 2, this proposed rule for April of 2002; and currently the Commission has before it papers relative to 50.44, combustible gas requirements, and 50.46, risk-informing ECCS.

Now, on the last two, these are I think very sensitive issues, combustible gas requirements having come out of TMI, and obviously a significant amount of concern on a variety of important stakeholders about how we go about emergency core cooling systems.

Now, these are high priorities for the industry, and yet for our part, we need to have a strong technical understanding of what these mean. And before I take a vote on those issues, I want to make sure that we are going in the right direction, and we have that basis, that safety basis, for moving forward in a confident manner.

An issue which has been of significant interest I know to the Chairman is the issue of PRAs. It is clear that there is not a uniformity within our licensees in terms of quality of PRAs. I think it is positive that licensees have been putting in an increased amount of effort in terms of peer reviews on PRAs.

I think it is positive, for example, that Dominion has invited David Lochbaum in to be part of their peer review effort. I think Dominion should be congratulated for that. I think hopefully that will be a positive experience for them.

Certainly Mr. Lochbaum is going o be vigilant in his comments, but I think -- and as they have been in many cases -- they will be thorough and well considered.

On the part of ASME and ANS, obviously there is work there as well. Having greater uniformity within the ASME process I think is a very positive one.

On the issue of ANS and the lower power and shutdown conditions, and the PRAs for those, I think that effort is a positive one as well. As it relates to the ASME, our TAs, the Commission's Tas, were briefed yesterday.

I believe that they are now on Revision 14A of that particular effort. There have been, I think, in the past significant differences between our staff and some of the other participants, upon where that effort is heading.

What we were led to believe, or what the Tas were led to believe today, is that in fact there is convergence in that area, and that we are coming together. And not to say that there aren't still issues out there, but I think convergence is underway.

In the case of ACRS, I think oversight of what we are doing as an agency on PRA, and having an understanding of what the licensees are doing in the utilization of PRAs, is quite critical.

Overviewing the research program and how folks in research are using risk I think is obviously of foremost concern. It is important, and I think a role that ACRS has, and will continue to provide great utilization for the Commission, at least for me, of the understanding of the scope in depth of the knowledge of the Commission staff on PRA.

And then again this is in an area where there is not uniformity, and I think the Commission has got to do as a whole a better job of making sure that we provide the training necessary so that our line inspectors, so that folks in the field, so that folks in headquarters, have the right grasp of PRAs as a tool, and we have it appropriately framed within our regulatory framework.

As part of that, I think it is important for the ACRS, when it perceives that the Commission does not have an understanding of risk, or where our understanding of risk is not commensurate with the regulatory decisions being proposed, that they notify us.

Now, obviously that is something that the ACRS has always done, but something that I think obviously will need to continue. We need to have that signal from you when our staff may not be where they need to be relative to our framework.

For my part, in looking at Option 2 and Option 3, I am very much eager to find out where ACRS is on various of the elements there, and I hope that you continue as you do to keep I and other members of the Commission informed.

I don't think there are any particularly noteworthy issues that I would want to say in this regard that there is one that I would mention. I know that I have discussed this with the Chairman, and that is related to NFPA 805, in risk informing our fire protection requirements.

I had a briefing initially on that some months ago, and I had some doubts as to whether after having gone through that effort to have a risk-informed option for fire protection, whether anyone would take advantage of it.

Now, if you spend a lot of resources to have a risk-informed option, and at the end of the day no one wants to take advantage of it, it is hard to justify the fact that you spent all that money.

In the meantime, and I think since we have had our discussion, I think there has been some conversation between our staff, and between industry, and other parties about where we need to go on that, and I look forward to a further briefing from our staff in terms of where we are going, and how that may resolve itself.

The role of research. I want to come back and credit Dana Powers again. This is an area which I have spent a lot of time thinking about over the last few years, particularly as it relates to our budgetary process.

Clearly, we do not have the resources available to us that this agency once had on research. Dollar for dollar, you can make all kinds of comparisons, but we don't have what we once had.

What that means is that we have to treat each dollar that we have ever more seriously, and make sure that we are getting the highest benefit from each one of those dollars.

It also means that increasingly that we are going to have to -- that as an agency, we have to recognize that we, like utilities, aren't the sole source of knowledge on one given area.

We can't be insular about our beliefs and our knowledge on the fuel for which we regulate. Thirty years ago, clearly that wasn't the case, and we had a whole host of people that were looking to in this agency.

But today there are examples, I think,

where we can look to our counterparts, whether it is in Switzerland, Japan, France, England, Germany, or elsewhere, who have capabilities that exceed ours that we should tap into and not necessarily attempt to replicate.

We should make sure that we can identify the areas which are most important for research that we do need to have capabilities to address to meet our regulatory framework.

And so the work that was done in that effort, I realize that is not something or a product of the ACRS that can or want to do every year to that level.

But it provided a very important tool for me, in terms of reviewing what are the dollars that we should be spending on research up and down, up and down.

I think it made for a more informed budgetary process for me, and certainly I would expect that it made it more informed for the other members of the Commission.

It provided insights on what research is doing well, and insights on things that research is not doing so well. Now, I went back this morning, and I remembered the slides that had been provided to us.

I think it was in a meeting when we had a review of the research efforts.

And I think the framework -- and this is on page 5 of your slides -- is the work needed for NRC's independent examination of regulatory issues. Has the work progressed sufficiently to make regulatory decisions, and should the program be modified to better meet agency needs.

And that is the real heart of the question that the Commission has gotten, and that the Commissioners have to ask in our process. We need the information to make regulatory decisions.

If we have the information, maybe sometimes we need to think about moving on and identifying those areas where we need to move the resource issues.

Now, going forward, there are obviously some daunting challenges for research; new reactor designs, extended power uprates, risk-informed regulation, extended fuel burn-up, MOX, fire protection; and a more emerging issue of control rod drive mechanism cracking; and steam generators, which has always been an issue.

There are a myriad of things that we are going to have to take a look at. As we go along, it is important for I think the ACRS to look at do we have the right coordination between research and NRR to make sure that we are identified, and that is the heart of much of this, although NMSS is clearly important as well.

But do we have the right communication and coordination, and to identify areas, be they current needs or anticipated means. Are we enhancing our technical capabilities to meet emerging challenges. Are we linking our research programs to our performance goals, or our strategic performance goals.

That is one of the things that Congress obviously looks very closely at. Are we communicating value. Are we breaking down organizational barriers that are isolating people within our organization and elsewhere.

And are we appropriately leveraging our international resource initiatives, or are we dollar-for-dollar getting the best value out of our research, and I think that is an important criteria that we need to hear or I need to hear from ACRS, and it is helpful for me in the policy decisions that I have to make as a Commissioner.

Part of that is obviously assessing high priorities and identifying areas where the Commission and the staff needs to put more resources. As a sidelight to that, I think the ACRS needs to be ever mindful during your reviews during the course of the year to identifying the areas where maybe enough is enough, or maybe we don't need to put as many resources, and I think we need to be mindful of that as well.

We do not have -- and I don't think there is an expectation among any of the Commissioners, nor in Congress, that there is an open path in terms of what we are going to be able to get for money.

So we need to make sure that we are identifying not only the add-on's, but perhaps we also don't need to put as many resources, and I urge your continued thought on that matter as well.

I want to mention -- and this is the last part of what I want to say today, but we have had a lot of concerns about human capital, and it has been expressed by each and every member of this Commission.

So of what I am going to say is obvious, and many of you are within university communities, and so I am telling you things that you well know. We have a level number of engineers coming out, but a dramatic drop in the number of nuclear engineers.

We have had a significant drop, and half of our research reactors have been shut down, and many very vital research reactors are under consideration to be closed.

Now there is a variety of dynamics for which that provides a challenge to the agency. The first one from a human capital standpoint -- and I have been able to go out and visit some universities, and I have more planned to do so this year.

But when you go out to those universities, not only are there fewer people there in those university programs, but increasingly the percentage of those individuals who are foreign nationals is higher.

So the yield that we can take advantage of for staffing our ongoing research needs becomes more complicated. We can't always hire all of those people, and obviously for national security reasons.

And in some positions, we have got to have people who are American citizens, and so that is a challenge to us. At the same time that we have a demand for that, those very same demands are within the industry itself.

They have many of the same demographics that we do. Now, obviously the number of nuclear engineers in the industry is much lower. They have a need for a much wider variation of engineers, of chemical, of electrical, of mechanical, of civil engineers, than we do.

But that level of expertise and having the ability to tap into that is very, very important. At the same time, we also utilize those research reactors and the staffs for basic research, the research that we are doing.

The University of Michigan is one that has a lot of questions, and are they going to continue to be there for us, and we spend -- I don't know what the dollar level is, but it is no small amount of money that the University of Michigan gets each year.

We spent some dollars there putting in special equipment so we could take advantage of that reactor, and that has been a very, very positive program at the University of Michigan.

If they shut that down, that is a capability that we lose in our Office of Research, and where we are going to put that is an open question. And so those reactors are very, very important to us for that reason as well, and as we talk about human capital, I think we also need to talk about research capital and the importance of those facilities.

I am pleased that the Commission has

supported legislation on Capital Hill and introduced on both sides, which would provide additional dollars to university research programs.

We have tried to encourage Congress not only to focus that on some of the DOE programs, but also on the need to be mindful of the NRC as well, and hopefully they will do that if that indeed moves forward down the line.

But we have got to maintain that focus in that area. Now, in the discussions that I have had with industry, one other thing which I think is a little different, and I think we need to be mindful of -- and it is a little bit more difficult given the current nature of the economy, but for a long time the demographics within the industry have been the same.

We have a lot of folks there, and the average age in the plants is in the 40s, in the mid-to-high 40s. For them there losing some of their profession, some of their engineers, but the loss of craft work is also very important there as well.

In the economy that we have had over the last 10 years, there is a lot of opportunities for welders, electricians, pipe fitters, and others in the crafts to go elsewhere at higher or equal or higher rates.

And that is going to be a continuing issue for our utilities. Can they attract and maintain the line staff to operate these facilities at the levels that we have become accustomed to, and that is something that I think we are going to have to -- well, that is an issue that is appropriate for licensees to manage, but one that I think we certainly need to be mindful of.

There are a lot of issues there. For all of us -- and the last point -- I would make -- I think Congress has been paying a lot of attention to us recently. I think that attention has been somewhat more positive than it has been in the past.

When I came on board three years ago, I think there was a lot of criticism about the way this agency was run, and in the more recent discussions that I have had with Members of Congress, and in the more recent hearings that I have participated in, I think there is a greater belief that the Commission is on the right track.

We are more risk-informed, and we are more disciplined, and we are not as bureaucratic and red-taped oriented as we used to be, and we are providing a level of safety that the public expects, and at the end of the day that is the most important matter of them all.

So, with that, that is my presentation. Unfortunately, I don't have a whole lot of time left because I have got a meeting coming up, but in the few minutes left, I can certainly take one or two questions.

DR. APOSTOLAKIS: Any members that would like to ask any questions?

DR. POWERS: Let me first interject and thank you for the kind comments about the research before, but let me make it clear that that was very much of a committee product, and to the extent that maybe I orchestrated it, my name might be attached to it, but in fact all of the members contributed substantially to that.

COMMISSIONER MERRIFIELD: I knew that and I apologize for not --

DR. APOSTOLAKIS: For praising Dana.

COMMISSIONER MERRIFIELD: No, I don't apologize for praising Dana. I apologize for not fully appraising the entire committee.

DR. POWERS: And I would want to say that, I, too, have worried a little bit about the ancillarity of the nuclear industry as we move to some consolidation in the ownership.

But fortunately I have had the opportunity attend some of the industry's fire protection forums, and where you get to see the continuation of a history of the exchanging of information within the industry of safety information.

And as we grow an interest in fire, I might invite you to attend one of those fire protection forums. I think that you will see that it is an industry that is very healthy still in its ability to transfer within itself good practice, good safety practices in at least the fire protection area. And that has been gratifying to me.

COMMISSIONER MERRIFIELD: And I would agree with that, although I would say that I think that has been an issue of no small debate. I had a chance last year to go down to the INPO CEO forum, and there was a lively debate that occurred there amongst some of the CEOs about the level of sharing within the industry.

And I think there are individuals of different minds on that matter. For my part, I think that sharing is a good thing, whether you are a utility, whether you are a Commission. You know, we share with our international counterparts and seek information from the as well.

And in nuclear safety, withholding of information is not the right thing to do. Sharing is the right thing to do, and I hope the utilities continue to follow that premise.

DR. APOSTOLAKIS: And maybe one last question?

COMMISSIONER MERRIFIELD: Yes.

DR. KRESS: Well, recently the new reactor oversight process has been much on our minds and agendas. And we wonder -- well, there seems to be a lot of enthusiasm for it out there among almost everybody.

We wonder if that enthusiasm is brought about because it is mainly more transparent and more acceptable, and an easier thing for everybody to do, as contrasted to perhaps its real technical foundation.

And is it doing what it is intended to do, in terms of assuring that there is no undue risk from the specific plants. I wondered if you might want to comment further on that.

COMMISSIONER MERRIFIELD: Well, I mean, obviously that is an area where we want to have ACRS continue to keep an eye to it. I use fire protection as an example, and I think in the old process that we did not take a look at fire protection to the extent that we needed to.

And I think the new system does. I think we are conducting inspections on fire protection on a much more disciplined and vigilant manner than we were. If we were pursuing this program, and weren't finding problems, then I would have more questions about it.

The fact is that the new program is in fact identifying areas that we had missed before, and picking out areas where we needed to do a better review.

So is it perfect? No, I don't think it is perfect. Will it continue to evolve? Yes, it will continue to evolve. Is it better than what we had before? I think so, and I think there is uniformity in that respect.

Is it technically better? Yes. I am hearing that it is, and I think there is some indicators that are out there that would lead one to that conclusion, but obviously if there are some concerns, we can continue to probe.

We should not be satisfied with the product. We should continue to improve it, and to the extent that we can identify the urge to improve, we should certainly move forward.

DR. APOSTOLAKIS: Well, thank you very much, Commissioner Merrifield.

COMMISSIONER MERRIFIELD: Well, thank you for allowing me to come in and share some of my thoughts.

DR. APOSTOLAKIS: That's great.

COMMISSIONER MERRIFIELD: I know that this isn't always something that you have had an opportunity to do, and it is very helpful for me.

DR. APOSTOLAKIS: Thank you.

COMMISSIONER MERRIFIELD: And any reactions that you have, I look forward to a continuing positive dialogue.

DR. APOSTOLAKIS: Good. Thank you. Okay. We will recess until 10:20.

(Whereupon, the meeting was recessed at 10:03 a.m. and resumed ats 10:29 a.m.)

DR. BONACA: The meeting is called to order. We are now going to review TRACG, best-estimate of hydraulic code, to head this session.

DR. WALLIS: Thank you. I was not at the subcommittee meeting on August 22nd, and Paul Boehnert has just come around and said that I should never be allowed not to be at a committee meeting because of issues that I may raise later on.

I was the November 13th one, however, and let me give you an overview. This is a code which has been around for a long time. It has various features in some hydraulics which one can question, but that is true of all codes.

And what GE has done is they have applied it to these anticipated operation occurrences using the CSAU methodology. And whatever the defects may be in the code, if you do a proper assessment of uncertainty, then that takes care of them.

If it is a bad code and has big uncertainties, and it has a better code, it has lower uncertainties. but the whole issue of best estimate code is that it is an estimate code, and you estimate the uncertainties quantitatively.

And best is really not the right adjective. As you get a better code, you get smaller uncertainties, but the real issue here is that you must quantitatively assess the uncertainties.

And I think what is impressive about what GE has done is that they have done that. They went through the CSAU methodology, and whatever may be the faults in the modeling in the code, this comes out in the assessment of these uncertainties, using CSAU, and in comparisons with data.

And the comparisons with data for these plant occurrences I think we will see, and what we saw in November are really pretty darn good. So the conversions are good, and they have gone through an exemplary exercise, or it appears to be an exemplary exercise, in using this methodology.

And the staff, and another thing which is very important in this, is that the staff has had the opportunity to exercise the code. So if there are strange things about the code, the staff has had a great opportunity to run the code and try to find them.

And I think that is a very important reason why the staff, and we, and why we would have confidence that the staff has done these things and that the code is robust, and indeed stands up to the tests that they have put it through, as well as GE has put it through.

So personally, unless there are some surprises coming up, I don't think that it matters too much that I wasn't at the subcommittee meeting. But now maybe Tom Kress would like to add something to what I have said.

DR. KRESS: I think you have covered it

pretty well. I think we had a number of questions that we had and that were raised at the previous subcommittee, and I think that the presenters at the next subcommittee did a very laudable job in addressing those particular questions.

DR. WALLIS: So, I think that we really -- who is first, is it the staff,or --

MR. BOEHNERT: Yes.

DR. WALLIS: The staff is first. Ralph. It is a great pleasure to welcome Ralph Landry back to make a presentation to this committee.

MR. LANDRY: Thank you, Dr. Wallis. My name is Ralph Landry, NRR, the staff lead on the review of the TRACG code. I would like to give just a brief overview of some of the topics that I want to hit on rather lightly this morning with the time available.

We can't go into a great deal of detail, but I would like to give you an overview of what we did in this review, and what some of our findings were in the review. So I would like to very briefly talk about the time line, and when we received the code, and what has led up to this draft SER.

And how we approached the review to the code, and the applicability of the code, and some of the assessment, and our evaluation, our traditions and limitations which we have stated in the draft SAWYER on the use of the code.

And we would like to point out that when we get to that point that these conditions and limitations really are an extension of the code beyond its requested review. That the conditions and limitations which we have stated are those which would be imposed should the code be taken beyond its stated application.

Some of our conclusions, and then I would like to touch on the lessons learned. Dr. Wallis talked about the review of the code and what we have done in this review, but this is the third code that we have reviewed in the past 2-1/2 years, the third thermal-hydraulics code that we have reviewed.

And in each of those reviews, we have seen a different presentation of the code, and different support of the code, and the application of the code has been different.

But we have learned something and I would like to touch on some of those lessons that we have learned in this process.

MR. BOEHNERT: Ralph, let me interrupt a second. I should have said this before you came up, but I need to make a statement that both Dr. Ford and Dr. Bonaca are in a conflict of interest for this session because of owning GE stock. But that needs to be on the record. Thank you.

DR. POWERS: Do we maintain a quorum?

MR. BOEHNERT: That's a good question. Well, they can be present here in the room. So that should not be a problem regarding the quorum.

MR. LANDRY: Okay. A quick overview of the time line. We received preliminary information on the code in the spring and summer of 1999. These were times when the applicant, General Electric, came in and then presented to us what they wanted to do with the code, TRACG, and how they wanted to approach the approval process, and gave us an overview of the code itself.

We started receiving the actual submittal in January of 2000, and that submittal was completed in February of 2000. This was submitted in sections,m the documentation, and finally the last piece we received was the code itself.

We received the code in both source form and in executable. So that we were able to install the code on a computer. We were able to install its executable, and we were able to build an executable version of the code.

DR. WALLIS: And you were executes for the plants, too.

MR. LANDRY: Plus, we have received some input from the applicant. In November 2000, as Dr. Wallis pointed out, we met with the ACRS thermal-hydraulic subcommittee, and presented a number of the results of our review of the code, and the applicant presented an in-depth detailed overview and discussion of the code and its capabilities.

In July of this summer, we formally issued our REIs, and in August, we formally received the response to those REIs. What we have done is follow the course that we have with the other code reviews, and we feel like this has been very successful.

Where we have come up with questions and concerns, and have shared those with the applicant during the course of the review, those are informal, and we have sent E-mails to the applicant, and told them what our concerns were.

They would respond informally with E-mails. Some of those requests resulted in further requests, further requests for clarification, and meetings, and phone conversations, and until we finally arrived at a point this summer where we said, okay, we have all of our questions listed for the application in this code.

We went through the formal process of management approval, and issued the formal request for information to the applicant. Of course, they had been interacting with us for the past year-and-a-half, and knew what the questions were, and knew what the answers were, and were able to respond immediately with a formal set of responses.

We prepared our draft safety evaluation report in July, and we shared that with the subcommittee, and met with the thermal hydraulic subcommittee two weeks ago, at which point we discussed the findings of our draft SAWYER.

Now, how did we approach this review. TRACG, as Dr. Wallis pointed out, has been around for quite a while. It is a decedent of the TRAC-B code developed INEL, or now INEEL.

The code was submitted several years ago during the SBWR review, which was subsequently withdrawn. The code was submitted at that point for a LOCA application to SBWR and received a very extensive review, both by the staff and by the contractor, BNL, located at the National Laboratory.

DR. SHACK: Is that a best estimate LOCA

code?

MR. LANDRY: No, that was for an Appendix K application at that point, and that will come up again. During that review the code received an extensive thermal hydraulic review, thermal hydraulics capability, and --

DR. WALLIS: Excuse me, but did the ACRS get involved with that?

MR. LANDRY: Yes, the ACRS was involved in a good part of that review also.

MR. BOEHNERT: We had some subcommittee meetings on it, but I don't believe we had a formal review with the full committee, because the review was terminated because the project was terminated.

MR. LANDRY: The decision of the staff was because of the nature of the application of the code at this point for anticipated operational occurrences that what we would try to do would be to look at the review that was done for SBWR and build on that review, rather than go back and do an in-depth thermal hydraulic review of the code.

We tried to build on what was done, and we only asked a few REIs on the thermal hydraulic aspects of the code which were pertinent to the application to the AOO transients which were pertinent to the application to the AOO transients.

Instead, we felt that it would be more productive if we would apply our resources to a more in-depth review of the neutronics of the code, because there was a 3-D kinetics package in the code.

If you will remember when we reviewed the RETRAN 3-D code, the 3-D for RETRAN was referenced to the neutronics package, and not to thermal hydraulics. We did such an extensive review of the neutronics of that code, and because this code also had a 3-D neutronics capability, we wanted to focus heavily on the neutronics capability because we knew that the package was different than that which we saw in the RETRAN 3-D code.

And we knew that it was going to be different than that which we have in our own TRAC-B Nestle combination.

DR. WALLIS: Can I ask you something here? When you ran the code, you also ran the thermal-hydraulics part of the code?

MR. LANDRY: That's right.

DR. WALLIS: And you actually tried various things with that to see if it was giving the right response?

MR. LANDRY: Yes, we ran some full-plant

calculations also.

DR. WALLIS: And you didn't just do neutron kinetic --

MR. LANDRY: Right. We have run the code in other areas. But we wanted to focus our review on a couple of areas that we felt would be very important for AOO transients.

One thing that -- and getting to Dr. Shack's question, when the code was submitted prior to this, it was not as a statistical or realistic LOCA, but now it is being submitted as a statistical or realistic AOO code.

It is being submitted to take advantage or utilize the CSAU methodology to support and defend the code's capabilities.

DR. WALLIS: And by statistical methodology, you mean CSAU?

MR. LANDRY: Yes. We were focusing on the uncertainty analysis which was provided in support of the code. Questions came up about, well, shouldn't a code be reviewed in depth on every single thing it can do.

Well, we really can't have that leeway with a code. When it is submitted for AOO transients, we can't go back and support a complete review of every single aspect of the code, and every potential application of the code, because the code is not being applied for that.

It would not have been fair to the applicant to review the capabilities of this code for a LOCA application, because it was not submitted for a LOCA application.

It is going to be submitted for a LOCA application though, and so we are going to get a shot at that. General Electric has informed us that they are coming in in the first quarter of 2002 with a realistic CSAU LOCA application for the code.

And we will get a chance at that point to do another look at the thermal hydraulic capabilities.

DR. WALLIS: Well, the statistical methodology is tied to the application.

MR. LANDRY: Correct.

DR. WALLIS: And you go through the application and look at the uncertainties for the predictions for that particular application. And if some professor at some university shows that the code does a poor job of protecting her experiments, let's say, in a lab which has nothing to do with a reactor, that is irrelevant isn't it?

MR. LANDRY: It can be. It can be

relevant if you can show the uncertainty in the important parameters.

DR. WALLIS: As it applies to --

MR. LANDRY: And are the parameters for the application represented properly in that experiment, and are the parameters important, and how do you represent those parameters, and what is the uncertainty in the way you represent those parameters.

DR. WALLIS: I think that this is something that we need to perhaps say clearly though, is that there are models in the code which will not represent full separate effects tests done everywhere by everybody.

MR. LANDRY: Correct.

DR. WALLIS: And you can always find tests on which the code does a lousy job. If there are too many of those, I guess you worry, and I guess you have to say are the same lousy jobs present in this application, and you have to do the investigation.

MR. LANDRY: That's correct.

DR. WALLIS: And if they are not present in this application, they don't matter; is that a true statement?

MR. LANDRY: Maybe they are less important. I would not want to be so harsh as to say that they don't matter. I would rather say that they are less important, or we have to understand the importance.

DR. WALLIS: Yes, they do understand the importance, and they turn out to be small, and that you don't worry so much about it.

MR. LANDRY: That's correct.

DR. WALLIS: And if it is small enough in terms of some evaluation criteria, it does not affect your approval of the code?

MR. LANDRY: That's correct. I would also like to point out at this time that all of the codes which were received thus far for review have been submitted prior to the staff's issuance for comment of draft reg guide 1096 and the draft SRP.

This was the first time that we have seen a submittal of a transient analysis tool under the evaluation of CSAU methodology. This was using the full CSAU methodology, and this is the first time that we have seen such an animal coming out.

The applicability of the code. I don't want to go through all of the transients within these categories. These are just the major categories that the code was going to be applied to.

And increase and decrease in heat removal by the second system. Decrease in reactor coolant flow rate, and reactivity and power, distribution anomalies. These do not go into the area of reactivity insertion accidents, such as rod ejection, or stability analysis, and I will get into those in comments later.

DR. WALLIS: But some of these are actually supported by plant data and real transients?

MR. LANDRY: That's correct.

DR. WALLIS: Do you recall which ones of these there is real plant data on? Maybe we will get into that later.

MR. LANDRY: I think GE may have some comments on that later, and I would rather defer to them and have them -- because not all the plant data were used for the full assessment. Plant data were used in assessments specifically --

DR. WALLIS: This is something where unlike large break LOCA, you don't have plant data?

MR. LANDRY: That's correct.

DR. WALLIS: But we do have plant data, and that gives us much more assurance that the code is being realistic if it can predict that data?

MR. LANDRY: That's correct.

DR. WALLIS: I think that is one of the

things that helps us to agree with you if we are going to do so. It helps us to agree with your conclusions.

MR. LANDRY: Well, that will lead that into the next slide. The assessment code that was performed included the phenomeological tests that Dr. Wallis was referring to a few minutes ago, separate effects and integral tests, but also plant operational data.

BWR-based in the country has a large database of operational data. Start-up test data, and specific tests that have been performed, plus operational occurrences.

And the data that are available from those occurrences -- the main stream line isolation valve closures, the turbine trip tests that are performed -- provide us with a database wherein we can take scaling effects out of the assessment process.

You don't need to do a scaling report, a scaling assessment report, when you have full-sized plant data. So, scaling is one; whereas, if you do phenomenological testing, now you worry about are you scaling the phenomena properly.

DR. WALLIS: Can I ask you another question now then? GE did some evaluation of their code against plant data. Did you run the code and assess it against plant data?

MR. LANDRY: No.

DR. WALLIS: So we have to go on GE's assessment there? What did you assess it against?

MR. LANDRY: We ran cases, some sample cases, to determine how the code performs, and to see if it was performing full plant cases --

DR. WALLIS: Excuse me, but the one thing you could have done was to say, okay, let's take this plant data that they fit so nicely with the code, and see what happens if we try and do it, and maybe tweak things in the code.

MR. LANDRY: Well, for the big plant data, one specific area where we did run was a narrow focus on the neutronic capability. We ran some of the neutronic cases which we had from the full-sized plants in looking at the neutronics packages.

DR. WALLIS: But then that still is not independent of the thermal hydraulics are they? You have to know the reactivity, and the effective voids and things.

MR. LANDRY: Yes. Those were run by Tony also. So, let me ask Tony to respond to that.

MR. ULSES: Let me jump in here. I am Tony Ulses, now of the Office of Research. I need to catch my tongue here. What we did was that we set up a sample problem, which was basically similar to what we did in the RETRAN work, where we were looking at a reactor that was initially specified by me to be a very easy problem to set up.

It is not a real reactor, and it will never run, but we also did run the test cases that were given to us by GE, basically, and we did run the Peach Bottom deck.

But beyond looking at the output to make sure that it was the same output that was in the licensee document, we did not go in and run any safe assessment for the sensitivity test.

DR. WALLIS: So you did get the same output for --

MR. ULSES: Oh, sure, yes. But that was run to confirm that the deck was actually giving us the same answer that was in the actual licensing documents. But going in and actually varying parameters, no, that was not done in this case.

DR. WALLIS: And it might have given you some more assurance that it was a robust code, and if you varied some assumption or whatever, you might be a bit suspicious about whether it was within the uncertainty estimates of GE or something then?

And it would be useful to do that, rather than just checking that you get the same run that they do.

MR. LANDRY: Right. As I said earlier, part of this review process has been a learning curve. We have learned a lot of lessons, but we have tried to focus each review on what we thought was the most important area for each code.

Continuing with the code assessment, one of the things that we did point out, and that GE has taken care in, in their assessment reports, is to make sure that the nodalization for the plants is consistent with the nodalization that was assumed and used for all the assessment and uncertainty analysis cases.

Now, this of course comes right out of the CSAU recommendations. Part of phenomena identification, a ranking table was prepared, as required for CSAU analysis, and if we are going to correlate the phenomena with the test, and with quantitative assessments that were performed in support of the code.

All of the medium and high-ranked phenomena listed in the PIRT were assessed in the uncertainty analysis.

DR. WALLIS: By GE.

MR. LANDRY: By GE. And the assessment shows the capability in the code to represent the experimental and operating data. Some brief remarks on the thermal hydraulics, and some observations. As we have pointed out in the past, it is a two-fluid code.

It has six conservation equations; boron transport equation, and non-condensible gas mass, and it uses a two-regime unified flow map. And while this can be criticized --

DR. WALLIS: Excuse me, but is this a one-dimensional model?

MR. LANDRY: Yes. Now, this can be criticized as being rather restrictive. The two-regime map is acceptable and does cover all the normal, and operating, and anticipated transient regimes that would occur in a BWR.

Questions have been raised about the applicability of the map for a LOCA. Those questions were raised during the SPWR review, and questions were raised on the mixture level TRACing model for a LOCA.

Those are items which General Electric is aware of which we discussed with them, and which we will be reviewing when they submit the code for the realistic LOCA next year.

The old TRACG code, TRAC-B code, took the kinetic energy term out of the energy equations to make the solution easier. However, that creates problems in that you end up with non-conservation of energy, and energy unbalanced.

The kinetic energy terms have been put back in and retained in the energy equations for TRACG, and this helps to avoid energy balance errors. We do point out in the draft SAWYER that there was a question raised on the GEXL correlation, the critical boiling length correlation.

This question came up not with GEXL in general, but with the specific application of GEXL14. Those questions came up during the power uprate review that was being performed by the staff, independent of the --

DR. WALLIS: Was this the one that our computer was used to generate data?

MR. LANDRY: Well, General Electric does have other data that they can use in support of GEXL14.

DR. WALLIS: But this is the one isn't it? This is the case where --

MR. LANDRY: Yes.

DR. WALLIS: -- they used the computers to generate data, which were then regarded as being data?

MR. LANDRY: Yes. That was one of the things. That review is ongoing and is coming to a closure, and because GEXL is used within TRACG, we wanted to make sure that we had not left any doors open.

And we wanted to be sure that because we knew this other review was going on, and questions were raised, we wanted to have closure of that same issue with TRACG. This is not a unique TRACG question.

But when the GEXL14 question is resolved by the staff, that resolution will be applied to TRACG also. The inclusion of the comment was intended to bring closure and to alert future reviewers of applications of the code, that this question had come up, and to make sure that the closure has been taken should they be looking at an application of the code relying on GEXL14.

The basic component models are used as building blocks, as with TRAC-B. We also noted in and wanted to point out, that there is a full-sized steam separator validation in the code.

Full-sized steam separator data are

available, and very good data, and are used to validate the steam separator model in the TRACG code.

DR. WALLIS: Now, the NRC has its own TRAC code, which is no longer worked on.

MR. LANDRY: We have TRAC-B, and --

DR. WALLIS: But research has its own TRAC code.

MR. LANDRY: Yes.

DR. WALLIS: So you have an opportunity, or they must have run it on something. They just didn't develop it. Have they run it on these kinds of transients?

MR. LANDRY: I am not sure what research is going with the TRAC-M code.

DR. WALLIS: Well, presumably they use it for something. Didn't they try to evacuate some transients with it? It is not just --

MR. ULSES: Actually, Dr. Wallis, by --

MR. LANDRY: Well, in his new job in research, Tony is involved in --

DR. WALLIS: I think it would be very useful if -- and I think we have said this in our letters, that besides this running the user code, NRC runs its own code on the same problem. This engine has a TRAC, and it would be interesting to see if the two TRACs give the same answer on the same TRAC.

MR. ULSES: By no small coincidence, Dr. Wallis, I happen to be working as we speak on the TRAC-M assessment and we are actually participating in the international standard problem, looking at the Peach Bottom assessment, and we are actually going to be comparing the codes to the plant data.

DR. WALLIS: So we have some of the same problems with the NRC code.

MR. ULSES: Yes, sir.

DR. WALLIS: But you have not gotten any results yet; is that correct?

MR. ULSES: We are in the process of doing that, right.

DR. WALLIS: So we don't want any surprises do we, or it would be interesting if there were surprises.

MR. ULSES: Well, we hope not. Actually, I wanted to make another comment on the question of assessment that you asked, Dr. Wallis. I think maybe you were kind of driving at the question of the user effect on the code, and that might be based a little bit on our experience with our previous reviews, where the user had the ability to really go in and make a lot of changes to the internal mechanisms of the code.

I think what you are going to find is that with the TRAC series of code is that the user does not have nearly as much flexibility. In other words, you can't go in and specify a Weber number, for example, in the TRAC input deck.

I mean, that is in the code, and it is there, and the user can't go in and change that. So the user effect is obviously there, but it is not nearly as large as we have seen in the past.

DR. WALLIS: But in the NRC code, you can do these things.

MR. ULSES: Well, I can go into the source code, and change it, and recompile it certainly. But the input itself, you can't go in and say -- well, make it change as I was talking about before, and like in the previous codes that we have reviewed without naming names.

MR. LANDRY: Names are being withheld to protect the innocent.

DR. SHACK: Or the guilty.

MR. LANDRY: Or the not-so-innocent. I would like to address very briefly now the neutron kinetics, since we did spend a great deal of time looking at the 3-D kinetics in the code.

The focus as we discussed already was on the code, and does the code work, and why does it work, rather than on how. The emphasis was on execution of the code, and in particular execution of the kinetics package.

Comparisons to benchmark data and comparisons to our own TRAC-B Nestle combination.

DR. POWERS: When you say focused on, does it include work, and why does it work? Could you tell me a little more about what you mean by that, or are you speaking in a numerical method?

MR. LANDRY: We did not go in depth looking at the numerical methodology, and looking at the derivation of the equations, but rather what was looked at is whether the code predicting data from such items such as the Peach Bottom test, and does the code predict the SPERT test, the SPERT-3 test, well.

Does the code compare with our code in predicting the same test. When we did a prior review of the 3-D capability, we were showed how or found how our code and the other codes, the 3-D kinetics capabilities compared, and compared extremely well.

We wanted to see how this code's 3-D kinetics capability, which was a little bit different approach, compared with our code, because we already had two codes that looked almost the same, and now how is this one going to look compared to what we have.

DR. POWERS: So it was more of the black box approach?

MR. LANDRY: Yes. Until we ran into a problem. In this process, we ran into a problem and found that we did not understand why the two codes were predicting very dramatically different results, and started looking at the input data, the structure that generated the input for the two codes.

And we found that -- and I will get into that later, but that one of the lessons that we learned was we had to be very, very precise in specifying the problem, especially thought problems, and we also had to look at the upstream codes and methodologies.

When you have upstream methodologies that are very old, or that rely on a very limited number of groups, you get results that are very hard to compare with methodologies that are much newer, and are using multi-group techniques.

So when I say we were trying to look at how our -- well, not look at how, but look at why there are differences and do they work, this is where the focus was.

What is the difference between these two methodologies and why is there a difference, rather than how does this code work.

DR. WALLIS: So you did this for neutronics -- I mean, you compared TRACG with TRAC-B?

MR. LANDRY: Right.

DR. WALLIS: But you did not send the thermal hydraulics to do something similar. It was like comparing TRACG with TRAC-M, which would be the complimentary thing to do with the thermal hydraulics. So you have just done it with the neutronics?

MR. LANDRY: Right.

DR. WALLIS: Now, we wrote a letter to the agency suggesting that work be done on Y codes work, despite the differences in assumptions, and despite some of the assumptions being unusual.

And we have gotten a reply that it was difficult to do this, and it was going to be very expensive, and so on, and you seem to be doing it anyway to some extent through these neutronics.

MR. LANDRY: But if you remember, Dr. Wallis, at the beginning, I said that we were focusing our review in specific areas.

DR. WALLIS: But I think we ought to take some lessons from this; that you found it useful to run the NRC code and the GE code as far as neutronics goes, and make comparisons, and look at the reasons for differences, and ask why, and to figure it out, and to resolve those differences?

MR. LANDRY: That's correct.

DR. WALLIS: And this may be a good example of how things should be done with the thermal hydraulics end of things in the future.

MR. LANDRY: You are getting into my lessons learned; and, yes --

DR. WALLIS: And maybe we are on the same TRAC.

MR. LANDRY: No, we are on the same course. This is TRAC, but we are on a different course. We are in full agreement. In other reviews, and our stepping back and saying how should we approach other reviews, with each review what should be the focus of the review.

And we learned so much in this review, or we learned so much on every review, and on this particular review, a value in doing just what you are talking about, a detailed comparison.

And that that same philosophy can be applied, and probably will be applied in future reviews in other areas as the need arises. And continuing with the kinetics examination --

DR. WALLIS: Well, let me say that this gives a lot of public confidence if you can do that. If you can say that we have done independent runs with some NRC code which we understand, and this has given us a basis for evaluating the other code.

And we have learned as we have gone along about perhaps faults of both codes, but the result is a better understanding and a better judgment about what is acceptable.

MR. LANDRY: Yes. We agree with you, and we are making strides in those directions.

DR. WALLIS: I hope that you will have the staff to be able to continue doing it.

MR. LANDRY: That is out of my control. Some of the conclusions on the kinetics review, we felt that the code does capture the relevant physics. We felt that the documentation was adequate for internal General Electric use.

We did have some criticisms of the documentation, especially in the kinetics area. However, we felt that because the code is used internally, and it is not put out in the public sector,the applicant controls the education and training of the users, and has the capability to fill in where there are gaps.

So it is adequate for internal use, even though we felt that it could have been better. We felt that the test problem definitions that we based on ABWR code design was good, but we did learn that we had to be very specific and very careful in defining test problems.

We felt that there was reasonable assurance that TRACG can model the AOO transients.

DR. POWERS: Well, you have to be very careful in defining problems. Presumably that is a lesson that we learn about everything. Can you tell me more here? Are you telling me that it is impossible to define a problem well?

MR. LANDRY: No, but it just means that we have to do more homework in defining the problem to be sure that when we define it that it is going to test what we want to see tested, and it is not going to mislead us into an examination of something that is occurring that isn't relevant.

DR. POWERS: Okay. So it is not a case of reaction to the statement. Okay. I find it very difficult to -- in challenging to define a test problem, and test some -- to compare against some data.

And I am going to use this calculation to calculate something that I have not been on, and I can never be sure that I am actually getting what I think I am getting out of it. That's not what you are saying?

MR. LANDRY: No. That means that you have to be very cautious when you set up that problem to be sure that what you get out is what you want to get out. It doesn't mean that you can't get it, but it means that you have to be very careful to make sure that you are focusing in on the problem that is real, rather than a problem that is not.

DR. WALLIS: What does it mean by -- what do you mean by this "reasonable assurance TRACG can model" statement? TRACG can model anything presumably and get some answer. What is your criterion for acceptability?

If they run the code, what is your criterion? Is it because it is close enough to the data or isn't the assurance that the uncertainty evaluation is sound. Therefore, when you do your figure, you have got a good assessment of how close you are to some boundary, and what is the chance of stepping over it and all that sort of stuff?

MR. LANDRY: It is looking at the uncertainty evaluation that was performed and saying the uncertainty evaluation is well done.

DR. WALLIS: Is it good enough for regulatory use?

MR. LANDRY: But in this case, or in one of the cases that we are looking at, is a thought problem, a made up problem, and we look at the problem and say, okay, it is a reactivity transient.

The peak powers are different, but it is over an extremely short period of time, and when we look at the longer period of time for that transient, we see that even though the peak powers are different, the energy deposited over the entire transient is the same.

And if the right phenomena are occurring and are in the right spots, and --

DR. WALLIS: So the uncertainty and the overall power is small?

MR. LANDRY: Right.

DR. WALLIS: So you have some sort of acceptance criterion which says that the uncertainty has to be within some limits or something, or you just guess?

MR. ULSES: Well, actually, let me jump in here. Basically, what that statement is intended to mean is that if you look at the review of the kinetics package in its entirety, including both the test problem that -- called the GE validation against experimental data on all of the other work that we did, basically the bottom line conclusion was that the effect of any of the -- well, I am just thinking how best to put this.

That was really intended to discuss the fact that as Ralph said, we did have some -- well, some malingering differences in the prediction of power for the sample problem.

However, the effect of those differences on the bottom line answer for AO transients, which is the effect on changes in the minimum critical power ratio, was effectively nil, and actual what I mean by nil, was that it was basically almost impossible to see the effect.

But that's the relevant output of all of these transients. We do all this stuff with all these big codes, and we get one number out of it.

DR. WALLIS: What number did you get for uncertainty?

MR. LANDRY: Well, this is just looking at this transient.

MR. ULSES: Right. This is how it is applied in actual licensing of the plants. I mean, that's what they use to set the operating limits of the plant.

DR. WALLIS: I see. Well, the criteria for accepting this code are that there is reasonable models over physics, and that is part of it. But the other part of it is that when you make a prediction, you can also predict the uncertainty.

Now, that is the requirement for the best estimate code isn't it? Now, what the staff does with that I think is still up in the air. The use of the code may be able to do all the things with CSAI and predict all these uncertainties.

But I don't think the staff has really thought through what it is going to do with these uncertainties when it gets them, and that's where I think we have also mentioned in our letters that, yes, our codes are doing all these things that we have asked them to do, and you need a measure of the predictions, and the answer, and the causes of all the answers and all of that.

But what are you going to do when you have got that? I mean, there has still got to be some relationship with these uncertainties to margins and acceptance criteria, and so on.

I am not sure that the staff really has

thought that through. Do you have any comments on that?

MR. LANDRY: At this point, we would just have to say we are continuing to study that, and we are trying to define.

DR. WALLIS: Well, that's typical. I mean, you see, there must be a criterion, some acceptance criterion, when they want to uprate the power to some point where it is meeting some boundary.

Then how big the uncertainties are in the code are very important to know, and whether you may step over that boundary or not. So it seems to me that maybe the acceptabilities then are going to depend upon the use.

Yes, they have got a good code, and they have an assessment of uncertainty, and then look at something like power uprate, and start using this code, and then you can figure out perhaps how big the uncertainty or what is the effect of the uncertainty on your decision about whether or not they should be allowed to uprate power.

MR. CARUSO: Dr. Wallis, this is Ralph Caruso from the staff. We do actually have some criterion in this area for AOOs. For example, we set a safety limit minimum critical power ratios to ensure that 99.9 percent of the rods don't undergo boiling transition.

I think that your question is what does reasonable assurance mean, and I think that the ACRS has had this discussion with the Commission in the past about what reasonable assurance means, and I don't think there has ever been any definition that everyone has agreed to.

This is an eternal question that we try to deal with, and it comes out of judgment to a large extent at this point. When we can quantify it, for example, and say setting safety limit MICPRs, we try to do that.

We are trying to do our regulation in a more risk-informed manner, and that is another attempt to do it in a more quantifiable way. But right now these are the words that the law requires us to use to make a finding.

So those are, unfortunately, the words that we use and they are not well defined.

DR. WALLIS: But the law requires you to make a finding with 95 percent confidence.

MR. CARUSO: No, the law requires us to make a reasonable assurance finding.

DR. WALLIS: If your criterion is 95

percent confidence, then the fact that they have evaluated these uncertainties enables you to make that assessment.

MR. CARUSO: We could say that a 95 percent confidence does define reasonable assurance, but --

DR. WALLIS: That is the thing that I think is not being worked out yet. I mean, you have got the tools to do it, but if someone comes around like tomorrow and says reasonable assurance is 99 percent, then you have still got the tools to do it, but where you come out on allowing some change in the plant may be different.

MR. CARUSO: I really hate to pass the buck on this, but I do believe that this has been the subject of some extensive discussions with the Commission about the definition of reasonable assurance, and I don't believe that anyone has come up with an acceptable definition for all the parties involved.

DR. WALLIS: So maybe my --

MR. CARUSO: This is a little bit beyond my pay grade as they say.

DR. WALLIS: -- saying that you have got a good tool is, but the staff isn't quite sure how to use it, is a true statement.

MR. CARUSO: I can't explain why. I don't want to get into philosophy on this particular issue.

DR. WALLIS: It is not philosophy. It is really very real.

DR. KRESS: Yes, and in a number of our letters, we have commented that the staff needs to get more into formal decision criteria, and this is exactly what we mean by formal decision criteria. How do you use these uncertainties to make our decision.

And you would come up with some sort of a technical definition of reasonable assurance that way, and we said that in a number of letters. And I think it could be repeated over and over. I think it is needed.

DR. WALLIS: And the reasonable assurance probably should be risk-informed. If it is not important to risk, then you can do it with less assurance perhaps.

MR. CARUSO: And there is a lot of effort going on in that area for a formal decision.

DR. KRESS: And that would be part of the formal decision process.

DR. WALLIS: That is part of a broader picture. So, maybe we should move on.

DR. KRESS: But I don't think that is these guys' job. They just have to be sure that the code can -- well, I agree with you that if there is reasonable assurance that it does the uncertainty correct, then they have got a basis for saying its okay for this.

MR. CARUSO: As a lower level engineer, I would be thrilled if someone could define the term for me, but I have not seen it defined yet.

MR. LANDRY: Okay. Moving on to experience, user experience with the code, some of the things that we wanted to point out from our use other code was that TRACG uses input decks that are very closely related to the TRAC-B specification, which means that a person who is knowledgeable in any of the TRAC codes can come in and with a very minimal level of training become proficient in the use of TRACG.

So it opens up a pool of people who have the capability of using the code proficiently. That major changes between TRAC-B and TRACG are well described in the report.

We do feel that and we have said to General Electric that additional guidance to the user would be useful on time step size selection. We also point out that the General Electric Company has developed a set of standard input decks, and standard input specifications, for the code.

This, we feel, is a big step forward in reducing the user effect, and as we have seen in other code reviews, users can have a great effect on results by how they specify the input deck.

A lot of that has been taken out with the code and with its internal use with the company. So that the user effect is reduced significantly.

Some of the conditions and limitations which we specified in the SAWYER. As I said earlier, these really are conditions and limitations which would apply to the extension of the code beyond the specified use of the code at this point.

And dealing with GEXL14, we have already discussed. Our application to stability and ATWS analysis. In the past, there were two reviews of the code, TRACG Code 4 stability analysis, and for ATWS.

Those reviews were done in an extremely focused and an extremely narrow way. The application for stability was for setting set points, and what we wanted to do was to acknowledge that, yes, those reviews had been done for that specific purpose.

And that use of that code in general to stability and ATWS would be far beyond the conduct of those reviews, and far beyond what we have done in this review.

So that if the code is to be applied for stability analysis or for ATWS, that it should be reviewed further for those specific applications. That this is not approval for those applications.

DR. WALLIS: Doesn't this also apply to LOCA?

MR. LANDRY: Yes.

DR. WALLIS: Why didn't you say that?

MR. LANDRY: Because this is transients.

DR. WALLIS: So by implication, LOCAs would not be included?

MR. LANDRY: By implication, LOCAs are not.

DR. WALLIS: So that is well understood by the language then?

MR. LANDRY: This is anticipated operational occurrences.

DR. WALLIS: And that is well understood by GE, too.

MR. LANDRY: LOCA is not an AOO.

DR. WALLIS: Because I think there was a concern that this was a sort of back door approval. That you approved the code for one thing, and then GE says, oh, you approved it for this, and therefore it is good for everything.

MR. LANDRY: This is not an approval for LOCA.

DR. WALLIS: Okay. Thank you. Can we move to your conclusions?

MR. LANDRY: Conclusions. As we have talked about GEXL14 in the past, and we said that he kinetic solver is adequate to support the conclusion that the models are correctly derived in a competent phenomena, and involved in AOO transients.

We feel that the analysis that we have performed give confidence that TRACG can be acceptable for AOO transients. We believe that the uncertainty analysis follows accepted CSAU analysis methodology.

We were very pleased to see a transient code come in applying the CSAU methodology. Uncertainties and biases have been identified in all of the highly ranked phenomena based on experimental data, and have been validated.

The bottom line is that the staff finds the TRACG-02A code acceptable for application to the AOO transients presented in the submittal. So the lessons learned, we touched on all of this already.

We have reviewed three codes, and each

code has been unique in its application, and in its submittal, and in its support. Each of the codes were submitted prior to the draft REG guide and draft SRP section being released to the public.

The review that we have seen so far is that CSAU can be used successfully to support a transient methodology. That it is not limited to LOCA methodology.

As we have talked about already, when you generate a thought problem, you have to use a great deal of care in generating that problem to be sure that the problem is going to focus in and test what you want tested, rather than mislead you, and lead you down the wrong path.

But we also have learned from the discussion from this review that the upstream codes that are used should also be reviewed. We should have access to upstream codes.

If a code is used to set lattice physics parameters, we should look at that methodology if those parameters become important to the kinetics package and for the application of the code, for example.

The experience from these reviews has taught us a great deal about the usefulness of having a code and being able to exercise a code, and even if we exercise specific parts of the code, we have learned a great deal from that process.

And a great deal that we would not have learned had we not had the code in-house, and had we not had the code, we would not have gone down the wrong path on the kinetics examination.

But we would not have learned things about the background for the kinetics input that we did learn in this process because we had the code. Having the code in-house has been an extremely useful tool to us, and has helped us a great deal in the reviews.

And as Dr. Wallis has pointed out, there are areas in which we can improve in the code and having to put in-house, and other areas that we can examine further for official reviews.

This has been a building process for us, and from each of these codes we have learned something in the review process, and we have been able to build in the way that we conduct each of these reviews.

DR. SHACK: What is a best estimate AOO code buy for it?

MR. LANDRY: Well, in this case it can change the operating limit, the minimum critical power ratio. You can use it to set your set points, and your power ratios, more accurately, more realistically.

DR. WALLIS: Do these set limits on something like power uprates?

MR. LANDRY: I'm sorry?

DR. WALLIS: Do these transients limit power uprates in any way?

MR. LANDRY: Yes. This can buy you in the power uprate arena. When the code comes in for review for LOCA, that can buy in in the larger power uprate arena also.

There are a lot of applications for which understanding margin -- and maybe we should say understanding margin rather than reducing margin. But understanding the margin available can help you if you want to increase power, or if you want to change operating limits.

MR. CARUSO: In discussions with the vendors, we have learned that a lot of them use these margins not just necessarily to raise power, but for example, to reduce -- for example, to reduce diesel generators start time requirements, or to reduce valve stroking time requirements.

And they give the plants more breathing room and a better idea of where the cliffs are, and a better idea of how they can operate their plans. So it is not just that they can raise power and make more money.

It is that they can operate more safely because they understand where the limits are.

MR. LANDRY: This concludes the staff's remarks.

DR. WALLIS: Thank you very much.

MR. LANDRY: And I believe that General Electric is next on the agenda.

DR. WALLIS: Are we going to close this session?

MR. BOEHNERT: No, they intend to have an open session.

DR. WALLIS: To have it completely open?

MR. BOEHNERT: And then close, if necessary, in final discussions.

MR. ANDERSEN: Okay. I'm Jens Andersen, and this is my colleague, Fran Bolger, and we are here representing GE, and I am pleased to make this presentation to the ACRS.

It deals with the application for Anticipated Operational Occurrences, which can be abbreviated to AOO,or also called transient analyses. What I would like to do is, and primarily for the benefit of the ACRS members that have not participated in the previous thermal-hydraulics subcommittee meetings, is to just give a brief overview of the scope of the TRAC application, and the application methodology.

And then I would like to discuss some of the issues associated with the review, the NRC review, and the reviews with the ACRS thermal-hydraulics subcommittee.

As Paul Boehnert said, the presentation that I have here I tried to keep it non-proprietary and it is completely open, and there are some slides that I may want to use, and which may contain proprietary material.

TRAC is a realistic goal for BWR transients analysis. TRACG is the GE version. I don't know if you know, but back in 1979, a project was initiated to generate a BWR version of TRAC.

It clearly started from the PWR version, and that was at that time, it was rejoined an NRC-EPRI and GE project. And that project lasted through a couple of phases, and finished in 1985, and that was clearly what we saw in the first TRAC-B version.

What we have done in GE is that we have continued the development of the code. We have incorporated some of our GE proprietary models, and probably most significantly we have incorporated the same nuclear message that we use in our current design and licensing evaluation into the code.

And that is probably the major additions in TRACG. The code has the capability to do a lot of different type of analysis, including LOCA, ATWS, and stability.

However, in this submittal, we have focused on the application to AOO transient and that is all that we have asked for the NRC to approve. It does have some capability to do multi-dimensional flow int he vessel part, the model size, and essentially one-dimensional in the code.

It has a flexible modular structure that do allow the user to simulate virtually any problem that you want to simulate. However, we have done extensive nodalization sensitivity studies as part of our assessment, and that is documented in the qualification licensing topical report.

And basically what we have done is that we have come up with a standard nodalization to use for BWR, and that is the one that we recommend for use for these types of calculations. This is a nodalization that we will fix in our internal procedures for how to do these calculations.

The nuclear kinetics model is a 3-D nuclear kinetics model, and is essentially the PANACEA nuclear 3-D nuclear simulator model. This is the one that we use in all of our current licensing analysis, and what is unique in this application is that we have implemented it, together with TRAC, and we are applying it for reactor transients.

Conservation equations. The two fluid model simulating steam liquid also has the capability for boron and non-condensible gases. However, these models do not come into play for AOO transients.

Boron would only come in for ATWS analysis, for example. We have a relatively simply flow regime map, and it is used consistently by all components in the TRAC.

For example, a jet pump component, or the components that we use to simulate the regions in the vessel, or the components that we use to simulate the steam line, all use the same flow regime map --

DR. WALLIS: That's the same for the horizonal and vertical flow, and bends, and everything, is it?

MR. ANDERSEN: The recognition was started by flow for a horizontal flow in the flow regime map, based on the critical part number. However, most of the components, or virtually all components in the BWR where you have two-phased flow are vertical components.

And so the focus has been on the vertical flow machines. Based on the determination of the flow machine, we then come up with a consistent set of correlations for heat transfer for that particular flow regime, and again that is used by all components.

And the users do not really have any options to change these models in the code. We have models for all of the major components in the BWR. The recirculation pumps, the jet pumps, the fuel channels, the steam separators.

We have performed an extensive qualification based on separate effects, which are simple tests where you can isolate individual phenomena. We have done component testing where we have looked at full-scale component data -- and let's say jet pump data, steam separator data.

We have done integral system effects test, and these are basically scale simulation of the BWR. These were primarily tests that were done for LOCA applications, but they do have relevance in showing the interactions between the various components in the

BWR system.

And most importantly though we have full-scale plant data that we have used in the qualification, and that is important in dealing with the scaling issue, and essentially having the full-scale data means we don't have to address the scaling issue.

DR. WALLIS: When you do a CSAU, you have to make comparisons with data?

MR. ANDERSEN: Yes.

DR. WALLIS: And presumably all of these data, from separate effects test through full-plant data, play some role in the CSAU comparisons?

MR. ANDERSEN: Yes, they do.

DR. WALLIS: But you would expect that perhaps some of them should have more weight than others?

MR. ANDERSEN: Well, what we have done is that we have used primarily the separate effects test and the component test to quantify the model uncertainty.

For example, we have full-scale wide-fraction data for a full-scale BWR bundle. We have full-scale data for jet pump performance; and full-scale data for a full-scale separator.

Those are the models that we have used to quantify the model uncertainty. Now, we then went ahead -- and you are kind of getting ahead of my presentation, but I will answer the question now.

But we have then gone ahead and quantified all these model uncertainties, and the way that we used the data is that we applied our proposed application methodology to the plant data.

In the plant set, what we are doing is that one of our critical safety parameters as mentioned by Ralph Landry is the minimum critical power ratio.

And what we do is that we determine that at a 95 finding value, a 95 percent probability, a 95 percent confidence, which is roughly a two-sigma level.

What we did was that we went in and we took plant data like the Peach Bottom turbine trip, and we applied our application methodology, and said, well, if we account for the uncertainty in predicting the wide fraction or the wide coefficient in the core, and the uncertainty in predicting the carry-on from the separator and so on, we took all these uncertainties and said what is the impact on our prediction, say, of the power response, which was mentioned at the Peach Bottom test, and we do that at the two-sigma level, then we show that we bound the data.

So we have used the plant data primarily as a confirmation of our application methodology.

DR. WALLIS: This is a tremendous step forward from the days when people simply took some line through another point and looked at it, and said, oh, this looks excellent, or good, or maybe, or whatever, and made some qualitative judgment.

Now, there is a quantitative, logical basis for using data to assess the code. I think that is what you are giving us an example of.

MR. ANDERSEN: Yes.

DR. WALLIS: And I think that is a tremendous step forward from the days of guess work and judgment, and just looking at some things and saying, oh, it looks good enough.

MR. ANDERSEN: Well, that was clearly one of our lessons learned from the previous review under the SBWR program, and instead of saying this agreement is good, or this agreement is excellent, we tried everywhere in our assessment to put numbers, and to say, well, we predict these data within, for example, of 5 percent, or whatever the number is.

The scope is to apply to plants operating in the United States which are BWR-2 through BWR-6, and the events are the anticipated operational occurrences, and these are the events that increase and decrease, and react to pressure increase or decrease in core flow, and increase or decrease in reactor coolant and ventry, or decrease in core coolant and temperature.

And these are the primary classes for the operational occurrences.

DR. WALLIS: That is what you are trying to predict?

MR. ANDERSEN: Those are the ones that we normally analyze to set the operating limits.

DR. WALLIS: And which of your plant data covered which of these --

MR. ANDERSEN: We have pressurization events, and we have a flow chain event, and we have one of the stability cases, and, for example, the LaSalle case that we analyzed that involved a decrease in the reactor coolant temperature.

We had a loss of feed water transients, and so we have had plant data in each of the event categories.

DR. WALLIS: This is another reason, I

think, that the subcommittee felt some confidence, is that you had full-scale plant data for all of these transients that you were intending to analyze, unlike the LOCA situation, where you don't have that data.

MR. ANDERSEN: Yes. The documentation that we submitted to the NRC, this was the first document, and was really a document that laid out our plans. We had early discussions with the NRC back in the spring of 1999.

Most of the licensing topical reports were submitted, and I think the first were submitted in December of '99, and the last in January and February of 2000. The model description qualification report, a report outlining the application methodology. We also submitted the users manual.

We submitted the TRAC source code, and a number of sample problems for the NRC to use in their evaluation, which included most of these plant cases that I described up here that we used in our qualification.

And what we were asking for was a safety evaluation for the applications AOO transient. This is really a brief overview of the process, and what we decided to do was to adapt the CSAI methodology to transient, and basically follow the guidelines as they are described in the report that the NRC put out in the CSAU methodology.

And also in the guidelines in Regulatory Guide 1.157, which was really the application of the best estimate methodology to LOCA analysis, but that really laid out the CSAU process.

And we tried to follow that. So it started with the first step, the identification of the plant and the events, which are the BWR226 and the AOO transients.

And then we went through the phenomena identification and ranking process, where we looked at all of these event categories, and we looked at the importance of the phenomena by judging the impact on the critical safety parameters, and that is critical power ratios, the peak vessel pressure, the minimum water level, and the fuel thermal-mechanical parameters, such as maximum cladding strain, or market to assembly line melting in the fuel.

And what we did was that we addressed in our quantification of the uncertainty all high and medium ranked parameters. I think the CSAU, the original CSAU methodology, only calls for the highly ranked parameters.

However, there has been a lot of

discussion on whether medium will make high, and it is not really such a big deal to include the medium. What you can do is that you can in many cases get away with just picking bonding numbers for the uncertainties.

And where you really want to sharpen your pencils are on the highly ranked, which are the really important parameters.

DR. WALLIS: But you might find out when you do your qualifications and determinations that some of your mediums were really low, and perhaps some of them were high, and you learn as you complete the loop.

MR. ANDERSEN: And we learned something like that, and what we learned is that if you get enough experts together in the PIRT process, then everything becomes important.

When we actually did the sensitivity studies, and we looked at the top 20 of what was important, there was only one of the medium that made it in there, and its impact was really insignificant.

The CSAU calls for starting with this process, and this is really how you evaluate the co-applicability and how you do the quantification, and the accuracy, and the uncertainty, because you look at the PIRT parameters, and you say, well, when you evaluate the code, you do it relative to what is important.

And we looked at the structure of the basic equations models and correlations, and in the merits, and basically what we did was that we cross-referenced that against the PIRT table, and for example, in the application methodology, there is a cross-reference that tells you that for each of the parameters, where do you have to go in the model description to find the documentation on that model.

Similarly, there is a cross-reference that says that for a given parameter that was judged to be important, where do you find test data that can be used to evaluate the accuracy of that model, and that can be used to quantify the uncertainty of that model.

The other thing that the CSAU called for is that you have to account for the effective reactor input parameters in operating States, and are you beginning a cycle or ending a cycle.

Uncertainty in plant parameters, and we have accounted for all of these, and then essentially at the end, you go ahead and you do your statistical analysis.

And what we do is that we calculate the

statistical limit for the critical safety parameters. For example, the minimum critical power ratio is evaluated as a tolerance limit at the 95 percent probability, and 95 percent confidence.

And there we really followed the guidelines that were in Reg Guide 1.157 for a LOCA. That Reg Guide says that you have to use 95 percent probability, and it also says that two-sigma is good enough.

And it turns out that when you do 95 and 95, you are really close to two-sigma.

DR. WALLIS: Now, you referenced DG-1096 in your slide. Did that make any difference?

MR. ANDERSEN: Well, DG-1096, as Ralph Landry pointed out, came out after we had submitted these reports, and I have looked at DG-1096, and I believe that we covered all the major elements in both DG-1096 and also in the requirements of the Standard Review Plan 15.0.2.

DR. WALLIS: And you don't have any disagreement with the methodology described in DG-1096 then?

MR. ANDERSEN: I don't think I have. There can be discussions on the degree of detail. I think the major elements are covered. The only disagreement I had with DG-1096 is that DG-1096 has a significant emphasis on scaling, and I don't think that scaling is required in a case like this, where we have full-scale plant data.

DR. POWERS: Okay. I think maybe you have to change your thinking a little bit about scaling, instead of just being sized. The full-scale plant that you have is not identical to the plant that you are calculating, right?

MR. ANDERSEN: Well, the --

DR. POWERS: The data that you have is not precisely for the plant that you are going to calculate.

MR. ANDERSEN: Well, the data that we have, the plant data, are for different plant types. For example, the Peach Bottom turbine trip is for a large BWR04. We have data for Nine Mile Point Two. That is a BWR05.

We have data from LaSalle that is BWR05, and we have data from the Leibstadt plant, which is a BWR06. We have data from most of the plants that are operating out there.

DR. POWERS: But not the same dataset -- well, is there a dataset for the same transient at 4, 5, and 6?

MR. ANDERSEN: We have -- well, for the pressurization event, we had that from the Peach Bottom, which is a BWR04.

DR. POWERS: Now, what happens at a pressurization event at a BWR06?

MR. ANDERSEN: We know, because they usually test that at the plant start-up testing, that it is milder at a BWR06 because of the much faster SCRAM speed.

The other thing that was done in the Peach Bottom test was that normally there is a SCRAM on the position of the turbine control valve.

In the Peach Bottom test, that was disabled, and so you only had SCRAM and the flux, which made it a more severe transient. So the Peach Bottom test really is more severe than what you would expect to occur in a real plant.

DR. POWERS: All I am suggesting is that maybe you need to look at the words in the CSAU methodology and translate them in comparison to what you have, and what you are going to calculate for the biases and things like that.

I mean, it is not -- you didn't use the word geometric scaling because by and for in most situations they are talking about is where someone has done some small test, and now they are trying to predict a plant.

But you have a different situation, and you just have to interpret the words.

MR. ANDERSEN: Yes.

DR. WALLIS: It could be that some transients that you have observed took you into a region where certain things happen, and in some other transient, you might get into a region where something physically was different, and that would be a scaling question.

MR. ANDERSEN: Yes.

DR. WALLIS: And though it is at full-scale, you are into some region or diminimous group which we have not explored yet.

MR. ANDERSEN: That's a good comment. We have tried to address that in the model description, where we talked about the model. In the sections that talk about, for example, friction, we have tables and paragraphs that discuss what is the range that you are expecting in the BWR plant, versus what is the range of the applicability of the models that we use.

So we have made an attempt to determine that these models are valid over the ranges that you would expect in a BWR, but you have a good point.

But the one important point that I wanted to make is that we have submitted basically three LTR model description and qualification reports in an application methodology report, and a match all tendency -- and I would probably do it myself, is that you start by reading the model description.

And that is probably not the best thing to do. The best thing is to start with the application methodology, because that really describes what is it that we want to use it for, and what are the requirements that we are trying to satisfy.

And then it goes through the PIRT tables and says that these are the things that are important for this application, and then it has the tables that says, well, this is where the important phenomena are described in the model description, and this is where they are assessed in the qualification report.

And you really need to know that when you make a judgment and whether the model is good enough. You need to know what it is going to be used for, and what are the requirements. What is good enough, and you need some criteria to make that judgment.

So you really have to start with the application methodology, and that is what we have tried to provide in that report. And basically the goal of the application methodology was to demonstrate that we meet the requirements as specified in 10 CFR 50, Appendix A, and those are basically the one, the two, the standard review plan.

And it boils down to the General Design Criteria, 10, 15, 17, and 26, and probably 10 and 15 here are the ones that deal with the calculated response, which deals with the specified acceptable fuel design limits, and the peak vessel pressure.

What we have tried to do is to demonstrate the criteria and its applicable for licensing calculations. And that when we use that tied to the proposed application methodology, and account for the uncertainties and biases, then we can assess the overall conservatisms in the methodology relative to the regulatory requirement for the AOO events.

DR. WALLIS: Now, I want to ask the NRC. You said that you set out to demonstrate these four things here.

MR. ANDERSEN: These are the regulatory requirements and these are the ones that basically were addressed when we did our PIRT table. We said, well, what are the critical safety parameters. It is a minimum CPR.

And the way that we satisfy General Design

Criteria 10 in the specified acceptable fuel design limits is that we say, well, we shall have no boiling transition.

DR. WALLIS: So you are saying that these are the things that we have to be able to show that TRACG can do?

MR. ANDERSEN: Yes.

DR. WALLIS: All right. And this is more specific than actually what the staff presented, and does the staff accept that these have been demonstrated?

MR. LANDRY: Yes.

DR. WALLIS: Thank you.

MR. ANDERSEN: The methodology, the statistical methodology is outlined in the CSAU process. We have quantified the uncertainties in the model, and in the plant parameters, and in the initial conditions that could be like uncertainty in the void quotient, and uncertainty in SCRAM speed at the plant, or uncertainty in the operating conditions, like the power flow combination at the plant.

For each of these models, we have tried -- or for each of these phenomena, we have identified what is the uncertainty, and the uncertainty distribution. You can then combine them through your statistical methodology.

DR. POWERS: Are they all independent?

MR. ANDERSEN: We have treated them as independent.

DR. POWERS: Are they really?

MR. ANDERSEN: And some of them are not and we have shown that in the application methodology.

DR. WALLIS: So your methodology can handle situations where they are not independent?

MR. ANDERSEN: Yes. What we have done then is we have performed sensitivity studies as I mentioned earlier, and basically once you have quantified these uncertainties, you can vary the parameters over their uncertainty range, and you can determine what are their impact on critical safety parameters like minimum CPR.

And we have done these studies to evaluate the ranking that we did on the PIRT table, and that is where we concluded that it tended to be very conservative.

And when it comes down to what is really important, there are surprisingly few parameters that are really important. It is primarily the parameters that deals with the responses of the reactor core.

DR. WALLIS: Now, in this you have just

picked., for example, void fraction in initial conditions. Those aren't some hydraulic parameters, such as phase slip models?

MR. ANDERSEN: No, these are just examples. I mean, everything that is in our PIRT tables would be here.

DR. WALLIS: Such as some of the thermal hydraulic models?

MR. ANDERSEN: Yes. They are all in here, like the void fraction, which is this here, and the uncertainty in the carryover for the separator. They are all in here.

MR. BOLGER: This is Fran Bolger with GE. When we do our statistical analysis, we vary all our high media ranked parameters together and randomly to determine the combined uncertainty.

MR. ANDERSEN: And that's essentially what Paul Boehnert described. That is what we do in our applications.

DR. WALLIS: And how many runs do you need to do?

MR. BOLGER: We can do a minimum of 59 trials if we decide to use an order statistic method, and we will do at least that many trials, and then we will determine whether we can -- whether the distribution is normal.

If we can't demonstrate as normal, then we will normal distribution statistics. If not, we will use order statistics.

DR. POWERS: What kind of confidence level?

MR. BOLGER: Depending upon the type of parameter that we are looking at, some of the safety parameters, such as the clad strain, center line meld, peak pressure, reactor water level, we do that on a 95 percent confidence level.

And in the operating limit methodology, we have a method by which we combine the uncertainly in critical power with the uncertainly in the individual critical powers preceding the event to determine or to calculate the number of rods susceptible to the transition.

DR. POWERS: If you wanted a 95 percent confidence level on the 95 percentile values, wouldn't you have to use more than 59 rods?

MR. BOLGER: Well, based on the number of trials we use, we apply a corrective factor so that our tolerance limit is representative of 95 percent.

DR. POWERS: So you fudge a little bit in other words?

MR. BOLGER: That's correct.

MR. ANDERSEN: Well, 59, if you apply all the statistics, 59 is the minimum number of tiles for a 95-95. In reality, we have run closer to a hundred tiles, which allow you to pick the second highest of the set, and get the 95-95.

DR. POWERS: Yes. My experience with the order of statistics is that you run around with 150 or 200 it takes to kind of get some feel for the 95-95 number.

DR. WALLIS: And this is made possible by the fact that you can run your program now more rapidly on computers that exist today. You couldn't perhaps do this 10 years ago.

MR. ANDERSEN: Oh, yes. Computers today enable us to do this.

DR. WALLIS: So in a way, CSAU may have been a bit ahead of its time, and it should be done, but the ability to do it was limited because of computer capability. And now that there is no limitations, there is no reason why people should not use CSAU.

MR. ANDERSEN: We find that it works very well for these events. I would like to talk a little about the fact that this is about the same time line that Ralph Landry showed. We had our first meeting with the NRC in May of '99, where we laid out the plan.

All the documents were submitted by February of 2000, and we had a kick-off meeting both with the NRC and with the ACRS thermal-hydraulics subcommittee meeting in the middle of March.

DR. WALLIS: You can move on. I think we have seen this before.

MR. ANDERSEN: Okay. I will do that.

DR. WALLIS: We are very close to the conclusion. We are getting very close to finishing on time.

MR. ANDERSEN: Okay. We received a total number of 21 formal RAI from the NRC, and some of these questions had multiple parts. And some of the comments that we had received from the ACRS were addressed as part of these RAI, and particularly RAI Number 19.

Other comments that we received, we addressed at the meeting that we held two weeks ago. It had to do with the guidance that are specified in Draft Regulatory Guide 1096. I believe we covered all the elements in 1096.

And justification and assumptions for the basic equations, and that's why I really showed this slide before that showed that you start with the application methodology, and you look at what is important.

And then you quantify what are your uncertainties, and what are your assumptions, and you say, well, is that relevant for the intended application.

And, yes, there are simplifications in our basic equation, but we believe that we have shown that they are -- that the equations are adequate for the intended applications for BWR AO transients.

There were a number of issues on clarification of the models. How is the wall shear treated, and clarification ont he flow regime map,a nd clearing on some of the interfacial terms for the interfacial shears, as well as the interfacial area, and heat transfer.

And we provided that information in the August 22nd meeting. There were some issues that were addressed or raised on the TEE-based component, and what we have in TRAC is that we have a number of special components that are based on a generic TEE-component.

For example, the jet pump is a TEE-based component. You have the suction and dry flow mixing. The steam separators are a TEE-based component. And in these components, we have specific models that we have incorporated into the code to address the unique phenomena.

And we have quantified that on using full-scale data, and so we believe that the areas in the BWR were TEE-based phenomena are really important. We have incorporated adequate models, and we have demonstrated the adequacy to comparisons, the full scale data.

And then coming back to Dr. Wallis' opening comment, is that depending on how good or bad it is, we have quantified the accuracy, and we are using that in the CSAU methodology.

There were some questions on the nuclear modeling, and how we deal with the decay heat groups, and the delayed neutron precursory groups, and we have addressed those comments also.

DR. WALLIS: We need to just get the idea that you addressed all the questions that we have, and then we can perhaps ask the subcommittee who were there whether this was a satisfactory addressing on your part. You will tell us, Dr. Kress, whether these were addressed.

DR. KRESS: I felt that the responses and the way they addressed our particular questions were very responsive, and were satisfactory answers. Now, there was another set of issues raised by our consultants, and it was unfortunate, but I don't think the GE people had these ahead of time.

And we touched on most of them, but I am not sure how --

DR. WALLIS: Well, I don't think we need to go into the details unless any other committee member has a question.

DR. KRESS: Well, unless another committee member has a different opinion, I thought that they did a very good job of clarifying and addressing these particular issues.

DR. WALLIS: So we could perhaps move to the last slide.

MR. ANDERSEN: Okay. And that is basically concluding remarks, and summarizing what I said in my introduction, and applied it for BWR2 to 6 transients. We meet the regulatory requirements, and we have demonstrated the capability of the model.

And there has been an extensive review, including the NRC and the ACRS, and we have attempted to use the full-blown CSAU methodology, and I believe that we have followed the requirements of draft Regulatory Guide 10-96 very closely.

And we have demonstrated the methodology for all event type, and in our conclusion that is what we are asking the NRC to approve in the SAWYER, is that TRACG are applicable for AOO transients for licensing analysis. Thank you.

DR. WALLIS: Any other questions? If not, I would like to thank you for a professional presentation, and I will hand the meeting back to the chair.

DR. APOSTOLAKIS: Thank you, Dr. Wallis. We will recess until five minutes past 1:00.

(Whereupon, at 12:07 p.m., a luncheon recess was taken.)

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

(1:05 p.m.)

DR. APOSTOLAKIS: The next item on the agenda is the proposed final revision to Regulatory Guide 1.78, Main Control Room Habitability During a Postulated Hazardous Chemical Release. Dr. Powers, it's yours.

DR. POWERS: It is?

DR. APOSTOLAKIS: Yes.

DR. POWERS: Gosh, what a present.

DR. APOSTOLAKIS: You see how generous we are.

DR. POWERS: Since we are doing historical things, let me comment that the second time that I worked for the ACRS on this side of the table, as opposed to that side of the table, I was asked by Dave Moeller to come in and consult on control room habitability.

And not only that, but I saved all the documents that I got from that particular exercise, and have them to this day, and can use them to check the current speaker.

We are going to delve into this issue, and one aspect of the many issues of control room habitability that have arisen lately is that this one is an interesting issue.

We have spent quite a little time on it in the past, and it has to do with assuring that the control room remains habitable in the event of an accidental release of toxic chemicals either as a result of an event on the site, or something off-site.

We got a detailed presentation on this in the recent past. I see all the members who are sitting around the table now actually got to experience that. So, they should be familiar with it.

And in the course of that presentation, what was explained was that they were trying to update and combine a couple of regulatory guides, and help make the licensees' challenge in dealing with chemical hazards less burdensome.

As the presentation went on, we recommended that they think about producing a regulatory guide that was more performance oriented than it was prescriptive, and the staff has done that and are ready to go final on this regulatory guide.

And to give us a few moments of discussion, because as the speaker will explain, when he went off to find a template for what a performance based regulatory guide would like, he was told that when he produced it, he would have it.

So, with that introduction, I would ask Sud to come up and give us a brief discussion. We are not planning to go into every chapter and verse on the regulatory side, and more to concentrate on the issues of how you make a regulatory guide performance oriented. Sud.

MR. BASU: Thank you. Let's see. So, with that introduction, I thought, well, maybe I don't need to say anything and I can go home. On the other hand, I remember that it is two years this month that I gave a briefing on the subject to the full committee.

And since then, there has been one or two new members in the committee. So I thought for the benefit of the new members that I will go through the background a little bit, and then just focus on the highlights.

DR. POWERS: Just test George, and see how much he actually remembers. Ask him what IDLH stands for.

DR. APOSTOLAKIS: No questions.

MR. BASU: Okay. So, I will go through very quickly the Reg Guide 1.78, which addresses the control room habitability issue, and in fact just one aspect of the control room habitability issue, and that is the habitability during a postulated or accidental release of a hazardous chemical.

That was published in 1974, and a couple of years later, there was another Reg Guide published on specifically the chlorine issue in 1977, and that addressed the protection and control of operators against accidental release of chlorine.

Since then, somewhere in the 1983-1984 time frame, a Generic Safety Issue 83, GSI-83, was formulated to address the control and habitability issue, which led to further studies of control room habitability, and again not just the habitability during a chemical release, but other aspects of habitability.

There were a couple of reports that came out in the 1985 to 1987 time frame on various aspects of control room habitability, and then in the mid-1990s, the '95 time frame, NRR identified a need to revise the Reg Guide 1.78, given that by then we had more information available on toxic chemicals, the toxicity limits, and also on dispersion modeling, et cetera.

Also, there was an incentive to combine at that point Reg Guide 1.78 with 1.95, and simply because a lot of things that are common within the two guides, and as we are moving to NRC performance based regulations, towards risk-informed regulation, it was the most appropriate thing to do to combine the two to reduce the unnecessary regulation burden.

So with that, and giving as short an introduction as I could provide, let me tell you about what the proposed final revision to Regulatory Guide 1.78 is.

Revision 1 provides the screening measures for determining toxic releases that should be considered for control room habitability evaluation. It is nothing different from Regulatory Guide 1.78, and that guide also provided screening measures.

But of course now these screening measures will be based on updated toxicity limits that we have. For releases that require consideration in the control room habitability evaluation, the revision provides guidance to determine concentration in the control room.

And again 1.78 did also determine concentration in the control room based on outdated or old, or dispersion modeling, and so what this does is that this takes advantage of the new and improved discussion modeling to provide or to determine the concentration in the control room.

And the Revision 1 provides guidance for protection of control room operators against accidental toxical limits, and 1.78 did, and so did 1.95. Again, the difference here is that now this guidance is now more performance based than prescriptive, and I will elaborate on this shortly.

So, let's see where we are. So to give you a highlight of the revision, the focus is on developing a Reg Guide that kind of strikes a balance between the prescriptive approach that we had, and the original Guide 1.78, and more of a performance-based approach.

And if we go back to the September '99 time frame, when we get the presentation on the then-draft revision to Reg Guide 1.78, this is before coming up with the draft for public comments, and to the period when the subcommittee chair of the ACRS recommended that we move into the performance based approach, and that we take advantage of the risk insights to come up with a guide that will then provide burden reduction.

So our focus in the revised regulation or in Revision 1 to Regulatory Guide 1.78 is to strike that balance, and to come away from the prescriptive approach and go into the performance based approach, but in some areas where we have retained the prescriptive approach, and I will address that shortly.

This is of course motivated by the fact that there are fewer LERs in recent years, and there is no TS requirements for toxic gas monitoring systems, and naturally the burden associated with the prescriptive guide could be somewhat relaxed, and that is the motivation.

Now, we have retained in Revision 1 the latitude for the licensees to continue using the traditional engineering approach to submit applications or calculations in favor of the license amendment, but we are also encouraging licensees to make better use of the risk insights in assessing the control room habitability.

When we published that guide for public comments, there was a general comment of regulatory significance, and a fairly significant one, that addressed the somewhat implied backfitting requirements.

And this is sort of the implementation language in the Reg Guide. It was not intended, and the implementation language was not properly put together at that point. We have since taken care of that and coming away from a draft guide to the revision one.

And I think that you all have copies of that, and so that's what I mean by Revision 1 not imposing the backfitting requirements. Licensees have the flexibility to continue using current licensing bases in addressing the control room habitability issue.

Once again, licensees are encouraged to make better use of these insights to reduce the burden. And so that would be the highlights, and so let me go through the summary of changes between the Regulatory Guide 1.78 and the Revision 1 to the guidance.

We have revised the toxicity screening measures based on the toxicity information. This is the time to give the quiz on IDLH.

DR. POWERS: George will explain the acronym on that.

DR. APOSTOLAKIS: It was only two years.

MR. BASU: It was only two years, that's right. The original guide was based on a reference that is back in 1968 on toxicity limits and dangerous properties and chemicals by sex.

It not only contained much fewer toxic

chemicals, but it also had toxicity limits based on the then available data. Since then, and that is 30 years plus, we have updated the data available on toxicity limits of many more chemicals, and these data are based on research findings, and technical work, and so what we are proposing is the so-called IDLH, the Immediately Dangerous to Life and Health limit.

And that is the limit that is endorsed by NIOSH, the National Institute of Occupational Safety and Health, and other safety organizations, like OSHA, the American Institute of Hygienists, and so on and so forth, and the IDLH limit, which is defined as the level that would cause injury or fatality if you will if no protection is afforded within 30 minutes of exposure to that level.

And that is considered more appropriate because there is the provision and there is the guidance for the control room operators to don protective gear within 2 minutes of the detection of a toxic chemical.

So the operators are not expected to be subjected to these levels for an extended period beyond 2 minutes. And this provides relaxation and burden reduction.

It is still prescriptive in the sense that we are providing a very prescriptive limit, an IDLH limit, but it is more appropriate.

DR. KRESS: What triggers the response of the operator to go put on the mask? Is it an odor, or are there alarms?

MR. BASU: Detection devices.

DR. KRESS: A detection device?

MR. BASU: Yes. There is a protector that sets off an alarm.

DR. KRESS: What is it detecting?

MR. BASU: What is it detecting? The concentration of a chemical in the control room.

DR. KRESS: So it is sensitive to a whole range of toxic chemicals?

MR. BASU: There are detectors for individual chemicals.

DR. KRESS: Now, there are different toxicity limits for those.

MR. BASU: That's correct.

DR. KRESS: And different detectable limits. What I am trying to get at is will these detection devices detect these things long before they get up --

MR. BASU: You mean before a toxicity limit is reached?

DR. KRESS: Yes.

MR. BASU: Yes.

DR. POWERS: Well, I think in fairness, in some cases IDLH and the detection limit are pretty close.

DR. KRESS: Well, is there some distribution around this two minutes that the operators can don these masks? For example, are some of them going to take 4 minutes, or is there some probability that it will take 4 minutes?

And the other question that I had with this was that given that probability, is 4 minutes enough time to damage them? It won't kill them, but it may impair their ability to function or something?

DR. POWERS: Well, IDLH was set up so that -- well, I think it is about 90 percent of the population suffers no damage within 30 minutes.

DR. KRESS: I see.

DR. POWERS: Now, I am not sure of that, whether it is 90 percent or 50 percent. Well, it must be 90 percent.

MR. BASU: It is actually 95.

DR. POWERS: So, 95 percent.

DR. KRESS: Okay. Then that gives me some comfort. I mean, that is why I am looking for --

DR. POWERS: It is a horribly misnamed level, because it says immediately dangerous to life and health.

DR. KRESS: Well, that is what really threw me.

DR. POWERS: Well, it is not immediate, but pretty soon.

DR. BONACA: Actually, the report is pretty vague about what --

DR. POWERS: Everybody has a different -- you know -- there is a distribution within any population in your sensitivity to any given chemical, and in fact some people are extraordinarily sensitive to formaldehyde in some means, to the point that you can't use Scotch tape and things like that.

And they are on the tails of the distribution, and you really don't take care of that, but it takes care of most people.

DR. KRESS: My concern is can you detect these things before you get to a problem, and if you detect them, is there assurance that the operators will don their masks, and that is just one number, or is it a distribution --

MR. BASU: Well, that two minutes is also that 95 percent.

DR. BONACA: I have the same kind of question also, because it gives the option of human detection this says. For example, smell. So I was thinking how do you calibrate that, and how do you know that you are donning quickly within 2 minutes.

Is two minutes totally realistic for human detection, and yesterday we discussed that, and then it was pointed out that in some cases that it is actually the finest --

MR. BASU: You mean the toxic chemical manufacturer resident, and if you are a resident for more than 2 minutes, you will not be able to detect by odor threshold.

DR. BONACA: How do you correlate the smell to the two minutes?

MR. BASU: The odor thresholds -- I think all the cases that I am aware of are much lower than the IDLH standards, and also lower than the detection limits of the detection instruments.

So you will know, and if you are detecting by the odor threshold, you will know it is there. And the question is whether or not in two minutes that it builds up to the level that then exceeds the toxicity limit.

DR. BONACA: Are operators being trained?

MR. BASU: Yes.

DR. BONACA: Because I know that there is general training for wintergreen smell, or --

MR. BASU: Well, if you look at the emergency procedures and planning, there is a planning guidance for the operators to be familiar with various chemicals and their toxicity limits.

MR. SIEBER: Actually, the complexity of the detector is relatively small, because you run a stringing process to determine either on-site or off-site the presence of whatever toxic chemicals there are.

The water power plants, especially the ones out in the country, the only thing that is there is that they use gaseous chlorine as part of their chlorination process. So that would be the only detector that you would have.

If you lived in an industrial complex where you would have potential for other businesses to leak toxic gases, and you would be required to be able to detect this.

DR. POWERS: If you want my opinion on the detectors, with the exception of a few, I think the ammonia detectors have gotten pretty good. The rest of them, I am going to trust my nose.

MR. BASU: For chlorine, it is the detection limit and IDLH.

DR. POWERS: Yes, very close.

MR. BASU: And we are talking about the dispersion model, and that is different from the Reg Guide 1.78, and Revision 1, and I touched on that previously.

The Reg Guide or the original Guide 1.78 has a very simple model, with the diffusion not having any temporal dependence, and it has a very special spatial dependence.

And since 1974 onward, there has been a lot of work done on it, and mostly dispersal modeling. So we took advantage of that, and at the NRC, we have been using the HABIT code, which has a couple of models that are relevant to the toxic chemicals, the EXTRAN and the CHEM model that are used to determine the dispersal and the concentration in the control room.

There are other models available, and we are not necessarily endorsing one and only one model. Licenses are certainly encouraged and come up and can use other models that have similar capabilities to do the calculations, and submit the calculations. And if these calculations bear out, then they will be given the appropriate credit for them.

DR. KRESS: Does the Reg Guide specify anything about the meteorological conditions? For example, that they should use the most conservative dispersion co-efficients?

MR. BASU: No, no, we are not saying -- and this is the chemical part of it. Did you say radiological?

DR. KRESS: No, I am talking about meteorological.

MR. BASU: No, we are not actually saying that, that they need to use the most conservative ones. We are saying to use the most appropriate one which has certain features, like it can --

DR. KRESS: No, no, what I am talking about is in these, you have to put in usually the atmospheric stability.

MR. BASU: Well, the atmospheric stability for most plants, the stability category in the 95 percent level is Category F, and I will be coming to that shortly.

DR. KRESS: Okay.

MR. BASU: And which is what is used, and I will show you a simple algorithm.

DR. KRESS: Which is conservative?

MR. BASU: Yes.

DR. KRESS: That is what I was after. Do you specify that in the reg?

MR. BASU: Yes. I will come to that algorithm, but there is a plan that does not fit that category, and we also have adjustment factors specified that you can use to take care of that plant site.

Risk evaluation or risk insight, there was none in Reg Guide 1.78 back in '74, and understandably so. We were not thinking in a risk-informed space in those days. We do now have a consideration of risk in this revision, and risk insight for Reg Guide 1.174 in a broad best sense.

And again that is not regulated by the fact that there are fewer LERs in recent years, and no tech spec requirements for TGMS. So this is a way to reduce unnecessarily burden by taking advantage of the risk insight. Where we have --

DR. APOSTOLAKIS: Isn't one answer for dealing with changes, permanent changes, to the licensing basis?

MR. BASU: Changes in licensing basis? Yes.

DR. APOSTOLAKIS: And it is not supplied

here?

MR. BASU: Well, if the licensees propose voluntarily there will be changes, then they can --

DR. APOSTOLAKIS: Changes in what? In requirements?

MR. BASU: Changes in TGMS requirements.

DR. APOSTOLAKIS: So they can use this?

MR. BASU: They can use this if they wish.

DR. APOSTOLAKIS: Well, how would they do that? They can't really quantify the PRA, although --

MR. BASU: That's right, and that is what the challenge is.

DR. APOSTOLAKIS: So they have to be creative.

MR. BASU: That's right, they have to be creative.

DR. KRESS: Very creative.

DR. APOSTOLAKIS: Very creative.

DR. POWERS: Just claim all your operators god, and say, gee, the plant --

MR. BASU: I have seen a couple of examples of license amendment applications in the past -- and this is before even 1.174 was published -- where the licensees did make use of the probability argument, and so I think they can be creative enough to do this.

DR. APOSTOLAKIS: I would like to see that. Have you ever seen any analysis along these lines?

MR. BASU: Not making reference to 1.174, but I have seen analysis to the probability arguments in a couple of applications, yes. Maybe I can dig those up.

DR. BONACA: I had a question with regard to the evaluation and main control room habitability. In the text, it specifies in cases where you have chemical containers that are not designed to withstand earthquake or flood, you should consider these releases in conjunction with the event.

MR. BASU: Coincidence.

DR. BONACA: Coincidence. And then it says in evaluation that it may also be proper to consider releases coincident with, for example, design basis, and loss of coolant accidents. Isn't it -- why would that be? I mean, even if there is no mechanistic link between the LOCA and the release?

MR. BASU: Well, if these are two events, there is always a probability, however small it might be, for the two events to occur coincidental with each other is it not?

DR. BONACA: Well, I thought we were going to what is in the licensing basis.

MR. BASU: Well, it is not in the licensing basis, and I understand that, but it can occur. Now, I think -- and I am not sure, but are you reading from the draft Guide 1.78?

DR. BONACA: I am reading from 1.78.

MR. BASU: I think we made some modification on page 9 of 1.78, and we said that in the evaluation of the control room habitability, it may also be appropriate to consider releases coincident with the radiological consequences, as for example, et cetera, and demonstrate that such coincidental events do not produce an unacceptable level of risk.

And we have defined the unacceptable level of risk like that.

DR. BONACA: It seems to me quite prescriptive. I thought that you were going more in a risk-informed direction, and in a case you may find that the coincidence of a release and the LOCA are such low probability that you shouldn't --

MR. BASU: That is exactly what we are saying, that if it is such a low probability, then you don't have to worry about it.

DR. BONACA: But you said that with such coincident events not producing an unacceptable level of risk.

MR. BASU: Yes, and that unacceptable level of risk was previously defined as the one that has a very low probability.

DR. BONACA: Oh, I see, very low probability.

DR. KRESS: Can't you make a judgment ahead of time in this case?

MR. BASU: Did we make a judgment?

DR. KRESS: It seems to me like you could already say that that is such a low probability that it should not even be a consideration without actually calculating it.

DR. APOSTOLAKIS: Unless you have a mechanical --

DR. KRESS: Unless it is on the site itself, inside the plant. That may be it.

MR. BASU: Yes.

DR. KRESS: I was thinking off-site.

MR. BASU: Oh, no. We have moved into the performance based approach, and providing guidance for protection measures. We prescribed the toxicity limit, and we said that if you exceed this toxicity limit, then what are the measures that you will be checking, and that's where the performance-based measures come in.

Of course, the objective is adequate protection, and at the same time unnecessary burden reduction. The last one is --

DR. APOSTOLAKIS: Could hou give an example of an actual performance-based --

MR. BASU: Let me go into the -- well, it is probably a couple of slides back, and let me see if I can do that. This is the prescriptive part of it that I am talking about, where we did the hazard scan, the toxical chemical hazard screening.

And where we said that chemicals stored within 5 miles of the plant or in transit within 5 miles of the plant, or 5 miles away or more away from the plant are exempt from any further consideration, and that is in the original guide.

And in-transit within 5 miles, but infrequent shipments also are exempt. Chemical stored within 5 miles or in-transit frequently, and there is a definition in the guide of what that frequency is for various modes of shipments, and I am not going to go into detail on this unless anyone has a question about it.

But in terms of in-transmit frequently within 5 miles require consideration as follows, and we are providing a simple algorithm of calculating weights of chemicals that you need to consider for the distance and for various air exchange rates.

And that is the table that you see in front of you, and then of course these weights are also proportional to toxicity limits. These weights are based on a toxicity limit of 15 milligrams per meter cubed, toxicity limits.

So if you had a hundred milligrams per meter cubed, then the weights are then directly proportional to that. And the weights are inversely proportional to the air exchange rates as you can see from the table itself.

And then the weights are also adjusted for meteorological conditions, and I think that Tom had a question previously with regards to that, and if you have stable conditions, the multiplier is one. If you have Stability Category E, which is a better condition, then your multiplier is 2.5., and that means that you can allow more weight.

If your condition is worse than F category, the multiplier is 1.4 and you allow less weight. So these are the prescriptive parts. And then for chemicals not meeting the screening criteria -- in other words, you have more weights of a particular chemical within a given distance, and for a given air exchange rate, et cetera, then the guidance is to perform detailed control room habitability evaluation, and here is the traditional approach that is in 1.78, except that in Revision 1 that it is updated and improved.

And that is the latitude of providing for the licensee to continue using that approach, and we are encouraging once again the risk evaluation, because if your risk is very low and insignificant, and acceptable, and then you don't have to do for the evaluation.

Performance-based guidance, an example, and someone asked me -- the Chairman asked me for an example. I think the objective is to provide adequate protection for control operators and an assurance that the control room is habitable.

So that is the overall objective of the performance-based, and how we go about doing it is we recommend periodic survey of stationary and mobile sources of toxic chemicals to see what kind of sources are there, and what kind of release events have occurred in the past, and the statistics, and the concentration, et cetera.

And also testing of control room envelope leakage. Once you have done this, then -- and you satisfy yourself that the highest concentration that you can achieve for a given chemical in the control room is still below the toxicity limit, we are saying that implementation of a protection measure is not required.

I mean, you don't have to do it, and if you have it, so be it, but it is not a requirement. When the concentration does exceed the toxicity limit, you, of course, require some protection, and the protection has various elements.

First of all, you need to be able to detect the concentration level, and then you need to be able to isolate the control room, and finally of course you need the protection of control room operators.

If you recall in the original 1.78, all these attributes were very, very prescriptive detections, detection in terms of detection measures, and we prescribe what kind of detection instruments, and how many, and where they should be located, and what should be their protection.

DR. APOSTOLAKIS: I don't think that a

performance-based. I think that is prescriptive.

DR. POWERS: He sets a standard of safety, and he doesn't need it.

DR. APOSTOLAKIS: Well, where is the performance?

MR. BASU: What I was saying was the original, and in the original 1.78 we said how many detectors you need, and where you need to locate them, and install them, and all other features.

Here we are saying that if -- in the revised guide, we are saying that if the concentration, and you do not know whether your concentration is exceeding the toxicity limit or not, you need some detection.

And you need to be able to detect a particular or a given chemical species at a level which is below the IDLH. We are not going anything beyond that.

So it is really up to the licensees to determine what should be the detection limit and based on what that detection limit be, that there are certain instruments that they need to install, and whether they need to look at these instruments as long as you can detect the concentration which is below the IDLH. So that is performance-based.

DR. APOSTOLAKIS: Is that the second bullet or the third bullet? You don't mean to imply that all of these are supposed to be performance-based?

MR. BASU: Which one?

DR. APOSTOLAKIS: All these bullets.

MR. BASU: No, no, I am just giving you -- you asked for an example, and this is an example where the performance-based --

DR. APOSTOLAKIS: I'm sorry. Does this comply with the four characteristics of a performance-based rule that the staff has promulgated? That you have a measurable quantity.

MR. BASU: A measurable quantity.

DR. APOSTOLAKIS: And specifically calculatible.

MR. BASU: Yes.

DR. APOSTOLAKIS: And then you have a measure, and then the licensee will be free to demonstrate -- to use methods to demonstrate compliance. What was the fourth one?

MR. BASU: And a measure of performance.

DR. POWERS: And exceeding the --

MR. BASU: And a measurable performance, and I think that is what is captured here in this, and the same thing with the control room isolation. Again, if you go back to 1.78, it is very prescriptive, in terms of how you isolate, and what is the air exchange rate, and how you calculate these air exchange rates, et cetera.

And we are not -- we came away from that, and we said that you need assurance that the control room is isolated, and there is no inadvertent air leakage beyond a certain amount.

And, of course, the protection of the operators, in terms of providing the protection gear. Again, the 1.78 was far more prescriptive in that regard. We are saying that the protection gear should be provided.

Not how many, and not when and where kind of thing. And I think about the only thing that is prescriptive here within that 95 percent confidence, Tom, or 95 percent level, is donning the protective gear within 2 minutes, and that is kind of based on the actual time it takes in the 95 percent population. There is always that 5 percent population that it takes a longer time.

So that's it in a nutshell of the changes to the revision, and I should mention that since the publication of the draft guide in February of this year, that we have received public comments on the guide, and in what I would consider broadly in 3 or 4 categories.

General comments of regulatory significance and I have given an example already where the implementation language was such that one could conceivably interpret that language as an implied backfitting requirements.

That it is not intended, that that was not intended. We have revised that language, and this is the tendered language put in there that sort of reflects the voluntary initiative on the part of the licensees.

Otherwise, they can continue to use the licensing basis approach. So that is what I mean by the general comment of regulatory significance. There was a category of technical comments of regulatory significance, and I also gave an example of that.

There was a comment that -- and that Dr. Bonaca asked about coincident release of chemicals with a LOCA type event, and I think that I answered that in the risk-based.

So those are the types of comments. There were technical comments on the adequacy of either a number, or a statement, and those have all been addressed in the revision.

And the final category was purely editorial comments, like a comma was missing somewhere, and the numbers were not properly aligned in the table, and that kind of thing. Hopefully we addressed those as well. So I think we are in a position that this can go final for publication.

DR. POWERS: What I found attractive about the way the thing had been put together is they have a very prescriptive screening criterion that can be done with a minimal amount of investment.

I mean, you find out how much weight you have, and where, and you compare it against the table suggested by location, and atmosphere, and the nature of your control room.

And that gets most people out of the woods very quickly. And then the staff comes in and they say, okay, here is the standard for safety. And there are actually two of them in there.

One is that they adopted the IDLH as the limiting concentrations, and those are pretty good. They are endorsed by huge numbers of people, and at least there is some consistency there nationwide.

And the other one is this 2 minute donning thing. And they said, okay, licensees, go ahead and meet it. On the other hand, they also say that if you don't want to mess with this stuff, and you want to do what you have done in the past, that's okay, too, because that is highly prescriptive.

My thinking was, especially as we wrestle with material licensees, many of whom are not in the financial position to go a risk-type of approach, but still would like to have some flexibility in the way they engineer systems, this is a pretty good pattern for setting things down.

The licensees that are small operations have a prescriptive path and they just follow the prescription, and the thinking has been basically done by the staff.

And licensees with a little more capability can use creative engineering to meet the safety standard that the staff has set. The licensees with a lot of capability can come in and argue over the safety standard by doing risk analyses.

And I thought that was a nice combination of things that could serve as a pattern for doing these kinds of things where they don't affect an enormous number of plants.

I mean, there is only a handful that really get into this, and similarly with the materials licensees, you have a similar kind of situation, and I thought it was a good pattern and worth looking at in that regard.

DR. APOSTOLAKIS: Okay. Thank you.

MR. BASU: Okay. Thank you. Actually, I need to thank the ACRS for providing comments back in September of '99, and that is what prompted us to take another look at and make this more performance-based.

DR. POWERS: I think it makes it a cleaner regulatory standard, because now your focus is just on what is the safety limit, rather than how you organize the chlorine detectors on-site.

And that gets you out of the position of having technical innovation outdate your regulatory guide. Are there any other questions that people would like to ask?

Again, I think with the specific issue, this is a pretty arcane issue. As a pattern for how we can think about doing performance based regulatory guides, especially in the nuclear materials area, I think it is worth reading in that regard.

And incidentally, those of you who went to Waterford, it very much affects them. They are very affected by this particular reg guide, but most plants aren't. Browns Ferry doesn't have to worry. Well, they may have to worry about ammonia actually, because there is enough agricultural work around there that they might have ammonia. Okay, Mr. Chair.

DR. APOSTOLAKIS: Okay. Thank you very much for your presentation.

MR. BASU: Thank you.

DR. APOSTOLAKIS: Now, we are scheduled to take a break, but we have first drafts of two letters that I know of, Waterhammer and the control room habitability, and we have also Larkinsgram that I understand has been drafted. And then we have to debate the oversight process.

Now, we can proceed and perhaps dispose of one of those.

DR. WALLIS: My preference is that I think I would like to do that now.

DR. APOSTOLAKIS: Well, after the break. I was coming to that. We have a couple of competing priorities here. One is that it would be nice to approve of something so we have a sense of accomplishment.

And I think that Dana's letter is probably a prime candidate for that. I get a sense that the Committee doesn't have any problems with what was just presented, and the letter is written in the --

DR. KRESS: And we have the Larkinsgram.

DR. APOSTOLAKIS: And we have the Larkinsgram. Maybe we can do those first and get rid of them in 15 minutes.

DR. POWERS: The Larkinsgram is undergoing a final tweak.

DR. APOSTOLAKIS: Okay. If it is not ready, then --

DR. POWERS: Sherry says it is finished.

DR. APOSTOLAKIS: Then we can perhaps pick up your subject, Graham, and how much time do you think we should spend on that?

DR. WALLIS: Well, I think you will agree with me.

DR. APOSTOLAKIS: Yes, but how much time do you think it will take to agree with you, 45 minutes or a half-an-hour?

DR. WALLIS: I would like to have just 5 minutes for you to agree with the conclusion and the scope of what I want to say, and then I will flush it out.

DR. APOSTOLAKIS: Okay.

DR. WALLIS: But I don't want to go and write a letter which is diametrically opposed to the view of the committee.

DR. APOSTOLAKIS: That is perfectly all right. Then we will pick up, I think, the oversight process, because even though we have lots of time tomorrow, if we are still debating it tomorrow, we will never write a letter. So I think Jack needs the night tonight to do whatever the committee decides and what advice they give you.

DR. WALLIS: Poor fellow.

DR. SHACK: You are wildly optimistic, George, but that's okay.

MR. SIEBER: I may have difficulty writing something I don't believe in.

DR. APOSTOLAKIS: Well, if you don't believe in it, you will participate in the debate, and you can express your views.

MR. SIEBER: Right.

DR. APOSTOLAKIS: But the alternative is to do it tomorrow, which is impossible, where nobody can write anything. So I really want to go into the oversight process as soon as we can, and after we get the warm feeling that, yes, the outline of the letter is in sight, then we can look at other things, okay?

So the first thing we will do then is Dana's letter, and then we will look at the Larkinsgram if it is already, and then we will go to

Graham. Yes, Sherry?

MS. MEADOR: Would you like Dana's letter upon the screen?

DR. APOSTOLAKIS: Yes, but in 20 minutes.

DR. POWERS: Mr. Chairman, we have quite a few mark-ups on that letter already.

DR. APOSTOLAKIS: Mark-ups?

DR. POWERS: Yes. Do you want me to read it to you as it is marked up? I can do that.

DR. APOSTOLAKIS: You mean she doesn't have that?

DR. POWERS: No, she doesn't have that yet.

MR. ROSEN: The Larkinsgram is ready.

DR. KRESS: I also have a second draft of the Waterhammer.

DR. APOSTOLAKIS: Okay. We will be back in 20 minutes and see what is ready, and whatever is ready, we will do that then.

(Whereupon, the meeting was recessed at 2:00 p.m.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Reactor Safeguards

Docket Number: (Not Applicable)

Location: Rockville, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Rebecca Davis
Official Reporter
Neal R. Gross & Co., Inc.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D.C. 20555-0001

August 20, 2001

REVISED
SCHEDULE AND OUTLINE FOR DISCUSSION
485th ACRS MEETING
SEPTEMBER 5-8, 2001

WEDNESDAY, SEPTEMBER 5, 2001, CONFERENCE ROOM 2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND

1) 8:30 - 8:35 A.M. Opening Remarks by the ACRS Vice Chairman (Open)
- 1.1) Opening statement (MVB/JTL/HJL/SD)
- 1.2) Items of current interest (MVB/NFD/SD)
- 1.3) Priorities for preparation of ACRS reports (MVB/JTL/SD)

2) 8;35 - 10:00 A.M. Proposed Resolution of Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on PWR Sump Pump Performance" (Open) (SR/AS)
- 2.1) Remarks by the Subcommittee Chairman
- 2.2) Briefing by and discussions with representatives of the NRC staff regarding the proposed resolution of GSI-191.

Representatives of the nuclear industry will provide their views, as appropriate.

10:00 - 10:20 A.M. ***BREAK**

3) 10:20 - 12:00 Noon EPRI Report on Resolution of Generic Letter 96-06 Waterhammer Issues (Open/Closed) (TSK/MME)
- 3.1) Remarks by the Subcommittee Chairman
- 3.2) Briefing by and discussions with representatives of the NRC staff and the Electric Power Research Institute (EPRI) regarding the EPRI Report, TR-113594, "Resolution of Generic Letter 96-06 Waterhammer Issues."

[Note: A portion of this session may be closed to discuss EPRI proprietary information]

12:00 - 1:00 P.M. ***LUNCH***

4) 1:00 - 1:30 P.M. Reconciliation of ACRS Comments and Recommendations (Open) (GEA, et al./SD, et al.)
Discussion of the responses from the NRC Executive Director for Operations to comments and recommendations included in recent ACRS reports and letters.

5) 1:30 - 2:00 P.M. Subcommittee Report (Open) (GBW/PAB)
Report by the Chairman of the Thermal-Hydraulic Phenomena Subcommittee on the results of the meeting held on July 17-18, 2001 at the Oregon State University.

2:00 - 2:30 P.M. *****BREAK*****

6) 2:30 - 4:00 P.M. Reactor Oversight Process (Open) (JDS/GEA/MWW)
6.1) Remarks by the Subcommittee Chairman
6.2) Briefing by and discussions with representatives of the NRC staff regarding the use of performance indicators in the reactor oversight process, initial implementation of the significance determination process (SDP), and technical adequacy of the SDP to contribute to the reactor oversight process.

Representatives of the nuclear industry will provide their views, as appropriate.

4:00 - 4:20 P.M. *****BREAK****

7) 4:20 - 7:00 P.M. Proposed ACRS Reports (Open)
Discussion of proposed ACRS reports on:
7.1) EPRI Report on Resolution of Generic Letter 96-06 Waterhammer Issues (TSK/MME)
7.2) Reactor Oversight Process (JDS/GEA/MWW)
7.3) Proposed Resolution of GSI-191, Assessment of Debris Accumulation on PWR Sump Pump Performance (SR/AS)

THURSDAY, SEPTEMBER 6, 2001, CONFERENCE ROOM 2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND

8) 8:30 - 8:35 A.M. Opening Remarks by the ACRS Chairman (Open) (GEA/JTL/SD)

9) 8:35 - 9:00 A.M. Peer Review of PRA Certification Process (GEA/MTM)
9.1) Remarks by the Subcommittee Chairman
9.2) Report by Mr. Markley, ACRS Senior Staff Engineer, regarding the application of the PRA certification process described in NEI 00-02, "Probabilistic Risk Assessment (PRA) Peer Review Process Guidance," for the North Anna Power Station that was conducted by the Westinghouse Owners Group and discussed with the licensee on July 16-20, 2001 in Richmond, Virginia.

10) 9:00 - 10:00 A.M. Meeting with the NRC Commissioner Merrifield (Open) (GEA/JTL)
Meeting with Commissioner Merrifield to discuss items of mutual interest.

10:00 - 10:20 A.M. *****BREAK*****

11) 10:20 - 12:00 Noon TRACG Best-Estimate Thermal-Hydraulic Code (Open/Closed) (GBW/PAB)

11.1) Remarks by the Subcommittee Chairman

11.2) Briefing by and discussions with representatives of the NRC staff and the GE Nuclear Energy regarding the General Electric TRACG best-estimate code and its application for anticipated operational occurrences transient analyses.

[NOTE: A portion of this session may be closed to discuss General Electric Proprietary Information.]

12:00 - 1:00 P..M. ***LUNCH***

12) 1:00 - 2:00 P.M. Proposed Final Revision to Regulatory Guide 1.78 (DG-1089), "Main Control Room Habitability During a Postulated Hazardous Chemical Release" (Open) (DAP/NFD)

12.1) Remarks by the Subcommittee Chairman

12.2) Briefing by and discussions with representatives of the NRC staff regarding the proposed final revision to Regulatory Guide 1.78.

Representatives of the nuclear industry will provide their view, as appropriate.

2:00 - 2:20 P.M. ***BREAK***

13) 2:20 - 7:00 P.M. Proposed ACRS Reports (Open)
Discussion of proposed ACRS reports on:

13.1) TRACG Best-Estimate Thermal-Hydraulic Code (GBW/PAB)

13.2) Reactor Oversight Process (JDS/GEA/MWW)

13.3) Proposed Resolution of GSI-191, Assessment of Debris Accumulation on PWR Sump Pump Performance (SR/AS)

13.4) EPRI Report on Resolution of Generic Letter 96-06 Waterhammer Issues (TSK/MME)

13.5) Proposed Final Revision to Regulatory Guide 1.78 (DAP/NFD)

FRIDAY, SEPTEMBER 7, 2001, CONFERENCE ROOM 2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND

14) 8:30 - 8:35 A.M. Opening Remarks by the ACRS Chairman (Open) (GEA/JTL/SD)

15) 8:35 - 9:30 A.M. Future ACRS Activities/Report of the Planning and Procedures Subcommittee (Open) (GEA/JTL/SD)

15.1) Discussion of the recommendations of the Planning and Procedures Subcommittee regarding items proposed for consideration by the full Committee during future ACRS meetings.

15.2) Report of the Planning and Procedures Subcommittee on matters related to the conduct of ACRS business, and organizational and personnel matters relating to the ACRS.

16) 9:30 - 6:00 P.M. **(12:00-1:00 P.M. LUNCH)** — Proposed ACRS Reports (Open)
Continue discussion of proposed ACRS reports listed under Item 13.

SATURDAY, SEPTEMBER 8, 2001, CONFERENCE ROOM 2B3, TWO WHITE FLINT NORTH, ROCKVILLE, MARYLAND

17) 8:30 - 11:30 A.M. — Proposed ACRS Reports (Open)
Continue discussion of proposed ACRS reports listed under Item 13.

18) 11:30 - 12:00 Noon — Miscellaneous (Open) (GEA/JTL)
Discussion of matters related to the conduct of Committee activities and matters and specific issues that were not completed during previous meetings, as time and availability of information permit.

12:00 Noon — **Adjourn**

NOTE:

- **Presentation time should not exceed 50 percent of the total time allocated for a specific item. The remaining 50 percent of the time is reserved for discussion.**
- **Number of copies of the presentation materials to be provided to the ACRS - 35.**

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
485TH MEETING
GE NUCLEAR ENERGY TRACG CODE - APPLICATION TO AOOs
SEPTEMBER 6, 2001
ROCKVILLE, MARYLAND

PRESENTATION SCHEDULE

TOPIC	SPEAKER	TIME
1. Subcommittee Report	T. Kress/G. Wallis	10:20 a.m.
2. NRC Staff Presentation • Introduction • SER Overview • Code Assessment • Kinetics Evaluation/ Lessons Learned • Code User Experience • Concluding Remarks	R. Landry, NRR	10:30 a.m.
3. GE Nuclear Energy Presentation **(Closed as Necessary)** • Introduction • TRACG Code Application To AOO's • Response to ACRS Comments - 11/13-14/00 Sub. Meeting • Concluding Remarks	J. Andersen, GNF[1]	11:15 a.m.
4. ACRS Discussion		11:55 a.m.
5. Recess		12:00 noon

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[1] Global Nuclear Fuels - a wholly-owned subsidiary of GE Nuclear Energy

TRACG CODE FOR ANTICIPATED OPERATIONAL OCCURRENCES

DRAFT SAFETY EVALUATION REPORT

ACRS

RALPH R. LANDRY
REACTOR SYSTEMS BRANCH
SEPTEMBER 6, 2001

TRACG DSER

TOPICS

- REVIEW TIMELINE
- APPROACH TO REVIEW
- CODE APPLICABILITY
- CODE ASSESSMENT
- STAFF EVALUATION
- CONDITIONS AND LIMITATIONS
- CONCLUSIONS
- LESSONS LEARNED

TRACG DSER

REVIEW TIMELINE

- MAY 25, 1999 - PRELIMINARY INFO MEETING
- JULY 15, 1999 - PRELIMINARY INFO MEETING
- JANUARY 2000 - TRACG SUBMITTAL
- NOVEMBER 13, 2000 - ACRS T/H SUBCOMMITTEE
- JULY 2001 - FORMAL RAIs ISSUED
- JULY 2001 - DRAFT SER
- AUGUST 22, 2001 - ACRS T/H SUBCOMMITTEE

TRACG DSER

STAFF APPROACH TO REVIEW

- EXTENSIVE T/H REVIEW DURING SBWR REVIEW EFFORT FOR LOCA APPLICATION
- STAFF BUILT ON THAT REVIEW FOR AOO REVIEW
- EMPHASIS ON NEUTRON KINETICS AND STATISTICAL METHODOLOGY

TRACG DSER

TRACG AOO APPLICABILITY

- INCREASE IN HEAT REMOVAL BY SECONDARY SYSTEM
- DECREASE IN HEAT REMOVAL BY SECONDARY SYSTEM
- DECREASE IN REACTOR COOLANT FLOW RATE
- REACTIVITY AND POWER DISTRIBUTION ANOMALIES
- INCREASE IN REACTOR COOLANT INVENTORY
- DECREASE IN REACTOR COOLANT INVENTORY

TRACG DSER

CODE ASSESSMENT

- ASSESSMENT PERFORMED BY COMPARISON WITH DATA FROM:
  - PHENOMENOLOGICAL TESTS
  - SEPARATE EFFECTS TESTS
  - INTEGRAL SYSTEMS TESTS
  - PLANT OPERATIONAL DATA
- PLANT NODALIZATION IS TO BE CONSISTENT WITH ASSESSMENT MODELING
- PIRT PREPARED CORRELATING PHENOMENA WITH TESTS AND QUANTITATIVE ASSESSMENT PERFORMED
- ALL MEDIUM AND HIGH RANKED PHENOMENA ASSESSED
- ASSESSMENT SHOWS CAPABILITY OF CODE TO REPRESENT EXPERIMENTAL AND OPERATING DATA

TRACG DSER

STAFF EVALUATION
THERMAL-HYDRAULICS

- Two-fluid model, six conservation equations, boron transport equation, noncondensible gas mass equation.

- Two-regime unified flow map - covers normal operating and anticipated regimes for BWR.

- Kinetic energy term retained in energy equations. Avoids energy balance errors due to nonconservation of energy.

- GEXL heat transfer correlation:

    - Resolution pending - when NRC staff approves critical boiling length correlation uncertainty, it will be applied in use of TRACG.

- Basic component models are used as building blocks to construct physical models.

- Steam separator validated against full-scale performance data for two-stage and three-stage steam separators.

TRACG DSER

STAFF EVALUATION
NEUTRON KINETICS

- FOCUSED ON DOES THE CODE WORK AND WHY RATHER THAN HOW.
- EMPHASIS ON EXECUTION OF CODE AND COMPARISON TO BENCHMARKING AND COMPARISON TO STAFF'S TRAC-B/NESTLE
- CAPTURES RELEVANT PHYSICS
- DOCUMENTATION ADEQUATE FOR INTERNAL (GE) USE.
- TEST PROBLEM DEFINITION BASED ON ABWR CORE DESIGN - NO BALANCE OF PLANT.
- REASONABLE ASSURANCE TRACG CAN MODEL AOO TRANSIENTS.
- OLDER METHODOLOGY AND SMALL NO. GROUPS USED TO SET PARAMETERS.

TRACG DSER

STAFF EVALUATION
USER EXPERIENCE

- TRACG uses input deck closely related to input deck specification of original TRAC-B code.
- Knowledgeable TRAC user can readily understand structure and design of TRACG input.
- Major changes from TRAC-B to TRACG well described in Model Description report appendix.
- Additional guidance to the user on time step size would be useful.
- Standard input has been developed for classes of BWRs and transients. Reduce user introduced errors in code results.

TRACG DSER

STAFF EVALUATION
CONDITIONS AND LIMITATIONS

- USE OF GEXL14 CORRELATION IS ACCEPTABLE PROVIDED THAT WHEN NRC APPROVES THE CRITICAL BOILING LENGTH CORRELATION UNCERTAINTY IT IS APPLIED IN USE OF TRACG.

- SHOULD TRACG BE APPLIED TO STABILITY ANALYSIS, THE METHODOLOGY IS TO BE SUBMITTED FOR STAFF REVIEW.

- TRACG HAS NOT BEEN REVIEWED FOR ATWS.

- PIRT18 MODEL NEEDS FURTHER JUSTIFICATION BEFORE APPLICATION TO RIA ANALYSES. HOW CAN A MONTE CARLO MODEL RELIABLY PREDICT POINT KINETIC ANSWERS?

- SEPARATE ISOLATION CONDENSER MODEL OR ABILITY TO ADEQUATELY MODEL THE CONDENSER NEEDS TO BE DEMONSTRATED SHOULD APPLICATION BE MADE TO ISOLATION CONDENSER IMPORTANT TRANSIENTS.

TRACG DSER

CONCLUSIONS

- USE OF GEXL14 CORRELATION ACCEPTABLE PROVIDED NRC APPROVED UNCERTAINTY APPLIED.
- KINETICS SOLVER IS ADEQUATE TO SUPPORT CONCLUSION MODELS ARE CORRECTLY DERIVED AND ACCOUNT FOR PHENOMENA INVOLVED IN AOO TRANSIENTS.
- KINETICS SOLVER BENCHMARKING DEMONSTRATE TRACG ADEQUATELY PREDICTS RESULTS FOR AOO TRANSIENTS.
- STAFF ANALYSES PROVIDE CONFIDENCE TRACG ACCEPTABLE FOR AOO ANALYES.
- THE UNCERTAINTY ANALYSIS FOLLOWS ACCEPTED CSAU ANALYSIS METHODOLOGY.
- UNCERTAINTIES AND BIASES HAVE BEEN IDENTIFIED AND HIGHLY RANKED PHENOMENA BASED ON EXPERIMENTAL DATA VALIDATED.

TRACG DSER

CONCLUSIONS CONT'D

- THE STAFF FINDS THE TRACG02A CODE ACCEPTABLE FOR APPLICATION TO THE AOO TRANSIENTS PRESENTED IN THE SUBMITTAL, NEDE-32906P, "TRACG APPLICATION FOR ANTICIPATED OPERATIONAL OCCURRENCES (AOO) TRANSIENT ANALYSES," DATED JANUARY 2000.

T/H CODE REVIEWS

LESSONS LEARNED

- THREE CODES REVIEWED RETRAN-3D, S-RELAP5, TRACG
- EACH APPLICATION UNIQUE
- ALL SUBMITTED PRIOR TO DG-1096 AND DSRP
- CSAU CAN BE USED SUCCESSFULLY TO SUPPORT TRANSIENT ANALYSIS CODE
- CARE IS NEEDED IN ESTABLISHING "THOUGHT" PROBLEMS FOR CODE-TO-CODE COMPARISONS
- UPSTREAM CODES USED TO DEVELOP INPUT DATA NEED TO BE EXAMINED IN ADDITION TO MAIN CODE

PRA PEER REVIEW FOR THE NORTH ANNA POWER STATION

Presented to
Advisory Committee on Reactor Safeguards

by
Michael T. Markley, ACRS Senior Staff Engineer
(301) 415-6885

September 6, 2001

- ACRS last reviewed the NEI 00-02, “Probabilistic Risk Assessment (PRA) Peer Review Process Guidance,” in October 2000.

- All Owners Groups and licensees are performing PRA “certifications” in accordance with NEI 00-02.

- PRA peer review for the North Anna Power Station (NAPS), owned/operated by Dominion Resources, Inc., conducted by Westinghouse Owners Group (WOG), on July 16-20, 2001.

GRADE DEFINITIONS

Grade 1: Corresponds to attributes needed for identification of plant vulnerabilities, i.e., Generic Letter 88-20. Most PRAs expected to meet these requirements.

Grade 2: Attributes needed for risk ranking of structures, systems, and components (SSCs). PRA methods and models yield meaningful results for assessment of SSCs, when combined with deterministic insights (i.e., blended approach).

GRADE DEFINITIONS - Continued

Grade 3: Risk significance determinations by PRA adequate to support regulatory applications (e.g., licensing submittals), when combined with deterministic insights.

Grade 4: Comprehensive, intensively reviewed study that has scope, level of detail, and documentation to ensure the highest quality of results. Routine reliance on PRA for certain changes. Usable as the primary basis for developing licensing positions.

LEVELS OF SIGNIFICANCE FOR FACTS AND OBSERVATIONS

A. Extremely important and necessary to address to ensure technical adequacy of PRA, quality of PRA, or quality of PRA update process (Contingent Item for Grade Assignment).

B. Important and necessary to address, but may be deferred until next PRA update (Contingent Item for Grade Assignment).

LEVELS OF SIGNIFICANCE FOR FACTS AND OBSERVATIONS - Continued

C. Desirable to maintain maximum flexibility in PRA Applications and consistency in the industry, but not likely to affect results or conclusions.

D. Editorial or Minor Technical Item, left to the discretion of the host utility.

S. Superior treatment, exceeding requirements for anticipated applications and exceeding that in most PRAs.

- NAPS PRA appears relatively mature as compared to other PRAs, much to the credit of past Surry initiatives (WASH-1400, NUREG-1150, NUREG/CR-6144, etc.) and risk-informed pilot applications . Surry PRA was one of the first to be subjected to the Peer Review Process per NEI 00-02.

- Peer Review Process is highly dependent on the knowledge and experience of the Peer Review Team members. NAPS Peer Review Team averaged more than 25 years of nuclear experience and 17 years of PRA-related experience. There will be variability in the composition of Peer Review Teams and the associated outcomes.

- Peer Review Team members demonstrated a healthy questioning attitude in examining issues and made some valuable observations, insights, and recommendations. There was no apparent rush to certify the PRA. Team members looking for opportunities to improve the PRA.

- Peer Review Process is an extensive, structured sampling. Because it is a sampling, it does not ensure that all weaknesses have been identified. Nevertheless, there were lots of individual observations that revealed common themes, cross-cutting issues, and trickle-down effects.

- Extensive discussions during consensus sessions over the level of significance and recommended actions for the licensee to address contingent grades. Licensee not normally present during consensus sessions.

- Grading is a central part of the process. However, the value is in the insights and what the licensee does with the Peer Review observations in improving the PRA and associated decisionmaking. Overall, it is a good industry initiative, but there is no follow-up procedure for NEI 00-02.

- Incompleteness will still exist in PRAs and there will be variability in the use of plant-specific data and treatment of uncertainties. It is important to recognize that the Peer Review Process represents progress and not perfection.

- Worthwhile for individual ACRS members to attend a PRA certification in order to examine first-hand how NEI 00-02 is implemented. Provide added perspective for the Committee's consideration of this and other risk-informed initiatives. At NAPS, the Peer Review Team did have the benefit of the recently approved version of the ASME Standard on PRA for Nuclear Power Plant Applications.

- Although risk-informed regulation is voluntary, it is expected that licensee participation in risk-informed initiatives will enhance achievement of the NRC Strategic and Operating Goals for maintaining safety, enhancing public confidence, reducing unnecessary regulatory burden, and increasing effectiveness and efficiency.

- Better PRAs should enhance NRC licensing (i.e., through shorter review times) and inspection (ROP implementation) processes. Cognizant NRC staff should observe implementation of NEI 00-02 to become more familiar with licensee PRAs.

FUTURE ACRS ACTIVITIES

- Review the results of NEI 00-02 implementation after the Owners Groups have completed peer reviews at respective licensee facilities. Appropriate to hear briefings from the various stakeholders on the results of NEI 00-02 (e.g., NRC, industry, concerned citizen groups, and other interested parties).

- Items of interest could include lessons-learned, follow-up actions, experience in using certified PRAs for regulatory applications, and activities to harmonize the initiatives related to PRA quality (e.g., RG 1.174, ASME and ANS Standards, etc.).

United States Nuclear Regulatory Commission

REVISION 1 TO REGULATORY GUIDE 1.78

EVALUATION OF CONTROL ROOM HABITABILITY DURING A HAZARDOUS CHEMICAL RELEASE

Presented to:
Advisory Committee on Reactor Safeguards

Presented by:
Sudhamay Basu
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission

September 6, 2001

REVISION 1 TO REGULATORY GUIDE 1.78 - SCOPE

- **Revision 1 to Regulatory Guide 1.78 provides screening measures for determining toxic releases that should be considered for control room habitability evaluation**

- **For releases requiring consideration, the revision provides guidance to determine concentrations in the control room**

- **Revision 1 also provides guidance for protection of control room operators against accidental toxic releases**

SUMMARY OF CHANGES IN THE REVISED GUIDE

ATTRIBUTE	RG 1.78 GUIDANCE	REV. 1 GUIDANCE	REASON/BENEFIT
Toxicity Screening	Sax (1968)	IDLH per NIOSH (1997)	- prescriptive and more appropriate - adequate safety margins - unnecessary burden reduction
Dispersion Modeling	Murphy-Campe model	NUREG/CR-6210 (HABIT) or similar model	- permits improved assessment of toxic concentrations - non-prescriptive; latitude provided
Risk Evaluation	None	Consideration of risk insights per RG 1.174	- fewer LERs in recent years - no TS requirements for TGMS - unnecessary burden reduction
Performance-Based Guidance	None	Guidance for protection measures	- adequate protection - unnecessary burden reduction
Combined approach to chlorine and other toxic chemicals	RG 1.95 separated from RG 1.78	RG 1.78 and RG 1.95 combined	- consistency - unnecessary burden reduction

PERFORMANCE-BASED GUIDANCE FOR CONTROL ROOM HABITABILITY

- Assurance of control room habitability and adequate protection of control room operators

- Periodic survey of stationary and mobile sources of toxic chemicals; testing of control room envelope inleakage

- Implementation of protection measures not required if detail evaluation shows highest concentration below the toxicity limit

- Concentration exceeding the toxicity limit requires protection measures: detection, control room isolation, protection of operators

- Detection system capable of detecting toxic concentration level significantly lower than the IDLH level; control room isolation initiated upon toxic chemical detection

- Provisions for self-contained breathing apparatus and protective clothing in the event toxicity level exceeds the IDLH level; ability to don protective gears in two minutes

GE Nuclear Energy

TRACG Application for Anticipated Operational Occurrences (AOO) Transient Analyses

Presentation to ACRS

J. G. M. Andersen
F. T. Bolger

September 6, 2001

Overview

- ***TRACG Application for AOO Transients***
  - *Scope of TRACG Application*
  - *Application Methodology*

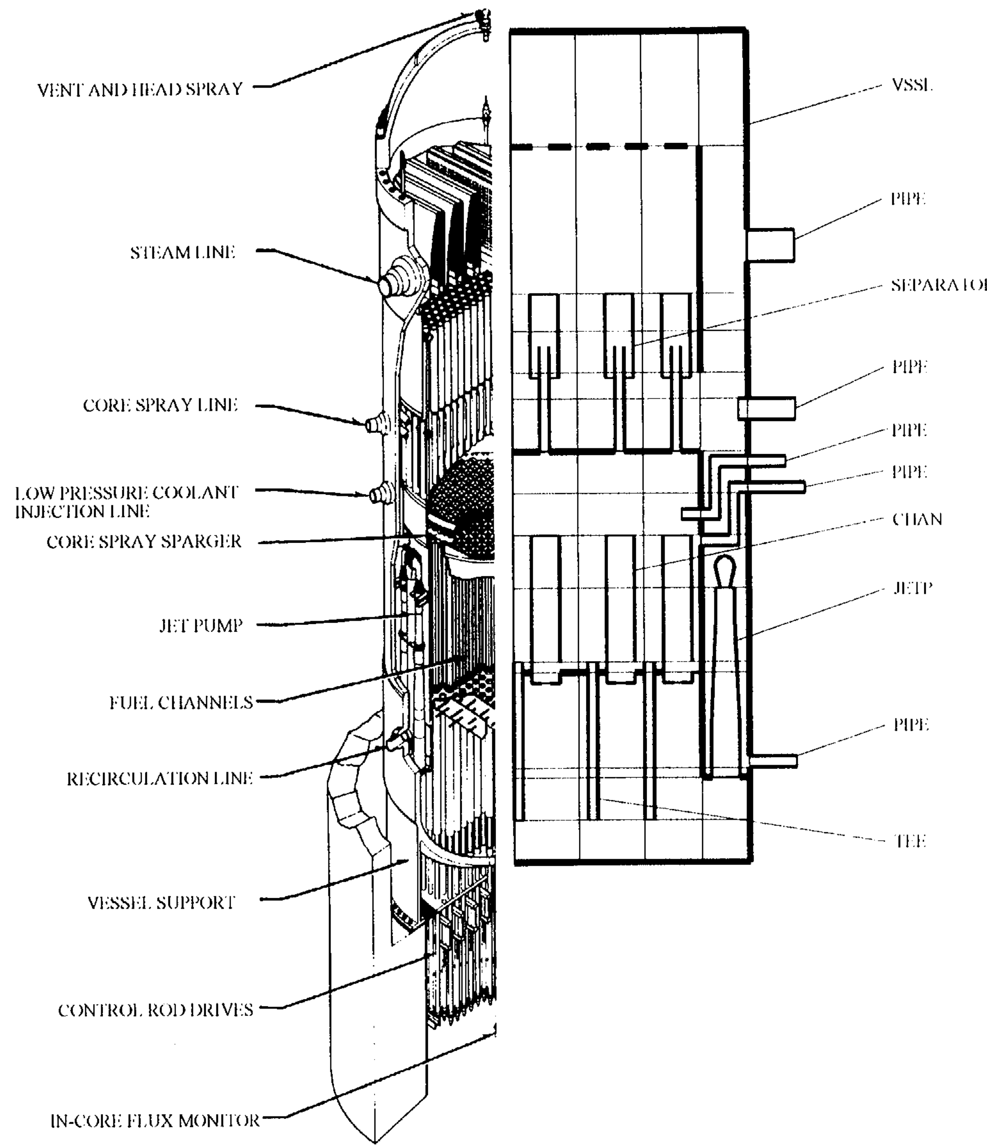
- ***Review***
  - *Extensive documentation on TRACG submitted to NRC*
  - *NRC Review*
    - *Meetings and communication with NRC*
    - *Request for additional information and GE responses*
  - *ACRS T/H Subcommittee review*
    - *Response to Subcommittee Comments*

- ***Concluding Remarks***

TRACG

Realistic Code for BWR Transients
GE Proprietary Version

- *Transients, ← Focus of submittal*
  LOCA, ATWS, Stability, RIA, RIPD
- *Multi-dimensional vessel*
- *Flexible modular structure with control system capability*
- *Proven 3D nuclear kinetics consistent with PANACEA*
- *Steam, liquid, boron and non-condensable gases*
- *Flow regime map covering all hydraulic conditions*
- *Consistent use of constitutive correlations*
  - *Shear and heat transfer*
- *BWR component models*
  - *Pump, Jet Pump, Separator, Fuel Channel*
- *Extensive qualification*
  - *Separate effects tests*
  - *BWR component performance data*
  - *Integral system effects*
  - *Full scale plant data*



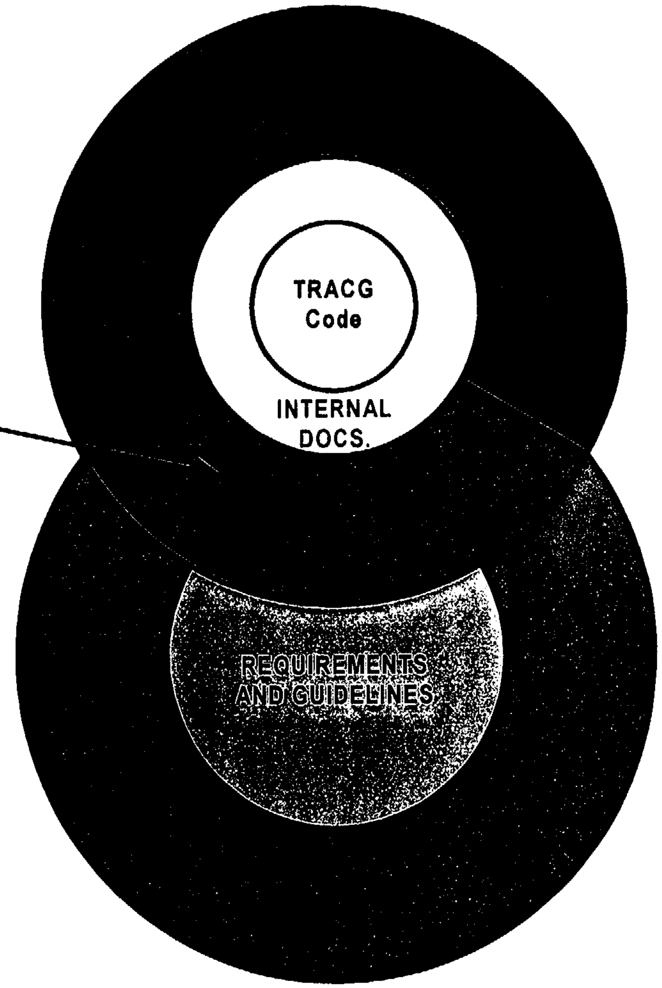
Scope: Application of TRACG for BWR Transients

- ***Plants:*** ***BWR/2/3/4/5/6***
- ***Events:*** ***Anticipated Operational Occurrences (Transients)***
  - *Increase / Decrease in Reactor Pressure*
  - *Increase / Decrease in Core Flow*
  - *Increase / Decrease in Reactor Coolant Inventory*
  - *Decrease in Core Coolant Temperature*
- ***Documentation***
  - *TRACG Licensing Application Framework for AOO Transient Analyses, NEDC-32900P*
  - *TRACG Model Description LTR, NEDE-32176P, Revision 2*
  - *TRACG Qualification LTR , NEDE-32177P, Revision 2*
  - *TRACG Application LTR for AOO Transient Analyses, NEDE-32906P*
  - *TRACG02A Users Manual, NEDC-32956P*
  - *TRACG02A Source Code and Sample Problems*
- ***Review Scope***
  - *SER for Application of TRACG to BWR AOO Transients*
    - *Applicability of TRACG for AOO Transients*
    - *Qualification*
    - *Application Methodology for AOO Transients*

TRACG Application Methodology - Major Elements

- ***Plant and Event Definition***
  - *BWR/2-6 AOO transients*
- ***Identification of Important Phenomena***
  - *All Identified Event Categories*
  - *Ranking by Impact on Critical Safety Parameters*

    CPR, Pressure, Water Level, Fuel T/M response
  - *All high and Medium ranked parameters included*
- ***Determination of Code Applicability***
  - *Structure, Basic Equations,*
    Models and Correlations, Numerics
  - *Cross reference to PIRT*
- ***Qualification and Determination of Code Uncertainty***
  - *Separate Effects Tests, Component Tests, Integral Effects Tests, Full Scale Plant Data*
  - *Cross reference to PIRT*
- ***Determination of Effect of Reactor Input Parameters and State***
- ***Determination of Total Uncertainty***
  - *Plant sensitivity studies*
  - *Statistical Limit for Critical Safety Parameters*



Structured Approach Consistent with CSAU Methodology and DG-1096

TRACG Application Methodology

- ***Application Methodology LTR***
  NEDE-32906P Rev. 0

1. *Introduction*
2. *Licensing Requirements and Scope of Application*
3. *Phenomena Identification and Ranking*
   - *NEDC-32906P Table 3-1*
4. *Applicability of TRACG to AOOs*
   - *NEDE-32906P Table 4-1 - Cross Reference to Model Description LTR*
   - *NEDE-32906P Table 4-2 - Cross Reference to Qualification LTR*
5. *Model Uncertainties and Biases*
6. *Application Uncertainties and Biases*
7. *Combination of Uncertainties*
8. *Demonstration Analysis*
9. *Technical Specification Modifications*
10. *References*

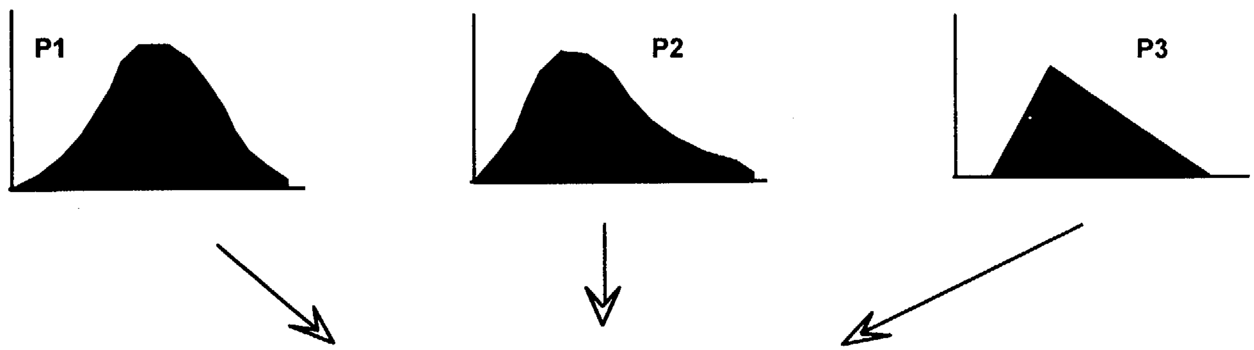
Identify which parts of Model and Qualification LTRs that are significant for TRACG application to AOO transients

TRACG Application Methodology

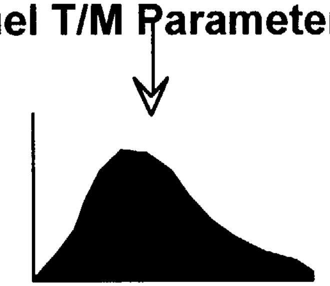
- ***Demonstrate that NRC requirements in 10CFR50 Appendix A are met as exemplified by conformance with the specific AOO items stipulated in Section 15 of the Standard Review Plan (NUREG 0800).***
- ***Demonstrate that the Specified Acceptable Fuel Design Limits (SAFDLs) pertaining to AOO transients required under General Design Criteria 10, 15, 17 and 26 are satisfied. NRC-approved SAFDLs are defined in GESTAR II (NEDE-24011-P-A).***
- ***Demonstrate that TRACG is applicable for licensing calculations of AOO transients when used in accordance with the proposed application methodology.***
- ***Demonstrate that the proposed application methodology produces results for which the uncertainties and biases have been sufficiently quantified to allow the overall conservatism to be assessed relative to regulatory requirements and the perceived risk of AOO events.***

TRACG Application Methodology
Determination of Total Uncertainty

- **Uncertainties in All Important Model and Plant Parameters Defined, e.g., Void Coefficient, Scram Speed, Initial Conditions ···**



- **Determine Sensitivity Y = f(P1, P2, P3, ···)**
- **Sensitivity Studies Confirm Phenomena Ranking**
- **Distribution Determined for Critical Safety Parameters CPR, Level, Fuel T/M Parameters, Pressure**



- **Statistical Limit for Critical Safety Parameter**
- **Methodology Confirmed by Application to Plant Data**
- **Methodology Demonstrated for All Event Categories.**

TRACG Review

- **Plan and Road Map for TRACG AOO Application** — **May 1999**
- **All TRACG documents submitted** — **February 2000**
- **Review Kick-off** — **March 2000**
  - NRC and ACRS
- **NRC Acceptance of TRACG for Review** — **April 2000**
- **NRC Review Concerns** — **September 2000**
- **ACRS T/H Subcommittee Review** — **November 2000**
- **NRC Requests for Additional Information (RAI)**
  - 23 Requests for Additional Information (RAI)
  - Responses provided to RAIs
  - All issues resolved
- **Draft Safety Evaluation Report (SER)** — **July 2001**
- **ACRS T/H Subcommittee Review** — **August 2001**
  - Responses provided to ACRS comments
- **SER on TRACG Application to AOO Transients** — **September 2001**

Response to ACRS Thermal/Hydraulic Subcommittee Comments

- ***Some comments included in NRC RAI (19)***
  - *Justification provided for formulation of steam/air conservation equations*
- ***Other comments responded to at ACRS T/H subcommittee meetings***
  - *DG-1096 documentation guidance - All elements covered*
  - *Justification for assumptions in basic equations.*

    BWR applications

    AOO transients
  - *Clarification of treatment of wall shear in documentation*
  - *Important phenomena in TEE based components incorporated in Jet Pump, Separator and Channel components*
  - *Clarification of flow regime map*
  - *Clarification of interfacial shear terms*
  - *Clarification models for interfacial area and heat transfer*
  - *Clarification of nuclear modeling*
  - *Adequacy of assessment*

Models and Assessment Adequate for BWR/2-6 AOO Transients

Concluding Remarks

- *Scope: BWR/2-6 AOO Transients*
- *Meets All Regulatory Requirements*
- *Demonstration of Model Capability and Applicability*
- *Extensive Review and Acceptance of TRACG*
- *Rigorous and Sound Statistical Methodology*
- *Application Methodology Demonstrated for All Event Types*

TRACG is Applicable to BWR/2-6 AOO Transients for Licensing Analysis