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NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

June 7, 2000

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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MEETING: 473RD ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

Two White Flint North, Room T2-B3
11545 Rockville Pike
Rockville, MD
Wednesday, June 7, 2000

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

MEMBERS PRESENT:

DANA A. POWERS, Chairman
GEORGE APOSTOLAKIS, Vice-Chairman
JOHN J. BARTON
MARIO V. BONACA
THOMAS S. KRESS
ROBERT L. SEALE
WILLIAM J. SHACK
JOHN D. SIEBER
ROBERT E. UHRIG
GRAHAM B. WALLIS

C O N T E N T S

P R O C E E D I N G S

[8:30 a.m.]

CHAIRMAN POWERS: The meeting will come to order. This is the first day of the 473rd meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the Committee will consider the following: Proposed Resolution of Generic Safety Issue 173-A, Spent Fuel Storage Pool for Operation Facilities. I'm sure this will prove to be totally non-controversial; Regulatory Effectiveness of the Station Blackout Rule; Proposed Final Standard Review Plan Section and Regulatory Guide Associated with the Revised Source Term Rule; and Assessment of the Quality of Probabilistic Risk Assessments.

The meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Dr. John D. Larkins in the Designated Federal Official for the initial portion of the meeting.

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

The 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 they can be readily heard.

I want to begin with a few items of current interest. First, members will notice in their package that Mr. McGaffigan has been reappointed to the Commission.

And members will also notice that Oconee got its license extension. However, there is one item of interest that is of special importance to this Committee, and that is the NRC has seen fit to award Mr. Theron Brown a Meritorious Service Award, so I think he deserves a round of applause for this.

[Applause.]

CHAIRMAN POWERS: This is a well-deserved award, and we have benefitted greatly from this.

Are there any items that members want to raise before we begin the scheduled proceedings?

[No response.]

CHAIRMAN POWERS: If not, we'll turn to the first item of business, which is the spent fuel storage pool for operating facilities, and Dr. Kress, I think you are taking the lead on this?

DR. KRESS: Yes, this is Generic Safety Issue 173-A. It's been with us awhile.

The issues are the potential to either lose inventory out of the spent fuel pool due to some sort of leak, may be driven by seismic or otherwise, or to lose cooling to the pool so that eventually it heats up, and boils off.

This is for operating reactors, and recently we had a similar condition we were looking at for decommissioning plants. Basically, the issues are the same, only with operating plants, the pools is there all the time and the heat load may even be greater, because it's decreasing with the decommissioning plan.

So the issues are virtually the same, in my mind.

There have been events, and in response to some of these events, this GSI was initiated, and in 1996, we were briefed, the Staff was briefed, briefed us on an action that was developed, and the action plan, I think, basically had three components:

One was a plant-specific evaluation or regulatory analysis for safety enhancement backfits. They determined that this was not a compliance issue. It was a safety enhancement issue.

Then they were going to implement rulemaking as part of the shutdown rule to deal with this particular issue. And then they were going to revise the Staff Guidance. That's the Standard Review Plan, Regulatory Guide 1.13.

What we have is SRP and the Reg Guide to look at. When we reviewed this in 1996, I went back and dug out our letters and looked at them. Apparently there were no identified outstanding technical issues at that time.

And the staff did not ask for us a letter at that time, so we didn't produce one.

We did produce a letter in 1998, which endorsed a high priority ranking for this particular GSI. And currently, the Staff is in the process of revising its guidance, and I think the intention is to work with the industry to revise an ANSI ANS standard and use it.

I think the objective of the presentations today is to see if they could get our endorsement to close the issue. And so with that as a really abbreviated introduction, I'll turn it over to George Hubbard, I guess.

MR. HUBBARD: I'm George Hubbard, the Acting Branch Chief for Plant Systems Branch. I think Dr. Kress has pretty much summarized the history of where we've been on this issue, and what we're looking for today is to get your agreement with regard to our proposed action on the GSI-173.

With that, I'll introduce Chris Gratton, who is in the Plant Systems Branch, and he will walk us through some of the history and bring us to where we are today and deal with that.

Chris?

MR. GRATTON: Thank you. Also here today is Tim Collins from the Plant Systems Branch. That was a very good lead-in to the situation that we're in right now.

We initiated this issue back in 1992, and haven't really addressed, other than trying to revise those -- the guidance documents that Dr. Kress was talking about, in the last two or three years.

So as we go along through this, the background and the history, if there are any questions on where we are or what it was that we were attempting to do, please stop, and I'll try and clarify what where we're going.

The purpose of the presentation is to update the ACRS on the status of the GSI-173, and to inform you that based on the results of the reviews and the evaluations, that we intend to close the GSI.

We do not have any additional actions or recommendations, and we intend to seek your concurrence that the GSI can be closed.

As Dr. Kress said, the last time the Staff presented to the ACRS on this topic was in August of 1996, after completing our review of the technical issues.

Since that time, the Staff evaluated certain design features to determine whether plant-specific safety enhancement backfits could be justified at those plants. The Staff completed that review and published our findings in a report dated September 30, 1997.

At the time, the ACRS did not request a presentation on the followup activities for GSI-173-A.

Slide 4. The Staff developed and implemented a generic action plan for ensuring the safety of spent fuel storage pools in response to two postulated event sequences at two separate plants.

The principal safety concern addressed by the action plan involved the potential for sustained loss of cooling and the potential for a substantial loss of coolant inventory that could expose irradiated fuel.

The latter concern, Part B to the action plan, was previously resolved and will not be discussed here today. The first postulated event sequence was reported to the NRC in November of 1992.

In the report, it was contended that the design of the Susquehanna Station failed to meet regulatory requirements with respect to sustained loss of cooling function to the spent fuel pool that could result from the loss of offsite power or a LOCA.

The heat and water vapor added to the reactor building atmosphere by the subsequent spent fuel pool boiling could cause the failure of accident mitigation or other safety equipment, and the associated increase in consequence -- and have an associated increase in consequences from the initiating event.

Using probabilistic and deterministic methods, the Staff evaluated these issues and determined that public health and safety were adequately protected for Susquehanna.

However, the Staff also concluded that a broader evaluation of the potential for this type of event to occur at other facilities was justified.

In addition to reviewing the Susquehanna safety issue, the action plan also called for a review of the events related to wet storage of spent fuel. From these reviews, the Staff identified areas to evaluate for further regulatory actions.

Design information in support of the evaluation was developed through four site visits, reviews of plant SERs, and a Staff survey of plant operating procedures and designs that was completed in May of 1996.

The Staff published its findings in a report dated July 26th, 1996. During the development of the action plan, the Staff met with the ACRS several times.

The Staff received and implemented recommendations from the ACRS that aided in the Staff's coming to a resolution on these issues.

Over the next few slides, I'll discuss the focus of the action plan, and the findings and the followup actions.

Concurrent with the action plan, the Executive Director for Operations directed the Office for Analysis and Evaluation of Operational Data to perform an independent study of the likelihood and consequences of an extended loss of spent fuel pool cooling.

NRR reviewed the AEOD report upon its completion, found the results were consistent with the findings from the action plan, and modified our action plan to include certain insights from the AEOD study.

DR. KRESS: That AEOD study, my impression is that they really didn't quantify the consequences; they just said they were severe or something like that?

MR. GRATTON: I don't know the exact answer to that question. Jose Ibara from AEOD is here and may be able to shed more insight on that, on the exact --

MR. IBARA: Yes, Jose Ibara from Research. We did not quantify it, but we did have data as to how many degrees events occurred, and so forth. It was not quantified.

DR. KRESS: Thank you.

DR. WALLIS: I'm not sure now. You're talking about the consequences here?

MR. GRATTON: For the AEOD study?

DR. WALLIS: The consequences are released to the environment of radioactive material. That was not investigated?

MR. GRATTON: Not in the AEOD study.

DR. WALLIS: But it was part of your thought process? Somebody must have thought about it.

MR. HUBBARD: This is George Hubbard with the Plant Systems Branch. We did not carry it to the consequences. What we looked at in the Susquehanna study in looking at this action plan, we were looking at the low probability of these events or the sequences that we looked at, and we didn't carry it forward to -- I believe we felt the possibilities of these events was low enough that we didn't carry it through to the consequences.

DR. KRESS: My impression, Graham, is that this is like looking at a LERF, where you don't really do the consequences, but you have something that's relating to the consequences.

DR. WALLIS: I'm just asking because your transparency says they evaluated the consequences, and it appears that they didn't. So, that's the only reason I'm following up on this.

MR. GRATTON: The request from the EDO said the likelihood of consequences, but what they actually looked into, I don't believe, went into the consequence stage.

CHAIRMAN POWERS: I guess there is the question of suppose that I come along and say, gee, the probability of an accident is very, very low? But I'm supposed to be risk-informed. Don't I have to multiply that by the consequences before I start taking it off my list?

DR. KRESS: The risk ought to have consequences built into it. The risk is the product of the probability of the consequences.

So you can't say the risk is very low until you do the consequence part, in my opinion.

DR. WALLIS: So does that mean that we will not know what the risk is today?

DR. KRESS: Well, once again, if you have -- if you calculate a LERF for an operating reactor, say, and then you basically have a measure of consequences built into your LERF.

I think the appropriate question is what value of LERF is an acceptable value? I think you have a -- you don't have a measure of the consequences if you're using a LERF that is for one situation, and you're trying to apply it to another, I don't think.

DR. WALLIS: At least you have an order of magnitude.

DR. KRESS: Yes, it may be conservative and ought to be.

MR. GRATTON: To identify the spent fuel storage issues and evaluate concerns for identified spent fuel storage issues, we focused the evaluation on design features and safety functions of the spent fuel storage system.

Coolant inventory, coolant temperature and fuel reactivity were areas evaluated for identifying and evaluating spent fuel storage issues.

Coolant inventory affects the capability to cool the stored fuel. It provides radiation shielding from the stored fuel, and mitigates the effects of fuel handing accidents.

We found common design features that reduce the potential for loss of coolant inventory.

A reinforced, seismically designed structured capable of retaining its function following a design basis event was found at each facility, welded, leak-tight liners with leak detection piping, anti-siphon measures on piping entering the pool, and alarms and indications relevant to coolant inventory that alert operators to level decreases.

DR. KRESS: I'm sorry. My impression is that you looked at every plant?

MR. GRATTON: Yes.

DR. KRESS: The design of every plant?

MR. GRATTON: Right, exactly.

CHAIRMAN POWERS: That includes Sharon Harris?

MR. GRATTON: Yes, it did. If you remember in the beginning of the slides there were four site visits. They were all not visited, but information about the design of the spent fuel cooling system was collected on each site.

CHAIRMAN POWERS: I have a letter from Mr. Thompson concerning the spent fuel storage facilities at Sharon Harris, and it calls attention to some peculiarities of that design. Have you looked at that?

MR. GRATTON: What peculiarities are you referring to, in particular?

CHAIRMAN POWERS: Availability of makeup water supply, the ability to drain the pool down into lower regions of the plant and things like that. He has an extensive list of things.

DR. BONACA: Yes, also the use of cooling water from the cooling system from one power plant to multiple pools, and the original design was intended to have power and cooling coming from different units to the different pools. Therefore, you have certainly a higher potential for common cause consequences from failures of the cooling system or electrical system.

I mean, I believe that there was a USQ, and in the report we received, there was no explanation of how the USQ was resolved.

MR. HUBBARD: This is George Hubbard again. On the Sharon Harris, the -- you know, we are aware of it, but due to the hearings that are going on, we don't feel that it's appropriate to get into a deep discussion, you know, of the Sharon Harris situation.

DR. KRESS: In addition, that's just one plant. The other plants don't share these peculiarities, I presume?

MR. GRATTON: That's correct that Sharon Harris is a unique site.

DR. WALLIS: You mentioned seismic and design basis. Now, there's always a probability of seismic events with exceed the design basis and do actually rupture a liner. Does that figure into this?

MR. GRATTON: The liner is not the leak-tight or the structure that provides the assurance that the inventory will remain there. It protects the concrete behind there.

The liner is leak-tight, but it is not a design feature that maintains the coolant.

DR. WALLIS: But to get back to seismic, there is a seismic event with some probability which will rupture the reinforced concrete. Does that figure in these calculations, or is it just the design basis?

MR. GRATTON: It's just the design basis.

DR. WALLIS: So this is not really risk-informed then?

DR. KRESS: If you do a risk analysis, you have to include the seismic.

DR. WALLIS: Yes, you would have to. But that's not included your assessments?

MR. GRATTON: No, we did not consider beyond design basis seismic events. From coolant inventory, we identified five categories of plants that had design features contrary to the design guidance that the Staff uses.

Four plants lacked passive safety, anti-siphon devices on piping that extended below the top of the stored fuel. Five plants had spent fuel pool transfer tubes entering the spent fuel pool below the level of the fuel, and were not separated from the fuel by a Wier or other passive device.

Three plants in the category above with the transfer tubes have interfacing systems connected to those transfer tubes. These are all at Oconee.

Six plants have indirect spent fuel pool level indication. Four plants do not have isolation capabilities for liner leak-off systems.

These were the design features that were identified relative to inventory, while we were going through and picking up and performing our review of the individual plants.

DR. KRESS: But these don't constitute compliance issues?

MR. GRATTON: Exactly. These were not compliance issues, but they were different from the other plants. The majority of the plants had certain features. These had these unique features.

The Staff also concluded that temperature had a less direct effort on safe storage of fuel compared with inventory. Coolant temperature was limited by evaporative cooling and the rack design ensures a subcooled environment surrounding the fuel. As a result, forced cooling of the pool is not required to protect cladding integrity when adequate level is maintained in the spent fuel pool.

However, temperature does have an effect on structural loads, the purification system operation, operator performance and the environment surrounding the pool.

Normal operation of the spent fuel pool cooling system keeps the pool temperature low enough to prevent exceeding the acceptance standards. Short term exposure under abnormal conditions to temperatures above 150 degrees, which could be experienced during a temporary power outage, should not affect the pool structure, the large thermal capacity --

DR. KRESS: I take it that's Fahrenheit?

MR. GRATTON: Yes -- the large thermal capacity.

While the purification system performs no safety related function it does keep the pool's activity low, reduces corrosion and keeps the water clear to aid the operators during refueling operation. Coolant temperature also affects fuel handling operations. High temperatures result in operator heat stress and can hamper operations by fogging.

DR. WALLIS: You talked about the temperature of the pool. You talked about subcooling in the racks.

How good is the analysis for temperature distributions throughout all this pool? It is not a uniform temperature.

MR. GRATTON: It is not a uniform temperature but they have natural circulation through the pool.

In the previous analysis we did not actually do a thermal hydraulic analysis of the pool as part of this study, but what we had found was that the licensees' calculations indicated that the region and the rack stayed subcooled even under boiling conditions so the racks, which are 40 feet below the surface, stayed subcooled.

DR. WALLIS: So someone reviewed the licensees' analyses and said they were okay?

MR. GRATTON: As part of licensing action when you do the original design work that is looked at.

Latent heat and vapor are added to the surrounded buildings at very high spent fuel pool temperatures. Subject to the ventilation system, this could affect the operability of equipment sharing spaces through condensation and operating temperature.

This issue was extensively evaluated for Susquehanna. Three features defined this issue -- multiunits, open paths from the spent fuel pool to the safety-related equipment, and a short heatup time.

The Staff identified seven sites that have this configuration.

Because of a wide variety of cooling system designs at operating plants the Staff reviewed the capability and reliability of each. The Staff noticed that some reactors lacked the design capability to supply onsite power to a system capable of cooling the spent fuel pool. That was identified at seven sites.

Some spent fuel storage systems have low primary cooling capability relative to the potential decay heat load in the spent fuel pool. That was at four reactors.

Some reactors rely on infrequently used backup systems to address Loss of Offsite Power Events and mechanical failures. That was at 10 reactor sites.

DR. KRESS: Were these judgments made before or after the NRC started allowing higher density storage in the pool and more fuel in the pool?

MR. GRATTON: What decisions are you -- are you referring to the allowing of this configuration in the pool?

DR. KRESS: Things like the subcooled boiling.

Did that include the higher density fuel?

MR. GRATTON: That was an original, the way I understand it, that was an original concept but every time a plant goes through a relicensing --

DR. KRESS: -- they have to relook at those things.

MR. GRATTON: That is a reconsideration.

What I want to do right now is to let you understand that we are looking at the -- this is a portion of the presentation that has already been given in 1996. I am just sort of recapping what the Staff presented previously, so on the previous slide where the coolant inventory issues that the Staff identified that looked into it and the results of it, these were the coolant temperature issues or the areas that the Staff identified when reviewing features about coolant temperature.

On the next slide --

DR. WALLIS: Can I ask you about the temperature distribution? Is it all theory or have there been events in pools where there have been temperature transients which in some way confirm that the analysis was okay or is it all a matter of someone looks at theory and says I don't see any mistakes, looks reasonable, must be okay?

MR. GRATTON: Are you referring to heatup rates or the distribution of the --

DR. WALLIS: All these questions about subcooled boiling and temperature distribution and what happens in a transient and how hot does it get.

MR. GRATTON: I am not familiar with any studies --

DR. WALLIS: Was it all theoretical studies or are there some evidence from real pools?

MR. HUBBARD: This is George Hubbard again.

In some cases in particular we had one plant that came in for a rerack within the last three or four years. We went to Research and had them run some CFD codes to determine the heat distribution throughout the pool because there were some concerns with the circulation because they were putting racks or asking for permission to put racks in the cask pit for a period of time and so with NRR and our people there and Research folks we ran some CFD calculations to determine what is the good distribution.

From that effort I believe we found not a big variation in the temperature from the bulk temperature that we consider when we normally do the rerack calculations. I would say it was maybe on the order of 10 or 15 degrees difference with that particular analysis that we did there.

MR. GRATTON: What George is referring to is another analytical type thing.

Plants have instrumented -- I don't want to speculate, but I know plants have instrumented their pools and have calculated things like decay heatup rates. For a particular decay heat rate, the pool heatup rates, but off the top of my head I do not remember if they have instrumented the pool such that they have gotten a temperature gradient from the top to the bottom to verify --

DR. WALLIS: It just seems to me that when so much depends on codes and analysis in all these nuclear plants, have we any evidence at all, like some event, that you could use to check those? It would be very useful.

MR. GRATTON: I mean other than a loss of cooling event where the pool heats up slowly over a couple of hours, that would be the only thing that I could think of, off the top of my head, where you could go back and use the analysis to go back and verify that the system, the natural circulation system, is performing properly.

DR. BONACA: One interesting point is that typically these pools run well below the 150 degrees. I mean they run around at least 50 degrees below that, something on that order, so it gives some confidence that if you have variations there will be --

DR. KRESS: That is if your cooling system works.

DR. BONACA: Absolutely. I agree with that.

I am saying that the design limit of the pool under normal conditions is a way from --

DR. KRESS: I don't think from a risk perspective you worry very much about these temperature distributions and subcooled boiling, because all you are doing is possibly damaging individual fuel -- what you really worry about is if you lose all the inventory and lead this thing into a meltdown type situation.

DR. BONACA: That's true.

DR. KRESS: And that is a completely different question.

MR. HUBBARD: George Hubbard again. I believe relative to AEOD when they took a look at it, and I don't remember the numbers right offhand, but they looked at events that led to heatup and how frequent that was and if you want a little more detail on it, Jose maybe can give us the actual numbers, but I think they divided it up on how often you had a heatup of 10 degrees or 20 degrees and it was very infrequent.

Do you have the numbers there, Jose?

MR. IBARRA: Yes. We did look at actual events and there were a few but we did look at events in which the temperature rose like 20 degrees, and if I remember, that occurs only in 3 in 1000 reactor years.

DR. KRESS: There is certainly not enough information to validate the code.

MR. GRATTON: Right. On Slide 7 it summarizes the

Staff's review of the fuel reactivity portion of the spent fuel pool action plan.

The Staff reviewed the design of the spent fuel pool storage, structures and components which control the stored fuel including the use of solid insoluble boron and did not identify any issues relative to the spent fuel pool reactivity control and therefore did not include any followup actions for fuel reactivity.

DR. KRESS: But what happens to soluble boron as you boil away water? Does it concentrate or does it go off with the steam?

MR. GRATTON: No, it concentrates.

MR. BARTON: Is there a saturation limit on it where it would precipitate out at some --

CHAIRMAN POWERS: Isn't there vapor pressure?

MR. GRATTON: I don't know.

CHAIRMAN POWERS: I mean I think there is a vapor pressure for boric acid.

DR. KRESS: So it would leave with the vapor?

CHAIRMAN POWERS: I don't know. It may depend on the partition.

DR. KRESS: Yes, it depends on the partition coefficient.

CHAIRMAN POWERS: Do you know what that is?

DR. KRESS: Well, I think at low pressure it is such that it would concentrate. At high pressure it is such that it would dilute. But these are low pressure, so I suspect he is right. It concentrates.

MR. GRATTON: At the completion of this portion of the review the Staff concluded that existing systems, structures and components related to the storage of irradiated fuel met the regulations.

Protection was provided by several layers of defense. The Staff also concluded that because of the design and operational factors associated with spent fuel pools they constituted only a small fraction of the overall risk of operating a nuclear power plant.

DR. KRESS: Most of these pools are located outside of containment?

MR. GRATTON: That's correct.

DR. KRESS: Was there any defense-in-depth thinking going into this?

MR. GRATTON: Let me correct something. The BWRs are in the secondary containment. Is that what you are referring to? Are you talking about the primary containment?

DR. KRESS: I am talking about primary containment. BWRs are in secondary.

MR. GRATTON: There was only one that was in primary containment, I believe.

DR. KRESS: Yes, one of the MARK IIIs, I think, would be --

MR. GRATTON: Well, I think it was Big Rock Point. Was that the only one that was in containment, George?

I don't remember. Go ahead.

DR. KRESS: But anyway, I was thinking here's fuel that we are talking about some sort of an accident condition. It is basically outside containment.

MR. GRATTON: Right. It is either in the fuel handling building or in the secondary containment.

MR. HUBBARD: George Hubbard again. I believe you were mentioning did we look at defense-in-depth and that was considered with regard to multiple systems for providing makeup and that was looked at as part of this, in coming up with these conclusions. We did look at that.

DR. BONACA: I have a question on that, because in the original report -- he talks about several layers of defense and refers specifically to prevention, mitigation and radiation protection, and when it talks about prevention it specifically states quality control and design, construction and operation.

Now several of the older plants do not have in fact a quality requirement imposed on the cooling systems and we have reviewed one just recently and it didn't have it, so is it that old plants have these quality requirements or controls or is it just that you have a few that do not have them?

I mean this is a very generic claim made in the front of the report to say it is not a generic concern and prevention is identified as purely quality controls.

MR. GRATTON: I think the intention of the statement was that consistently across all the plants that there was a defense-in-depth applied.

If it was not a quality control like let's say a seismically qualified spent fuel pool cooling system that they had a seismically qualified pool and seismically qualified makeup systems, redundant makeup systems, that could provide water to the pool such that evaporative cooling would be available to cool the pool in the event that a seismic event took the cooling system out, so it is very hard to make a general statement about all the pools since they are all so different but since we looked at them all, I think that this general statement was made in the effect that at each -- if you took an individual slide of plant there was a defense-in-depth at that plant that was noted.

DR. BONACA: I mean one, they were reviewed, claimed, and it was accepted that they do not have to monitor aging of the system because it's not part of the design basis and is not part of quality commitments, so I know for one that it is not the only pool out there, so I am saying that the statement is general to me and I immediately had some examples that don't meet this.

DR. KRESS: If you entered into one of these loss of cooling or loss of inventory sequences, the response is all operator action, I presume?

MR. GRATTON: There is no automatic response, that's correct.

DR. KRESS: And he is told what to do in some sort of procedures, operating procedures?

MR. GRATTON: Yes. Notwithstanding the Staff reviewed each plant against the criteria in identified areas where potential safety enhancements could be investigated.

Ten design features, five inventory related and five related to spent fuel pool decay heat reliability, were identified for further evaluation by the Staff to see whether safety enhancement backfits could be justified.

We added an additional design feature to the review based on the results of the AEOD study; 48 plants had one or more of the design features of concern.

The Staff also planned other actions as a result of the study. Rulemaking, which was previously mentioned, was in progress for the shutdown rule at the time and the Staff plans to incorporate lessons learned into the review guidance documents that the Staff uses to review changes to spent fuel storage designs.

DR. KRESS: Is that still the plan, to have the shutdown include --

MR. GRATTON: No.

DR. KRESS: No?

MR. GRATTON: No, that has been tabled from the time that this was originally issued.

The Staff presented the results of the spent fuel pool action plan, which is the previous four, five slides, to the Commission and to the ACRS in July and August of 1996, respectively. At the time the committee was satisfied with the performance of the review and the Staff did not feel it was necessary to obtain a closure letter on this issue from the ACRS at the time.

Where we are is that was the spent fuel pool action plan -- about 1996 in August. We have just finished the presentation on the Staff's review, identification and review of the spent fuel storage issues.

From that we identified 11 followup activities that in 1997 we went out and evaluated.

The Staff planned to address the followup issues from the spent fuel pool task action plan either by performing a regulatory analysis to determine whether a safety enhancement could be justified or by gathering additional information to augment the information during the spent fuel pool task action plan.

The Staff determined that seven design criteria warranted regulatory analysis. For the other four issues some evaluation was warranted. This could be an evaluation of the administrative controls, the capability to align and operate a backup cooling system, or a review of the actual design of the component of concern.

For each of the issues requiring regulatory analysis a probabilistic analysis was first performed as a screening criteria to determine the likelihood of obtaining a given endstate. The Staff visited seven plants to gather information about five of the seven issues requiring a regulatory analysis. With the other two issues the Staff addressed the issues either through a voluntary action by all of the licensees in that group or by using information already available to the Staff here at headquarters.

Conservative endstates were chosen for these evaluations. One was for the inventory issues an endstate of one foot above the top of the fuel was chosen and for the loss of decay heat removal eight hours of sustained boiling in the spent fuel pool was chosen.

DR. KRESS: Why was eight hours decided? I figure that's the amount of time that anybody could recognize what is going on and make corrective actions, or something?

MR. GRATTON: No. It really had to do with the capability of equipment, the vapor to transport to areas where equipment, safety equipment, was located.

DR. KRESS: Oh, you were worried about the effect of the steam on other equipment?

MR. GRATTON: Yes. It is not the boiling itself, it's the shared systems and structures, components of the design features, and I believe the eight hours was a conclusion in the Susquehanna safety evaluation report.

Is that correct, George, or Sam, do you remember that -- where the eight hours came from?

MR. LEE: The eight hours is in addition to about 14 hours of time that is heatup time already, so we are looking at about 22 hours of time starting from the loss.

MR. GRATTON: The Staff used the following screening criteria with these endstates, which parallels the Staff's guidance on regulatory analysis.

If the frequency that was calculated was less than 10 to the minus 6 per reactor year, the probability was low enough so that a safety enhancement backfit would not be justified.

If the frequency was greater than one times 10 to the minus 5th the Staff would do further evaluation on the design feature to determine whether or not a safety enhancement backfit was justified.

Between those two limits, 10 to the minus 6th to

10 to the minus 5th engineering judgment was used considering the available margin to determine whether further analysis was justified.

DR. KRESS: Now these criteria are basically the same as the safety goal screening criteria of regulatory analysis? They are based on it.

MR. GRATTON: Right. We try and base it on it.

DR. KRESS: You have to dig it out of that matrix but they are basically the same, which brings to mind a number of questions --

MR. GRATTON: -- that I hope I can answer.

DR. KRESS: Okay. Number one, I presume none of these -- the reason you didn't proceed with any of these backfits is that none of them passed the screening criteria?

MR. GRATTON: Well, as we go through, one group did meet this -- I will call it meeting the screening criteria if it exceeded 10 to the minus 6th --

DR. KRESS: Okay.

MR. GRATTON: -- and I will tell you how we addressed it on those. The rest of them, as you will see, did not contain a frequency of greater than 10 to the minus 6th.

DR. KRESS: Now let me see if I can express my question in a way that it is understandable.

The safety goal screening criteria is basically a

LERF. It is a CDF and a conditional containment failure probability, but if one looks at it properly it is basically like a LERF, and the numbers, the values, the limiting values or acceptance values or the values that pass the screen come out of the prompt fatality safety goal. They are derived from it.

It is like the LERF in 1.174 is derived from the prompt fatality safety goal. That is why it is called a safety goal screen.

Now for a given LERF value, or a given combination of CDF and containment failure probability, to meet the prompt fatality safety goal it relies on information or knowledge about what fission products are released, how many and what mix of isotopes there are because those are what cause these prompt fatalities, plus it also depends on the atmosphere transport things but those can be dealt with.

But the problem, the question I have, is these particular safety goal screening criteria that are part of the regulatory analysis are based on the standard source term for an operating reactor if an operating reactor undergoes a core melt accident.

Now there is some question as to whether a spent fuel pool accident produces the same mix of fission products. The quantities may be more or may be less, depending on when and how much fuel is in there, but it is the mix of fission products that is of concern to me, particularly if the accident leads to the final conclusion, which is a higher oxidation of zirconium driven accident.

The question that this brings to mind is are the safety goal screening criteria in the regulatory analysis appropriate to use for a spent fuel pool accident, and that is the question, and if it is not appropriate, what acceptance criteria or what screening criteria should be used?

Do you understand my question?

MR. GRATTON: I understand it but I am not -- my legion of experts over there can also assist me in this response, but I am not sure there is a one for one correlation.

The endstates that we chose are not accident conditions per se.

DR. KRESS: Of course you have got some conservatism there in the endstates.

MR. GRATTON: We had a large conservatism in both of these things, plus the progress of the accident beyond that point is really not very well understood or researched.

DR. KRESS: But to have an acceptance criteria you need to know something about that additional progress and you need to know how conservative your endpoints are.

MR. GRATTON: What we tried to select were endpoints that were conservative enough that we felt if we fell in the 10 to the minus 6th range that it was an extremely conservative --

DR. KRESS: Well, that is the part that bothers me because those are intuitive judgments.

MR. GRATTON: Right.

DR. KRESS: And sometimes we found out in the severe accident business that our intuition tells us the wrong things.

I worry about using intuition to determine precise acceptance criteria for something like this.

MR. GRATTON: Sure.

DR. KRESS: And that is the part that bothers me about the whole study, I think.

DR. BONACA: I had one other questions, by the way. You referred to these probabilistic evaluation or analysis but to what extent has there been an evaluation of both potential initiators, because we talk about not looking at source term because of very unlikely events but I am not aware of any thorough, systematic assessment of the potential initiators to be considered.

For example, you are more focusing on certain criteria that you have to meet and how unlikely it is, but it is also, it seems to me, surmised that it is unlikely to get there.

For example, I would suspect that sabotage wasn't considered as a possible initiator.

MR. GRATTON: No, it wasn't.

DR. BONACA: And just making an example here, and typically if you want to have some credible probabilistic assessment you would do some systematic assessment of the potential initiators and you would find it varies significantly from plant to plant, and I don't think that was done, was it?

MR. GRATTON: Yes, we did.

DR. BONACA: You did?

MR. GRATTON: For each plant, and Sam can give a more detailed answer to this, but for each plant we selected lead plants which were representative of the issue for, like say for the shared systems and structures issue.

There were 13 plants in it and I believe they were at four or five different sites so obviously they were all multiunit sites, but we went in and -- Sam, I will let you describe how we described the initiating events and evaluated the probability or the frequencies.

MR. LEE: This is Sam Lee. First of all, I would just like to make a minor correction for the record -- the criteria that we had used was 10 to the minus 5. I think there was a mixup. It was 10 to the minus 6.

As far as the initiating events go, there were about five initiating events that we looked at, which include loss of offsite power, loss of spent fuel pool cooling system, and loss of spent fuel pool inventory, and we even considered earthquake as well in the analysis, so those all factored into the analysis.

When we looked at the results, depending on the plant, for one specific plant like Hatch the dominant initiating event frequency that contributed most to the total estimate was from the loss of offsite power sequence and second to that was the earthquake initiating event, so we did look at it pretty comprehensively.

DR. WALLIS: May I ask a much simpler question?

MR. GRATTON: Sure.

DR. WALLIS: You have all this instrumentation here. Are other people around in this building? If the pool is boiling, is there someone in there to see it is boiling?

MR. GRATTON: Yes.

DR. WALLIS: All the time?

MR. GRATTON: Not all the time, but there are operators --

DR. WALLIS: So every eight hours maybe someone is around that's supposed to look? Maybe that is where the eight hours comes from -- every eight hours someone is going to be around the building, and if it is boiling it is going to be obvious.

MR. HUBBARD: This is George Hubbard. I think particularly for an operating plant someone is going to be around, particularly in the high heat load situations during refueling. Those situations are going to have people definitely there and they are going to recognize it is getting awful warm before it ever gets to the boiling state, so for the operating plant I think there's going to be people there to realize that something is different.

MR. GRATTON: I still believe though, and I can't find it right now, it's in the Susquehanna SER, that there was a concern about how long safety-related equipment could last in an environment where the spent fuel pool was boiling.

There was a conclusion made, based on expert judgment I believe or whatever the conclusion was, was that for boiling of eight hours the safety-related equipment was robust enough that they felt it could continue to operate in the environment in a pool and adjacent space boiling. I think that is what we used for the basis of it but I can -- it is in the Susquehanna safety evaluation report.

So the first group of plants -- I'm sorry?

DR. KRESS: How long does it take for a typical pool with its loading to uncover the fuel?

MR. GRATTON: To uncover the fuel?

DR. KRESS: If it went into boiling.

MR. GRATTON: A typical pool -- none of them are typical but if you use a boiloff rate of 50 gallons per minute it takes a significant amount of time for a 400,000 gallon pool or 350,000 gallon pool to boil off.

As a rule of thumb there is about 200,000 gallons of water above the racks -- above the top of the racks -- on a typical pool.

In the followup actions, in the first group, these are the ones that we plan on doing the risk assessment for the probabilistic analysis on. There was another group that required additional evaluation when the Staff gathered information via the site visits that we went on and we also had teleconferences with licensees and reviewed material at the NRC to determine the need for further regulatory action.

DR. KRESS: You actually didn't proceed to any kind of cost benefit analysis?

MR. GRATTON: No, we did not.

DR. KRESS: Didn't get that far in the regulatory --

MR. GRATTON: The seven design features -- we'll go back to that, number 9. The seven design features was the plant performed probabilistic analysis are the absence of passive anti-siphoning devices, the transfer tubes that I talked about with Oconee, piping entering the spent fuel pool below the fuel -- and this is at the SSF at Oconee has piping actually attached to the transfer tube in a configuration where the transfer tube isolation valve is operated with it open when the plant is operating, limited instrumentation for loss of coolant events, the effects of adverse environments on the multiunit plants with shared systems and structures -- this was the issue that came out of the Susquehanna review, the absence of onsite power for spent fuel pool cooling systems and limited instrumentation for a loss of cooling event.

These were the issues that we did regulatory analysis on.

The four design features which the Staff gathered additional information on are shown on Slide 10.

And that is the absence of a liner leak detection or isolation system limited to K heat removal capability for the systems that supply cooling to the spent fuel pool, infrequently used backup systems for spent fuel pool cooling and the issue that came out of the AEOD study, which was the influence of reactor cavity seals on inventory losses in the spent fuel pool. We focused that review on the seals with pneumatic components.

Giving an overview of the results of the 11 design features that were evaluated up in the follow-up actions, five design features were reviewed using probabilistic analysis and did not meet the screening criteria for further evaluation, so they were screened out.

One design feature category was eliminated from evaluation when all the licensees in the category took voluntary actions to address the concern.

DR. KRESS: Which one was that?

MR. GRAFTON: I will go over that. But that was -- the design feature was the anti-siphon devices. And I believe there was four plants that had deep-running pipes in their spent fuel pools, and they either committed to cut the pipe or to provide certain administrative controls that the staff reviewed and found acceptable to address the issue.

One design feature did meet the screening criteria for this design feature, which was the shared systems and structures at multi-unit sites. The staff performed additional analysis to determine whether the safety enhancement backfit was justified.

For the design features where the staff needed additional information to determine whether to perform further analysis, the staff gathered the necessary information during site visits and by reviewing in-house material. And after evaluating the information, determined that none of the four requirement further review. And I will go into a little bit more detail on each one of those, just so you get an idea of which ones we looked at.

DR. KRESS: That is sort of like George's three region approach.

MR. GRAFTON: For each of the five design features listed on this slide, the staff collected plant-specific information and performed probabilistic evaluations to determine the frequency of each end state. In each case, the frequency of the end state occurrence was low enough that the staff concluded that no further evaluation was warranted. The first issue was draining the spent fuel pool through the fuel transfer system. That was evaluated at Oconee.

Draining through an interfacing system, again, but I repeated myself, but it is Oconee because of the SSF system. An absence of a direct low level alarm and limited instrumentation for loss of cooling, the last one, were both evaluated at Hatch and Dresden. And the absence of on-site power for spent fuel pool cooling system, in this issue there were four sites that had this. Two plants took voluntary actions to supply emergency power to their spent fuel pool cooling system, and the other two were evaluated and found to have a low frequency of the end state.

One of those plants, which was ANO-2, their backup cooling method is actually evaporative cooling, so, they don't rely on a backup system to cool their spent fuel pool.

DR. KRESS: But do they have to make-up water then?

MR. GRAFTON: Yes. There is a seismic qualified --

DR. KRESS: They have a good make-up, seismic qualified make-up system.

MR. GRAFTON: Event frequency of one design feature exceeded the screening criteria. This design feature was the shared systems and structures. Thirteen plants share this design feature, they are Calvert Cliffs, D.C. Cook, Dresden, Hatch, LaSalle, Quad Cities and Point Beach. You notice there is 13 of them, which doesn't make much sense, but the design of the Hatch plant isolates the Unit 2 safety-related equipment from the spent fuel pool area, so only Unit 1 is susceptible to this condition.

The plants that we used to evaluate this condition were Dresden and Hatch. The staff estimated the frequency of sustained boiling events at both of these plants using plant-specific information obtained from the site. The results indicated a low likelihood of the events resulting in sustained boiling, but one that exceeded the screening criteria. As a result, the staff performed the following additional evaluations.

The staff reviewed an evaluation by the Dresden licensee on the effects of sustained boiling event on the safety-related equipment in the adjacent spaces. The staff agreed that, considering the low event frequency, the multiple reliable cooling systems, plus the low LOCA event frequency, makes the likelihood of a sustained boiling event that affects safety-related equipment in the reactor building a low frequency event. No backfits were justified. At this plant they have two off-site power supplies and five on-site power supplies.

DR. WALLIS: What do you mean by low frequency? What is the number?

MR. GRAFTON: The number for Dresden, I believe was 4.3 times 10 to the minus 6th. Is that correct, Sam? Do you have that?

MR. LEE: You are looking at the total number, yes, that is correct.

MR. GRAFTON: That was the total number for all event sequences.

MR. LEE: That's right.

MR. GRAFTON: Hatch had a higher event frequency for sustained boiling, I believe theirs was, in an operating condition, theirs was 4.4 times 10 to the minus 4, okay, for operating. All right. However, no credit was given for contingent actions to restore cooling by operator staff, either by supplying temporary power to the spent fuel pool cooling system or obtaining a diesel for their auxiliary decay heat removal system. During refueling, the frequency for Hatch was calculated -- was actually recalculated for 9 times 10 to the minus 6th, which was more in line with other plants that we looked at.

Hatch has a unique design. They have a normal spent fuel pool cooling system which is not safety-related and does not have emergency power to it, but they have an alternate decay heat removal system that, when they do refueling, they bring in an auxiliary diesel generator to provide emergency power to the system, so it is a very reliable system, plus they use RHR in the spent fuel pool cooling assist mode, which is also a safety-related system that is supplied from an on-site power supply, as another method for backup cooling.

So, if you were to look at Hatch when it is operating, the diesel for the ADHR system is not required to be on-site because you do not have the high heat load in the pool. Well, without a high heat load in the pool, you don't have a rapid heat-up rate and boiling rate, you know, but, you know, you do have both plants operating. So, even though they have a high event frequency when the plant was operating, there is a low decay heat load in the spent fuel pool at that time. And, conversely, when you off-loaded the pool, that is when the frequency went way down because you have a much more reliable system.

One other thing to note about the Hatch system was because of the size of the piping, they are not able to use the DHR system -- excuse me, the RHR system in spent fuel pool cooling mode when the plant is operating, because they have to have the top of the plant off and use a circulation path that goes from the reactor vessel back to spent fuel pool, otherwise, it will cavitate the large RHR pump if they just did it recirculating the spent fuel pool.

So, those individual plant-specific factors are what dropped the frequency from the higher rate down to the 10 to the minus 6 range.

DR. POWERS: The auxiliary diesel at Hatch is located on-site someplace?

MR. GRAFTON: Yeah. They truck it in. It actually sits on a truck and it is pigtailed out, I believe it was outside of the building. Sam, do you remember that?

MR. LEE: That's correct.

MR. GRAFTON: Yeah, they just, they back it up to the outside of the spent fuel pool cooling building and the rigs sits outside the spent fuel pool cooling building and they just pigtail it to the cooling system.

Regardless, the staff reviewed the licensee's evaluation of a sustained boiling event at Hatch and agreed that no safety-related equipment would be affected by the relatively mild environment created by the sustained boiling event. The staff also concluded that because of the differences in plant design, all plants in this group should be reviewed for sustained boiling.

So, we looked at the frequency of it and the frequency said that it was a low probability event, but we also went in and said, okay, what happens if it does boil? Let's look at where the safety-related equipment is located. Let's look at happens if it were to flood and make an evaluation on that. And we found that the safety-related equipment was located far enough away and in an area where it would not flood, that we did not feel that there was a problem at that plant.

But because the sites were so unique, when looking at Dresden and at Hatch, we said we need to go back and look at the other plants that were in this group of 13. So, the staff conducted reviews on Hatch and Dresden. One of the conclusions from the reviews was that on-site power to the spent fuel pool cooling system resulted in low frequencies of sustained boiling. So we focused in on the factor that brought the frequency down, and that was the factor, that they had emergency power to the spent fuel pool cooling pumps, it brought the frequency of boiling way down, because the systems were very reliable.

So, when we looked at the other 13 in that group, we eliminated or we screened out those that had emergency power to the spent fuel pool cooling pumps, and the only plant that remained was LaSalle. And LaSalle had a unique configuration that left it vulnerable to a grid-centered loss of off-site power.

After evaluating the design weaknesses, the licensee took voluntary actions that were acceptable to staff to address the concern. They went back in and they modified their procedures to ensure that 120 volt power was resupplied to two valves in their system that would have lost -- they were not supplied with on-site power, and even though the pumps were available to operate, these two valves would have isolated and stopped cooling to the spent fuel pool. So, the LaSalle issue went away.

In addition to performing probabilistic evaluations, the staff gathered and evaluated further information about certain design features to determine whether further regulatory actions were necessary. This is the second group, the group of four that we are collecting additional information on. The staff looked at all the plants with liner leak-offs to make sure that the make-up capabilities exceeded the leak-off rate should a tear develop in the liner that maximized the leak rate through these leak-off lines. And we found that all of them did have make-up that exceeded that capacity.

The staff reviewed plants in the group for limited decay heat removal to determine whether any additional administrative controls were warranted. The staff found that licensees had procedures to take early actions on the loss of decay heat removal, to isolate the purification system and to line up make-up early. They also took actions to refuel in months where their ultimate heat sink temperature was lower and, thus, the cooling systems that reject heat to the ultimate heat sink were lower.

We found that they did not have a problem, even though when we looked at their design numbers, and when you take into consideration the design of these plants, you look at the maximum heat load and the minimum capability to cool it, so the highest ultimate heat sink temperature, what their actual practices were, they would tend to refuel in off months and they were able to keep their temperatures well below even though their low temperature alarm of 125 degrees.

For the refueling cavity seal issue, AEOD identified a loss of the seal during refueling could dramatically lower the spent fuel pool level. The staff previously reviewed this issue in response to an event at Haddam Neck in 1994. The staff found that no plant was vulnerable to this type of failure, to the type of failure experienced at Haddam Neck.

Design changes included those that employ a solid wedge type primary seal to reduce the probability of significant leakage through the seal. Other seals employ similar design features or ones that act to reduce flow from the reactor cavity seal should a leak occur.

There was -- I believe there was four plants with this design that had pneumatic components to them. We looked at all of them and we felt confident that the work that was done in response to the bulletin in 1994 would limit the flow out of a cavity seal such that the spent fuel pool could be isolated if one of these minor leaks were to occur.

DR. WALLIS: What is the life of these seals?

MR. GRAFTON: That I don't know.

DR. SIEBER: I think that the probability of a malfunction during installation or removal, or the failure of the air supply pressure to the seal itself is more common than the seal just aging and falling apart.

DR. WALLIS: Because it does eventually age, doesn't it?

MR. GRAFTON: It does age, but they are all tested prior to having them, you know, filled and aligned. They put them in place and then with the spent fuel pool isolated, they fill the area around the seal and check for leakage. So, it is tested in place. If it were degrading, it would --

DR. WALLIS: Then replacing a seal is not -- to what activity?

MR. GRAFTON: I would I think it would be extremely large activity.

DR. WALLIS: I think it would be, wouldn't it?

MR. GRAFTON: Yes.

DR. KRESS: I recall Sandia did some aging studies on those seals, and there are numbers for how long they last. I don't recall what the results were, but there were values available for that.

MR. GRAFTON: I am not familiar with their inspection activities on the seals, so I can't comment on that.

DR. SIEBER: What is your modification to the gates that close the gap between the wall of the pool and the edge of the gate, so as to minimize the flow through a failed seal?

MR. BARTON: That sounds familiar.

MR. GRAFTON: Are you talking about spent fuel pool gates?

DR. SIEBER: Gates, where the seals are.

MR. GRAFTON: There was an event, and I believe it was at Hatch, where they had a gate that had a double seal but it was supplied from the same air supply.

DR. SIEBER: Right.

MR. GRAFTON: And the air supply failed and caused a leak through that gate. And they came back and they split the air supplies such that, you know, half the seals were provided from one unit's air supply, the other one from the other air supply.

DR. SIEBER: I seem to remember some kind of a physical barrier that they installed to help close that gap.

MR. HUBBARD: This is George Hubbard. Jose Ibarra just told me, I guess from the AEOD study they looked at, and the cavity seals are periodically replaced.

MR. GRAFTON: For the infrequently used backup system, the staff verified that the backup systems are aligned and tested before they are put in use, and there are administrative controls to ensure that these systems are operated properly.

One other note was that we found that the licensees employed outage safety assessments in a manner consistent with NUMARC 91-06, Guidelines for Industry Actions, which gives outage safety guidelines for ensuring that there is adequate core in spent fuel pool cooling at each site. So, for the sites that we looked at infrequently used backup systems and the limited decay heat removal capability, this -- each one of those sites had guidance documents that ensured that the systems were available, i.e., they had all their maintenance performed on them before the outage would start, and they were tested in place before they were needed to be used during the refuelings.

To sum up what's been presented, the technical issues that were identified by the Part 20 report, and the issues identified during the Generic Spent Fuel Pool Task Action Plan, have been evaluated by the Staff, and found that the plants are in compliance with the current regulations.

The Staff's identified design features as a result of the review that we felt warranted further review and evaluation to determine whether the safety enhancement backfits were warranted.

Some design features received regulatory analysis; others, the Staff gathered information on about the design feature. As a result, the Staff could not justify safety enhancement backfits at any plants.

The Staff completed their review of all technical issues, and we plan to close GSI-173 on this basis.

DR. KRESS: Let me ask you a question about the backfit procedures, rules, backfit rule: You have a safety goal screen, and then you look to see if there is substantial increase in protection of the health and safety, and substantial decrease in the risk.

And then you look at cost/benefit. Where is the substantial stuff? Is that in there before the safety goal screen or after it, or is it a part of the safety goal screen somehow?

I didn't see any here where you looked at delta changes and asked if this was a substantial or not, and I'm not sure where it fits into the regulatory analysis.

MR. LEE: This is Sam Lee. We didn't look at a delta, per se. When these plants were identified as having unique features, we wanted to take a look at what the -- I don't want to say the word, risk, because the end state that we evaluated were far, far -- were pretty conservative.

MR. COLLINS: This is Tim Collins. Dr. Kress, in regard to your general question. Substantial would come after the screen. First, you get passed the screen, and you don't even look at substantial.

Then you look at substantial, just in case. You may get a very small benefit, which is still cost-beneficial, because of the very small cost associated. Okay, so first you've got to get by the screen, and then it has to be substantial enough to make it worthwhile at all.

Those are really the steps: Screen, substantial, cost-benefit, right.

MR. GRATTON: Anyway, that's the end of my presentation.

DR. KRESS: I have no more questions.

DR. WALLIS: Did someone on this Committee look at this report?

DR. KRESS: I did.

DR. WALLIS: So the report has been -- I want to make sure it isn't an oral evaluation because --

DR. KRESS: We had intended to have some committee meeting on this, but we decided we could look at the reports and handle it all in one full Committee meeting.

Are there any other questions?

CHAIRMAN POWERS: I'm still a little uncertain on where we stand with these spent fuel pools as a risk contributor. It looks to me like this analysis looks very much at the boil off scenarios.

And the question comes about, what about the drain off scenarios initiated by the seismic event? It looks to me like it looked at primarily the facilities susceptible to design basis earthquake damage, and they're not -- they're design to meet that earthquake.

DR. KRESS: Yes.

CHAIRMAN POWERS: And so we come back to Dr. Wallis's question. Surely there is some earthquake that will fail those, and with some repeat frequency.

And so what is that risk? What risk do they pose when you consider those earthquakes? I guess I don't have a real good feel for where we stand there.

MR. HUBBARD: Let me refer you back to the GI-82, which took a look at whether the zirconium fire at an operating plant -- and that was done back in, oh, mid-80s.

And based on that study, it determined that the seismic risk was the significant contributor to it, the spent fuel pool zirconium fire.

But from that study, we were not able to justify backfitting that on industry, as the licensing basis or a design basis requirement.

And it may be that you want to go back and take a look at the GI-82, which I think probably more addresses your question.

DR. KRESS: What was the basis for the lack of justification? Was it also a safety goal screen, or was it a cost/benefit?

MR. HUBBARD: I believe the answer is, yes, it do a cost/benefit. It was a safety goal screen, yes. So I think that for that issue, the whole regulatory process was followed for, you know, justifying the backfit.

And we were unable to justify the backfitting.

DR. KRESS: Does the -- how -- this is a regulatory process question, I guess. If you read the backfit rule, it doesn't -- it's silent about safety goal screens.

But if you look at your Regulatory Analysis Guides for rulemaking and backfitting, that's where you see the safety goal screen brought up.

And it tells how to do it, and gives acceptance criteria, or gives a matrix for what you do, depending on various values.

The Regulatory Guide, does that bind you to actually go by the results that one gets from following the Regulatory Guide, or is that just -- or do you have a lot of flexibility in looking at that and saying, oh, maybe that's not quite appropriate for the given case or something? How binding is that on your ability to do a backfit or something?

MR. COLLINS: It's not binding. You can make recommendations which take into account, other considerations which you can't quantify. So the Guide is really a guide, yes.

DR. BONACA: I had just a question. As we look at these power plants, most of them were designed with spent fuel pools, and there was an understanding that by sometime in the early 80s, fuel would be taken out.

Most of them were not ever filled their pools. In fact, many of them right now around with full spent fuel pools, and they're putting additional fuel in dry containment storage and so on and so forth.

I think there has been some kind of true shift here in the scenarios we're looking at insofar as spent fuel at sites. Have you thought at all as you were reviewing this issue of the spent fuel pool, about the fact that there has been truly a shift.

These facilities now have, if you go and travel around, you see that they have spent fuel pool full, some of them are expanding, like the Sharon Harris facility where they will have literally each pool 4,000 assemblies of different types, loaded and supported by the same systems.

And many of these sites have also now dry storage facilities there. I mean, you know, it's a different scenario from what we envisioned in the early 80s.

Have you given any thought about how that would affect to some degree, this issue of spent fuel storage?

MR. HUBBARD: I think the answer is, yes, we did put some consideration to it. And, in particular, when a utility comes in and looks at the -- you know, they ask for a re-rack or increase in their capacity, you know, we look at it from the thermal hydraulic standpoint, the criticality, the structural standpoint.

The Division of Engineering gets involved in looking at these issues. The people, Chris and the others, Steve Jones, who was involved in this very deeply, was very well aware of the fact that now we're dealing with more fuel in the spent fuel pools. We're packing them in tighter, and that was part of the consideration.

As you go through this, it's concern with having the more fuel there is, you know, the temperature control. You know, what is the --

DR. BONACA: Well, I think there is a rising public expectation for this final repository somewhere. I will expect that we will see a rising public interest on these repositories that are not anymore temporary. In fact, in some cases, they may become permanent.

MR. HUBBARD: Yes.

DR. BONACA: There is a real shift there, and I notice also a shift in public interest.

MR. HUBBARD: And I think definitely there is the shift. As you mentioned Harris, you know, license amendment that's before a hearing panel, Millstone III also is in for a re-rack.

There is public interest there, so, one of the issues that got us even more focused on this was the Millstone I and the Time Magazine article.

And so we were quite aware of the increased storage, and, you know, the public interest. And it's -- you know, yes, people are concerned, and we are aware of that.

CHAIRMAN POWERS: It looks to me like the resolution of this issue is focused very much on full probabilities of occurrence.

And I don't have a good feeling for the actual risk, because as a strong believer in the structural component of defense-in-depth, I said, well, you can prevent accidents only so far.

I have qualms about or arguments about those to ten to the minus fifth or ten to the minus sixths kinds of levels. What about consequences of these accidents?

I don't have a good feel for what that product of probability times consequence is.

DR. WALLIS: I think there is also the question of how risk averse you are; that these things get less likely but have bigger consequences. It's not necessarily a linear process that you go through in evaluating your criteria for decisionmaking.

DR. KRESS: Well, I certainly share Dana's feeling.

CHAIRMAN POWERS: You don't believe in prevention lower than ten to the minus fifth or ten to the minus sixth, and, you know, there are not too many options here, unless you're going to build a containment over it.

DR. KRESS: You almost have to rely entirely on prevention, and some mitigation, based on operation action.

But the question is, have we provided enough prevention based on the real risk? And that involves knowing what the consequences actually are.

DR. SHACK: Just coming back to Dana's question again, when we went through for the decommissioning plants, I thought the seismic was really the thing that left you out there.

And what was the fraction of plants when you -- I mean, there they looked at the severe earthquakes, and there was a -- what was the fraction of plants that didn't have the high confidence?

DR. KRESS: I don't recall, but the problem is that with decommissioning plants, there are a limited number of those at any given time, and a limited amount of time they're at risk.

You know, the risk goes away after a certain amount of time.

DR. SHACK: After a couple of months.

DR. KRESS: Here we're talking about operating plants where the risk is there all the time. And it's all of them. So it's quite a different situation.

DR. SHACK: You don't know how often the pool is going to get busted up.

DR. KRESS: Well, that should be part of a risk analysis, and that's what Dana, I think, is partly asking. Do we have a good feel for what the full number of -- the full probability is and the full consequences, which we need to know for the full risk equation?

And whatever that value is, which maybe we have to go to this GI-82 to find out something about it.

Then the question is, is that an acceptable number to us, even though there are no risk acceptance criteria out there that are binding by law, other than the safety goals.

And so, I think that's the question that bothers Dan and bothers me also, is, I don't have a good feel for what the risk actually is, because I haven't seen a good convolution of the frequency times the consequences. And that's the thing that bothers us.

CHAIRMAN POWERS: The question comes up that you've got some coupling between these systems and the systems of an operating plant.

And so when I come in to use Reg Guide 1.174 and I want to locate myself on a horizontal axis, is this probability big enough that I need to take it into account? If I locate myself on that horizontal axis, and is the change that I'm proposing to the plant causing a delta in this risk that I need to consider, along with the delta on the normal operation risk?

I don't have a good feel for that.

DR. KRESS: I don't either, and it's a good question, because I don't think 1.174 deals much with spent fuel pools.

CHAIRMAN POWERS: I think it's a stepchild of all of them.

DR. KRESS: A stepchild of all them.

CHAIRMAN POWERS: One of the things that people struggle with, I think, when we ask these questions, typical PRA really doesn't make the rest.

DR. KRESS: For example, how would a PRA determine the effects of steam on safety equipment and a change in reliability of that, given the number of hours of exposure or something? You couldn't deal with it very well.

CHAIRMAN POWERS: I'm not sure we have good database, deterministic number on that.

DR. KRESS: I don't think we have, either. So, it's a question that is another one of those model uncertainties that you have to deal with with defense-in-depth, I think. How much defense-in-depth do you put on it? I don't know.

Well, you can see what's bothering us.

MR. HUBBARD: I tried, in looking at it, is that, you know, we did the GI-82, and determined that we couldn't backfit the zirconium fire. We had these issues that came up with regard to Susquehanna.

We took a look and addressed the Susquehanna issue. We then took the bigger generic look, taking to see did the plants -- do they meet our regulations? Is there a big concern there?

We identified that the plants were meeting our requirements or guidance. Except in some cases, we went and made plant-specific backfits, and so, you know, we came to this conclusion, and as you probably have recognized, we probably haven't been looking at operating plants.

We probably should have asked you, when you asked us whether we wanted a letter from you back in '96, we should have said, yes.

We didn't, so, the thing that I would like to also mention is the fact that the operating plant still has its full EP, you know. That's there.

You've got the full complement of safety and non-safety systems that, you know, we've had all along. And I think the biggest part of risk at the operating plant is the reactor itself.

And, yes, we didn't go through and carry this through to give you other than the GI-82. We didn't go through in this effort that we've been doing in the 90s to carry it through to the risk which includes consequences. And that's your concern.

CHAIRMAN POWERS: Maybe the situation here is that -- maybe you've got a specific question that's addressed by this GSI. Maybe this is resolved, this specific question, but we've got this larger question that Art Bonaca mentioned. It's a permanent feature that's not going to change until the Department of Energy gets its act together.

Spent fuel storage --

VOICE: I can't hear you.

CHAIRMAN POWERS: Storage -- and maybe we need to look at it in a more holistic fashion, independent of this specific question, because this is a fairly specific question.

DR. KRESS: What is the specific question being asked of this GSI? I think it is, are there particular vulnerabilities to loss of spent fuel pool cooling and loss of inventory.

And I think you have to think the risk issue is tied into the answer to that question, because that's what you mean by vulnerabilities.

I don't think we can divorce this particular issue from the question of risk.

DR. BONACA: The reason I raised that issue before is that it ties into the issue of consequences. I mean, the size of, the amount of spent fuel in the pools, as well as in the dry storage, et cetera, has created really a different kind of scenario from what we saw just a limited number of batches discharged and they're removed from the sites.

So, to some degree, it ties into the issue of understanding the potential.

DR. KRESS: Every couple of years, you get a fresh load of fuel.

DR. BONACA: That's right, and you add up, and you have thousands of assemblies now sitting there. So, it ties into the consequences.

DR. KRESS: I'm reluctant to divorce this issue from the risk.

Any further comments?

[No response.]

CHAIRMAN POWERS: Thank you very much. I think that was a fine briefing that you gave us. I very much enjoyed it.

We'll recess now until 17 after the hour.

[Recess.]

CHAIRMAN POWERS: Let's come back into session.

Our next topic is one I am really looking forward to. We have assumed that in the move for greater use of risk that indeed we would be able to have a more quantitative and better understanding of regulatory effectiveness and as a first step in that area we are moving toward -- we are going to hear a briefing on the regulatory effectiveness of the station blackout rule.

Mario, I think this is a topic you are going to lead us through?

DR. BONACA: Yes, Mr. Chairman.

We have a report in front of us that shows that the station blackout rule has brought significant risk reduction on the one hand, and it will be interesting to the committee to see the specifics of it.

It also shows that some of the benefits obtained by the implementation of the rule are somewhat being eroded by some conflicting guidance and regulation and there are opportunities there for reducing this erosion by some clarification, so I think it will be an interesting thing for the committee to look at how the special blackout rule was implemented and the benefits brought about and the opportunities there.

With that I will let the presenter go ahead.

MR. ROSENTHAL: I am Jack Rosenthal. I am the Branch Chief of the Regulatory Effectiveness Assessment and Human Factors Branch in the Office of Research.

Our office director, Ashok Thadani, asked me to make some introductory comments.

We try to relate our work to the Agency's goals and we have this initiative to look at the effectiveness of major rules, which is clearly related to the maintain safety goal or factor, and you will hear about that.

Equally or perhaps more important, throughout the Agency, another one of our goals is to make things more efficient and effective and we used this as almost a buzzword and it means different things to different people throughout the agency, and sometimes, often we are talking about it in terms of our internal processes, so here is an example now in our branch where we are trying to look external to the Agency and to say, okay, has this Agency been effective in achieving its desired outcomes external to the Agency. I think it is an important piece of work.

We are budgeted to do about two rules a year. The first one out of the chute is the blackout rule. Shortly thereafter we will look at, we will publish a draft report on ATWS, then we are going to look at Appendix J, Option B, for which we put in a lot of work and want to see what it would get for us. After that, we are going to take a look at the resolution of A-45, decay heat removal, which did not result in a rule but there was considerable action, and then we will march out in time from there and there will be progressively more external impact on how we pick our rules.

The particular report now is a draft report and we decided that it would be better to come to the ACRS as a draft where you have an opportunity to influence the product rather than to come with a final and say it's done, so that is the mode we would like to be in.

But it is a draft report and we have already gotten comments internal to the Staff that have been incorporated in the report and we have provided it to Union of Concerned Scientists, Public Citizen, EPRI, NEI, INPO, et cetera, for public comments. I think now is an ideal time to publicly discuss what is in the report.

With that, I am going to turn it over to Bill.

MR. RAUGHLEY: What we are talking about is the draft report, Regulatory Effectiveness of the Station Blackout Rule. As Jack briefly mentioned, this report reflects comments made by NRR and the Regions and that we have asked the industry for their comments, specifically the reasonableness of the approach, the appropriateness of the conclusions, and what other rules, Reg Guides, inspections procedures that we should address as part of this regulatory effectiveness process.

I am addressing this in the context of you were asked to be informed about the paper -- so I'll pick certain highlights to speak to.

As some background, the report will provide a basis to respond to the Commission. We expect to write a SECY after revising the report to address the industry comments. The Commission first asked the question after hearing about the NUREG-1560, which provides the perspectives on reactor safety, and that was back in 1997.

At that time that NUREG showed a station blackout and ATWS to be dominant contributors to core melt and the Commission asked what about the effectiveness of the SBO and

ATWS rules in view of that, and then this became an action item in the PRA implementation plan.

Station blackout is defined in 10 CFR 50.2. It is a complete loss of offsite and onsite AC emergency power and a turbine trip. The risks were first known in WASH-1400, 1975 report that highlighted the station blackout could be dominant, and if you look at the 1560 which summarizes the IPE PRAs for all the plants in the industry you would conclude it is a dominant or the dominant contributor to core melt.

As far as some historical highlights before the station blackout rule was passed there were requirements to address offsite and onsite power. Specifically we are in the 1974 to 1977 timeframe.

We had Reg Guide 1.93, which addressed or required LCOs, limiting conditions of operation, when you have less than the required number of either offsite or onsite power supplies and if those problems persist for a certain amount of time they are required to go to hot shutdown and shutdown.

There is Reg Guide 1.108, which has since been cancelled but that required tests to demonstrate the reliability, and those of you familiar with the topic may be familiar that plants were required to do 69 tests per site, 23 per plant and to demonstrate diesel reliability with no failures.

That Reg Guide also speaks to EIS CB-2. It is Branch Technical Position from the Electrical and Control Branch, which is part of the Standard Review Plan and that establishes that these are reliability goals, 99 percent at a 50 percent confidence level, so it is a point estimate.

Reg Guide 1.9 has been revised several times but that basically addresses start and load testing as EQ testing of the diesel when it was originally purchased, and you may recall that was the famous 300 start/stop test with no failures.

Some of the evolution to the SBO rule, the Commission, A-44, is an unresolved safety issue. The Commission thought that in view of events in the late '70s dealing with loops and diesel unavailability that this should be a generic issue. Just some of the scores at the time -- there were 11 of 78 plants surveyed had less than 95 percent diesel reliability, two of 78 had less than 90 percent reliability, only seven of 57 sites monitored diesel reliability and only three of 56 sites surveyed kept records of diesel reliability.

In response to A-44, the Staff issued NUREG-1032, and this integrates the results of several engineering analyses that were completed.

DR. WALLIS: If they didn't keep records of reliability, how did you know that they were 90 percent reliable?

MR. RAUGHLEY: The NRC had sent out an information notice and asked people for bean counts.

DR. WALLIS: They hadn't been keeping records so maybe this was an assessment other than based on tests?

MR. RAUGHLEY: There was a Generic Letter, an IN sent out, and I guess they provided them with the information.

NUREG-1032 pulled together several engineering studies that were done by contractors for the NRC to address different aspects of station blackout. That report provided four findings or results that provided the basis for the station blackout rule and the accompanying Reg Guide 1.15. That is that the station blackout was highly dependent on the redundancy and reliability of the EDGs and it was also highly redundant on the frequency and duration of the loops.

The NRC also performed a regulatory analysis which provides the cost benefit analysis of implementing the station blackout rule and that was documented in NUREG-1109.

The station blackout rule itself, there's three basic parts -- (a) requires that the licensees be able to withstand the station blackout for a certain amount of time and recover from that event, and that the duration of station blackout is based on the four factors I mentioned from NUREG 1032, and it requires licensees to do a coping analysis to demonstrate the degree to which the support systems will support a station blackout, and lastly it asks licensees to specifically supply the coping duration based on the plant design factors they picked, procedures offsite and procedures to cope with an SBO specifically in terms of recovery from loss of either or both of onsite or offsite power and to make any modifications necessary to achieve desired coping times.

Other documents that are related to the rule are highly important in our assessment.

Reg Guide 1.155 was the Reg Guide that accompanied the station blackout rule and that establishes specific diesel reliability requirements, that they be .95 or .975 reliable. It requires or provides guidance for reliability programs. It provides guidance for procedures to restore offsite and onsite power and it provides the tables -- there's eight or ten tables -- that they go through to determine the coping capability based on severe weather condition category, offsite power configuration, onsite power configuration, et cetera.

DR. WALLIS: If 95 percent is the number and the reliability of a truck diesel is 99.999 and they always start -- why is this not the same?

MR. RAUGHLEY: I don't know.

CHAIRMAN POWERS: Big diesels?

MR. BARTON: Big diesels that were designed to run all the time but they sit there.

DR. WALLIS: They sit there. That's the problem.

DR. KRESS: And they have to have a signal to start them up.

MR. ROSENTHAL: Let me also point out that what you are talking about is the emergency start of a standby electrical power station, and that the focus has been on the diesel engine but it includes the diesel engine, the generator, the voltage regulator, the output breakers, the support systems, air support systems dependency, service water dependencies, et cetera, et cetera, so you are really starting, emergency starting a small power station and when we go today and when we look at the reliability of the equipment, which we will hear about later, it is meeting the goals but the problems involve not so much the engine as the output breaker or some service water dependency or the voltage exciter, et cetera, et cetera tends to be a lot of the peripheral equipment.

DR. KRESS: You are going to tell us how you verify that the reliability has been met?

MR. RAUGHLEY: Yes.

DR. KRESS: Okay.

MR. RAUGHLEY: Two slides up.

The two documents in parentheses, the first one, NUSTACK-108 is an EPRI document that the Reg Guide 1.15 relies on for the definition of valid starts and stops and the Reg Guide also offers a NUMARC document for an alternate means of compliance and that closely parallels the Reg Guide.

The station blackout rule resolution specifically referred the details of the reliability program to the resolution of Generic Issue B-56, which is diesel reliability and that resolution tied the reliability program to the maintenance rule, so we get into a lot of maintenance rule documents -- Reg Guide 1.160, the corresponding NUMARC document 9301, which references another NUMARC document, which refers to Rev. 1 of NUMARC-87-00. We have the inspection procedure and there is a maintenance rule handbook so that there's a number of documents.

As far as the assessment, the definition we picked for regulatory effectiveness was that a regulation is effective if the expectations are being met.

DR. WALLIS: I am not sure that many regulations are too clear about the expectations --

MR. RAUGHLEY: I'm sorry?

DR. WALLIS: Just I am not sure that expectations are specified in a way that enables measurement of them but

I see regulations, so I would like to see a much clearer statement of what an expectation is from them in the statement of considerations or something, and it often isn't there, so I wonder how you determine what the expectations really are.

MR. RAUGHLEY: It's on the next --

DR. WALLIS: Maybe the next station blackout rule has a good job done on expectations.

MR. RAUGHLEY: There could be very objective expectations in terms of diesel reliability, costs, risk reductions, coping time. This is one of the more --

DR. WALLIS: Explicit --

MR. RAUGHLEY: -- performance-based, risk informed rules that we have, I think. It is quite quantitative.

I'm doing the ATWS rule also, but that's not the case. But the deregulation within the regulation would include the rule, the accompanying Reg Guide, and the accompanying inspection documents.

But the scope of the assessment was to determine if the rule is effective and if there are any areas that need attention.

I didn't try to second-guess. I worked only from documentation. I worked only from publicly available information. I didn't try to second-guess or read anything into it.

I didn't rely on what people said they did, just tried to keep it objective.

DR. WALLIS: Now that you've set the standard, we can use these when we look at others.

MR. RAUGHLEY: That was the point, we would address something that was a little cleaner than others and maybe have a template to address other things that maybe aren't as effective.

I did not address plant-specific problems. One of the comments from the internal review I did have some plant-specific problems in there, and the consensus was it drew too much away from the station blackout rule itself, and drew too much focus to plant-specific problems.

And consistent with the original station blackout rule, which didn't address seal failure, we did not either, however, that was resolved by RES on 11/99.

DR. SIEBER: Isn't the seal failure for a number of plants, though, the dominant pathway to core damage? So if you don't address that --

MR. RAUGHLEY: That was addressed as a separate generic issue.

DR. SIEBER: But you did put a number in there that says the risk, the overall risk of SBO includes potential for seal failure in certain plants, and that dominates the risk?

MR. RAUGHLEY: That number is in the risk numbers in the appendix of the report. Again, I did what the station blackout did, so it deferred the resolution and the discussion. That's all another subject.

DR. SIEBER: Okay.

MR. RAUGHLEY: But as a matter of interest, I did point out in the report that there's a paragraph in there that discusses an 11/99 resolution if GSI-23. The method was, we compared the expectations to the outcomes in areas where we could find objective measure being risk, value impact, coping time, and reliability.

And we used operating experience trends to look at the loop frequency and duration. They were readily available in NUREG 54.96.

The data, I used publicly available data. We obtained the expectations from NRC documents.

There's an FRN which is very detailed, that issued the station blackout rule as the statement of considerations of all the relevant documents and summarizes the relevant numbers.

For the outcomes, I used the NRC databases of the IPE. I developed from the IPE, LERs, the station blackout rule safety evaluations completed by NRR and several NRC EDG reliability studies that were completed and a few in progress.

DR. WALLIS: Are you going to go through the outcomes?

MR. RAUGHLEY: Yes. The areas that we addressed, as I mentioned, were risk, value impact, coping time, and EDG reliability. In the area of risk, the expectation was that the mean industry SPO CDF would be reduced by 2.6 E to the minus five.

And we actually achieved a reduction of 3.2 E to the five. And what the rule did was, it had five or six licensee-specific IPE PRAs. I believe the NUREG 1150 plants had models of its own, and from that it was able to determine that the average mean SBO CDF was 4.6 or 4.2 E to the minus five, and it set a goal to reduce that to 1.6 E to the minus five.

In fact, the industry average is 1.0 E to the minus five.

As it turns out, what I did is, I rank-ordered the plants from the highest to lowest loop initiating frequencies, so those -- there were 21 plants that had a loop initiating or loop frequency of .1 or greater.

And 15 of the 21 plants had an alternate AC power supply. Nineteen of these 21 plants had reduced their station blackout CDF to less than ten to the minus six.

Eight plants that had the most severe weather category, ESW-5, and the ten plants that had the eight-hour coping time, also had alternate access power supplies.

What we did find is that the Reg Guide 1.93, which I mentioned before, requires plant shutdown with less that the full complement of power supplies, and in the context of station blackout, that would add risk, so we address that in the conclusions.

In the area of value impact, that was completed in NUREG 1150, and it's dependent on the risk and estimates of the mods that were expected from the station blackout rule.

And what the NRC did is, they issued that as a draft, initially, and significant revisions were made as a result of industry comments that our costs were too low, so we ended up using their numbers.

So the basis was to establish them on our risk number and their cost estimates. And it was done on averted rem and it gave a range of values, and the result is that we are just within the range of values.

But there are two reasons for that. One is the original expected that 39 plants would make modifications. And at least 72 made modifications.

These ranged from adding diesels, to making cross ties, to changing, upgrading battery sizes. There were several hardware modifications made. This just wasn't a paper exercise.

DR. WALLIS: Why didn't the averted rem go up?

MR. RAUGHLEY: The averted rem stay the same, but the costs --

DR. WALLIS: Why didn't they go up?

MR. RAUGHLEY: The original cost was based on 39 plants making modifications, and actually 72 did.

DR. WALLIS: I can see why the cost goes up, but surely the averted rem would also go up; wouldn't it? I don't know why it stayed the same.

MR. RAUGHLEY: Well, it went down, the risk went down.

DR. WALLIS: The person-rem seemed to stay the same. I would expect it to have changed, to have gone up, actually. You've done a better job so you've averted more rem; haven't you?

MR. RAUGHLEY: But you spent significantly more -- four times more money.

DR. WALLIS: I understand that. The money, I understand, but the rem, shouldn't the rem change, too? You've changed the CDF.

MR. RAUGHLEY: The rem would go down in proportion.

DR. WALLIS: But it stays the same, the same number of averted rem.

MR. RAUGHLEY: The arithmetic worked out --

DR. WALLIS: It puzzles me. I think that would change.

MR. RAUGHLEY: The cost that was expected that they would spend $60 million, and they actually spent $200.

DR. WALLIS: So this averted person-rem is calculated, though, but --

MR. ROSENTHAL: Let me try again. If there were plans that chose to add additional equipment, such as chose to add a diesel, and they may have made that choice for a combination of risk and also operational convenience, and there are circumstances where they are incurring the costs or racking the cost of that additional diesel against the blackout rule.

But in the risk analysis, there isn't a corresponding --

MR. RAUGHLEY: Reduction.

MR. ROSENTHAL: Reduction of risk, but rather that diesel was added because they thought it was proper to do, or it gave them operational flexibility, et cetera.

And that's why --

DR. WALLIS: You've reduced CDF by this three to minus five, which sounds great. Why isn't there some change in your expected averted rem because you've done better on CDF?

DR. KRESS: Well, it's not much better. It's about the same, and so you get about the same averted rem as you were expecting, I think.

DR. WALLIS: I was just puzzled that someone had carried the same calculation over without changing it.

DR. SHACK: It's the same rounded off.

DR. KRESS: I think it's roundoff of significant figures or something, 2.6 and 3.2, in my mind, are the same thing, so you get about the same.

DR. WALLIS: Well, the 145 and 145 are exactly the same.

DR. KRESS: Yes, that is peculiar to some extent, yes.

MR. RAUGHLEY: I will get back to you with the specific arithmetic.

DR. WALLIS: It will look better if you do.

MR. RAUGHLEY: Pardon me?

DR. WALLIS: If you check it, it might look better.

MR. RAUGHLEY: Well, what I did there was, I made a list of the mods which are an appendix to the report from the licensee submittals. I used the industry estimated costs.

Licensees also added power supplies. There were 19 diesel generators added.

Davis Besse was the only licensee that supplied a cost estimate for the diesel additions, so we used that for the others. They said they spent $9.07 million.

They had a non-safety diesel, and they received $5 million. They estimated $5 million in cost benefit from reduced outage time and increased additional -- not having to replace power.

In the area of coping time, the Reg Guide provided for licensees to select two-, four-, eight-, or 16-hour coping times. And most of the licensees ended up in the four- and eight-hour range. That's documented in an appendix in the back of the report.

In the area of diesel reliability, the Reg Guide required that the licensees establish a goal of 95, based on individual diesel reliability.

We have a report, INEL report that was done in 1995 for diesel operating experience between '87 up through '93. I used a draft report that's out for comments, which updates the operating experience from '87 through '98, so I relied on that because it has more of the post-station blackout rule operating experience.

But that report uses the unit average train performance. And so you sort of are comparing an apple and an orange here, but you have to recognize that if the individual reliabilities -- well, if the safety performance is better than 95, then the individual reliabilities would have to be that.

It would be conservative. The INEL report is conservative in that it may not show all the diesels that have less than 95 percent reliability, but nonetheless, that's what we had to use.

What was good about the INEL report was that it developed a standard model for diesel reliability. So all the licensees have different ways they've modeled the diesel, so what it did is, it created its own model, and then it dissected each PRA to take the inputs and run it through their model. So we have a consistent comparison across the industry, and I thought that was really good to get away from all the diversity between the different IPE PRAs.

The results were that .95 target reliabilities were generally met with and without MOOS, which is maintenance and testing out of service while at power. And what this accounts for is, if a licensee takes a diesel out of service while the unit is running, and then has a loop, loses voltage to the bus and it's called into service, then that would be counted as a demand and that would count against them. We'll get into that a little more pretty quick here.

And the .975 target reliabilities, the MOOS had risen to levels that many or most of the licensees were not able to meet the .975 target considering MOOS.

We've done a -- there is another NUREG available which looked at the risk significance of MOOS, and basically it was based on six IPE PRAs, a sample.

And it shows that less than two percent MOOS is likely not to have much risk impact but values between 02 to 04 could be risk significant in that they would cause changes on the order of ten to the minus five to the risk.

What I also did was, I took the three lowest values from the INEL report and did a followup at the plant sites to find out that when we think or we're saying the reliability is less than .95, they think it's .99, and I identified some differences in the scorekeeping here that we need to clarify.

Basically, this report, the INEL report, is based solely on actual safety demands of the diesel while in service, and the annual tests where you actually run the diesel through its full pace.

So it's based on those demands and starts. And you would expect that if -- well, you would expect the plant site numbers to be equal to those numbers, and there are some different methods of scorekeeping going on that need to be addressed.

The INEL report also shows that many licensees have achieved higher diesel reliabilities than used in their

IPE PRA, so if they were to plug those numbers into their IPEs, they would obtain additional risk benefits. There is some unclaimed risk benefit from the station blackout rule that we have yet to -- you have to recognize that it is there, but it hasn't been claimed yet.

In the comment cycle for the internal comment review, there was considerable discussion on what was the diesel performance basis. So what I did was to address all those concerns. There is two sections of the report that pretty closely plagiarized what is in the Reg. Guides, with specific reference to the section, so there is no question about what is said. And then I go on to show, to point out the conflicts between those individual sections.

You have NUREG-1032, which is the technical basis of the station blackout rule, and that established that MOOS was small, both at power and non-power, it was .006. It established -- it used the diesel, or the emergency power system boundary to include the load sequencer and the bus, and it only used -- and it used actual tests and unplanned demands to count valid start load runs.

Then we get to Reg. Guide 1.15, establish the target reliabilities, and, specifically, in the discussion it excludes MOOS, but it points out that it is small and it used .007. And it specifically addresses that this is small compared to the reliabilities expected in the regulatory position. It says, however, this can be significant. It goes on to say the contribution must be kept low. And then they had the vision to say that as long as the unavailability due to testing and maintenance, that is MOOS, that is my words, that is MOOS, is not excessive, the maximum EDG failure rates for each diesel specified would result in overall acceptable reliability. And the fact of the matter is, it is not -- the amount of it is not small. I would think we appropriately considered it in the reliability assessment.

And then the Reg. Guide also uses NUMARC 87.01, which requires or stipulates that the licensees monitor EDG unavailability versus the industry, and they have been doing that since 1989, and that is available as an industry PI.

Then we get into the station blackout rule, which gives you several alternatives. The point being there that, with the exception of the Reg. Guide, target reliability, all those other alternatives could be non-conservative with respect to risk, and you could erode the risk benefits obtained from the station blackout rule. So, there is nothing in there to cap how much unavailability you can have, there is nothing in those Reg. Guides that say how do you balance availability and reliability and unavailability. And then maintenance preventable failures is a different score.

It also endorses --

DR. BONACA: Could you explain this balance reliability, the unavailability?

MR. RAUGHLEY: In the discussion, the maintenance rule has three basic elements. It has got A-2, which is performance criteria; A-1, which is if you don't meet the performance criteria, you go and establish goals under A-1 to get your performance back up. And then A-3 says that you should balance reliability and unavailability. And there is not much detail on how to do that.

So we know from 1032 and the licensee IPE PRAs, you know, the decreased reliability or increased unavailability erode the risk benefits. So, you have got, if you are going to give up one, then you have got to raise the other. And that detail is not there, which could cause licensees to erode the diesel reliabilities. So that is the point of that slide.

And then there is additional requirements. Reg. Guide 1.93 was revised as part of GSI 56 resolution, and it says the start and load run failures should include conditional failures from maintenance, and nobody has -- you go out and do maintenance, and you find the problem, you don't generally count that as a failure. That is why you are doing the maintenance and testing is to identify the problems and fix them before they happen in service.

And the system boundary there excludes the load sequencer and the bus. That was a point of discussion in the review, that the INEL study included the load sequencer and some people believe that it shouldn't. However, the load sequencer, you need the load sequencer for the diesel to perform its safety function. It starts and load the diesel, keeps it from being overrated.

DR. POWERS: It seems like we have had recent events where the load sequencer --

MR. RAUGHLEY: Yeah, there is six events, I believe, in the INEL report where the load sequencer failed, and that influences the reliability.

And then the last, but not least, is that the SBO and maintenance rule inspection documents introduced another performance standard in that they required inspectors to go out and verify compliance to the target reliability used in trigger values. And that was a considerable -- statistical wars I guess went on between the ACRS and the industry from 1988 through 1992.

DR. SEALE: That is Hal Lewis.

MR. RAUGHLEY: Yes. And Med helped me dig out the correspondence from that and Appendix D provides that the -- from what we can make there. The ACRS was using the binomial theorem and coming up with failures and demands to assure with high confidence that the reliability goals were met. And the industry's position, or the industry used the binomial theorem to develop failures and demands to assure with high confidence that it didn't meet the goal. They didn't think --

DR. POWERS: I would love to tell Ray, tell that --

MR. RAUGHLEY: Yeah. So, finally, the EDO issued a memo and that specifically says the triggers do not in any statistical fashion demonstrate the target reliabilities. However, unfortunately, they crept back into the inspection procedure, so that is what we have been inspecting to.

The other point of the ACRS at the time was that if you used the industry values, you would be waiting for long periods of time before you identified problems, and that is not consistent with maintaining high reliability. If you think you have got a problem and you investigate it and you find out it was a no-never-mind, that is the way you assure reliability, you know, and go about it in a timely fashion rather than waiting for the score to go bad.

And then if you also, if you use those trigger values and superimpose those on the information in the INEL reports, you would clearly be outside the IPE PRA bounds for the six and eight hour -- the diesels with six and eight hour emission times. So you would clearly erode the risk benefits using those.

DR. BONACA: Just before we leave that point, I mean you had two slides there, and essentially, it seems to me that meeting the reliability targets is really central to the station blackout success.

MR. RAUGHLEY: Yes.

DR. BONACA: And what you are saying, you have the guidance resulting from, you know, multiple Reg. Guides and rules, et cetera, it is confusing enough that it is not clear what the licensees are measuring to demonstrate they are meeting their reliability targets.

MR. RAUGHLEY: Yes. Yeah, we have got a half a dozen different documents, all addressing diesel reliability. They need to revised in a consistent manner.

DR. BONACA: And you are going to give use an estimate of the amount of erosion of the 3.2 and 10 to the minus 5 that you expect to happen from this variation, variance.

MR. RAUGHLEY: I put two tables in the report.

DR. BONACA: That's right. Yes. Okay.

MR. RAUGHLEY: To show how much it would erode.

DR. BONACA: And I would appreciate it if you can tell us how do you estimate that erosion. Could it be more than what you are looking at here?

MR. RAUGHLEY: Yeah, it would be more or less, depending on what your case CDF is. If you are SBO CDF is

10 to the minus 6 or 10 to the minus 7, it is not likely that the diesel reliability is going to make a whole lot of difference, but there are a number of plants, I believe, -- well, there is about half that have SBO CDFs in the 10 to the minus 5 range and changing the diesel reliability would affect those. And what I did was I extracted information from NUREG-1032, went through the different permutations and combinations of things, Table 3 or 4 in the report. It shows you at what point it could become important.

DR. BONACA: All right. Thank you.

MR. ROSENTHAL: Let me just interject, because I want to make sure that we, at least in my mind, that we have right tonal quality. From the reliability studies, much of that comes out of Pat Barnowski's branch, that you have been briefed on separately, those are studies where you drop a wrench on an electrical bus in the middle of the night, and you ask, do things really start and load and power-actuated equipment? You know, not the monthly stylized tests. So I think that that is real good data industry-wide on how good the diesel system is. Of course, the data density is sparse.

DR. BONACA: Right.

MR. ROSENTHAL: Okay. But from that work, it says that, at least on an industry-wide basis, including MOOS, we are meeting the .95. So I don't want to be -- from a safety standpoint, we think that you are meeting the safety objective. There is some question on the 975. But we are meeting the 95. And we have good, experimental basis for saying that on an industry-wide average basis. So we don't want to be overly shrill. Safety-wise, I think we are okay.

But what we are saying is, wait a minute, there is all this guidance out and here is an opportunity to clear up, to clean up the regulatory bases documents consistent with the principles of good regulation. But I don't want to leave the impression that we are sitting here saying that we have an imminent safety problem, because we don't.

DR. BONACA: Yeah. No, I didn't mean that. It is just simply that the impression I got is, given the fact that this was a costly rule, in fact it cost four times as much as was supposed to be invested, I mean, you know, you certainly don't want to squander this other benefit from this costly rule implementation, invaluable rule implementation, by having confusing guidance. And we have noted that issue on confusing definitions of availability and reliabilities in other reviews. And, certainly, I just wanted to ask that question to make sure that was the message you were giving us.

MR. RAUGHLEY: Yes, sir. Some of the insights from the operating experience review is some of the modifications from the SBO rule have been used specifically.

I put an example in there on Turkey Point. Originally, they had two diesels, two safety-related diesels and five non-safety diesels shared between two plants. As a result of the station blackout rule, they added two safety diesels. During an event subsequent to the addition of those diesels, they lost all five non-safety diesels and one of the two original diesels. So, had they not made the mod, they would have been reduced to one diesel.

The information in the NRC inspection report shows that the load running on the remaining diesel would have been about 20 percent more than its rating. We could debate whether it would have burnt up or not, but likely it would have. And you realize in that condition, all the protective features are bypassed because the philosophy is you run the diesel till it does burn up. So, fortunately, so I think you can hold this up as a shining example of a case where the SBO rule did a lot of good.

In addition, their initial analysis, Turkey Point's initial analysis showed that the SBO CDF was on the order of 10 to the minus 4 and, as a result of adding these diesels, they were able to reduce it to 10 to the minus 6. And the proof was in the pudding.

And several licensees, there were 19 non-safety diesels added, they have provided many licensees with increased allowed outage times and replacement power benefits. So there has been some economic benefit, if that is important.

As far as the LOOP, there are favorable trends on the LOOP frequency and duration. They are documented in NUREG-5496, which looks at the operating experience from 1980 through 1996, and there haven't been many LOOPs since then either. But I think the important point there is -- I looked at all the events where restoration took more than four hours. For the plant events, we noted in a report that the number of plant events more than four hours was up from zero to four, but the recovery time stayed about the same, about 20 minutes. For the grid events, the recovery times increased from 36 to 140 minutes. And for the weather-related events, the recovery times decreased from 4-1/2 hours to 2-1/2 hours.

But I think the point of all the LOOP, what we see there is that the diesels worked when they were actually needed.

The other insights, I think the station blackout rule provides some defense-in-depth to deregulation of the electric power system. We don't have a whole lot of control or say on how that goes, but should the LOOP initiating frequency increase, or take longer to restore power, there are additional benefits there from the hardware that was added.

And then one thing we did find in looking at the events, we identified four events where there is the potential unavailability of the alternate access power supply when it was needed. There were AC and DC dependencies on the unit that was down. There was an IN issued on it, but there have been events subsequent to that. So maybe we need some things in the inspection, attributes in the inspection procedure to address common mode failure. The NUMARC document that I mentioned earlier, 87001, has specific guidance that could be used as inspection attributes in that area.

So, our overall conclusion was that the rule was effective and the costs were reasonable because the reliabilities were achieved, the risk reduction was achieved, most of the licensees -- or all the licensees picked four hour or eight hour coping times. But there are opportunities to improve the clarity of the Reg. Guides, and this would be consistent with the principles of good regulation. In the area of reliability, there is the Reg. Guides that we went through, but they need to be revised in a consistent manner so we put the reliability terms on an equal footing.

Just to recap those, you have MOOS, you need to include the load sequencer in the boundaries, address how to balance reliability and availability, and establish common start load run criteria. The inspection documents, you need to delete the use of the trigger values and provide some guidance on the common mode failure inspections. And in the Reg. Guide 1.93, which addresses the -- requires shut down with less than the number of power supplies, there may be a better way to go about that. For example, you might want to check the availability of your coping systems before you do something like that. You might want to check that the grid, you know, that when you shut the unit down, that the grid are able supply sufficient capacity shutdown loads. Maybe shutdown is not the right spot, maybe how shutdown is the right spot, but I think we can improve that.

As a Lesson Learned, I think as a result of seeing how the station blackout diesel reliability, addressing it in the station blackout rule and the maintenance rule, what it could have been done back then is when we issued the maintenance rule, when we issued one piece of regulatory information maybe go back through to make sure everything is consistent. It doesn't appear that there is a good process to do that, but we are about to go through some major changes to the regulatory documents to make them risk performance based and to the extent that we do that we need to be sure that we used terms, goals, criteria and measurements consistent with it we are going to have to go back, I think it would be wise to go back and make sure we don't undo anything like the station blackout rule as we revise on future revisions to the documents.

Your response?

MR. SIEBER: I have a question that is sort of a summary question. When you look at expectations and cost, you found that the actual risk reduction achieved was slightly better than the expectation that the rule envisioned when it was issued, but the cost -- NRC's original estimate was $60 million and the actual cost to the industry was $230 million, which is almost a factor of four.

MR. RAUGHLEY: $175 or $180 million to the 19 power supplies. We did not anticipate that at all.

MR. SIEBER: But nonetheless the SBO rule prompted licensees to change those power supplies. Is that correct?

MR. RAUGHLEY: Yes.

MR. SIEBER: Okay. Does the utility industry agree that the costs for the SBO rule were reasonable?

MR. RAUGHLEY: It is out for their comment.

MR. SIEBER: Okay.

MR. RAUGHLEY: You could debate that.

MR. SIEBER: I would prefer not to debate that here, but I just wanted to know whether, since you state that it was reasonable, if the people who spent the money think it was reasonable too, and I guess the answer is you won't know until somebody tells you.

MR. ROSENTHAL: But we specifically sent it to NEI, EPRI, INPO, et cetera, asking for their comments.

DR. BONACA: The other thing is in the evaluation we have to recognize some licensees chose to buy diesels because they were useful for other purposes too. They could have chosen to address the rule without purchasing that, so in the cost benefit you will have to eliminate those made their own choice, address it that way.

I know of some sites that had options --

MR. SIEBER: That might have happened in a couple of cases but I remember our budgets didn't allow for those kinds of things.

MR. RAUGHLEY: We're trying to look at things, simple things we can do to make us better regulators in the Lessons Learned, and belaboring sunk costs in the future is kind of -- I don't know the relevance of that.

CHAIRMAN POWERS: Well, the only relevance that I can think of for future would be is there something inherently flawed in your estimation, cost estimation process? The only thing that comes to mind is that there are going to be ancillary thinking about what is purchased -- (a) with the appearance of cost of a specific rule up and then how you split those out if you are going to do a cost benefit backward analysis on this is kind of a difficult thing.

You say the guy could have bought a wagon and instead he chose to buy a railroad car, for other reasons, how much of that railroad car actually applies to the rule? That is a tough one to figure out.

MR. SIEBER: I guess the only reason I bring it up is I recall other cost benefit analysis that sort of had the same result. NRC Staff sometimes comes up with a lower number than the actual cost to the utility and so the question is is your estimation process effective in some ways?

DR. WALLIS: In the introduction Jack talked about the goals of the Agency, one of which I believe is to maintain safety. It seems here that you have actually improved safety, which is what the Europeans prefer to use as a goal, rather than maintaining safety.

In the present climate the move seems to be to maintain safety and reduce the burden. Here you have actually improved safety and you have actually increased the burden, but you still have done a good job, so it just seems to me that, I am just pointing out that it seems to me a slight difference between taking literally the goals and the actual implementation here.

CHAIRMAN POWERS: I think that here's one where a risk analysis had clearly pointed to a vulnerability the plants had and it passed the backfit argument. I mean it is a real regulatory success basically.

DR. WALLIS: Oh, it is. It's fine, but some lawyer might say, hey, you are only supposed to maintain safety, not improve it, what are you doing?

CHAIRMAN POWERS: I think we would probably ask that lawyer to go look at the Atomic Energy Act.

DR. WALLIS: I am in favor of that --

[Laughter.]

DR. BONACA: I have a question regarding this is a draft document. Will the report include a recommendation regarding cleaning up guidance documents like Reg Guides and so on and so forth, or will it just be moot and say there are opportunities there and let's face them.

MR. ROSENTHAL: Of course, we are receptive to your input. The current plan would be to stop the report at the conclusions and then to have a cover letter or transmittal memo which would contain the recommendations and it's not clear to me -- the current plan is that Ashok would be sending it to in this case NRR. The Commissioners, single Commissioners have expressed an interest in this report as a prototypical document, so I am sure that we are also going to be communicating with them.

We intend to have recommendations and intend to follow up on the conclusions but I think that it will be in the transmittal memos.

DR. BONACA: The next question I have, regarding that, is that if you had to provide a recommendation for providing consistent guidance to all licensees on how to meet their reliability target or how to measure in order to demonstrate meeting reliability, would you recommend to have a new document do that or just simply going back and making all the previous -- the question I am asking is because you have all these Reg Guides and NUREG and rules with inconsistent data.

I have no appreciation for what it takes to change all these rules and that may be -- what would you recommend?

MR. ROSENTHAL: We haven't thought through the mechanics. The goal would be to go to, and the thing that makes most sense to us is to have reliability goals where we have good definitions for reliability. It is consistent with the way the Agency is going. We clean up the issue of maintenance out of service in that reliability goal. You know, RES is pushing to go from performance indicators that look at unavailability, which is what we are doing now, to looking at reliability.

If we could get agreement that what we ought to be looking for is the reliability and assure that reliability is consistent with what is in, presumed in the IPEs, then we have to go back and clean up the documents.

How we would clean up the documents we have not thought through.

DR. BONACA: The easiest way would be to have white paper that says in meeting these targets this is -- and really that could quote the work done by E&L as a means -- it would provide a standard for everybody to follow. I believe the industry would welcome a standard other than branching out and trying to figure out what they have got to do and then coming up with numbers which we claim are inconsistent with that.

MR. ROSENTHAL: But at a minimum Hal Lewis does deserve at least a footnote that says, hey, he really was right, and we --

DR. KRESS: Don't say that too loud.

MR. ROSENTHAL: -- and to change what we tell our inspectors to look at.

DR. BONACA: And it is a problem a white paper would not resolve, because still there is a guidance there in the field that says --

MR. ROSENTHAL: Right, so we are arguing that we ought to, that this is an opportunity to clean up the regulatory process and make it more coherent and consistent.

DR. BONACA: Another question is is the issue significant enough that it deserves that kind of action, and I don't know.

I have two opinions. They are personal opinions.

One is even if quantitatively there may not be a significant impact, qualitatively it is a problem to have incoherent items in documentation. So I just wanted to get a feeling from you and then from other members regarding that issue, because then we have to make a decision here, which is are we going to write a letter report on this, and I would like to hear also from Mr. Rosenthal what you expect from us.

MR. ROSENTHAL: We are conferring as we speak here.

DR. BONACA: Okay.

MR. ROSENTHAL: Officially we came to provide it for information to the ACRS so the choice would be yours.

My new Acting Division Director and I were whispering at each other letters are always welcome or useful.

[Laughter.]

DR. SEALE: And that is a sage hand that made that comment.

Could I make one other point? In your initial comments you made the observation that the station blackout rule had very in many cases plant-specific impacts. That is, all plants were not the same, that the influence of the station blackout rule varied considerably from one plant to another.

One of the concerns I have is that when you get your response back to be specific to just make the point, are you going to get a Florida Power response or are you going to get a -- what is the other one? -- St. Lucie or are you going to get a Turkey Point response?

The Turkey Point response based on what you said is going to likely say some very specific things that might not be said if you had a homogenized response. I hope it will and it strikes me that it would be very worthwhile in your review of the comments that you could somehow bring our attention to those facts or those things which were different from plant to plant and see whether or not the comments you get reflect those differences because, you know, if you make the room dark enough all cats are gray, and I don't think that this is a homogenous issue for all plants.

DR. UHRIG: It is also related to the era in which they were built.

DR. SEALE: Of course.

DR. UHRIG: Turkey Point was built in an era --

DR. SEALE: The regulatory climate was very different.

DR. UHRIG: Later on they would never been allowed to have two diesels for two plants.

DR. SEALE: That's correct, and that is one of the problems with the station blackout rule. That is, you have to make this homogenous assessment which doesn't mean the same thing for every plant.

MR. RAUGHLEY: In the Reg Guide that accompanies the station blackout rule it has got eight tables, one recognizing five different severe weather categories, so a plant located on the East Coast would be driven to pay more attention to this than a plant in Arizona because of the severe weather conditions.

It recognized the different power system configurations, where there are two lines, one line. You know, how are you counting the offsite power supplies that you have? Some people count the unit output.

DR. SEALE: On the other hand, the Secretary of Energy has just come out this last week with a warning that the plants, particularly in the Southwest and the Northeast, are going to be particularly vulnerable to grid system unreliabilities because of high heat loads this summer, and that is not in there I don't think.

MR. SIEBER: On your last slide where you talked about Lessons Learned, I think you have one there that you have listed, but I think an important one was one that was said right in the beginning, which is the analysis, the regulatory analysis was simplified because the expectations were explicitly and clearly stated when the rule was promulgated.

I would think that a Lesson Learned would be in new rulemakings to specifically identify and state what the expectations are for that rule so that you can do an analysis and determine after it has been in effect for awhile whether you have achieved the expectation or not, and that to me is another part of performance-basing.

DR. SEALE: Gets you out of the feel good business.

MR. ROSENTHAL: I have to actually compliment Bill. He has been a regulatory archeologist where you go to the rule. If it is not in the rule you go to the statement of considerations. If it isn't there you go back to a supporting NUREG or the NUREG to the NUREG and then the NUREG CR that backed that up, and always looking for something that is public and documented, but it has been quite a dig, and as he said earlier, ATWS is not as clean a story.

I think we probably chose the cleanest one.

MR. SIEBER: I was just remarking that I think that the fact that that is a Lesson Learned and it is something we should be doing in the future.

DR. BONACA: Any other questions?

[No response.]

DR. BONACA: Before we adjourn, I would like to go around the table, since we had no --

CHAIRMAN POWERS: Want to do that off the record?

DR. BONACA: All right.

CHAIRMAN POWERS: I'll take us off the record.

DR. BONACA: They I will pass it off to you, Mr. Chairman.

CHAIRMAN POWERS: Any other comments people want to make about this presentation?

[No response.]

CHAIRMAN POWERS: Fine. At this point we can stop the transcription until this afternoon, and I want to go and discuss the first two presentations we have had and receive any comments the members would like to make as guidance to authors or potential authors.

Thank you very much.

MR. ROSENTHAL: Thank you.

[Whereupon, at 11:30 a.m., the meeting was recessed, to reconvene at 1:00 p.m., this same day.]

AFTERNOON SESSION

[1:05 p.m.]

CHAIRMAN POWERS: Let's come back into session. Members have before them, a list of potential issues that might be associated with review of an AP-1000 design for certification.

I hope you will take the chance to look this over, make any comments on the list, and get it back to us. We are obligated to provide the staff with some indication of the kind of topics that we would want to look into if this certification does come to pass.

And I'd like to get that letter over to the Staff this week.

Okay, at this point we'll turn to the next item of business, which is the Regulatory Guide and whatnot associated with the revised source term rule. And, Dr. Kress, I guess this, too, is one of your areas of expertise.

DR. KRESS: Yes. You will recall that previously the Staff worked on a rule to allow the voluntary use of alternative source terms based on all the information we knew, and the NUREG 1465 source terms that were developed as a result of this new information.

We wrote a letter -- I forget the timing on that, but it wasn't too long ago -- commending the Staff on what a good job they are doing in determining all the ramifications of the use of the new source terms, and what risk implications there might be and things.

Well, they now have issued the rule for public comment, and they have also developed a Reg Guide and a Standard Review Plan to go along with the rule, and have issued it for public comments and received the comments back.

And we saw a draft of that, but we didn't review it, I don't think. I don't recall whether we reviewed the earlier draft or not. But at any rate, what we have before us is the final version, basically, of the Reg Guide and the Standard Review Plan.

Before they go up to the Commission and say we want to issue this in final now, they'd like our comments and perhaps a letter as to what we think about it.

They did make some changes over the draft that we may have seen, and some of these changes are noted in your package. They have to do with gap fractions, chemical forms of fission products. There is a list of them here that you can read. There is no use in my going over them, because I think the Staff intends to pretty much highlight what these changes were over what we've seen before.

So, with that as a really quick introduction, I'll just turn it over to the Staff.

MR. LaVIE: Good afternoon. I'm Steve LaVie with the NRR, Probabilistic Safety Analysis Branch, which, as you may be aware, also picked up the dose assessment people in a recent reorganization.

As Dr. Kress pointed out, I'm going to present to you, the changes that have occurred in the guidance documents we prepared for the implementation of the alternate source term.

Dr. Kress gave you a little bit of the background, and let me touch a couple of the points again. You may recall that we've been before the Committee several times. Back in 1998, we prepared a rulemaking plan which you folks provided us comments on.

And we also at that time presented the results of the baselining study. As a result of that rulemaking plan, what we recommended to the Commission and that the Commission endorsed, was to go prepare a rule change and also a new Regulatory Guide, and, of course, a Standard Review Plan section to support that Regulatory Guide.

This is the path we've taken. We haven't deviated from that too far. In March of 1999, we published the draft rule in the Federal Register for public comment.

In December of 199, we published the final rule in the Federal Register. That rule became effective in January of 2000.

At that time we included an announcement of a public comment on the draft guide. We did provide the draft guide as part of the final rule package to the Committee. That would have been in the September/October timeframe in 1999.

As I pointed out, the final rule became effective on the 24th of January, and the public comment period that ran for 75 days, ended at the end of March.

We received numerous comments, six official letters from the Nuclear Energy Institute, the Nuclear Energy Environmental Qualification Group, from Duke Energy, Virginia Power, South Texas Project Nuclear Operating Company, and the Florida Power Corporation.

We also received numerous informal comments by e-mail and other approaches. People came up to us and so forth and made a comment, and we attempted to address all of these.

We also addressed the ACRS recommendations that you provided to us in the October 1999 letter. There were a total of 138 comments, several of which were redundant, but nevertheless, we had some things to look at.

Now, we dispositioned all those comments we received. I provided in the package, and you should have, the disposition of the comments we did receive.

What I'm going to discuss this afternoon is the significant changes that we made that would change the technical content and a couple of policy items.

These are categorized, basically, into the areas of fuel gap fraction; fuel handing accident chemical form for the release; selective implementation; 50.59 guidance. As you may be aware, 50.59 guidance was being prepared in parallel with this effort. We have had to go back and adjust a little bit for what's proceeded in that process.

And there were several other smaller technical changes which we'll go over quickly.

Perhaps the most significant change we had, had to do with the fuel gap fractions. In the draft guide, we had, in essence, stayed with the traditional values we had been using in licensing for several years.

The industry provided us with several comments on this, both formally and informally, to the effect that we needed to do something different.

And the industry suggestions can be summarized as that they suggested that we have gap fractions that would vary from three percent at 50 gigawatt days per metric ton uranium, to 9.3 percent at 75 gigawatt days per metric ton of uranium.

DR. KRESS: Is that based on the experimental data?

MR. LaVIE: It was based on some experimental data, results of fuel sipping on fuel that has been irradiated in plants to date. It was largely based on an EPRI report, that EPRI had looked at this issue.

The industry had extrapolated that data to make the recommendation.

DR. KRESS: Extrapolated it to 75?

MR. LaVIE: Yes. They had no experimental data above 65.

DR. KRESS: That's interesting that you end up with 9.3, which is four significant figures because it's a percent.

MR. LaVIE: Right.

DR. KRESS: For something that's extrapolated.

MR. LaVIE: There is a large amount of uncertainty here, yes.

They also suggested that we allow the licensee to vary the gap fraction across the core. This hadn't been something that we had given a whole lot of thought to before, but we were able to come to some agreement on that for some accidents.

And they also suggested that we address the fuel heatup impact separately. This would largely address accidents such as the reactivity insertion accident.

Now, when the Staff looked at this comment -- of course, we had to consider it even before we published the draft -- is, we just felt there was insufficient data to support iodine gap fractions above 65 gigawatt day metric ton uranium. There was insufficient data above that point.

Now, the industry data they presented to us was largely the result of low burnup data that had been collected over fuel that's been burned to date. The majority of the data was much less than 50,000 and very few points above.

There are large amounts of uncertainty in these gap fractions, as you may be aware of. The data they presented was based on actual fuel, and as such, they did not have the operational transients that could occur during operations and still be within the fuel limits.

The current fuel management that's being used today in power plants is far more aggressive than that under which the data was collected. A lot of this data was historical and, say, maybe five-ten years old. We have much more aggressive burnup regimes right now, so there was uncertainty involved with that.

The biggest problem we had is, in the majority of experiments that had been done to date, iodine has not been measured directly. Iodine has always been inferred from some other measurement.

DR. KRESS: You don't get a gamma.

MR. LaVIE: Right. It's been done through thermodynamic correlations, ratio of the diffusivity of noble gases to iodine, which is the basis of the ANS 5.4 method, with a great deal of uncertainty.

So, we went into this comment with the idea of what can we do about this? While we did see all these uncertainties, we also had this feeling that based on some of the data we were looking at, that perhaps we were high on gap fraction.

DR. KRESS: The gap fractions you had been using, taking actual fuel and cutting it open --

MR. LaVIE: Right, back in 1960 or sometime. They were first documented in Reg Guide 125 for fuel handling accidents, based largely on work done by Westinghouse.

So we needed to come up with an approach for this. Recognizing this is a deterministic design basis proceeding with this Regulatory Guide, we decided we would use the NUREG 1465 data for the LOCA, for the gap fraction part of the LOCA, gap phase, and we would allow that to be used for ranges zero to 62 gigawatt day per metric ton uranium.

DR. KRESS: Let me -- associated with that, when I read the Reg Guide, you also decided for the gap fraction, that you would use the NUREG 1465 speciation for iodine.

MR. LaVIE: That's correct.

DR. KRESS: That strikes me as a little strange. You're saying that in the gap, the iodine consists of 95 something percent of cesium iodide, a certain fraction of elemental iodine, and a certain fraction of oriatic iodine.

But the NUREG 1465 values came out of chemical effects after the stuff got out of the fuel, and it certainly did not imply that gap had these, and, in fact, all the data I know of about gap fractions chose the cesium iodide as primarily -- I mean, the iodine is primarily cesium iodide.

MR. LaVIE: That's correct.

DR. KRESS: And so I don't think it makes much difference in what you apply or use the gap fractions for, and it doesn't change the gap fraction; it changes the speciation.

MR. LaVIE: Right.

DR. KRESS: And it's such a small amount of iodine, I don't think it makes much difference, but it seemed a little strange and inconsistent with the technical basis.

MR. LaVIE: True. I don't disagree. For the LOCA, as you point out, it's really not a large consequence, because you're looking at five percent of the total core inventory, which is immediately going to be followed by the other 95 percent of it.

So it's not going to make a lot of difference for the LOCA. Now, when we went to the other accidents, there was no data for what was in the gap.

However, we looked at the NUREG -- I want to say 737, but that's not correct. NUREG 0772 had the data that showed that what was in the gap was predominantly cesium iodide.

DR. KRESS: That's the only evidence.

MR. LaVIE: So we felt, you know, throwing in elemental made it a little bit more conservative, because we are in deterministic space here.

DR. KRESS: Yes, it certainly wouldn't hurt.

MR. LaVIE: It wouldn't hurt, and then the conversion gets us the organic. We used the same conversion ratio that was specified in 1465. We believe that's conservative and reasonable for this deterministic approach.

DR. KRESS: You're just saying that once you use this fraction for whatever you're using it for, you probably ought to be conservative and assume some of it got to be -- so it doesn't --

MR. LaVIE: Our intent was to be conservative, because we really -- there is -- all the research and data has been done on the LOCAs. Now, the risk-informing --

DR. KRESS: Now, the real problem is that those values for the LOCA, for the early in-vessel release, come out of very specific considerations.

MR. LaVIE: Right.

DR. KRESS: And what they were was, you look at the whole spectrum of accident sequences, and what happens is, you release the cesium and the iodine and the chemical reactions in the gas phase create cesium iodide, but part of the -- during part of the sequence, you're steam-starved and you're hydrogen-rich, and during that part, you get a certain amount of hydrogen iodide, which we called something different than a cesium iodide.

And then there was a certain amount of organic iodine that always gets produced because there is some organics in there, too.

MR. LaVIE: Right.

DR. KRESS: And these were the three values, the maximums in any of the sequences, and they used them in the NUREG 1465 as bounding values. And it all happened because the chemistry effects in the downstream of the core after it got released, none of those chemical effects are going to happen when the gap gets released.

The concentrations are different, the temperatures are different, and they're always steam-rich when the gap is there. So there's no reason to expect the NUREG 1465 in-vessel release speciation to be the same in the gap.

And I would have gone -- like you say, it's conservative and doesn't make any difference, probably, in what you do, but I would, just for consistency's sake, not had that kind of -- you know, it just looks funny in Reg

Guide to have something that doesn't have any technical basis at all.

And so that's my concern. My concern is not that it's there and will cause anybody any problem, because I don't think it will, but it's just a coherence, consistency type of problem.

MR. LaVIE: Right. Am interpreting what you are saying correctly, that you would prefer to have seen us specify that it was all cesium iodide?

DR. KRESS: I would have just kept it the way it was in the old Reg Guide, frankly, for the gap. You had a speciation in there, and it was 99 --

MR. LaVIE: 99 percent elemental, I think.

DR. KRESS: I'm sorry, I would have just called it cesium iodide.

MR. LaVIE: Okay, see, in the original draft, we called it elemental, 99.75 percent elemental.

DR. KRESS: I wouldn't have done that, because the evidence is that it's cesium iodide in the gap, and I would use that.

MR. LaVIE: And we thought this was a reasonably conservative compromise with considering the deterministic design basis approach we're dealing with here and would be appropriate.

DR. KRESS: I would agree that it is, but it just looks funny when you use an inconsistent technical basis to establish your conservatism. But I agree that it's not a big deal.

DR. LAVIE: We continued with the protocol we had in the draft guide, using the Reg. Guide 1.77 data for reactivity insertion accidents. As you're all aware, there's a great deal of work going on right now about the reactivity insertion accidents because of the Cabris results and the lack of beta data to change. We're holding the status quo on the reactivity insertion accidents, so they'll continue to use the gap fractions from the old data.

Now, we had some work done by PNNL to address the environmental impact of the fuel burn-up from 60 to 62 gigawatt days per metric ton uranium. And that data became available during this period. It is being documented as an update to the NUREG CR-5009.

Now the PNNL analyses were done for core average and the peak rod average at 35, 60 and 65 gigawatt days metric ton uranium. The analyses were done using the FRAPCON-3 code, with using the Missah release model. It was a best-estimate approach. There were no operational transients addressed.

DR. POWERS: Do I understand what the Missah release model is? Do I know what the Missah release model is?

DR. LAVIE: The FRAPCON model, the FRAPCON code allows the user to choose, I think it's three different release models --

DR. POWERS: What are those from?

DR. LAVIE: It has the traditional ANS 5.7 approach -- excuse me, 5.4 approach, which our contractor believes is extremely over-conservative. And based on his considerations, he decided to this of the three options he had available.

He also calculated the core inventories up to 75 megawatt day metric-ton uranium, although they won't be useful to us because we don't have the gap fraction data that high. The staff decided to use the PNNL data with some adjustments. In our approach, the bottom line here was to balance the uncertainty in the gap fractions with other analysis conservatisms. For example, in the fuel handling accident, we always considered the rod to be damages to be the peak burn-up rod, and it's also in the peak power position. With fuel management the way it's performed, this is an impossibility. The rod, the high burn-up rods would not be anywhere near peak-power position.

So what we ended up putting into the draft guidance -- and for comparison, I put the previous numbers from draft guide 1081 in there. For the local, we decided to stick with the .005 for the gap fraction and use that all the way up to 62 gigawatt days metric-ton uranium. This was consistent with some of the PNNL data that showed this would be appropriate. If you'll recall, 1465 did have some language that if you had long-term cooling, you could use .03. However, 1465 also said that the data was potentially suspect above 45 gigawatt day metric-ton uranium. So combined with that information and what we had from PNNL, we decided to settle on .005 for the entire range zero to 62.

Now for the norm locus, fuel handling lock rotor accident, we decided to split it into two regions. For that fuel which is lower than 40 gigawatt days metric-ton uranium, those would be the fractions we would suggest to use. It would be acceptable to the staff. And above 40,000 but no higher than 62, we would use the fractions shown there.

For the reactivity insertion accidents, as I mentioned before, we stayed with the old data until we have a basis for changing it. Now --

MR. KRESS: Is the expectation that when they look at these other accidents, that they will make an assessment of what burn-up --

DR. LAVIE: I'll be getting to that --

MR. KRESS: -- is -- oh, you're gonna get to that.

DR. LAVIE: I'm gonna get to that. One step --

MR. KRESS: Okay.

DR. LAVIE: What we are putting in the guidance is for the default approach, acceptable to the staff, is that the gap fractions associated with the peak burn-up, rod burn-up, in the core would be used with the rod inventory adjusted for the maximum radial peaking factor. So they've run the origin code, they've come up with a core inventory; they multiply for the maximum peaking factor for the entire core, out of the COLA. So this'll change with each core upload. And that'll give them the inventory in the entire rod. They then will pick up the maximum burn-up in the core, okay, and use that for the gap fraction. So the fraction times the inventory gives them the release.

Now that's -- for the fuel-handling accident, we are insisting on that approach because you really don't know which element you're gonna drop in the fuel-handling accident. Recently, at one time reactors used to shuffle one-third of the core, and that way only a third of the core moved. However, nowadays, for various reasons, we are seeing a lot more full core offloads. So there's an equal probability that any element could be dropped. So for the fuel-handling accident, we're retaining the conservatism that they must use the maximum COLA and the maximum burn-up.

Now, for the other accidents that get fuel damage in some designs -- a main steam line breaks, lock rotor accidents, steam tube ruptures -- if the licensee can demonstrate to us with reasonable certainty that he knows where the damaged fuel is in the core, then we will allow him to use the gap fraction appropriate for that element along with the radial peaking factor for that element. However, for maintaining some degree of conservatism because of the uncertainty of the gap fractions, we are not letting them use a radial peaking factor less than one.

In some of these three-burn cores, the radial peaking factor can get down to .6 and .7 in that third region. However, to maintain a degree of conservatism, we will not let them go less than one. Now this is totally an optional method. It will not apply to the fuel-handling accident.

I need to point out that very late in the process, after this document was distributed for review is -- in the last week, as a matter of fact -- we have gotten the technical comment on this table. And the NRR is working to resolve this technical comment. We expect to be able to resolve it and retain what we have here. If we find out that we cannot retain what we have here and we have significant changes, I will arrange to come back to the Committee and explain why we're changing it. But this is what we expect to publish.

This is the iodine spiking species, which we've jumped ahead a little bit. For the fuel-handling accident we had previously specified 99.75 percent elemental and .25 percent organic -- recognizably conservative. The industry suggests that we use the NUREG 1465 species. Now the staff, when they first got this comment, gave some thought to this because we do have a very, very low pH in the spent fuel pool, typically 4 or 5. And if you'll recall, 1465, with the iodine species specified there, if you maintain the sump pH grade of the 7.

We also had some concern about transport data. The transport data we have for pool DF came out of that original Westinghouse work back in 1959. Cold water -- now there's been an awful lot of work done on transport through pools, but it's typically not the, the stagnant pool such as a spent-fuel pool.

So for the final guide, we decided that we would adopt the fractions in 1465. However, from a release standpoint, to the environment, we decided that the cesium iodide completely dissociates in the pool water and that because of the pH, it will re-evolve as elemental iodine. Now, yes, this is a mechanistic process that would over time. However, for the purposes of deterministic calculation, we have taken this assumption. We are using a pool DF of 200, effective because it varies for the different isotopes, different species. And with a pool DF of 200, the release from the pool ends up being 57 percent elemental and 43 percent organic.

MR. KRESS: Now the 200 comes out of the DF for elemental iodine -- that's pretty high.

DR. LAVIE: And organic.

MR. KRESS: Unless it goes into solution.

DR. LAVIE: Right.

MR. KRESS: And then it has to dissipate. And the organic is essentially not captured.

DR. LAVIE: Not captured at all. The organic is what controls. The organic is what controls -- this is why the organic jumps so high.

MR. KRESS: So basically, everything that comes out -- well, it's about half and half when it gets there.

DR. LAVIE: Right.

MR. KRESS: But it's --

DR. LAVIE: We enter it here --

MR. KRESS: -- organic is so small that what you're doing is just reducing the elemental down --

DR. LAVIE: Right, and the organic becomes much more controlling.

MR. KRESS: Yes.

DR. LAVIE: So from an analysis standpoint to the environment, effectively we're back to what we had in the original. Now we do point out in the guide, however, if the applicant, or licensee wants to come in with a justifiable mechanistic treatment for pool treatment that looks actually at actual iodine species and so forth, it will be considered on a case-by-case basis. But the default deterministic method will, is what's hear.

MR. KRESS: The problem I have with that is -- I like to do a concept of the cesium iodide and go into the pool water with elemental iodine. It won't go in as the iodine, but you know, if it's gonna get released, it'd be released as the iodine.

DR. LAVIE: Right.

MR. KRESS: But the problem I have with this is the assumption that, that the gap has .15 percent organic. /v

DR. LAVIE: Right.

MR. KRESS: There's no basis for that choice at all. It might very well be .25, as is in the original DT 1081. I don't know what it is inside the gap, but there is no evidence for something like .15 percent organic in the gap at all. And to put it in here and then say, now you've got 43 percent of what's released is organic is a little strange to me. It's such a, such a small amount of stuff, all it does is govern things like the required closure time --

DR. LAVIE: Filters.

MR. KRESS: -- mostly. It doesn't have real risk implications as much; it has some exposure and it affects things you do. So I'm not really concerned. But here you have a whole set of deterministic regulations. They're basically based on this .15 percent organic, which has no basis at all. You know, it just shows up. And that's the kind of thing that bothers me.

DR. LAVIE: Okay.

MR. KRESS: You know, it's not a big deal, but it just bothers me to have regulations like that.

DR. LAVIE: The um, the Westinghouse data that was used as the basis of the original did point out that there was organic due to manufacturing processes.

MR. KRESS: Manufacturing --

DR. LAVIE: -- and, so that -- but they projected .25 percent.

MR. KRESS: Yeah, and I think that's a better number to use because it's the only data we have.

DR. POWERS: In this stage of the calculation, you're really hypothesizing, things go into the pool and then come back out.

MR. KRESS: Yeah, and in that case --

DR. LAVIE: Okay, that's a good point, because I want to point out that the way these analyses are currently done, it's considered to be an instantaneous release from the pool. Now if somebody wants to come back and mechanistically -- one of the things we have to stop worrying about if we start to say that some of this is gonna be captured in the pool and released over time is now we have to start looking, now the market changes the way this is modeled, to pick up the continuous release. Right now, we do a puff release and it's gone.

This is a simplification, granted. We think it's conservative. We think it's conservative. But if they want to come in with a mechanistic treatment, it will be considered.

DR. POWERS: Well, what I was going to point out is that we do have the results of the Febus experiments. They're a little different; they're looking at core degradation. But they have the iodine coming into the containment model, closing to the sump, and then they get a repartitioning out -- their consensus is for round-number purposes, it's about 50/50 elemental-organic, maybe actually a little higher in organic than elemental at various stages.

MR. KRESS: And that's because the iodine converts to organic in the pool, and they know that here.

DR. POWERS: That's right. And I'm wondering if -- the first line under final guide may well be wrong, but the third line ends up being right, perhaps for the wrong reasons.

MR. KRESS: It's probably right, but it will have the wrong quantities in it because of the DFs that are --

DR. POWERS: Right.

MR. KRESS: It'll have much lower quantities, but once again, they got the conservatism that they're assuming it comes in instantaneously, when actually it takes a considerable amount of time for this stuff to come out.

DR. LAVIE: So one of the things we recognize with this particular calculation, as you pointed out, the risk basis of this is maybe, as the risk-informed Part 50 process continues, this may be an accident we'll stop worrying about. So this particular accident is not worth an awful lot of modeling --

MR. KRESS: It's not, it's not worth a lot, that's right.

[LAUGHTER]

MR. KRESS: The other problem is that the DF factors are, are a little strange because they're based on, they're based on suppression pool data, where the gas that carries this stuff is a steam, it's a condensing gas.

DR. LAVIE: Okay --

MR. KRESS: And what you have here is, you're gonna have cold, relatively cool nova gases that carry up these things, and I don't think you'll get the same DF.

DR. LAVIE: Okay, the DFs we used here, Dr. Kress, we came out of the Westinghouse work back in 1959. Westinghouse did a series of experiments, small-scale experiments where they entrained iodine in a carbon dioxide carrier --

MR. KRESS: Oh, it was a carbon dioxide -- okay.

DR. LAVIE: Okay, and it was cooled, the water cooled and the pH was controlled in order to do that. They then took that data, recorded it, graphed it, what have you. They then went and got a 14x14 assembly, sheered it off, connected a gas volume below it, put it at the bottom of a 23-foot pool. But they didn't use the iodine; they used a carbon dioxide, they just used the carbon dioxide carrier. Okay, and then they measured the rate and the rise of the bubbles and how much bubbles actually had rose to the surface.

MR. KRESS: Okay, well that sounds like --

DR. LAVIE: And then they then correlated it --

MR. KRESS: -- pretty good chance of being appropriate.

DR. LAVIE: The staff took the Westinghouse data and then massaged it a little bit further, because the staff at that time was concerned that the Westinghouse model didn't match some formulas the staff already had on mass transfer, even though Westinghouse had actually measured it. Okay, the staff tried to backfit a formula into the data. So the Westinghouse originally came up with DFs for elemental iodine as high as 800, and then the staff, because of its manipulations, pushed it down to 100. We have brought it back somewhat.

MR. KRESS: Well, I tell you why I'm still in this discussion with this relatively minor thing, and that is that one of the purposes for redoing the source term itself was to get a little more realism into it. Now we've introduced completely unrealistic --

DR. POWERS: All this conservatism here.

MR. KRESS: Yeah, parts -- completely unrealistic, no basis parts for part of the thing that has little relevance or little impact in terms of things, but it's still, it's still going away from the intent of the new source term to put a little realism into it. So that's, that's all that's bothering me. It's not that I'm concerned about this point here or any kind of safety impact it'd have.

DR. LAVIE: We did recognize in conservatism is this is a decrease by a factor of two. Plants typically come in -- the limit for this particular accident is 75 rem thyroid, and they typically come in anywhere from 25 to 30. I don't think of any plant that's had a fuel-handling accident be eliminated. This accident's primarily done to ensure that the filters and systems involved with the spent fuel handling areas are adequate.

MR. KRESS: I guess the question is will this serve any purpose? I guess it will. I'll have to think about it.

DR. LAVIE: We'll consider your suggestion about sticking with the 100 percent cesium iodide --

MR. KRESS: You're gonna get basically the same --

DR. LAVIE: Right.

MR. KRESS: -- when you do that.

DR. POWERS: I guess I wonder -- you know, if I'm sitting around, trying to figure out how I'm going to respond to an accident, and you tell me, okay, you've got a puff release and everything's over. And I pick up one set of actions. If instead you're telling me I've got a protracted release --

MR. KRESS: Over a long period of time.

DR. POWERS: -- over days and days and days, I think I'd come up with a different set of actions.

MR. KRESS: Yeah, and that's the other thing that bothers me. Part of the source term specification is the time. And here we've gone back to the puff release, just for convenience, when we know it's not a puff release, but we're saying it's conservative and I'm not sure it is, because you, you have one set of actions versus another and I'm not sure which is the right things.

DR. LAVIE: I can try to address that. Is that -- when we model this accident, was assume partially at the release of the gap activity that has collectively up to the point where the fuel was removed from the core, so what we're releasing is in essence the gas that's in the rod; it's gonna come out. The rod is at 800, 1600 pounds of pressure, depending on its burn-up, and even at the 23-feet pool depth, you're only looking at about 30 pounds of pressure, so the gas release from the fuel element will be very, very rapid.

If the filter systems in the fuel handling building are capable of handling a puff release, they're capable of handling a protracted release.

MR. KRESS: Well, your puff release is gonna be, the amount of iodine that's in it, it's gonna be about one percent of the total that's release from the gap. The rest of it ends up in the pool, and what we're concerned about is that other 99 percent is not dealt with here at all, because it's gonna start coming out also.

DR. LAVIE: That's correct.

MR. KRESS: And it should be dealt with in terms of fuel handling accidents somewhat, and it may come out for a long period of time and it may be a lot more than the -- this thing may be designed only to handle at one percent, and here you've got 99 percent more of it coming out. But I think that's the concern.

DR. LAVIE: That's the basis of our second bullet. We're assuming that it completely dissociates --

MR. KRESS: Yeah, we're saying it will re-evolve.

DR. LAVIE: Instantaneously. Of course it won't, but we're modeling as it does, so we are capturing that release.

MR. KRESS: You're already adding that in as a puff release.

DR. LAVIE: Right.

MR. KRESS: Okay, so we're saying if it's designed to handle that as a puff release --

DR. LAVIE: Right.

MR. KRESS: But it may not.

DR. LAVIE: But if they want to come back and look at it more deterministically, more mechanistically, then we certainly will consider it.

MR. KRESS: Yeah, it comes out in more protracted time versus a puff release -- with a puff release, you've got competition between where that iodine goes. Does it all go into the -- if you're assumption is it all has to go through whatever the clean-up system is, then you may be right. But if the assumption is that that cesium iodide leaks out the containment, goes through some other sort of chemical reaction with the sprays or whatever, gets removed -- but you may be right. I guess I missed that statement through. You are using all of the cesium --

DR. LAVIE: Right. Right, yeah. Most licensees when they do this particular calculation, do this with a spreadsheet. You know, a times b times c. It's really -- most of them do not do it on a time-dependent basis. It's the total quantity released. They get a total curies released; they convert that right to rem. Very few people actually model this in any degree of --

MR. KRESS: I think I may have been tempted to go back and say, you know, the DG 1081 says you get 99 percent elemental, .75 and .25 organic, and it all goes into the containment instantaneously and deal with it, because you end up at the same place.

DR. LAVIE: Exactly the same place, but for a licensee who wants to do it mechanistically --

MR. KRESS: You can still say, all right, if you don't agree with this tell me, justify some other. So I think I'd, rather than have these arbitrary things in there that really, really raise questions -- particular the first line raising this question -- I would have just gone back to the DG 1081 and said it all goes into the containment immediately.

DR. LAVIE: Okay.

MR. KRESS: Or, as an alternative, I would have I would have said, .25 percent of it goes in immediately and only a DF of 500 of the element goes in immediately, and the rest of it comes out protracted over time. And I would have made a calculation for what that protracted time release is. But that's not an easy calculation to make.

DR. LAVIE: No. It may be very plant-specific.

MR. KRESS: It may be plant-specific, but you could, you could deal with the plant-specific issues in a general way.

DR. LAVIE: Actually we're hoping this one goes away when we risk-inform Part 50. We may be down to just a loca.

On the second limitation, just to refresh you, as you recall from our original discussions last fall, is we have two different ways a licensee can get into the alternate source term is a full limitation, in which they come in and do it as a minimum of the full-fledged, full-blown loca analysis, and then we would grant them a broad scope approval that this is now in your design basis; you can then use the alternate source in TEDE for all future radiological analyses.

Realizing that not all licensees may want to go that route, and with deference to the Commission direction, we also provide a means to do it selectively, that they could pick small little applications and apply that small application. When we wrote the draft guidance, it was our intent that, those selective limitation licensees, if they want to use the alternate source term for some other application that they had to come back and talk to us. This was one of the benefits of going to the full.

We got several comments on that, and when we started looking back at it, we had realized that we had probably gone a step too far. And what we finally decided to do and change the guidance to is, recognizing that when we gave them the approval for the selective implementation, we approved some characteristic of the alternative source term and the use of TEDE if they did something that required a dose calculation. And we put that in the design basis. Now once that's in the design basis, that's part of their design basis, and we really don't need to worry about that again. So if the licensee wants to make a subsequent modification using those characteristics that we have already approved, they can go ahead and do it assuming they can pass the 50.59 criteria.

However, the staff review will be required under

50.67, the regulation for the alternate source term, if they decide to use an alternate source term criteria characteristic, or the dose criteria, which is not already in their design basis. So a licensee who may come in and do a timing-only application could not subsequently go off without coming back to us and do a calculation that involved the other characteristics. Or, if the licensee decided he had new data on gap fractions and wanted to change his gap fraction, he could not do that without staff approval because that's what's currently required under 50.67.

The revised position here is consistent with the 50.59 guidance and 50.67. So it would give them a little bit more flexibility than what we had previously.

MR. KRESS: I particularly thought this was a very insightful part of your change. And it addressed the earlier question, one of the earlier questions we had --

DR. LAVIE: Right.

MR. KRESS: -- and I thought this was very good way of handling it.

DR. LAVIE: I believe this was always our intent, but when we wrote the language it didn't come across that way.

MR. KRESS: It just never came true that way, yeah.

DR. LAVIE: One of the things that came up -- out of all the 134 comments we received, and some of them were very, very good comments, this one was one of the ones that really blew us away because it was one of the last sets of comments that came in, and I think this was one of the best ones we got. The individual pointed out, under the alternative source term and the way that we wrote the draft guidance is that it's possible for a licensee to have analyses on his books that are not based on TEDE and are not based on the alternative source term. If he could show that they were bounding, he could let them stand. But our guidance said that in the future, if you have any reason to resolve those calculations for any reason, use the, what's now in your design basis, the alternate source term and TEDE.

This gave a problem with a guide to 50.59 because as you call the new 50.59 guide in determining what's a minimal increase in consequences has you comparing prior to after. Okay, so we had all these calculations out there on whole-body and thyroid, and the new doses were going to be in TEDE.

Working with Alan McKenna and the other folks on 50.59, we decided the approach to do is that for this particular regulatory guide, we would put in an equation and some guidance on how to convert that prior value, and it's nothing magic to this. This is the waiting factor for the thyroid, which goes into constituting TEDE. So what the guide will say is that if you have one of these situations, before making the 50.59 comparison, convert your result. It was a very good catch.

MR. KRESS: It was a very good guidance.

DR. LAVIE: We didn't want to go into too much detail in here because we prefer that people go to the 50.59 reg. guide and the industry document that it endorses, rather than going into all sorts of detail, what constitutes minimum and all that stuff. So all we did here is that, when you get ready to do the comparison, this is how to get the prior result.

There was a lot of other technical changes, not as major as the ones we've just gone over. With the guide to EQ, as you recall, we have a generic safety issue in progress resolving the cesium in the sump water. This has not yet been resolved, so because we're going final in the guide, we have added text to the guide that talks about the GSI and also specifies that until the GSI's resolved, the licensees are allowed to use TID 1484 or the AST.

MR. KRESS: When that GSI gets revolved, will you go back and redo the guide and the review plan, or just --

DR. LAVIE: We expect that we'll be revising this guide in probably the next two-year time frame because of what's going on in risk-informing Part 50, and at that time.

DR. SEIBER: I see. But you'll have the opportunity to pick it up.

DR. LAVIE: Of course, as guidance, the licensee could point out to us in their submittal that the GSI had now required them to do something different or said that they could use the TID 1484 all the time. This is only for re-analysis required under the guide.

It was pointed out that the appendix I we had put in, though it discussed all the good guidance on the EQ doses inside containment, we really silent with regard to doses outside containment, so there was some general guidance added there, on that topic.

The steam generator iodine transport -- we corrected an error regarding the decontamination credit when the tubes are uncovered. Although we had described very clearly the model for flashing and non-flashing and scrubbing, we negated all of it in the final paragraph that says, if your tubes are uncovered, you get no partitioning credit. That was technically wrong. That's been corrected. They now go back to the flashing fraction. If it's, if it is not flashed and stayed in the bulk water, then the partitioning would apply regardless of where the water was. However, for the fraction that did flash, then they would have to adjust the scrubbing fraction. So we corrected that error.

One the spray DF, although we would expect a lot of the licensees to use the rad trap models, which don't have a spray DF limitation per se, recognize that some people will stick to the models in the standard review plan, for which there is a spray DF maximum. We had put in some guidance there as to when you take the total volume, because recognizing the new source term enters the activity over time instead of all the time equals zero. However, we made a mistake when we put that in, and we have since revised that to correct the guidance.

We were asked to consider allowing building mixing credit for the fuel handling accident. This is something we have typically not done, but we decided that if a licensee can justify it, it ought to be allowed.

MR. KRESS: I'm not quite sure I understand that.

DR. LAVIE: Okay. In the fuel handling accident, traditionally we have assumed that that puff of gas that leaves the fuel goes straight into the ventilation plenum, no mixing in the building. And in most cases, that's the way it's going to happen. Now there are some designs, however, where there may be a potential for mixing, and if they can justify it, it'll be allowed.

MR. KRESS: So you have a mix-in and it goes into the ventilation, but it does it --

DR. LAVIE: But a, much delayed period of time.

DR. SEIBER: But in the aggregate, it's the same as a puff release.

DR. LAVIE: Exactly. Yeah, what comes out of the water is still a puff, but it mixes in the building and can be released over the next two hours.

DR. SEIBER: But it's still considered puff.

DR. LAVIE: Right. They get some dilution. The concentration's a little lower.

We have also decided -- there was a requirement that was added on the loss-of-coolant accident for the ECCS system leakage outside the containment. There was a requirement added several years ago, which was largely intended to force the installation of filters, that if you did not have an engineered safeguard filter system in those areas, then you analyze a 50-gallon-per-minute leak. That requirement has been deleted.

Dr. Kress pointed out, the ACRS gave us a letter last October. There were three recommendations. Two of the recommendations we had, part of our response to table action until we got to the guide, we we're going to discuss what we did to resolve them, now there we're in the guide stage.

The ACRS had recommended the removal, the requirement to have prior NRC approval for changes resulting in reduction of safety margins should be re-evaluated in light of analytical assessments performed by research and the results of the pilots. And the discussion also identified using 50.59 as an alternative. The Staff committed in the response to look at this requirement during the public comment period. As a result of our review, we've decided to retain the language in the guide, for two reasons.

One is, this particular guide has to apply to the initial implementation of the alternate source term for which 50.59 would not be applicable. The re-baselining in the pilots provided a lot of good insights, but it was based on a limited sample of plants, and we don't feel that that limited sample provides an a priori basis to summarily disposition all potential plant-specific and modification-specific impacts. So we retained the requirement that the licensee will need to consider that.

We did, however, add language referencing 50.59 for the subsequent modifications.

MR. KRESS: But I think that's basically what we had in mind anyway with this, was the subsequent modification. So I think this is a pretty good response.

DR. LAVIE: The other recommendation that was carried over to the guide was the recommendation we should modify the proposed redefinition of the source term to eliminate the connotation that the release is necessary to the containment, but should retain the wording "released from the RCS." At the time we responded, we pointed out that we weren't going to change the rule language, but that we were committed to reviewing the reg. guide to ensure that the description was appropriate, that it would not cause this confusion. The reason we did this is that the 50.2 definition had to address accidents other than the loca, since the reg. guide and the alternate source term does. And those accidents may not involve the RCS or containment. So we decided that we'd best leave the definition in the 50.2 alone and make sure that it was clear in the guide.

The accident-specific appendices in the draft guide and the final guide provide the guidance in what constitutes the source term. We don't expect a licensee to go back to 1465 and interpret it. The guidance is in this reg. guide.

MR. KRESS: As long as it's clear.

DR. LAVIE: believe it is, Dr. Kress. The final guide is a stand-alone document. We don't expect licensees to refer back to 1465. However, we did add clarifications to the final guide to ensure that the release from the loca is consistent with the definition of 1465.

MR. KRESS: I think that fixes that problem.

DR. LAVIE: Okay. Those were the major changes made. As I pointed out earlier on the gap fractions, we expected to resolve those and be able to use the numbers we currently have there. If we don't, I will get back to the Committee and will decide the approach we want to take at that time. Am I able to answer any more questions you might have?

MR. KRESS: I thought the reg. guide were pretty well-conceived documents that dealt with this issue very nicely. I had a lot of minor problems with it, some of which I've already --

DR. LAVIE: Okay.

MR. KRESS: -- with things like speciation and gap release. I had a bunch of other little things that I'd like to bring to your attention, and I don't think it's worthy of putting it in a letter, and I don't even know if it's worth wasting our time on here. A lot of them are editorial comments. Some of them are things like --

DR. POWERS: There are a few things that they've, you might help to go through that.

MR. KRESS: Well, okay. Some of them --

DR. POWERS: I mean, for editorial purposes, the draft guide does have quite a few --

MR. KRESS: Yeah, and I could give those to him separately. But there are things like, they've retained this business of requiring the power to be 1.02, the rating power, which in view of all the other uncertainties, that seems a little strange.

They justify the breathing rates when they calculate the doses, to three significant figures, which seems a little strange also.

MR. ESTRADA: Good catch.

MR. KRESS: They still are talking about some magic thing called an initiation temperature for, ignition, ignition temperature. And there's gap release speciation; it's not clear always in the reg. guide as to when the clock starts on these timing things. So there's a lot of little bitty, a few little bitty things in there that I don't think make a hill of beans in difference in the outcome, but these are mostly editorially things that I can probably write down as a list and give them to him and send -- but I don't think they're worthy of putting in a letter.

DR. POWERS: Have you received things like that?

DR. LAVIE: Yes, certainly.

MR. KRESS: I haven't done it yet, but I --

DR. LAVIE: Whatever we can do to improve the document is certainly appreciated.

MR. KRESS: You can look at them and dispose of them as you see fit. I don't see that it makes much difference.

The other thing, I guess, is -- if there are no more questions from other members, I think we, we have an NEI reg here, and you don't care to comment? Okay, so with that --

DR. POWERS: Sounds like the industry's happy.

MR. KRESS: Well, I think the industry's pretty well pleased with the outcome of this. It looks like a pretty good set of guidance to me.

DR. POWERS: The important thing is that we're injecting some of the products of the substantial research effort into the regulations.

MR. KRESS: And getting a little more realism into it.

DR. POWERS: I guess I need to cogitate more about this checkered approach toward defining some of the criteria here. I hesitate only because if the accident disappears from consideration, how much effort do I want to invest in an accident that's never limiting anyway?

MR. KRESS: That's always a good question.

DR. POWERS: Members have any other comments they'd like to make on this?

DR. BARTON: Nah, it's a pretty good piece of work.

DR. POWERS: Okay, well thank you.

DR. LAVIE: Thank you.

DR. POWERS: And we will -- I can't start until the Federal Register says I can start, recess until 2:30.

[Recess.]

DR. POWERS: Let's go back into session. We have got to welcome Professor Apostolakis here. I hope the graduation celebrations went well.

DR. APOSTOLAKIS: They went very well.

DR. POWERS: Members have before them a Document 14, Reconciliation of ACRS Comments and Recommendations. They should examine these and if they have any comments.

I am tempted to say that we are now going to explore an issue that involves an oxymoron, but I am going to avoid that, and turn to the issue of quality in PRA. And Professor Apostolakis, I think you are our leader in this area.

DR. APOSTOLAKIS: Yes. Thank you, Mr. Chairman. The Commission directed the staff to develop some recommendations regarding the judgment of how good a PRA is in the absence of the ASME and ANS standards, which, as we all know, are being developed right now. This is a very recent SRM, April 18, 2000. And your response is expected by the end of this month, I understand. June 30th, is that correct?

MR. MARKLEY: Yes.

DR. APOSTOLAKIS: We have not received the document from the staff, understandably so, but since the

Commission expects it by the end of the month, I suppose we will also see it then. And we will have to discuss at the end of this whether we want to write a letter. If we do, that will be in July.

The ASME standard, though, has been promised to us sometime in June. Right, Mike?

MR. MARKLEY: Yes, June 14th.

DR. APOSTOLAKIS: June 14th. And we have, in fact, scheduled a subcommittee meeting June 28th to discuss that. So I don't know now whether the work you are doing now will really ever be used, unless the ASME standard turns out not to be acceptable, in which case, of course, what you are doing now will be very, very valuable. But these are perhaps questions whose answers are coming.

MR. MARKLEY: Yes, that's correct.

DR. APOSTOLAKIS: Okay. So without further ado, I guess Mr. Cunningham has the floor.

DR. POWERS: Let me, before we get into this, the Commission asked you to address the issue of PRA quality. Unpleasant experiences that have occurred throughout my professional career have taught me that the definition of quality is a variable thing. And can you tell me what the Commission had in mind when they used this word "quality"?

MR. CUNNINGHAM: We will try, try to lay the context, anyway, of the question.

DR. APOSTOLAKIS: Okay. Go ahead.

MR. CUNNINGHAM: Thank you. My name is Mark Cunningham, I am with the PRA branch in the Office of Research. We have got four of us up here today. To my right is Mary Drouin, also with the Office of Research; Gareth Parry, from the Office of Nuclear Reactor Regulation; and Richard Barrett, the chief of the PRA branch in the Office of Nuclear Reactor Regulation.

I am going to start this out, but all of us are going to hop in at various points and talk about what we have got.

DR. APOSTOLAKIS: So there is much to be said about PRA quality then?

MR. CUNNINGHAM: Pardon?

DR. APOSTOLAKIS: Since all four of you will be contributing.

DR. POWERS: It takes that many people to search for PRA quality.

DR. APOSTOLAKIS: In the absence of tools.

[Laughter.]

DR. POWERS: Because they are being out-gunned.

MR. CUNNINGHAM: Okay. Well, let's see, there is four parts to our presentation today. I am going to provide some background of what is going on right now in terms of the SRM and other activities and give you a first, kind of a general idea of how we intend to respond to the SRM, at least today. Part of that response is going to be what we call an attachment to the SRM. We are writing a document that Mary and Rich and Gareth will talk to you about that contains some -- the substance of the presentation, and then I will come back at the end and talk a little bit about what we have to do over the next month or so.

DR. APOSTOLAKIS: Over the next month?

MR. CUNNINGHAM: In responding to the SRM.

DR. APOSTOLAKIS: But the paper is due the 30th.

MR. CUNNINGHAM: Yes. Well, this month. What we will be doing this month.

DR. APOSTOLAKIS: Okay.

DR. POWERS: This month is young yet, George.

DR. KRESS: Next month in the staff means the one coming up, not the one --

MR. CUNNINGHAM: Over the next 30 days is what I meant.

DR. APOSTOLAKIS: The next 30 days takes you into July.

DR. POWERS: Yes, but all these people are working 16 hours a day, so they actually get two months for every calendar month.

DR. APOSTOLAKIS: Maybe we can start to talk about serious matters.

MR. CUNNINGHAM: Anyway, right now the staff has got four issues related to the general issue of PRA quality facing it, that it will be facing over the next few months. The first is the response to the SRM that Professor Apostolakis talked about. This came about in a briefing that the staff had on the risk-informed regulation implementation plan. And in that briefing, the staff talked about some of its concerns, that the schedule for the ASME standard was slipping, or appeared to be slipping.

The Commission made comments, various Commissioners at that time made comments about the general question of, how are we going to deal with the fact that the standard is slipping in time, and what are we doing to make sure that the PRAs that we are reviewing and we are using are good enough for the task? So, in a sense, that is what I think the intention was in terms of the quality. Are these -- are the PRAs that we have available to us, or the licensees are using, good enough? And how are we confident that they are good enough to be used in the applications that we have got in front of us today?

So, I think that was, as I recall, kind of the general context of the quality question, and it got kind of condensed down to a definition of PRA quality.

So, anyway, right now we have this, we owe at the end of the month a response to that SRM. In parallel, we have got a couple of other things going on. The Nuclear Energy Institute has submitted a certification document, one of many documents that it is submitting in the context of possible use in the Option 2 analysis of Part 50.

DR. APOSTOLAKIS: I am not sure that we have really investigated or discussed the certification process. We had a small presentation, as I recall vaguely, but I think --

DR. SEALE: We had a presentation from the GE Owners Group, as I recall.

DR. APOSTOLAKIS: Right. But it was --

DR. SEALE: On their certification process.

DR. APOSTOLAKIS: It didn't go into detail, though. It was more a high level description. In fact, what I am saying is I am wondering whether the members would benefit by reading this document if you can give it to us.

MR. CUNNINGHAM: Yes, certainly in the context of how the staff is proceeding and things, and how --

DR. APOSTOLAKIS: Yeah, because we really have to understand.

MR. CUNNINGHAM: It is an important background document to the Option 2 work that you will be reviewing.

DR. APOSTOLAKIS: We have to understand the certification process. And I mean just to have high level discussions, as you know, we look at this and that, it doesn't mean anything to me. I really have to see the details.

MR. BARRETT: The schedule for the staff review of that document hasn't been firmed up yet, but it is going to be -- I believe it is going to be a schedule sometime toward the end of this year. So, in your thinking about what you want to review and when you want to review it, you might keep in mind that we will certainly be coming to talk to you about the staff review.

DR. APOSTOLAKIS: I would like to have the document itself, you know, to start educating myself, you know, in anticipation of your visit here, Rich.

DR. SHACK: Is that the NEI document that will also be used to classify components under the Option 2? That is a different document?

MR. BARRETT: Those are separate documents, but we are going to be reviewing them in tandem.

MR. MARKLEY: But there is also four separate certification processes, right, for each one of the Owners Groups, that they are not altogether that linked? I mean there are similarities, but they are different. Is that correct?

MR. CUNNINGHAM: That is correct.

MR. BARRETT: There is one NEI submittal, NEI 0002, but there are the sub-tier criteria that are used by the various groups are different, because of the differences in the reactors. Maybe Mike Cheok could --

MR. MARKLEY: That's fine.

MR. BARRETT: Okay.

DR. APOSTOLAKIS: So we will get a copy of this?

MS. DROUIN: Yes.

MR. CUNNINGHAM: Yes. As Rich was kind of alluding to, over the next few months or so, we will be -- the staff will be reviewing the information NEI submitted in the context of its possible use in the Option 2 work.

DR. APOSTOLAKIS: But what if the ASME standard is approved, is accepted by the staff, then what happens to the NEI document?

MR. CUNNINGHAM: I will come back to that.

DR. APOSTOLAKIS: Okay.

MR. CUNNINGHAM: The next slide, slide 4 is the other things that are happening kind of in parallel in time with the NEI information and the Commission SRM is that we expect to see the next version of the ASME standard for staff review, if you will, about the end of this month. So this is Rev. 12 of the ASME, proposed ASME standard.

DR. APOSTOLAKIS: Out of how many, do you think?

MR. CUNNINGHAM: Out of 12.

DR. APOSTOLAKIS: Okay.

MR. CUNNINGHAM: The goal of ASME is to have it out the latter part of this month. There is a public workshop on it June 27th, that sort of thing, to tell people. And they are asking, they are soliciting comment over a 60 day period for that. So, in the July-August timeframe, the staff expects to be looking at the ASME document.

In about the same timeframe, ANS expects to issue its draft standard on external hazards.

DR. APOSTOLAKIS: It says only seismic.

MR. CUNNINGHAM: It says seismic on the slide and I have to apologize. The slide -- the standard covers -- is mostly seismic, but it covers also things such as external flood and high winds and that sort of thing, how to analyze them.

DR. APOSTOLAKIS: Fires?

MR. CUNNINGHAM: Not internal fires.

DR. APOSTOLAKIS: Oh. Who is covering that?

MR. CUNNINGHAM: The National Fire Protection.

DR. APOSTOLAKIS: 805?

MR. CUNNINGHAM: Yes, the 805 at this point is the standard that is under review. So, ANS will be issuing its -- or has a goal of issuing its external hazards standard for public comment, again, around the end of this month or in early July, again, for a 60 day period or review. Just for what it is worth, that covers, in the seismic area, that covers both the seismic PRA and the seismic margins approach.

So, again, the staff is expecting that in the July-August timeframe, we will be looking at those documents and commenting on them.

The goal of ASME right now is to have the final version of their standard out in January of next year. The goal for the seismic or the external hazards work by ANS is to have it done in September. I should also note there, ANS is also working on a standard for low power and shutdown analysis. That right now is scheduled to be out in September and finalized in December, but we just have a feeling that that is not going to happen that quickly. That one is a little further behind that the seismic work.

So, at any rate, we have got three or four things in front of us.

DR. APOSTOLAKIS: The ANS low power shutdown work is the standard on how to do a risk -- a PRA for those modes. It is not how to manage risk during those modes.

MR. CUNNINGHAM: Correct. Correct. And it has a quantitative approach to assessing the risk and a more qualitative approach to assessing the risk. It is intended to be part of standard. But you are right, it is not how to manage an outage, if you will.

So, again, the staff has three or four things in front of us, all of which are related to the issue of PRA quality. So what we intended to do is --

DR. APOSTOLAKIS: Actually, you know, that is confusing. You can qualitatively manage risk, but you cannot qualitatively assess risk. The only way to assess it is quantitatively.

MS. DROUIN: What was proposed by the project team from the qualitative approach was to create a benchmark, and then you would compare your plant against that benchmark to see where you fell. And to try and establish a benchmark to the level where it didn't contribute on a relative basis to the full power, and as long as you met that benchmark or you were below it, then you were okay. I mean that is just kind of a quick summary of what the qualitative approach.

DR. APOSTOLAKIS: Which is really managing. Which is really managing rather than assessing.

MS. DROUIN: In a sense, yes.

DR. KRESS: When you said benchmark, you mean a benchmark PRA?

MS. DROUIN: A benchmark simplified, I should say simplified PRA.

DR. KRESS: Well, that is not managing risk at all, it is just a qualitative way to compare your PRA with something that has a known --

MS. DROUIN: Risk associated with it.

DR. KRESS: A known uncertainty.

MS. DROUIN: But it does have a management part, because you would manage, --

DR. APOSTOLAKIS: Yeah, because the management, it is really management.

MS. DROUIN: -- you know, your configuration to meet or stay below that benchmark.

DR. APOSTOLAKIS: What you do. Again, it is not really a simplified PRA. A limited scope PRA. You simply something --

MS. DROUIN: That is probably a better characterization, yes.

MR. CUNNINGHAM: Slide 5 then provides basically an outline of what we intend to -- of what the structure will look like of the response to the SRM, and that is going to lay out what we intend to do over the next few months to deal with this, how to deal in kind of a more integral way, each of these individual issues I have talked about before.

What that means is the SRM is going to first summarize what the Staff is now doing and what that means is again in the context of the Commission briefing is in the context of the applications that the Staff is now using, in the places the Staff is now using PRA what is the Staff doing to ensure the appropriate quality and scope of the PRA for that application.

One example of that really is in the license amendment context. Today we use Reg Guide 1.174 and SRP Chapter 19 to guide us through how we ensure that the PRA is adequate for the intended use. It is general guidance at this point but it served us well I think in terms of license amendments. That we are going to try to summarize to the Commission how that is being done today, and Rich will come back a little bit later to talk about how we are going to elaborate on what is in the existing Reg Guide and SRP.

We are going to then propose or recommend to the Commission that the Staff or inform the Commission that the Staff has some other things we are going to do to integrate all these pieces together.

One is we are in the process of writing a couple of things that will help better lay out how we use PRA in the Staff reviews and then what is needed in that PRA, in those PRAs for those applications.

The idea is to draft a document and attach it to the Commission paper and summarize it in the paper itself.

DR. APOSTOLAKIS: I must say, Mark, I am a little bit confused. Given the time scale on which the Agency operates, if the ASME standard is any good you don't need to do this because by the time you are done with this, the standard will be out, so do you guys know something we don't know?

MR. CUNNINGHAM: No, not well.

DR. APOSTOLAKIS: Are you preparing yourselves now independently to judge the last bullet there --

MR. CUNNINGHAM: Yes.

DR. APOSTOLAKIS: -- to be able to review the standard and --

MR. CUNNINGHAM: Yes, that is what we are doing.

DR. APOSTOLAKIS: So you are positioning yourselves?

MR. CUNNINGHAM: We are positioning ourselves. We are doing our homework or whatever to say -- and these Staff documents were intended to lay out what are we going to use as the basis to review the ASME standard when it comes in next month and what are we going to use as the basis for reviewing the certification document.

We think it needs to be one document that spells out how we are going to do that for each of those things.

To get back at a point that I believe you asked about earlier, I think we go back to Reg Guide 1.174. We talked about either a consensus standard or certification process could be found to be acceptable in ensuring needed PRA quality.

DR. APOSTOLAKIS: For some applications.

MR. CUNNINGHAM: For some applications, and I think that is the context we are still working in. We are not presuming that one or the other would obviate the need for the other, that we can see that either of these documents, the ASME standard, ANS standard or the certification process could be acceptable so we are expecting it. We are not prejudging at this point that either will replace -- one that will replace the other.

DR. APOSTOLAKIS: So you are not really sending a message to the ASME that the standard may not be acceptable?

MR. CUNNINGHAM: No, I don't think we are intending to send that message at all but we need to do our homework and set out what is it that we want to establish is what we want, if you will, and Mary and Gareth and Rich will talk about this in a little while.

DR. APOSTOLAKIS: Is Mary the only one who participates in the ASME activities --

MS. DROUIN: Yes.

DR. APOSTOLAKIS: -- from the Staff, I mean from you four?

MR. CUNNINGHAM: Mary is the representative of the NRC on a committee. All of us are involved in reviewing the material.

DR. APOSTOLAKIS: Oh, okay.

MR. CUNNINGHAM: But Mary is the official point of contact, if you will.

At any rate, we will talk about a little bit later these documents. We think it may be appropriate to update Reg Guide 1.174 and/or the Chapter 19 to reflect what we write in these documents and just somewhat coincidentally we are going through the process to come up with the next update of the Reg Guide and the SRP, so the timing may be right for that.

We intend to review the submittals, either the certification documents and the ASME standard draft, against what we are writing down, basically, provide comments back to the appropriate people, either ASME or ANS or NEI, and then when we get down the road and get the final versions of those documents we would be prepared to review them, again against what we have written down and endorse them or endorse them with exceptions.

At any rate, the remainder of the presentation is basically what is going to be in these couple of documents that we're talking about.

Mary is going to take it from here to talk about in general what will be in this attachment. That will be a mixture of Mary and Rich and Gareth talking about the details.

MS. DROUIN: Mary Drouin, Office of Research.

This attachment that is going to be to the SECY basically has three parts to it.

The first part is laying out what are those risk-informed activities where we feel PRA quality is an issue and needs to be addressed, because one of the things we want to do is come up with an integrated and uniform, consistent definition there that is going to be applied across these.

Now we do recognize that PRA quality is variable with application but when we define what a PRA is, that definition of a PRA should be uniform and consistent, so we first are going to talk about what are those activities that this will be addressing and then Rich will get into NRC's decisionmaking process, how PRA and the quality of the PRA folds into our decisionmaking process and we'll get into that next.

The last part of the attachment then gets into the details of what we consider to be technically acceptable in a PRA and then it has in there a discussion of what the PRA scope and level of analysis needs to be, the elements and characteristics of peer review, because that is one way to get to your technical acceptability.

The next one is we call it the PRA application process and that is intending to lay out the characteristics and attributes of a decision process in looking at what scope and elements you need for a specific application.

The last one, laying out the attributes and characteristics of an expert panel, because in many cases you might be using an expert panel to supplement your PRA if your PRA doesn't cover the necessary scope or elements.

DR. APOSTOLAKIS: Could we attempt to define what a good enough PRA is for a particular application by saying that we make some decisions using that PRA in a particular context. If one did a more detailed analysis the decision would not change. In other words, that the decision is robust.

Shouldn't that be the ultimate criterion, because when you are dealing with these things you can't experiment. You can't go and blow up things and see what happens. The only thing that makes a connection between risk assessment and whatever, with real life, the physical world, is the decisions you make, so that should be the ultimate criteria, that if somebody came back with a ten volume PRA for this issue, which you handled with three pages, the decision would not change.

DR. KRESS: It is like proving the negative, George.

MR. CUNNINGHAM: The decision might change.

DR. KRESS: Yes, you don't know whether --

DR. APOSTOLAKIS: Then it is not good enough.

DR. KRESS: You don't know whether the decision would change and so you have a never-ending set of things to worry about.

DR. APOSTOLAKIS: But this is the ultimate criterion though.

MS. DROUIN: I think there's a different way --

DR. APOSTOLAKIS: This is the ultimate criterion.

MS. DROUIN: I think there is a different way to look at it, George, in that you could lay out your minimum requirements for a PRA. I think that would be very difficult. That would cover every application --

DR. APOSTOLAKIS: Sure.

MS. DROUIN: -- because you could have an application that comes in that has nothing to do, where for example earthquakes have no effect --

DR. APOSTOLAKIS: That's right.

MS. DROUIN: -- and you might have a PRA where either it either didn't cover earthquakes or they did a lousy job.

DR. APOSTOLAKIS: That's what I mean, that they should really start from the endpoint, the decisionmaking process rather than starting by defining --

MS. DROUIN: And that is what we've done.

DR. APOSTOLAKIS: I don't dispute that. I am just saying that --

MS. DROUIN: That is why that shows up first.

DR. KRESS: I think you ask yourself on the application do you have some PRA need for this application, an output of some kind, and then you have to ask yourself based on the decision I want to make how good do I need to know that number.

DR. APOSTOLAKIS: Right.

DR. KRESS: And if I only know it this well then I make one kind of decision, and if I know it this well make another one, and then you ask yourself the secondary question how good does my PRA give me so I can tie that to my need in the decision.

I don't think you do what you do. I think you look at them both in that kind of context.

MS. DROUIN: I think we are going to answer your question.

MR. CUNNINGHAM: Yes, you are jumping into Rich's presentation already basically, because he gets at many of the points that you raise, Dr. Kress.

DR. WALLIS: What I would like to do is make a distinction between going through the motions and the quality of the work. This comes up in, say, codes, thermal hydraulics and so on. You can make a structure where you have all the scope and level and elements, you have all the right things in there but then when you are actually modeling something you have to have equations, you have to have coefficients, and they have to come from somewhere, and the weak point of a lot of these things is they look good, but there is very little guidance on what the coefficient should be, where you could get them from, how you know if they are good enough, so the devil is in those sorts of details, not in the fact that the scope looks good and everything. It's a different level.

Do you have something to say about that level in PRA?

DR. KRESS: I think that is in your PRA elements and characterization.

MS. DROUIN: If you bear with us, we are going to get to that.

DR. WALLIS: That is part of the elements and characteristics?

MS. DROUIN: Yes.

DR. WALLIS: Because you could have an element and it can be lousy.

MS. DROUIN: It could. They could do it lousy.

DR. WALLIS: Okay. You are going to tell us.

MS. DROUIN: So the point is that the paper has three parts. They have been done sequentially on purpose, starting off with here are the activities, here is the decisionmaking process of how the PRA plays into that, and then it gets into the technical acceptability.

So the first one is at a high level we view these more as areas where we feel that PRA quality is an issue and that the rest of the document would play into is risk informing 10 CFR Part 50, the plant oversight process, our operating events assessment and our license amendments, and all the different activities would fit into one of these categories where we think the PRA quality needs to be addressed.

On that, I am going to turn it over to Rich to get into the decisionmaking process.

MR. BARRETT: I am Rich Barrett with Nuclear Reactor Regulation.

I think a number of you have hit very early on what we think is a key point of all this paper and that is PRA quality is not something you can look at in isolation. It is, as some have pointed out, dependent on what application you are looking at.

I think more importantly it depends on your entire decisionmaking process and so what we intend to do in the paper is to address the decisionmaking process, the decisionmaking process that a licensee goes through to come to the application that they have submitted and the review process that the NRC goes through and the factors that we take into account in making those decisions.

Ultimately what we are trying to do here is not to get quality PRAs. Quality PRAs are a step toward getting to NRC reviews which allow us to make a finding, to make a finding that the risk is acceptable and that we understand the risk well enough that the risk can be bounded.

What we have here is perhaps a seemingly complex spider chart which is intended to talk about some of the factors that we take into account in making a decision and in reviewing and accepting a licensee application, whether it is a license amendment or some larger application.

If you go back and you read through Reg Guide 1.174, and SRP Chapter 19, as I have done in the last month.

You will find that there is an impressive amount of information in there that would enlighten us in that particular area. The people who drafted that document, and I was not one of them, did a very nice job of thinking this process through very carefully and I think maybe some of us have forgotten a lot of that information.

What it basically says is that the Staff will review an application from the licensees. We are not going to have cases where the existence of a peer review or the existence of a quality PRA will obviate the need for a Staff review.

The question is what will the Staff review consist of, how deep will it be, how resource intensive, and where will it be focused. In making those decisions where we want to start with is the question what is it that can give us assurance that the risk is in an acceptable range and that we understand the risk well enough to approve this application.

In a simplified way there are really three factors that I think come into play.

One of them is what I call, for lack of a better term, risk limitation. There are cases where you can examine an application and in a qualitative way after you have looked at it come to the conclusion that your exposure to risk is limited, and that is an important piece of information to have before you ever go in and start looking at the PRA results with the quantification or anything else.

The risk might be limited because of the nature of the change that is being made. It might be limited because of the extent of the changes being made. It could very well be that there are controls that have been placed on this application which limit. There could be backstops which again limit the risk exposure, and you need to understand those from the very start because that helps you not only decide how much analysis you have to do, but it can help you to focus where in the analysis you need to look.

Even if the risk is limited, there might be some risk and you can understand where that risk is. You know where to delve into the analysis.

We think it is very important that that is the first place you look when you look at an application.

CHAIRMAN POWERS: Earlier today we discussed an issue in which a persuasive case was made that the probabilities of an event were very low, but that didn't deter us because we had -- there was not a characterization of the consequences and we had one of our members portray sufficient of a nightmare to us that it looked like those consequences were very big.

When you use this word "risk" you really are looking at the products of these or are you only looking at the probabilities of an event?

MR. BARRETT: I think that if you make a qualitative judgment, I think my favorite example was that two years ago, the ACRS rightfully asked us to look at the potential risk significance of powerup rates in the BWRs. There were five-eight percent powerup rates.

And what we did was, we went in and we asked ourselves, what could be the impact of this on risk? And we looked at both the probabilities and the potential impacts on consequences, things such as different amounts of fission products, perhaps the different effects on containment response.

We looked at the probabilistic aspects, less time, perhaps, for operator reactions, maybe different success criteria for systems and operator actions.

And we did look at a couple of plant-specific applications. But by and large, we came to, I think, a pretty robust and qualitative conclusion that the risk from these small powerup rates was really quite limited.

DR. APOSTOLAKIS: So you looked at both, consequences and probability?

MR. BARRETT: Yes, you would have to look at consequences. You can't allow yourself to get seduced into just looking at CDF and LERF, and perhaps you miss some of the other factors that impact risk.

DR. APOSTOLAKIS: Maybe you need a better word than risk limitation.

MR. BARRETT: I would welcome a better term.

DR. APOSTOLAKIS: Risk implications or --

MR. BARRETT: Risk vulnerability.

DR. APOSTOLAKIS: Something, yes, because my mind went immediately to limitations of PRA, but that's not what you mean.

MR. BARRETT: Yes.

DR. APOSTOLAKIS: Implications? I don't know. Do you plan to talk about this more, or do you want me to make comments?

MR. BARRETT: I welcome your comments.

DR. APOSTOLAKIS: I would change this a little bit, and maybe combine the boxes, non-PRA insights and deterministic analysis into one and call it non-PRA insights, or traditional analyses. I would avoid the word, deterministic, because a lot of it goes into PRA as well.

What you mean is the traditional engineering analysis that the Agency is used to.

And then I don't know why PRA has this honor of being peer-reviewed and the other stuff does not. I would delete the boxes that says peer-reviewed, or everything is peer-reviewed.

MR. BARRETT: Everything, indeed, is peer-reviewed. I mean, anything that is submitted to the NRC goes through some sort of a quality check. What I was trying to highlight here is the role of PRA quality.

DR. APOSTOLAKIS: Okay.

MR. BARRETT: And there we're talking about the peer review which we're calling the certification process.

DR. APOSTOLAKIS: Yes, but you don't want to send the wrong message that you are imposing extra requirements on the PRA. I mean, the other stuff will be -- but do you agree that perhaps the two boxes should be combined into one?

If not, I would change the word, deterministic, to traditional engineering analysis.

MR. BARRETT: Well, I think -- which two boxes are you talking about?

DR. APOSTOLAKIS: Non-PRA insights and deterministic analyses.

MR. BARRETT: No, those are two different things, really.

DR. APOSTOLAKIS: They are two different things?

MR. BARRETT: Yes, those really are. I think in the case of the traditional deterministic analyses, what we're talking about there are questions of margin and defense-in-depth, and some of the traditional types of licensing questions that are issues that we bring into -- the things that make this risk-informed instead of risk-based.

Non-PRA insights really is non-PRA. It should really say unquantified risk insights.

DR. APOSTOLAKIS: Oh.

MR. BARRETT: That's what it really should say.

DR. APOSTOLAKIS: Okay, so why don't we say that?

MR. BARRETT: We will.

DR. APOSTOLAKIS: And you agree to change the other one to traditional engineering analysis?

MR. BARRETT: I understand that.

DR. APOSTOLAKIS: We had the same battle when you guys put together the diagram in 1.174. Deterministic analysis feeds a lot into PRA.

DR. WALLIS: It will become a traditional PRA analysis soon when it becomes a tradition.

DR. APOSTOLAKIS: Engineering? I don't know.

CHAIRMAN POWERS: It's hard to find a valid --

DR. SHACK: PRA is not engineering?

[Laughter.]

CHAIRMAN POWERS: You're going to get him upset.

DR. APOSTOLAKIS: I don't know what deterministic analysis is. You mean the traditional licensing kind of analysis, but you don't want to call it that?

MR. BARRETT: Yes, I don't necessarily want to call it that, because we don't necessarily do it in the same way as we do licensing analysis when we're doing this kind of thing. We may, in fact, do more best estimate than we would do in a licensing, in a case that was wholly based on licensing on deterministic design basis type events.

But let me try to find better terms.

DR. APOSTOLAKIS: Yes.

MR. BARRETT: Putting out a chart like this is difficult. It's difficult to find the right words. But I like unquantified risk insights. I could just put down defense-in-depth in margins, how about that?

DR. APOSTOLAKIS: If you want to.

MR. BARRETT: Okay.

CHAIRMAN POWERS: Good.

DR. APOSTOLAKIS: Well, actually, no, unquantified risk insights is better.

MR. BARRETT: No, I meant for the deterministic analysis.

DR. APOSTOLAKIS: Oh, yes, yes, that would be fine.

MR. BARRETT: Okay. Actually in the more complete version of this chart, that's what's in there.

DR. APOSTOLAKIS: Defense in depth and safety margin considerations.

MR. BARRETT: Okay, so we have PRA, unquantified risk insights, and defense-in-depth and margin considerations.

DR. APOSTOLAKIS: Right, and the peer-review is only for PRA, or do all three feed into a peer review?

MR. BARRETT: All three would fit into a peer review. There would always be a quality review internal to a licensee before they submitted it, but the peer review process we're talking about here -- and maybe what I would do is just put in NEI 002 as meaning that this is what that box means.

That box means that these plants, these PRAs have been subjected to a peer review of that type.

The second consideration before we get to the analysis part, is on the far right side here, which is performance monitoring.

We frequently find that one of the best ways of limiting risk and assuring ourselves of safety is if we can find that the application has a good way of defining measures and criteria that can be monitored, real-time, to assure that the decision we've made does not lead to unacceptable consequences.

Now, we've had a number of discussions as to what constitutes an acceptable performance monitoring program. You have to have relevant measures; you have to have good criteria; and you have to be sure that you can detect unacceptable performance in a timely way before it becomes a risk and a public safety issue.

But we do have examples where this is important, and so we need to look at this before we delve into the PRA as well. So, having said all of that, and we then look at the analyses and we see that the PRA, the quantified PRA, is an important part of the analysis but it's not the only part of the analysis.

The Reg Guide points us to other things such as unquantified risk insights and defense-in-depth, and margin, and other factors, operational experience and a whole wealth of information that can be brought to bear to give you assurance.

DR. APOSTOLAKIS: Should the box currently labeled risk limitation, also feed into the analysis? I thought what you said earlier was -- well, maybe you didn't say it, but if you do this assessment of the significance of the issue you are dealing with, that will certainly affect your analysis.

And right now it appears that it goes straight to the integrated decisionmaking, and the analysis is done independently of that. In reality, it won't be.

MR. BARRETT: I think you could probably draw lines from all three of these in various directions.

DR. APOSTOLAKIS: Maybe that's a shell of the issue that you are dealing with, and everything else is within that. You know, if you -- for example, if earthquakes is an issue that is irrelevant to the issue at hand, you're not going to ask a PRA to do an earthquake analysis.

MR. BARRETT: Right. The idea of this is to look at the whole process from the bottom up, as to say the Staff -- you're the Staffer and you're reviewing the application. What is it that you're going to be looking for? And it doesn't get so much into the internal workings of the licensee and how they went about making their decisions.

DR. APOSTOLAKIS: And the other point I want to make is that I congratulate you on spelling decisionmaking process correctly, as opposed to the ACRS Staff that makes it one word. It drives me up the wall.

MR. BARRETT: We'll accept any comment.

[Laughter.]

DR. APOSTOLAKIS: Even at the expense of your colleagues here.

[Laughter.]

DR. SIEBER: They actually have it both ways on that chart, so you can use.

DR. WALLIS: Which one do you think is correct, George?

DR. APOSTOLAKIS: They hyphenated one.

DR. KRESS: George, I will offer an opinion on this weighty subject that both ways are correct, and they used them correctly both there. In the integrated decisionmaking, it is a noun; it is a thing. Up there, it's an adjective talking about the process, and it's an adjective, so they've used it correctly.

DR. APOSTOLAKIS: These guys used it.

DR. KRESS: These guys used it --

DR. APOSTOLAKIS: But in our records, we don't.

DR. KRESS: Maybe not, but here it's used correctly both times.

DR. APOSTOLAKIS: Decisionmaking process in our letters is one word, decisionmaking.

MR. MARKLEY: George, we do it both ways also.

CHAIRMAN POWERS: I think we can move on.

DR. KRESS: Before you move on, though, I would like to be more substantive. I would like to see that other.

Now, what I envisioned, Rich, is that you have some sort of decision to make about some change, and whether or not its acceptable.

And you're going to have some criteria to guide you on whether it's acceptable or not. And some of that criteria may be, does it meet certain risk levels. And if it doesn't, you'll have to have a PRA or some sort of way to judge what the risk implications are.

But your decision as to whether it's acceptable or not, may depend on what quality of PRA you have in determining that, and it may or may not be acceptable, but if the quality is not very good of the PRA, you could offset that by having performance monitoring, more defense in depth and bigger margins, so that the integrated decisionmaking and these other things are all tied to the quality of the PRA.

If it's a poor quality, you have to have more performance, you have to have more defense-in-depth, better margins, so that the way I view it is that you have a set of basically a matrix of criteria that, depending on what quality of PRA you have, you will have an acceptance criteria that depends -- that varies these other things. Is that a way to look at this?

MR. BARRETT: If I was a licensee -- well, as a regulator, I think I look at these three areas as being tradeoffs, making tradeoffs.

If I was a licensee, I would think in terms of iterating. That is to say, if I could not, myself, make the arguments that risk is limited, or that I could perform as monitor, and yet I didn't think that I had the sufficient quality of PRA, I might go back and put controls on this thing or backstops on the applications so that I could further limit the risk, or I might go back and look harder for some way to monitor performance.

DR. KRESS: Or put more defense-in-depth in so that the actual risk numbers you get are coming down or something like that.

DR. SIEBER: If you were writing risk-informed rules, this would be the model that you would want to use to set up how those rules and all the supporting documents like Reg Guides and so forth would be, because it should, in my view, have a risk expectation associated with the rule, and a way to monitor performance to make sure that the input assumptions to the risk analysis are correct.

And so this then becomes the model.

DR. APOSTOLAKIS: That's what 1.174 does.

DR. SIEBER: Well, this is the model for risk-informed rulemaking, which is one of the tasks that's ahead of us in the near future.

MR. PARRY: I think this gets back to the question that you raised earlier; that if you had a -- if you could define a quality of PRA, then you could -- I don't know the way you phrased it, exactly.

But you'd say this is the -- once you've got that and you've got a robust decision.

I think you can look at it a different way, which we haven't quite addressed yet. And again, it's to do with tradeoffs.

The more confidence you have in PRA results, so whatever that role -- whatever the role of the PRA is in the decisionmaking process and it's balanced on these three legs that Rich has got in this diagram, the more confidence you have in the PRA results, then perhaps the less conservative you can make your decisions.

So I think that if you look at it in terms of Option 2, for example, the more confidence you have in your PRA -- in the PRA results that you're using, then perhaps you can shift more components into one box rather than another. So it's not a matter of making a robust decision at that level; the decision may change.

DR. APOSTOLAKIS: I still think I can place what you said in the context of my interpretation, in the sense that the decision is not robust if based on this current state of knowledge, somebody feels that you have made a conservative decision, and by doing more analysis, that person feels that he can convince you that that's the case.

So then your PRA is not adequate for the application. I think ultimately what drives it is the decision.

MR. PARRY: Yes, but I think it depends on what you want to get out of it.

DR. APOSTOLAKIS: I think we understand that. In fact, that's the point of Rich's comment when he addressed the risk limitation there. You know, let's not forget where we are and what kind of decision we're about to make, and then we jump into the analysis.

MR. BARRETT: I guess the last point I want to make on this slide is the importance of the staff's review of NEI 0002, and the allied process for risk categorization, because, in reality, we are going to be faced with PRAs that have been subjected to this peer review. That is going to be our tie to what is actually in the industry. And, so, it is very important, as Mary said earlier, that we have a common set of expectations that we apply to this peer review process and that we apply to our review of the ASME standard.

DR. KRESS: And when you say PRA here, this could be a PRA that has associated with it a fairly robust uncertainty analysis, or it could be one of these nominal PRAs that we call best estimate, for whatever that means, without uncertainty.

DR. APOSTOLAKIS: Could be.

DR. KRESS: Are we including both of those as the definition of what a PRA is?

MR. BARRETT: I think the logic that we are going to apply is that we are going to, and Mary is going to talk about this in just a minute, we are going to lay down our expectation of what is a PRA. And then the second question we are going to ask is, does the -- to what extent does the NEI peer review process give us the assurance that a PRA meets that standard? And it may give us 90 percent confidence, it may give us 100 percent confidence. We need to understand how much confidence it gives us and we need to understand where the deltas are. And then with that, armed with that knowledge, we can go forward to specific applications.

DR. APOSTOLAKIS: I would say, Tom, that there are many cases where you really don't need an uncertainty analysis. It really is very problem-specific. You don't need an explicit quantitative analysis, you always do it in your mind, of course. But that is a lesson that I think one can learn from actual applications, that you don't always need it. But, anyway, we will see when it comes.

DR. POWERS: George, do we have enough cases before us where people have done explicit uncertainty analyses that we are justified in drawing conclusions on when and where you don't need uncertainty analyses?

DR. APOSTOLAKIS: First of all, it depends on what we mean by uncertainty analysis. What I mean is the traditional failure rate type of thing. Yes, when people realized that jumping into a full scope, complete uncertainty analysis PRA was too expensive, they started doing it in phases.

The first phase was, you know, using insights from other PRAs and rough point estimates just to rank things. Very rarely, the insights regarding what is important from this point estimate calculation were upset by a detailed uncertainty analysis, I will say. You pretty much had the good grasp of the major accident sequences most of the time. And then you refine it and you refine it, you go down to more detail and so on. So, there are insights, important insights you can gain without going through the whole exercise.

DR. POWERS: But I guess when I think about detailed uncertainty analysis and PRAs, and where I have seen them, they come up with very few.

DR. APOSTOLAKIS: Very few what?

DR. POWERS: Very few examples.

DR. APOSTOLAKIS: Of complete uncertainty analysis?

DR. POWERS: Any kind of uncertainty analysis at all.

DR. APOSTOLAKIS: Well, the PLG, PRAs are full uncertainty analysis. How many have they done? I don't know. I am sure others have done it, too.

MR. PARRY: I think, though, where the uncertainty analysis is most important is when you are making the decision. And I think even if you look at -- it needn't be, as you say, a full quantitative uncertainty analysis. If you can understand what the sources of the uncertainties are, this is what Reg. Guide 1.174 says, understand the sources of uncertainty and see how they impact the decision.

In fact, if you look at the NEI guidance on categorization, you will see elements of that in that process. An example of what they do is for -- they will do the categorization according to Rohr and Fussell-Vesselly. But they will also ask you to do sensitivity studies to vary some of the parameters that are perhaps the more controversial parameters, and then use the results of those to adjust the categorization. And I think that is an appropriate use of uncertainty analysis in the context of your decision. I don't think you have to have a PRA that has fully quantified everything to play the game for many of these things.

DR. POWERS: Well, I guess what I am asking is, you somehow have reached this judgment that these sensitivity studies and varying some of the parameters is somewhat adequate for the --

MR. PARRY: It is adequate.

DR. POWERS: That it is potentially adequate.

MR. PARRY: Right.

DR. POWERS: And what I am asking is, have we had enough people do something that is akin to what they tried to do in 1150? Has that been done often enough that I can use a judgmental, that I can develop some judgment on when something much less than that is adequate. And George says that -- he is a bright guy, and he has seen a lot of these things, and he says, gee, I can get all the insights I want with very little.

DR. APOSTOLAKIS: Not all.

DR. POWERS: I am not nearly so bright, but I do get to do a lot of uncertainty analyses on deterministic models, and I am always stunned at what I find to be the influential parameters. I am 0 for 10 in outguessing the system.

MR. PARRY: But those are very nonlinear systems.

DR. APOSTOLAKIS: Very nonlinear systems, plus what you say about the number of studies. Yes, in level 1

PRAs for internal events, there are many of them, both nationally, internationally, so things are beginning to converge to a certain picture. You know, you sort of expect to see certain things for PWRs. We had this wonderful compilation of insights from IPEs that Mary put together. Yes, there is a wealth of experience there. You are not going to be surprised.

DR. POWERS: Well, I think of this wonderful compilation that Mary put together, an outstanding piece of work, that I continue to refer to, but, unfortunately, some of its most influential graphs which show the range of results obtained from a variety of analyses do not have uncertainty bars on them. And it makes it very difficult for me to interpret the significance of the range of core damage frequencies among PWRs if I don't have those uncertainty bars there.

DR. APOSTOLAKIS: And that may be an instance where you have to do uncertainty analysis. All I said was that sometimes you get very useful insights without an uncertainty analysis.

DR. POWERS: Well, what I end up doing --

DR. APOSTOLAKIS: And this is the major contributors to risk. I don't think that if you do the point estimate and then you go and round your uncertainty calculations, you are going to upset the order that much.

DR. POWERS: See, what I end up doing is I take Mary's plots and I use them as an ensemble. And I say -- and, so, somebody does a -- gives me a result from a PWR, I plot it, put it on Mary's plot, and I say, now that is the uncertainty that I am going to have to make my decisions in, because it is the ensemble. It is the only thing I have got to go by.

DR. APOSTOLAKIS: I don't know what to say to that. I mean you need uncertainty analysis there, what can I tell you. All I said was there are instances where you don't. You can have 80 percent of your insights by doing a very quick calculation with point estimates, that is all.

MS. DROUIN: And I think if you also go to those wonderful plots, and you look at the outliers that are forming the bands, you may not have uncertainty analysis on them, but on those few outliers you tend to have sensitivity studies and know what the effect of those things are, there is sensitivity analysis.

DR. POWERS: Well, you try to communicate it in your document.

MS. DROUIN: And you know why they are outliers.

DR. POWERS: Why they are there.

MS. DROUIN: So you are getting the same information. You are getting the information that you need to know.

DR. APOSTOLAKIS: Are you going to discuss uncertainty soon, or this is it?

MS. DROUIN: I'm sorry?

DR. APOSTOLAKIS: Uncertainty analysis. Is it going to be discussed separately today? Or we are discussing it now? I mean is there a slide?

MS. DROUIN: Not as a specific topic, as a slide, no. You might see one.

DR. APOSTOLAKIS: I think -- then let me make one last comment.

MS. DROUIN: But I will show --

DR. APOSTOLAKIS: If you have later, that is fine, I will wait. Do you want me to do it now or later?

MS. DROUIN: Do it later.

SPEAKER: Much later.

[Laughter.]

DR. POWERS: Let's go on. I think we have spent enough time on it.

MS. DROUIN: How about when we get into the slide where it will be addressed, even though it is not a specific topic.

MR. BARRETT: Let's skip -- I want to skip to page 12. The intervening pages have all been discussing.

DR. APOSTOLAKIS: Oh, wonderful. You should come here more often, Rich.

MR. BARRETT: Doesn't that feel good when you get to skip over some items. What I have tried to do is just work through three examples. What these examples are, what I have tried to do is pick three examples which are kind of extremes. One in which you are principally relying on the analysis for your assurance. One in which you are principally relying on your qualitative judgment that the risk is low. And one in which you are relying primarily on performance monitoring.

And, unfortunately, in our last minute rush to make this slide, we didn't quite get it right. So, I am going to -- what I want you to do is, on that -- what I have done here is basically say, if you see the word "high," what that means is that there is high reliance on that factor. So risk limitation, high reliance that there is a limited risk. High reliance on the analysis, or high reliance on a good performance monitoring program.

The intent of the first example was to refer to the risk-informed standard tech specs, or, in general, the use of risk for configuration management. Now, you could call the use of a risk monitor, or you could use the example of the industry's proposal to take A-4 of the maintenance rule and the tech specs and rationalize those into a single set of requirements that are risk-informed, or you could refer to element 4 of the risk-informed standard tech specs, which is a proposal for licensees in a -- who reach a LCO, a limiting condition for operation, to use their PRA or use their risk insights to decide what their end state will be.

Any of these examples of using your risk methods to determine the configuration of the plant, we would say that in those cases, the risk limitation is low. You really, you can't say that it is very limited, because the possibility is that you could stray quite a bit from a good configuration if you don't have a good PRA model. So we would say this is an example where you really have to have high consequences -- high confidence, rather, in your analysis methodologies. You cannot limit -- you can limit the risk, but it is very difficult to limit the risk, and it is very difficult to monitor the performance in a timely fashion. So that is an example where you really have to have consequence -- high confidence, I keep saying high consequence, high confidence in your methods. And not only your PRA, but your risk management method.

The second example is risk-informed ISI. Having done the pilots and having done the topicals, the Westinghouse Owners Group topical and the EPRI topical, we have come to the conclusion that the exposure, the risk exposure of this type of an application is not that high. What you are basically doing is you are using risk as one of two criteria for sampling the piping that you are going to look at to try to determine if you have a problem with the welds. And it is good to choose piping in high risk areas, it is also good to use the other criterion, which is to sample piping in areas where you expect to see degradation, but you are not very vulnerable to any error that you might make in selecting those areas. So that is --

DR. APOSTOLAKIS: Why is it high?

MR. BARRETT: We are saying that there is a high confidence that we can accept this application based on the low risk exposure. Okay. And we are not --

DR. APOSTOLAKIS: It means that you have high under tech spec and high under risk-informed ISI.

MR. BARRETT: Yeah, unfortunately, what that should say in the first line is "low."

DR. APOSTOLAKIS: Okay.

MR. BARRETT: All right. Sorry. In our haste to make the slide, we got it wrong.

DR. APOSTOLAKIS: No, that is fine, as long as you tell us what it should say.

MR. BARRETT: It should say "low," "high" --

DR. APOSTOLAKIS: Okay.

That's a case where you are defending -- well, we have made that conclusion and we are not going to be asking licensees for tons and tons on --

DR. APOSTOLAKIS: As I recall the analysis, actually, if you put there "nonexistent" that would be okay too.

MR. BARRETT: And the third example are the steam generator tubes where you know that you cannot say that you have high confidence that the risk is low because you are talking about something that represents two of the barriers.

The potential is there for high risk if you don't have a good handle on steam generator tube degradation so you are either going to have to have very high confidence in your analysis methodologies or you are going to have to place confidence in your ability to monitor performance in a timely way.

DR. APOSTOLAKIS: So tell us what the correct words are. Risk limitation is what?

MR. BARRETT: The risk limitation is low.

DR. APOSTOLAKIS: Analysis, medium?

MR. BARRETT: We think that in this particular case, if you have been following, and I know you have, NEI 97-06, we are putting our eggs in the basket of performance monitoring. We think that if you understand what the licensee finds at the end of a cycle, and then there's timely feedback into their ability to predict what is going to happen in the next cycle that that is where you are getting the risk limitation.

Without going into a great deal of detail, what we have here is three different examples of risk-informed applications where the confidence that you gain is from three different parts of the triad but in most cases we tried to work about six or seven other examples and none of us could agree where to put the highs and lows and mediums, so some of the other applications are not quite so simple.

The reason they are not so simple is because they can interact, because you can, if your PRA isn't good enough to do what you want to do then you will limit what you want to do, so there are tradeoffs.

CHAIRMAN POWERS: I find these examples illuminating. I hope in your document you are going to have several others in there, and it is illuminating in that it tells me the kinds of applications where you think you are going to be getting risk based applications in and it adds a little more meat to the concept of integrated decisionmaking that you are not just relying on the PRA to give you an answer, so I find this a useful slide.

MR. BARRETT: Thank you.

DR. APOSTOLAKIS: A low risk limitation means that the risk is potentially high?

MR. BARRETT: Right.

DR. APOSTOLAKIS: Okay.

[Laughter.]

CHAIRMAN POWERS: You might work on your risk communications a little bit.

[Laughter.]

MR. BARRETT: I have got to work on these two slides. That's all.

DR. KRESS: I think we had something like this, George, in our joint letter where we said that if you have an application where the inherent hazard or risk is fairly low that you don't have to have that good of a PRA and you could rely mostly on just performance and looking at how it goes, but if you had inherently a pretty high risk then you better have a pretty good risk analysis and your performance monitoring might --

CHAIRMAN POWERS: I am still struggling on when can I look at just the frequencies of accidents and I don't have to look at the product of those frequencies and consequences.

DR. APOSTOLAKIS: No, you always look at both.

CHAIRMAN POWERS: There must be some probability that I don't have to --

DR. KRESS: I am sure there is, Dana.

DR. APOSTOLAKIS: The consequences are huge -- no, no, the whole business here is called low probability, high consequence events. I mean you have to look at both.

DR. SEALE: PTS comes close to that, Dana. You said that it is so low that you don't --

CHAIRMAN POWERS: That's a good point --

DR. APOSTOLAKIS: But you know the consequences.

DR. SEALE: Not in their glory, you don't.

CHAIRMAN POWERS: You have a worst case.

DR. SEALE: Yes, that's right.

DR. WALLIS: The problem I have, Rich, with this very nice matrix, nine entries in it, is what does this tell me about the PRA quality subject, and I thought it was in the analysis somewhere, but that is only part of the analysis. I don't know what this tells me about PRA quality.

MR. BARRETT: What this tries to do is to remind everyone that when you look at PRA quality, and Mary is going to talk to you in a lot more detail about PRA quality itself, but you need to look at it in the context of other factors. That's basically what it does.

DR. WALLIS: Does it mean that if I have a low in analyses I don't need a good PRA?

MR. BARRETT: It may very well be that you don't need that -- well, from my perspective as a manager in NRR, it may well be that I don't have to concentrate the kind of resources on the review of that PRA that I might otherwise have to do.

DR. APOSTOLAKIS: Maybe using the word "quality" is not appropriate here. It seems to me we are talking about scope. You can't mean that you will accept something of poor quality because its significance is not high. That doesn't make sense.

You are accepting something that is of smaller scope. Maybe they don't do uncertainty analysis.

MS. DROUIN: Right.

DR. APOSTOLAKIS: Maybe they don't do the human error very well, quantification, otherwise I agree with Dr. Wallis.

MS. DROUIN: We always expect them when they --

DR. APOSTOLAKIS: I mean you can't say the quality is poor but I accept it anyway.

MS. DROUIN: We expect them to do their arithmetic correctly.

DR. APOSTOLAKIS: Of course. It is the scope that is different.

MS. DROUIN: Correct.

MR. PARRY: Quality has to be appropriate for the use that is made of it in this decision.

DR. APOSTOLAKIS: But when you say quality you really mean scope, I think. You can't mean that they are allowed to miscalculate things --

MR. PARRY: No, they have to follow certain basic rules but it's scope, level of detail, level of approximation.

DR. APOSTOLAKIS: That is the scope.

MS. DROUIN: For the scope that applies to the decision being made --

DR. APOSTOLAKIS: Right.

MS. DROUIN: -- the scope has to be done, the technical analysis for that scope has to be done correctly.

DR. APOSTOLAKIS: So the quality is still good.

MS. DROUIN: The quality is still good.

DR. APOSTOLAKIS: It is just a different scope.

MS. DROUIN: For the scope that doesn't apply --

DR. SEALE: You can't get blood out of a turnip.

If the information is not in the analysis you can't make it be there. I mean if you don't know enough to give yourself useful numbers from a PRA point of view about steam generator tubes, you can grind those numbers till the cows come home and you are still not going to get any more than what you got.

DR. APOSTOLAKIS: I really think that using the word "quality" the way we have been using it has created some confusion.

MR. CUNNINGHAM: We agree. I think it is a shorthand that we use.

DR. APOSTOLAKIS: Scope and detail is really the appropriate --

MS. DROUIN: As we go forward, you will see that we have tried not to use the word "quality."

MR. BARRETT: But there are gradations, even in terms of data. How recent is your data? How plant-specific is your data? There are gradations in quality and you --

DR. APOSTOLAKIS: That is a borderline issue, you're right, but I can still call it the scope and detail.

MS. DROUIN: Okay.

DR. APOSTOLAKIS: Ohhhh -- raise it up a little bit, otherwise we'll gave Gareth's head blocking everything.

MS. DROUIN: I'm sorry.

MR. PARRY: You need to raise the slide a little bit.

MS. DROUIN: Better?

DR. APOSTOLAKIS: Yes.

MS. DROUIN: Okay. In looking at the technical acceptability of the PRA that is going to support your decisionmaking process, I think there is a process for determining what that technical acceptability is. That is what is shown here in that shaded box.

You are trying to get risk insights out of the PRA, this process to support your decision, and there's steps here going through starting off with what your PRA is and then looking at it and determining what is the appropriate scope that you need to support those risk insights.

You are either going to be in scope or you are going to be out of scope. If you are in scope, then what are the elements in the characteristics that are needed to support that scope and then imposing a peer review to confirm that technical acceptability, and then coming out of the peer review and you look at the results from that if they are acceptable you are going over to an expert panel to integrate your risk insights.

If it is not acceptable then you are going to go through some decision process on what to do with this unacceptability and the unacceptability might be an insufficiency or it might be a difference or it might be something missing, because you can also get there because you are out of scope, but you would have some kind of expert panel input there too, and then you would go also back to the expert panel to integrate your risk to come through -- to generate your risk insights.

I kind of glossed over this quickly but I am going to go through each one of these boxes. I am just kind of laying the stage here to show you how it all fits together and hopefully as we go through these individually the flow chart will start to gel and make some sense.

So if we start at the beginning we first lay down independent of the application at this point, what is the scope and level of analysis for a PRA. You want to call it a PRA. We're saying here is what the scope and level of analysis is and starting off with your plant operating states the PRA is going to look at your full and low power and your cold and hot shutdown. You want to capture the entire risk.

On your initiating events, you want to consider both internal and external events.

DR. APOSTOLAKIS: Let me understand this. All the time you have to do this?

MS. DROUIN: No.

DR. APOSTOLAKIS: Oh.

MS. DROUIN: No.

DR. APOSTOLAKIS: Okay.

MS. DROUIN: We are going to get back to that. We are just saying right now if you call something a PRA this is what we are calling a PRA and the PRA is going to characterize your risk and we are looking at Level 1, core damage frequency, Level 2, LERF and including late containment failures, and we are not including Level 3 in defining what we mean by a PRA.

DR. APOSTOLAKIS: So you are beginning now to put fires under internal -- that's very good.

MS. DROUIN: We have been doing that for a long time now, George.

DR. APOSTOLAKIS: Really?

MS. DROUIN: Yes.

DR. APOSTOLAKIS: But you kept it a secret from me.

MS. DROUIN: Well, I didn't mean to.

DR. SEALE: Earlier today we'd been talking about our frustration about not having the consequences included in the result of an assessment or that we didn't carry the so-called risk determination to the point of assessing consequences.

It would appear that you are adopting that practice as standard.

MS. DROUIN: I will say what you are seeing now is preliminary, you know, and that is why you do not have, you know, the attachment to the SECY, because we are still formulating, we are still going through and discussing among ourselves.

DR. SEALE: Yes. The reason I mentioned it is, as I said earlier, we had some frustration with the fact that consequences were not a product of some of these so-called risk assessments and so this may very well be a concern we would have with this definition of what you have indicated on the risk characterization. You really haven't come up with consequences.

MS. DROUIN: Correct.

MR. BARRETT: If I could say a word about that, this is something that we are grappling with right now in the context of Option 2 and in the context of the pilot for Option 2.

That is, how do you categorize equipment that has no impact on CDF or LERF, equipment such as containment sprays, containment of fan coolers, filter systems, ventilation systems, and as you get to Option 3 things like containment leakage requirements and in fact we have already been dealing with these in license amendments.

I think I would agree with Mary. I don't think that the right way to do that is to go to a full Level 3 PRA. That is a lot of effort and expense to try to deal with that issue, but we are trying to figure out a way of dealing with that issue.

DR. SEALE: But you can't ignore it though.

MR. BARRETT: We are trying to figure out a way of not ignoring it but at the same time not placing a burden on the PRAs that I don't think they can meet right now.

MR. SIEBER: Those are really defense-in-depth kind of features for the most part.

MR. BARRETT: Yes, they are, but if you play the defense-in-depth card and you say because of defense-in-depth I need all of this stuff and I need all of it to be gold-plated, you are not putting it on the same footing as everything else. We are trying to come up with a way to put it on a similar footing so that you have some criterion that you can use that is comparable to CDF and LERF to make these decisions.

MR. SIEBER: Would you postulate that perhaps some defense-in-depth features would then disappear because they don't have an impact?

MR. BARRETT: I think whatever decision you made you would want to keep into account defense-in-depth.

For instance, suppose a licensee came in and said, well, you know, we think we can live with higher consequences offsite from a TMI type of accident. What would be the considerations?

The considerations might be reductions in your requirements on mitigating systems like sprays. It might be a reduction in your requirements on the leak tightness of the containment, or it might be a reduction in some of the gas treatment systems. In a sense, you might want to make a decision like that considering the defense-in-depth, so you might not say, well, I am not going to take away this or I am not going to take away that, but I might allow you to relax some of those, so you still have defense-in-depth but you have used some criterion to accept some relaxation.

MR. SIEBER: But in the case of containment leakage the probability doesn't change. The consequence changes.

MR. BARRETT: Exactly.

MR. SIEBER: And so if you don't look at Level 3 in the consequences, it doesn't show up.

MR. BARRETT: We try to deal with it qualitatively or at least --

MS. DROUIN: This was a very poor choice of words. When we were saying not required, it did not mean to imply that we weren't concerned about the consequences.

All we were trying to day by that is that we were not going to require a Level 3 PRA, so that was very misleading there.

MR. SIEBER: But the consequence to the public doesn't appear in either CDF or LERF either.

DR. SEALE: Have you entertained the idea of a so-called standard cite?

MR. BARRETT: He has gone that far. You know in past applications, let's take the example of the Decommissioning Technical Report. What we tried to do there was to look at a couple of types of sites, a high population site. We picked a specific site. We postulated a site where the uniform density -- you know, we tried to do it on a generic basis without going to the extent of asking every licensee that decommissions to have a level three PRA.

MR. WALLIS: Richard, your subject is PRA qualitative. If I look at this, I say, "Well, how does this help me access PRA qualities?" I look at this thing and I say "Well, this PRA that I have here doesn't have (inaudible) in it and I think it should have, therefore, it is of low quality" just to live a check list. If I need to evaluate for full quality purposes or how does it --

MS. DROVIN: It depends on the application.

MR. WALLIS: How does it affect my decision about whether or not this PRA is of sufficient quality.

MR. CUNNINGHAM: In a sense yes, though. It is kind of a first screen. You are expecting to see initiators of these types and if you get a PRA submittal and a missing logo or something like that. It's again --

MR. WALLIS: Then I would want to know why.

MR. CUNNINGHAM: And is it important to the application.

MR. APOSTOLAKIS: One question.

MS. DORVIN: We're going to have a slide on that.

MR. APOSTOLAKIS: Is level two really this definition? I thought level two was the source there; wasn't it?

MR. CUNNINGHAM: Yes, that's right.

MR. APOSTOLAKIS: So this is a variation.

MR. KRESS: That's a one plus.

MR. CUNNINGHAM: This is Level one and a half --

MR. APOSTOLAKIS: This is a level one plus.

MR. KRESS: That is what we call it. Yes.

MR. APOSTOLAKIS: Well, the Germans call something else level -- This is new level two perhaps, I don't know.

MR. KRESS: (Inaudible), maybe.

MR. APOSTOLAKIS: Level two minds.

MR. KRESS: It looks at containment cellular level.

MR. APOSTOLAKIS: Just containment, not the actual (inaudible).

MR. KRESS: It is not exactly true that this doesn't have consequences in it because LERF is a measure of consequences.

MR. CUNNINGHAM: LERF. Sure.

MR. KRESS: If you have it there.

MR. PARRY: Can I just add something to respond to Dr. Wallis. I think the way you have to look at this. This is really just a bit of semantics. It helps you define what your PRA contains. So when you come to judge the quality of the PRA, I think you have to judge it in terms of the quality given the scope of the PRA and given the results that it is providing for the decision making. So this is just really -- you don't say that a PRA is of low quality because it has low power and shut down, because it doesn't have low power and shut down in it. If you recognize that one, you're making a decision, and you compensate for that then you have used the results appropriately.

MR. WALLIS: So it doesn't meet the specifications. I would put it that way. Do you need the PRA's for some purpose?

MR. PARRY: I think what the decision, like for example, if we were doing something according to REGI 1174, what it says is that you look at all contributions to risk. Okay, low power and shut down on internal and external events. If you happen to have a PRA that doesn't cover all those things, then you would have to limit the role that the PRA analysis plays in the decision making. But within that context, you can still ask the question of the PRA for the use that it is being made of in the decision. It's no reflection on the quality of the PRA that it does not have a full power -- a low power and shut down portion to it.

MR. SEALE: That's why it's --

MR. POWERS: It seems to me --

MR. PARRY: That why I think we've talked about we don't want to (inaudible) quality in a bad way.

MR. POWERS: It seems to me that you are working here at a fairly high level and I might, as a commissioner, say it doesn't really matter about this stuff, none of the PRA's have most of the things in them anyway. Tell me about the ones that we actually have which are full power PRAs and what you are requiring there. And I might ask questions like: Is it all right for you guys to get a PRA that works only at the system level, or does it have to go to the training level or does it have to go to the component level? Are you going to address those kinds of questions?

MS. DROVIN: Bear with us.

MR. BARRETT: Yes.

MS. DROVIN: I mean we are just starting at the beginning first saying --

MR. POWERS: I understand.

MS. DROVIN: -- saying what the scope of the PRA and again, we are not saying that for every application the scope needs to be this. Remember I said this is independent of the application. We're just saying --

MR. POWERS: This is my checklist on what it's gotten.

MS. DROVIN: For a PRA this is the scope we are looking at. And we wanted to define --

MR. BONACA: I have a question about-- I am sorry.

MS. DROVIN: -- the details for this scope. Yes.

MR. BONACA: Do you consider (inaudible) accidents?

MS. DROVIN: Yes. But we're not covered here. If you went back, we're just talking about reactor activities.

MR. BONACA: But you are going to have that included?

MS. DROVIN: At some point, yes. Right now, I mean, Tom if you wanted to address that --

MR. KRESS: No. No.

MR. BONACA: No, no. I just am saying that, you know, I mean, I know that a lot of PRAs do not include (inaudible) pull accidents, since we've been talking about it.

MR. POWERS: I don't know of too many that do.

MR. KRESS: That's right.

MS. DROVIN: No. We're strictly focused on the reactor right now.

MR. PARRY: Right now this is the reactor.

MR. BONACA: And since you are looking at full low power and shut down, and you have operations there that include transfer to the pool, things of that kind, I would expect that would be part of the scope of a complete PRA.

MS. DROVIN: Ultimately, yes. But right now we're just looking at the reactor part.

So once you've established the scope, given that scope, we go to the next level and looking at the results that we are trying to use in the decision making process defining what those -- what are the results that we want to get out of this scope of a PRA such things as a core damage frequency; large early release; identifying what our dominant accident sequence is; having an understanding of these. So once you have laid out what are these results that you are trying to get out then to specify for the PRA what would be those elements that you need and then what would be the characteristics and attributes of those elements.

So this is the kind of level of detail. We gave you some examples here of what we are going to be getting into. Where we will lay out all the elements and for each of those elements what are the characteristics.

MR. POWERS: Let me ask you a question, and maybe it is just poor understanding on my part. Come along and you say, our initiating events and it says, "It has to be a thorough identification of the initiating events." I presume that's what you mean. And, I think it is pretty clear that none of us could make a thorough identification of the initiating events, or said more fairly, that if you came in with a listing of initiating events, I could always define an initiating event that you had not included in your list.

MS. DROVIN: Okay.

MR. POWERS: And so it wouldn't be thorough. There must be a different definition of thorough here.

MS. DROVIN: Again, I am not trying to say that this is what you need for every application. We are just laying out for a PRA given that scope, given that you want to produce a core damage frequency and you want to produce, you know, what your dominant accident sequences are, I mean, I just gave you some examples of the results, these are the characteristics and attributes that you would want for these elements.

MR. BONACA: I am having trouble with this in terms of quality.

MR. POWERS: So what you are saying really is not thorough but inadequate characterization of the initiating event.

MS. DROVIN: Probably a better choice of words.

MR. POWERS: Yeah.

MS. DROVIN: So then when, for example, when we go to review the certification process or we go to review the ASME standard we would be looking at did they achieve this; does the standard, when we look at the requirements that are in the standard will it give us an adequate identification and characterization of the initiators.

MR. POWERS: Suppose I come into you with my PRA and I say, "Look, I can't get a best estimate analysis code through Graham Wallis' committee. He doesn't like anything I produce. So all I did was come in with bounding conservative estimates on the success criteria." I know I'm conservative on these things, they're not best estimate. I mean, is there anything wrong with that? He's penalizing himself. Didn't have to be best estimate.

MR. CUNNINGHAM: It can be because depending on the application what is conservative and bounding in one application may not be in other application.

MR. POWERS: He has been very careful. He is a very careful guy. I mean he's smart enough to figure out what is conservative and what is not conservative on the outcomes.

MR. CUNNINGHAM: He's a very bright person if he can do that.

MR. POWERS: He's not dumb. He knows he can't get things through Graham.

MR. BARRETT: But if it materially effects the base line core damage frequency and lower frequency, it could put him outside of the acceptable ranges in REGI 1.174. So at some point that licensee is going to end up of putting himself out of the range where we could approve anything.

MR. POWERS: Might want to come in if he done that, I suppose. I mean --

MR. APOSTOLAKIS: Yes, bounding on our leases would probably play a role in some place here (inaudible).

MR. PARRY: I think part of the answer to that is recognizing that it is a bounding analysis and it comes into deciding how you cope with that uncertainty in the decision making. I mean we can't say it as a general rule but I think that is where you would have to address these issues. I mean in principle there is nothing wrong with it, but as long as you recognize what it is and what it is doing to the rest of your decision.

As Mark said what it could do is it could obscure some other things by raising --

MR. POWERS: Very often true.

MR. PARRY: -- raising certain frequencies of sequences that, you know, obscure others.

MR. SEALE: More than that if it is a bounding calculation, you have given up the capability in your PRA to make a value judgment between --

Mr. SHACK: Discrimination.

MR. SEALE: -- two alternative ways of doing things in terms of their risk consequences.

MR. BARRETT: Exactly.

MR. SEALE: Which is the problem we have had from the beginning.

MR. APOSTOLAKIS: This slide does not say anything about uncertainty or not. Is that some where else?

MS. DROVIN: What I was saying its buried in here in the sense that we haven't -- this table here is about three or four pages long.

MR. APOSTOLAKIS: Oh, you are just showing part of it?

MS. DROVIN: I'm sorry, I should have pulled out the one that showed the uncertainty analysis.

MR. APOSTOLAKIS: Okay. Now --

MS. DROVIN: I am just showing you some examples here.

MR. APOSTOLAKIS: Yeah, but all the examples really refer to the construction of the (inaudible) sequences. That is why I was wondering. You are talking about adequate identification of initiators put in the hardware but I --

MS. DROVIN: But all of the elements for --

MR. APOSTOLAKIS: I think it is time that we --

MS. DROVIN: If I go back here --

MR. APOSTOLAKIS: No. I believe you.

MS. DROVIN: I mean we have elements that cover all of this.

MR. APOSTOLAKIS: I believe you, Mary.

MS. DROVIN: You will see.

MR. APOSTOLAKIS: I want to make another point here.

MS. DROVIN: Okay.

MR. APOSTOLAKIS: That it seems to me that the uncertainty analysis that most PRA do, on federal rates and things like that, is really the easy part. The most difficult one is the modulate certainty issue.

MS. DROVIN: Absolutely.

MR. APOSTOLAKIS: And maybe it is time that we started emphasizing that. And at the beginning there will be some, you know, crude approaches perhaps, qualitative waving your arms and so on, but I think it is time we started emphasizing this that unless, in fact, coming back to the area of discussion, you know, can you really do without uncertainty analysis; yes. Now what is it going to opposite the order ranking of the accident sequences; not a different value of the failure rate. It is a model thing. If you have missed something; if you have mismodeled something. So is it a word like mismodeled?

MR. POWERS: If there isn't there ought to be one.

MR. APOSTOLAKIS: If there isn't there should be one.

MS. DROVIN: One of the elements that we have, George --

MR. APOSTOLAKIS: But I really think we ought to start emphasizing that. Recognizing that, you know, the methods, right now to handle it may be are not the best they need some proven. But we really have to do this.

MS. DROVIN: I agree. When you see the full document what you will see is one element that we call interpretation of results. And it get into what you do with the uncertainties.

MR. APOSTOLAKIS: Good. So put it up front.

MR. PARRY: Can I come back to this quality thing.

I am still struggling with quality. Because it seems to me you can have all these list of things you have in these slides here, and then if I -- let me give an example, I only think in terms of examples. If I'm thinking of say the quality of an automobile, there is brown A and there is Brown B, not to mention Rolls Royce and Ford and all those sort of things. And they all have steering wheels; they all have wheels; they all have brakes. They all have these things all these things you listed here all PRAs have. What is it that makes one better quality than another?

MS. DROVIN: Okay, it is not our intent to write in essence a standard. What we are trying to do here is at a high level put the frame work down and we were going to rely on either the standard or the certification to come in and tell us how have they done these things. The detail should be there. We are using --

DR. WALLIS: But how do you judge quality if your quality -- that's the thing -- At the very beginning the question was asked, "how do you define quality." I still don't see it.

MR. APOSTOLAKIS: I think you would go a long way towards answering that question if you selected a few PRAs or IPEs from your wonderful report covering a spectrum of quality as it was judged at that time and go through this process and say, "Look, this is what we decide that this particular PRA or in this particular issue they did the whole job." Because then you will start answering Dr. Wallis' --

DR. WALLIS: And then these sorts of things answer the questions.

MR. APOSTOLAKIS: This is too high level.

MS. DROVIN: And it is meant to be high level.

MR. APOSTOLAKIS: No, I understand. But I think giving a few case -- like Rich did earlier with risk conforming, risk conforming situations. I think you had some good examples there for human liability, for examples, "boy, these guys really did a lossy job." If you can tell us why you judged that and take out the criteria you used and put them in here I think that would go a long way towards answering these questions.

And then, "the other guy did an excellent job," well, why?

Mr. POWER: If I could just parathentically say when you look at the NEI 0002 document, you're going to find high level questions like this analogous to this. But you are also going to see sub-tier criteria of things that get down deeper and ask more detailed questions. If you are reviewing an application, as I said earlier, the first decision you have to make is how deeply are you going to go in a particular area in the review of the particular question.

MR. APOSTOLAKIS: Just a minute.

MR. Power: -- of the type that Mary has here. And that is going to depend on what you see also.

MR. PARRY: I think quality maybe defined in terms of what this garry will do, not what is in it. That goes back to the very beginning.

MR. APOSTOLAKIS: To the decision, yeah.

MS. DROVIN: And we're going to get to that. But I am saying if you just had the PRA and you're trying to judge it based on this thing here and let's use the ASME standard as an example. And if I go in and I'm looking at the initiating event and that there is no requirements in there that tell me how they do an adequate identification and characterization of initiators, they are going to flunk that.

MR. APOSTOLAKIS: Right. At this level, yes.

MS. DROVIN: Because I need that --

MR. APOSTOLAKIS: You're right.

MS. DROVIN: -- to get a technically acceptable PRA. So, I am going to be looking for requirements and all those requirements of sufficient detail to assure that.

Mr. APOSTOLAKIS: I guess Dr. Wallis' question, some of mine go beyond this. You are absolutely right.

Now this is page 15 of 19 and it is 4:05, for twenty-five minutes.

MS. DROVIN: We can do it. Trust me.

MR. POWERS: The question is whether we can do it, either.

MS. DROVIN: I'll talk about us here.

But the next slides, you will see kind of a similar format. Once we have established, you know, we say we have this scope that we have established and these characteristics and attributes that we are going to look at, how do you go about confirming that you've achieved those? One way is through appear/review process. You can use that to confirm your technical acceptability. So now if someone chooses to go that route, so when we look at the NEI certification there will be certain attributes just to that process that we would be looking for such that that process is an adequate mechanism for insuring your technical.

So again, here are some examples where the elements we would be looking for better talked about the team qualifications; the peer review process; the documentation; and then for each of those laying out what we would think would be the characteristics and --

MR. APOSTOLAKIS: You know team qualification is something that I think is utterly misleading.

MS. DROVIN: I'm sorry.

MR. APOSTOLAKIS: Usually, the team qualification, usually it is in terms of how many years you've been in the business, right. You could be in the business -- you could be for twenty-years and be consistently wrong.

MS. DROVIN: I don't think (inaudible) is.

MR. APOSTOLAKIS: I mean it's not a problem. I think the process it really what matters in qualifications. Conflicts of interest, I mean, yeah, right.

MR. PARRY: That may exclude anybody that knows anything valuable.

MR. APOSTOLAKIS: By the way you don't have twenty-five minutes because Mr. Bradley will have a few minutes.

MS. DROVIN: Okay.

MR. APOSTOLAKIS: Okay, we understand where you are coming from.

MS. DROVIN: The next one gets into the heart, in some sense, because we do recognize that not every application needs to meet that scope or all of those elements and attributes. So how do you go about deciding what needs to be in scope; what needs to be out of scope such that you have technically acceptable PRA and you can have confidence in the results you are going to be using to generate your risk insights.

MR. SEALE: So you're going to housesit us?

MS. DROVIN: So there is some, a decision process, that you can go through. We've tried to layout what we think are the necessary elements of this process and then for each of the elements what would be the characteristics and attributes for each element.

Then the last piece is getting to the expert panel. The expert panel review has a potential to be used in two ways. First taking your results to integrate them into the decision process, integrate your risk insights. The other thing is that when you look at your PRA and when you are out of scope or say you're in scope and you haven't done your arithmetic correctly, or you have some difference or some deficiency and you are going to use your extra panel to make up for that.

MR. APOSTOLAKIS: You know we are doing a lot of that, and I don't like it.

MS. DROVIN: Excuse me.

MR. APOSTOLAKIS: Every time a method is found to have problems we say, " Why don't the expert finally take care of that?" So I would be very cautious --

MS. DROVIN: Oh, I agree.

MR. APOSTOLAKIS: -- using that kind of argument. I mean, if the importance measures have a problem why don't the expert find out what to do about it. We miss something, ah, let the expert find it.

MR. SEALE: By the time you get the well developed

PRA, you may even have some expert panel members that are truly qualified.

Mr. Shack: Well, you might.

MR. SEALE: And their related process. They are an inverse process.

MS. DROVIN: So again, given that those are the two ways that an expert panel can be used, we are trying to identify what would be the necessary elements of an expert panel considering those two applications and then what would be, again, the characteristics and attributes, and again, these are just examples this is not complete just to give you a flavor of where we are going. And those are all the pieces that fill the (inaudible)

MR. APOSTOLAKIS: I think it would help you a lot and us for sure, if you actually -- if you would set an example from the ideas that you are very familiar with. Go through them; apply your criteria here and say, "Well, gee, my decision at the time was that this was a poor analysis." "Can I conclude that by strictly applying what I have here or do I have to expand this?" I think you are going to learn a hell of a lot by doing that, and then you are also going to convince others. Because I remember there were some outlines, right?

MS. DROVIN: Oh, yes. We can walk you through some examples.

MR. APOSTOLAKIS: You came in here you gave us reasons and so on. Are these judgments, you used at the time, do these judgments flow naturally from what you have here or do you have to add something; and then you will be able to answer Dr. Wallis' concerns, I think, much much better. But also you will have to select some good ones.

MR. CUNNINGHAM: Yes, that's right. You'd have to pick some --

MR. APOSTOLAKIS: Show that, you know, yeah, we decided that this was a very good one because this and that.

MR. CUNNINGHAM: That's right.

MR. APOSTOLAKIS: Because the problem is the (inaudible) presentation not the high level stuff. So I would like to see that and it shouldn't be hard for you to do especially, Mary.

MS. DROVIN: Yes, we've gone through several so we can do that.

MR. APOSTOLAKIS: Okay.

MS. DROVIN: Our last slide is (inaudible).

MR. APOSTOLAKIS: It's so sketch.

MR. SEALE: It's sketch.

MR. APOSTOLAKIS: I can't believe that you are talking about the weeks, usually here it is years.

MR. CUNNINGHAM: Well, sometimes you have schedules opposed upon you. At any rate, the bottom line on this is that we got two or three items facing us right now that are all related to this issue of PRA quality, if you will. How are we going to review the ASME; how we're going to review ANS; how are we going to review the NE document, any "I" documents in the context of option two.

What you heard about is a brief description of how we are going to take that on in a more integral way. Our goal is in the next couple of weeks to put together a commission paper that lays this out. We are going to be discussing with the PRE Steering Committee in the middle of June. The idea is to have the paper to the DDO on June 27th.

MR. APOSTOLAKIS: What is RILP, R-I-L-P?

MR. CUNNINGHAM: Risk Informed Licensing Panel. That is a panel of, basically, division directors but some others. Tom is the vice-chair, Gary Hollihand, is the chairman. It is used to air issues among the various organizations in NRA on risk informed issues, basically.

MR. APOSTOLAKIS: So they are risked informed in the since that they understand PRE?

MR. CUNNINGHAM: They bring together all of the disciplines that are (inaudible), yes. Believers and skeptics all brought together to hammer out the issues.

MR. APOSTOLAKIS: Are you asking us to write anything?

MR. CUNNINGHAM: No, we are not asking you to write a letter at this point. That you have nothing, as you said at the beginning --

MR. APOSTOLAKIS: That's right.

MR. CUNNINGHAM: We have nothing -- we've provided you nothing so it wouldn't be fair to ask to write a letter.

MR. APOSTOLAKIS: Would you like us to write one in July; or you really don't care?

Mr. King: Yes, we would like you to write something in July. This is Tom King.

MR. APOSTOLAKIS: Oh, you would?

Mr. King: Yes.

MR. CUNNINGHAM: Yes.

Mr. King: It is unfortunate do to the schedule we didn't have time to get you something in advance.

MR. APOSTOLAKIS: That's all right.

Mr. King: But, you know, consider this in effect what we are writing is a high level standard review plan that the staff is going to use to assess the various things that are on our plate that deal with PRE quality. And I think when you --

MR. APOSTOLAKIS: That is all we will have to review then (inaudible) schedule for (inaudible).

Mr. King: I think a letter in July would be very useful.

MR. APOSTOLAKIS: Anything else, lady and gentlemen?

Mr. King: Thank you for your time.

MR. APOSTOLAKIS: Well, maybe we can give Mr. Bradley a few minutes and thank you very much. Very cordial as usual.

Mr. King: Thank you.

BIFF BRADLEY

MR. APOSTOLAKIS: Welcome back, Mr. Bradley,

MR. BRADLEY: Back again. I am Biff Bradley. I am with the Indiana staff in their Regulatory Reform area. I think that I have more time than I need. I don't have a lot.

Mr APOSTOLAKIS: You don't have to use all of it.

MR. BRADLEY: Good. Well, you know bereavety is the sole of wit. I concur with, I think, everything I heard the staff just say and I think, you know, the philosophy that was laid out, there is no fundamental disagreement with that.

Mr. KRESS: Is it a lot like the certification process, the NEI certification process? What they laid out?

MR. BRADLEY: Well, I think what they laid out is one, it has to be -- as an acknowledgment there will have to be some NRC review for any application and I view the standard or certification process as a means to streamline and expedite that review and whichever one you use.

I also concur that it is like a, you know, trying to define truth or duty -- trying to define quality in the abstract of -- it is not a -- I think has created a lot of problems. In my view, quality has to be defined in the contents to the application. Maybe suitability is a better word to be using. And I think, you know, for option two, as we move along and we understand what the application is and what is involved, you know, we came to the conclusion that we could use this certification process for that particular application and that is what we submitted to NRC with respect to review for that purpose.

So, we look forward to working with the staff and working through the issues with the certification process. I think we've, you know, struggled a lot with the ASME standard and it has been in the context of trying to write a standard that would envelope all the different applications that are going on and that is a very difficult thing to do, and it is much easier to address a specific application and come to grips of what you need to do that.

The one thing I would mention, there was a fair discussion, not a discussion, of IPEs. I think the industry, we are going to have to take some initiative to update the data bank that is out there with regard to what has been done. IPEs are becoming, you know, extremely obsolete.

MR. APOSTOLAKIS: Becoming, Biff. Becoming.

MR. BRADLEY: Well, they have and we moved way beyond that. But I think it tends to be, that what is sort of in the public record, you know, and that's what -- we need to establish a new record that gets us --

MR. POWERS: Well, the IPEs are the sole virtue and up to datedness compare the IP tripilees.

MR. BRADLEY: Yeah.

MR. APOSTOLAKIS: No. But the reason that he brought up the IPEs is not to use them in any particular way, but to actually show what good or bad is in that context of that particular analysis for plan A. I mean we are not going to sing loud to anybody.

MR. BRADLEY: Right. So, you know, generally, I look forward to seeing the commission paper and we are, you know, facing a lot of challenges in regulatory reform and despite the amount of publicity that this PRA quality issue gets, I think there are other challenges in regulatory reform that are going to be more difficult in having to do with how you reform the regulatory treatment in light of these insights and how you measure the impact of that. And so, I view the categorization of something we can successfully accomplish.

I think the harder part is going to be dealing with non-internal events risk because generally you are going to be using some qualitative, or semi-quantitative methods there. If it is something we are going to do in the next, you know, reasonable five years or so.

So, you know, please to hear what the staff had to say and I think the industry concurs with the approach that was laid out.

MR. APOSTOLAKIS: I think you would help the whole thing along if you and the staff agree to drop the word "quality". Supergroup, perhaps, is a good word. Quality is really bad.

MR. POWERS: Unfortunately, it is the commission that is the one that has used the word.

MR. APOSTOLAKIS: Sometimes the commission uses staff's words. I mean, if the staff comes back and it says this is the reason. I think the commission will be willing to listen. You always want quality.

MR. BRADLEY: Right.

MR. APOSTOLAKIS: Quality is always there.

MR. POWERS: Well, I will -- many of you have not enjoyed the things that Dr. KRESS and I enjoyed during our careers at the National Laboratory where we learned that quality doesn't always mean what you think the dictionary says quality is.

MR. APOSTOLAKIS: [Laughter].

MR. POWERS: We learned definitions like, satisfying requirements of the customer and any number of other things that have --

MR. APOSTOLAKIS: To avoid fault.

MR. POWERS: -- a unique definition to the word quality. So --

MR. APOSTOLAKIS: You satisfies

DR. SEALE: Whimsy is the characteristic of many of these words.

DR. POWERS: That is why one of the reasons I asked for the definition of quality at the beginning.

DR. SEALE: Right.

MR. POWERS: Unfortunately, I had been brainwashed to learn --

MR. SEALE: MR. BRADLEY --

MR. POWERS: -- to give up my knowledge of the English language and adopt a bureaucratic knowledge of the word quality.

MR. APOSTOLAKIS: Dr. Seale.

DR. SEALE: You have had input to this process, clearly, in much the same way the NRC staff has in working with the ASME and also, I guess, the ANS people who are working on the other two parts of it. And presumably, but presumably, in addition to those inputs as you have gone along, you are going to be doing a similar review of the final document to, if you will, paint your imprint on this overall standard in much the same way that the NRC staff has done it.

Are you going to steal their outline and follow it when you go home, or if you got another outline of how you are going to go -- through process you are going to go through in reviewing the ASME standard?

MR. BRADLEY: If I understand your question correctly, I think much of that has already transpired in the writing of the standard. There is a history going back a couple of years and at various times I think the staff has, you know, weighed in with their position and then the industry has weighed in. I think our general sense has been that a standard should reflect to the degree possible and appropriate existing practice. And we at the existing practice in this case is the peer review process that has been developed and it has been applied. So our efforts as an industry has been to make the standard comport with that process to the degree we can and I think it has come a long way. We are looking at Rev. 12 now, and it will be out for public comment. And our view, I think a success in this is if we have a standard and ASME standard that is reasonably consistent with our process of (inaudible).

MR. SEALE: Thank you. That is a very fair characterization of your position. I appreciate it.

MR. APOSTOLAKIS: Okay, anything else? Any other comments?

Thank you, Biff.

MR. BRADLEY: Sure.

MR. APOSTOLAKIS: Back to you, Mr. Chairman

MR. POWERS: Thank you very much.

At this point we can dispense with the transcription.

[Whereupon, the recorded portion of the meeting was recessed, to reconvene at 8:30 a.m., Thursday, June 8, 2000.]

REPORTER'S CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

NAME OF PROCEEDING: 473RD ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

CASE NUMBER:

PLACE OF PROCEEDING: Rockville, MD

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

Mike Paulus

Official Reporter

Ann Riley & Associates, Ltd.

GSI-173A

Generic Spent Fuel Storage Pool
Part A: Operating Facilities

Christopher Gratton
Division of Systems Safety and Analysis
Office of Nuclear Reactor Regulation

GSI-173A

Generic Spent Fuel Storage Pool
Part A: Operating Facilities

- Purpose of the Presentation
- Background - Identification of Issues
- Evaluation of Issues
- Follow Up Actions
- Closing GSI-173A

GSI-173A

Purpose of the Presentation

- Review the Status of Spent Fuel Storage Issues for Operating Plants
- Obtain Agreement that GSI-173A Should Be Closed

GSI-173A

Background

- Initial Issue Identified
  - Susquehanna 10 CFR Part 21 Report
- Generic Spent Fuel Storage Pool Action Plan
  - Technical Review Identified and Evaluated Design Features Regarding Spent Fuel Storage
- AEOD Study on Spent Fuel Pool Cooling
  - Evaluated Likelihood and Consequence of Extended Cooling Loss

GSI-173A

Generic Spent Fuel Storage Pool
Part A: Operating Facilities

- Technical Review Focused on SFP Design Features and Safety Functions
- Coolant Inventory
  - Lacks Passive Anti-siphon Protection
  - Potential for Draining Through the Fuel Transfer System
  - Potential for Draining Through Interfacing Systems
  - Absence of a Direct Low Level Alarm
  - Lacks Liner Leakoff Isolation

GSI-173A

Generic Spent Fuel Storage Pool
Part A: Operating Facilities

- Coolant Temperature
  - Structural Intergrity and Leak Tightness Under Normal, Accident and Environmental Loading
  - Coolant Purification Cannot Be Performed at Elevated SFP Temperatures
  - Environmental Effects of High SFP Temperature - Multi-Unit Issues
  - Cooling System Reliability and Capability

GSI-173A

Generic Spent Fuel Storage Pool
Part A: Operating Facilities

- Fuel Reactivity
  - Solid Neutron Absorbers
  - Soluable Boron

GSI-173A

Generic Spent Fuel Storage Pool
Part A: Operating Facilities

- Results of the Technical Review:
  - Existing Facilities Meet Regulations
  - Follow Up on Certain Plant Specific Design Features
  - Other Planned Actions
- ACRS Presentation - August 9, 1996
  - Presented the Results of the Review of Spent Fuel Storage Issues to Full Committee
  - Committee Satisfied with Staff Actions
  - Letter Not Deemed Necessary at the Time

GSI-173A

Generic Spent Fuel Storage Pool
Part A: Operating Facilities

- Follow Up Actions on Plant Specific Design Features
  - Group 1: Plant Specific Regulatory Analyses (7)
    - Antisiphon
    - Transfer Tube in the SFP
    - Piping Entering SFP Below Fuel
    - Limited Level Instrumentation
    - Shared Systems and Structures at Multi-Unit Sites
    - Absence of On-site Power for SFP Cooling Systems
    - Limited Instrumentation for Loss of Cooling

GSI-173A

Generic Spent Fuel Storage Pool
Part A: Operating Facilities

- Follow Up Actions on Plant Specific Design Features (Cont.)
  - Group 2: Evaluate Additional Information (4)
    - Absence of Leak Detection/Isolation for Liner
    - Limited DHR Capability
    - Infrequently Used Backup Systems
    - Refueling Cavity Seal

GSI-173A

Generic Spent Fuel Storage Pool
Part A: Operating Facilities

- Overall Results of Plant Specific Follow Up Activities:
  - Group 1: Design Features Requiring Regulatory Analysis
    - Five design features did not meet screening criteria
    - One design feature closed by voluntary actions
    - One design feature exceeded minimum screening criteria and was subject to further evaluation
  - Group 2: Design Features Requiring Further Evaluation
    - Based on the review of additional information, the staff determined further regulatory analysis not warranted for these four design features

GSI-173A

Generic Spent Fuel Storage Pool
Part A: Operating Facilities

- Plant Specific Regulatory Analysis Results - Design Features Meeting Screening Criteria
  - Draining Through the Fuel Transfer System
  - Draining Through Interfacing Systems
  - Absence of a Direct Low Level Alarm
  - Absence of On-site Power for SFP Cooling Systems
  - Limited Instrumentation for Loss of Cooling

GSI-173A

Generic Spent Fuel Storage Pool
Part A: Operating Facilities

- Plant Specific Regulatory Analysis Results - Design Feature Not Meeting Screening Criteria
  - Shared Systems and Structures at Multi-Unit Sites
    - 13 plants with this design feature
    - Staff visited at Hatch and Dresden
    - Evaluation expanded to include all plants for this issue
    - Onsite power for SFP cooling system - Low likelihood of sustained boiling
    - Staff concluded no further regulatory action warranted for this design feature

GSI-173A

Generic Spent Fuel Storage Pool
Part A: Operating Facilities

- Results of the Review of Additional Information for Plant Specific Design Features
  - Administrative Controls
  - Plant Specific System Design and Operation
  - Previous NRC Evaluations

GSI-173A

Summary - Generic Safety Issue 173A

- Evaluation of GSI 173A Technical Issues Concluded - Existing Facilities Are In Compliance with the Regulations
- Follow Up Actions on Plant Specific Design Features Identified No Additional Regulatory Actions
- Close GSI-173A

BRIEFING TO THE ACRS ON THE DRAFT REPORT - REGULATORY EFFECTIVENESS OF THE SBO RULE

BY
BILL RAUGHLEY
OFFICE OF REGULATORY RESEARCH

JUNE 7, 2000

BACKGROUND

- Report will provide basis to respond to Commission
- SBO definition and risks
- SBO rule historical highlights
  - Regulatory requirements and guidance before the SBO rule
  -SBO rule evolution
  -SBO rule technical basis and regulatory analysis
- SBO rule, 10 CFR 50.63
  -SBO coping duration based on individual plant design factors
  -Procedures to cope with an SBO
  -Modifications, if any
- Related documents
  -Initially RG 1.155 (NSAC -108, NUMARC 87-00)
  -Subsequently maintenance rule documents from resolution of GSI B-56, "EDG Reliability"

ASSESSMENT

- **Regulatory Effectiveness**
  - -A regulation is effective if expectations are being achieved
  - -Regulation includes rule, regulatory guide, and inspection documents

- **Scope**
  - -Is the SBO rule effective and if any areas need attention
  - -Plant specific problems not addressed
  - -GSI-23 on RCP seal failure previously addressed

- **Method**
  - -Compared the expectations to the outcomes using objective measures in areas of risk, value-impact, coping time, and EDG reliability
  - -Used operating experience for trends in LOOP frequency and duration

- **Data**
  - -Expectations from NRC documents
  - -Outcomes from NRC PRA/IPE databases, LERs, SBO safety evaluations, and NRC reliability studies

RESULTS

- **Industry Wide Risk Reduction in Mean SBO CDF**
  - -3.2E-05/RY reduction which is more than 2.6E-05/RY expected
  - -Plants that had the greatest vulnerability did the most
  - -Plant shutdown with power supply unavailability may increase risk

- **Value-Impact**
  - -Outcome is just within range of expected averted rem
  - -NRC underestimated value and impact from added power supplies

- **Minimum Acceptable Coping Time**

- **EDG Reliability**
  - - Based on unit average safety performance from DRAFT INEL 95/0035
    - 0.95 target reliabilities met with and without MOOS at power
    - 0.975 target reliabilities difficult considering MOOS at power
  - -Plant followup found differences in analytical and site EDG reliabilities
  - -Many licensees could demonstrate additional SBO CDF reductions

EDG PERFORMANCE BASIS

- **NUREG-1032**
  - -MOOS while at power and non-power small (0.006)
  - -Equipment and system boundary included load sequencer
  - -Used actual test/unplanned demands to count valid starts/load-runs

- **RG 1.155**
  - -Minimum individual target reliability of 0.95 or 0.975 excluding MOOS (0.007)
  - -Notes that MOOS must not be excessive to achieve EDG failure rates
  - -Endorses NUMARC 87-00-monitor EDG unavailability versus industry

- **RG 1.160, Rev 2**
  - -Use as a goal or performance criterion
    - RG 1.155 target reliabilities, or
    - IPE unavailability assumptions in comparison to industry, or
    - Maintenance preventable failures.
  - -Balance reliability and unavailability
  - -Endorses NUMARC 93-01- allows PRA/IPE EDG performance assumptions

EDG PERFORMANCE BASIS

- RG 1.9, Rev 3
  -Valid starts/load runs includes conditional failures from maintenance
  -System boundary used to count failures excludes load sequencer

- SBO rule and maintenance rule inspection documents use NUMARC 87-00, Rev 1, Appendix D triggers values for assessing compliance to RG 1.155 target reliabilities

INSIGHTS FROM OPERATING EXPERIENCE

- Modifications Due to the SBO rule have been used to provide for safe shutdown and economic benefit
- Generally favorable LOOP frequency and duration; EDG(s) worked when needed
- Provide additional defense in depth from changing offsite power trends due to deregulation
- Potential SBO Alternate ac power source unavailability

CONCLUSIONS

- SBO rule was effective and the costs were reasonable
- Opportunities to improve the clarity of regulatory documents
  -RG 1.155, RG 1.9, and RG 1.160 EDG reliability calculation terms revisions
  -Inspection documents
  -RG1.93
- Lesson learned- to extent that regulatory documents are revised to be risk-informed and performance based, need to ensure consistent interpretation and use of terms, goals, criteria, and measurements.

Final Regulatory Guide 1.183 (DG-1081)

Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors

Final SRP 15.0.1

Radiological Consequence Analyses Using Alternative Source Terms

Stephen F. LaVie

NRR/DSSA/SPSB

Background

- 06/30/98 Rulemaking plan for implementation of revised source terms at currently operating reactors (SECY-98-158)
  - New rule section § 50.67
  - Miscellaneous conforming changes
  - New regulatory guide
    - Supersedes RG 1.3, 1.4, 1.5, 1.25, 1.77
  - New standard review plan section
- 06/30/98 Re-baselining study (SECY-98-154)

Background

- ☆03/11/99 Draft rule published in Federal Register *(ACRS 11/98)*
- ☆12/23/99 Final Rule published in Federal Register *(ACRS 9/99)*
  - ☆Includes announcement of public comment period on Draft Guide DG-1081 and Draft SRP 15.0.1
- ☆01/24/00 Final rule effective
- ☆03/31/00 Public comment period ends

ACRS6_7PN4 Slide 3 *Implementation of Alternative Source Terms at Operating Reactors*

Public Comments

- ☆6 Comment letters
  - ☆NEI
  - ☆NUGEQ
  - ☆Duke Energy
  - ☆Virginia Power
  - ☆STPNOC
  - ☆FPC
- ☆Several informal comments (e-mail, etc.)
- ☆Addressed ACRS recommendations (10/99 ltr)
- ☆138 total comments

ACRS6_7PN4 Slide 4 *Implementation of Alternative Source Terms at Operating Reactors*

Significant Changes

- ☆ Fuel Gap Fraction
- ☆ Fuel Handling Accident Chemical Form
- ☆ Selective Implementation
- ☆ 50.59 Guidance
- ☆ Other Technical Changes

Fuel Gap Fractions

- ☆ Industry suggested changes
  - ☆ Gap fraction ranging from 3% at 50 GWD/MTU to 9.3% at 75 GWD/MTU
  - ☆ Allow licensee to vary gap fraction across core
  - ☆ Address fuel heatup impact separately
- ☆ Staff Concerns
  - ☆ Insufficient experimental data to support iodine gap fractions above 65 GWD/MTU
    - ☆ Majority of industry data for low burnup; few data points above 62 GWD/MTU
  - ☆ Uncertainties in gap fraction data
    - ☆ Data from actual fuel; no operational transients addressed
    - ☆ Current fuel management more aggressive than that under which data collected
    - ☆ In majority of experiments, iodine is not measured directly

Gap--Staff Approach

- ☆ Use NUREG-1465 data for LOCA (0-62 GWD/MTU)
- ☆ Use RG 1.77 data for reactivity insertion accidents
- ☆ Work by PNNL to address environmental impact of change in fuel burnup from 60 to 62 GWD/MTU reported in this period
  - ☆ Will be documented as update to NUREG/CR-5009
- ☆ PNNL Analyses
  - ☆ Core average and peak rod average at 35, 60, and 65 GWD/MTU
  - ☆ FRAPCON-3 Code w/ Missah release model
  - ☆ Best estimate approach
  - ☆ No operational transients addressed
  - ☆ Core inventories calculated to 75 GWD/MTU
- ☆ Base RG on PNNL analyses with some adjustments
- ☆ Balance uncertainty in gap fractions with other analysis conservatisms (e.g., peak burnup rod in peak power position)

Fuel Gap Fractions

	DG-1081	LOCA	Non-LOCA		RIA
Burnup, GWD/MTU=	0-62	0-62	0-40	40-62	0-62
I-131	0.12	0.05	0.05	0.08	0.1
Kr-85	0.15	0.05	0.06	0.1	0.3
Other NG	0.1	0.05	0.03	0.05	0.1
Other Halogen	0.1	0.05	0.03	0.05	0.1
Alkali Metals	0.1	0.05	0.08	0.12	0.0

- ☆ Gap fraction associated with peak rod burnup in core is used with rod inventory adjusted for maximum radial peaking factor
- ☆ Optional for accidents other than FHA, RIA, LOCA: if location of damaged fuel in core can be projected with reasonable certainty, can use assembly-specific gap fraction and radial peaking factors (not less than 1.0) on assembly-by-assembly basis

Fuel Handling Accident Iodine Species

- ☆ DG-1081 retained Safety Guide 25 species--99.75% elemental, 0.25% organic
- ☆ Industry suggested using NUREG-1465 species
- ☆ Staff concerned about low pH of fuel pool, lack of transport data (e.g., pool DF)
- ☆ Final guide:
  - ☆ Release from fuel is 95% CsI, 4.85% elemental, 0.15% organic
  - ☆ CsI completely dissociates in pool water, re-evolving as elemental iodine
  - ☆ With pool effective DF=200, release from pool is 57% elemental, 43% organic
  - ☆ Justifiable mechanistic treatments considered on case-by-case basis

Selective Implementation

- ☆ DG-1081 required licensees desiring to extend an approved AST implementation to another application in the plant to request prior approval
- ☆ Final Guide:
  - ☆ Subsequent modifications using the approved AST characteristics incorporated into the design basis possible under § 50.59.
  - ☆ Prior staff approval under § 50.67 required if:
    - ☆ Use of AST characteristics or TEDE criteria not in the approved design basis.
    - ☆ Changes to previously approved AST characteristics.
- ☆ Revised position consistent with new § 50.59 guidance and § 50.67

§ 50.59 Guidance

☆ **Issue:**

- ☆ **Under guidance of DG-1081, it is possible to have some design basis calculations based on TID14844 and the traditional whole body and thyroid doses, while others are based on AST and TEDE.**
- ☆ **Guidance requires each these analysis to be updated to AST and TEDE if it is recalculated for any reason in future.**
- ☆ **How does one determine increase in consequences when dose quantities and criteria are different?**

☆ **Solution:**

- ☆ **Guidance added to final guide to convert prior analysis results before making § 50.59 comparison.**
- ☆ $TEDE_{prior} = WB_{prior} + (Thyroid_{prior} * 0.03)$

Other Technical Changes

☆ EQ

- ☆ **Since GSI not resolved, text was added to final guide to allow use of TID14844 or AST for re-analyses required under the guide.**
- ☆ **Added general guidance for calculation of EQ doses outside of containment**

☆ Steam Generator iodine Transport

- ☆ **Corrected error regarding decontamination credit when tubes are uncovered.**

☆ Containment Spray DF

- ☆ **Corrected error related to maximum spray DF when using SRP model**

☆ Building Mixing Credit for FHA

- ☆ **All credit on case-by-case basis with suitable justification; guidance provided**

☆ Passive ECCS leakage (50 gpm) Evaluation (w/ LOCA)

- ☆ **Requirement deleted**

ACRS Recommendation

- ACRS recommended that the requirement to have prior NRC approval for *"changes...that result in a reduction in safety margins"* should be re-evaluated for removal in light of both the analytical assessments performed by RES and the results of the pilot applications of the alternative source term. (ACRS discussion identified § 50.59 as alternative.)
- Staff committed to re-evaluating this requirement during public comment period in light of § 50.59 guidance.
- Staff has retained language in guide.
  - Guide applies to initial implementation for which § 50.59 is not applicable.
  - Rebaseling and pilots provided useful insights, but the limited sample of plants considered does not provide an a prioi basis to summarily disposition all potential plant-specific and modification-specific impacts
- Staff added language referencing § 50.59 for subsequent plant modifications.

ACRS Recommendation

- ACRS recommended that the staff should modify the proposed redefinition of the source term to eliminate the connotation that the release is necessarily to the containment but should retain the wording *"...release from the RCS..."*
- Staff declined to change rule language; committed to reviewing the draft guide to ensure that our description of the alternative source term for the LOCA does not misrepresent the NUREG-1465 basis
  - § 50.2 definition has to address accidents, other than a LOCA, that result in fuel damage, but may not involve RCS or containment
  - Accident-specific appendices in DG-1081 provide source term guidance.
  - Final guide is a standalone document. User does not need to refer to NUREG-1465 to be able to use the guide.
- Clarifications added to the final guide to ensure that the release for a LOCA is defined as the release from the RCS to the containment.

United States
Nuclear Regulatory Commission

Response to SRM on PRA Quality

Mary Drouin, Mark Cunningham Division of Risk Analysis and Applications Office of Nuclear Regulatory Research	Richard Barrett, Gareth Parry, Michael Cheok Division of System Safety and Analysis Office of Nuclear Reactor Regulation

Presentation to

Advisory Committee on Reactor Safeguards

June 7, 2000

OUTLINE

- Background
- Proposed Response to SRM
- Contents of Attachment
- Schedule/Milestones

Background

- Staff faced with issue of the PRA quality needed for risk-informed regulatory activities and the need for an integrated, uniform approach

  - Response to April 18, 2000, SRM

    "The staff should provide its recommendations to the Commission for addressing the issue of PRA quality until the ASME and ANS standards have been completed, including the potential role of an industry PRA certification process."

  - Review of Option 2 documents, including NEI certification submittal

Background (cont.)

- Review of draft standards, endorsement of final standards

	Draft	Final
ASME	6/00	1/01
ANS - Seismic	6/00	9/00
ANS - LPS*	9/00	12/00

*ANS anticipates delay

Proposed Response to SRM

- Summarize what staff is now doing
- Propose/recommend/inform Commission of additional activities
- Develop staff documents
- Update RG 1.174, SRP Chapter 19
- Review submittals against positions
- Review standards and NEI guidelines for possible endorsement

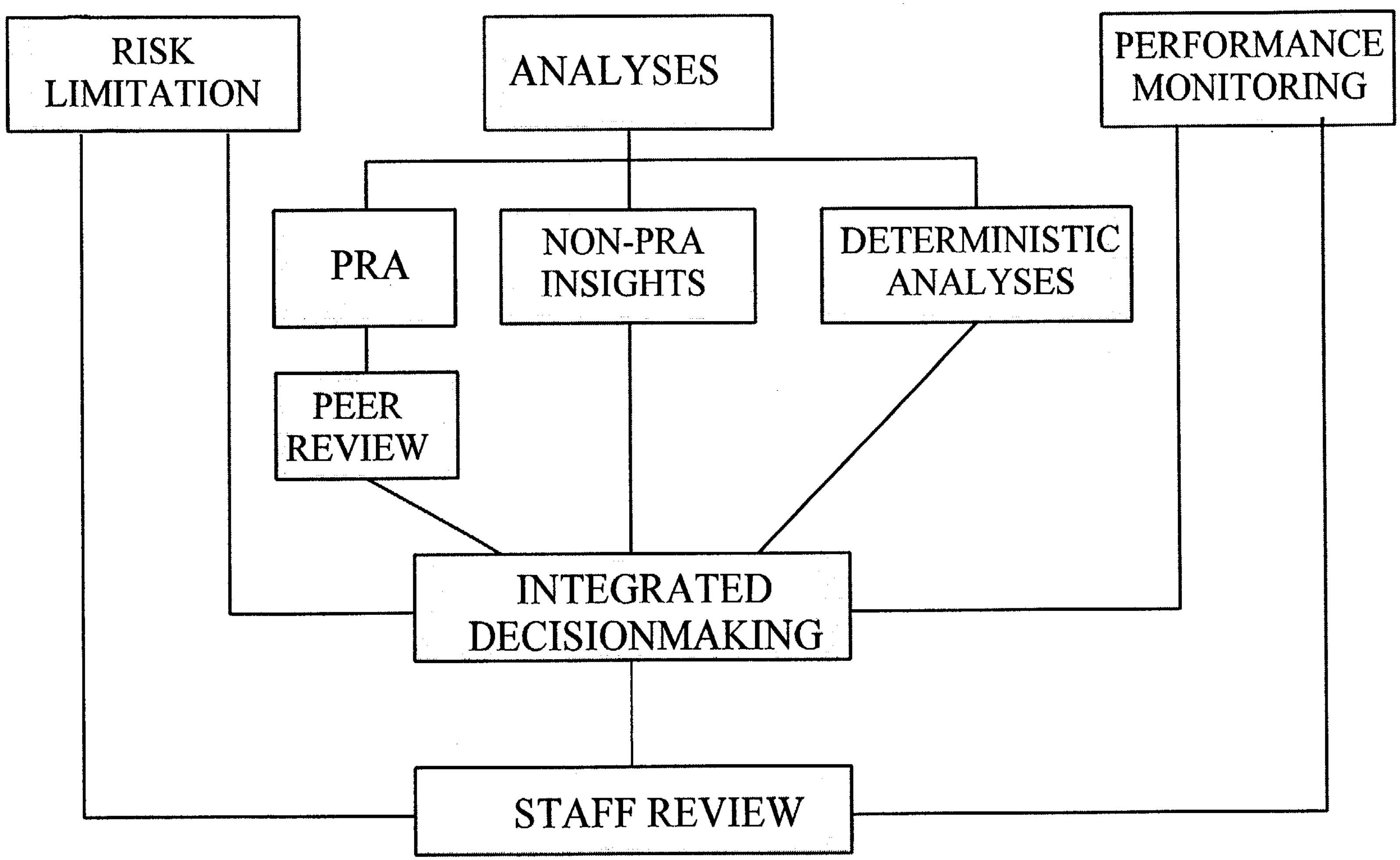
Proposed Response to SRM -- Attachment

- Risk-Informed Reactor Activities
- NRC Decision-making Process
- PRA Technical Acceptability
  - PRA scope and level of analysis
  - PRA elements and characteristics
  - Peer review
  - PRA application process
  - Expert panel

RISK-INFORMED REACTOR ACTIVITIES

- Risk-Inform 10CFR Part 50
- Plant Oversight Process
- Operating Events Assessment
- License Amendments

NRC DECISION-MAKING PROCESS



Factors Controlling Potential Increases in Risk

RISK LIMITATION

- Nature of the application

  "Categorization of equipment for the purpose of determining regulatory treatment"

- Extent of the application

- Controls and backstops

  Configuration risk management / Maintenance rule a(4)

  Functionality

- Limits and focuses the need for analysis

PERFORMANCE MONITORING

Attributes

- Measures and criteria
- Timely detection
- Margin of safety

Examples

- Maintenance rule monitoring
- Steam generator tube condition monitoring

ANALYSIS

- PRA
  - Quantitative risk estimates
    Focused on relevant issues
  - Standards
  - Peer review / Certification

- Non - PRA Risk Insights
  - Generic results
  - Qualitative findings

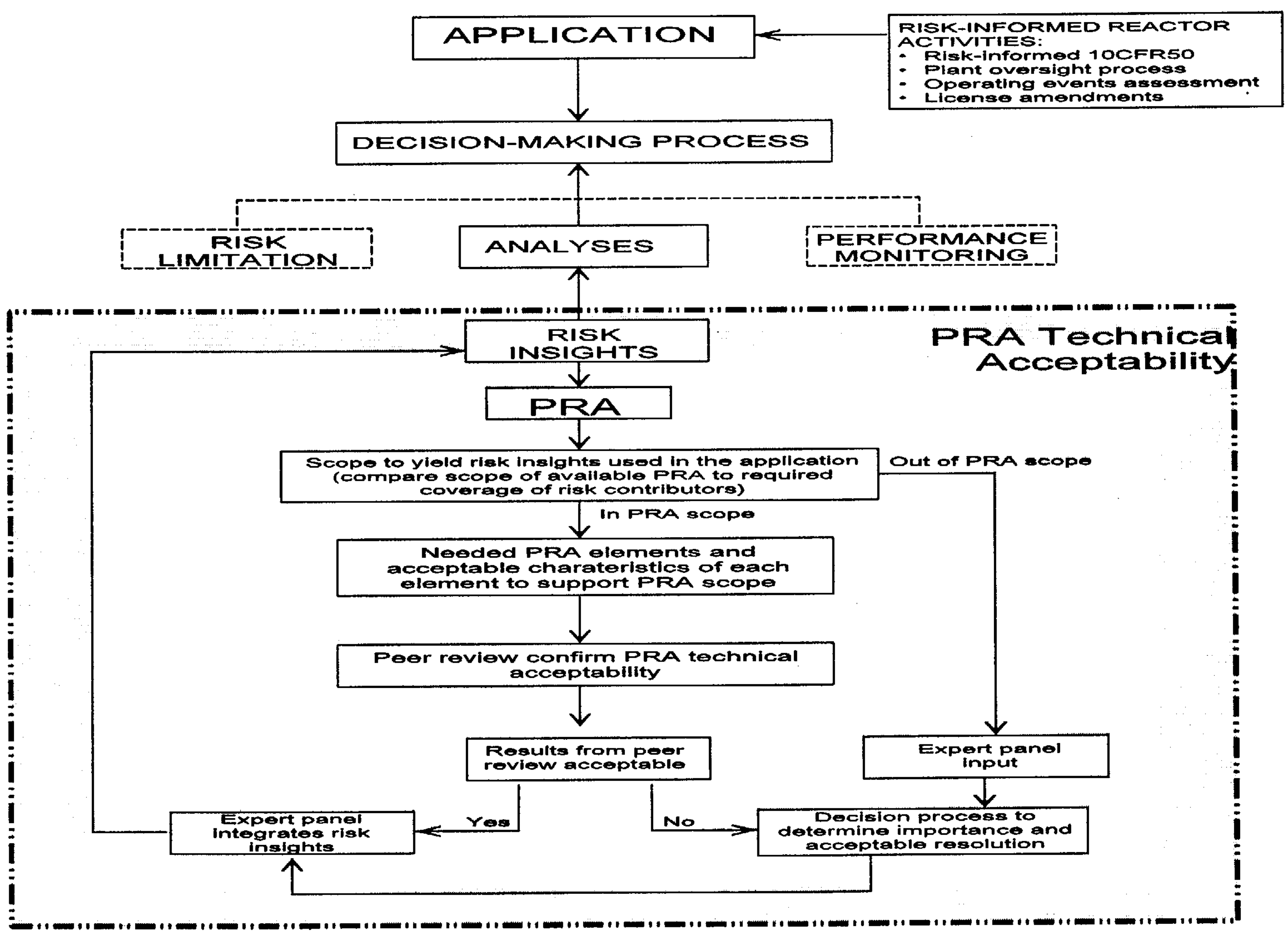
- Deterministic Analysis
  - Defense in depth
  - Margins

- Integrated decision making

ROLE OF FACTORS IN RISK-INFORMED APPLICATIONS

	RISK LIMITATION	ANALYSES	PERFORMANCE MONITORING
Tech spec AOT	high	high	med
RI-ISI	high	med	low
SG tubes	low	med	high

PROCESS FOR ESTABLISHING PRA TECHNICAL ACCEPTABILITY



SCOPE AND LEVEL OF ANALYSIS OF A PRA

Scope/Level Definition	Requirements
POS	full and low power, hot and cold shutdown
Initiating Events	internal • transients • LOCAs • floods • fires external • seismic • high wind • others
Risk Characterization	Level 1: core damage frequency
	Level 2: LERF and late containment failures
	Level 3: not required

TECHNICAL ELEMENTS AND CHARACTERISTICS OF A PRA

- Identify the PRA results used in the decision-making process (e.g., CDF, LERF, dominant accident sequences and associated contributors)
- Specify the technical elements (e.g., initiating event analysis)
- Identify the needed characteristics and attributes for each element

Element	Required Characteristics and Attributes
Initiating Event	• thorough identification and characterization of initiators • grouping of individual events according to plant response and mitigating requirements
Success Criteria	• based on best-estimate engineering analyses applicable to the actual plant design
Accident Sequence Development	• defined in terms of hardware, operator action, and timing requirements • includes all necessary and sufficient equipment (safety and non-safety) reasonably expected to be used to mitigate initiators • includes functional, phenomenological, and operational dependencies and interfaces

PEER REVIEW

- A peer review process can be used to help confirm the technical acceptability of a PRA

- Specify the necessary elements of a peer review process
  - team qualifications
  - peer review process
  - documentation

- Identify the needed characteristics and attributes for each element

Element	Required Characteristics and Attributes
Team Qualifications	• independent with no conflicts of interest • expertise in all the technical elements of a PRA including integration • knowledge of the plant design and operation • knowledge of the peer review process
Documentation	• describe the peer review team qualifications • describe the peer review process • document where PRA does not meet requirements of PRA standard • document adequacy of PRA maintenance process to incorporate plant modifications • assess and document significance of deficiencies

PRA APPLICATION PROCESS

- Required PRA scope and technical requirements may vary depending on application

- Specify the necessary elements of an application process
  - Define the application
  - Examine PRA scope and level of detail
  - Determine sufficiency of PRA "standard"
  - Determine sufficiency of PRA
  - Resolve insufficiencies and differences

- Identify the needed characteristics and attributes for each element

Element	Required Characteristics and Attributes
Examine PRA Scope and Level of Detail	▸ determination of the existing PRA scope ▸ determination of the existing PRA modeled SSCs ▸ determination of resolution for insufficient aspects
Determine Sufficiency of PRA Standard	▸ determination of sufficiency of PRA standard to assess the application under consideration ▸ determination of resolution for insufficient aspects
Determine Sufficiency of PRA	▸ identification of differences between PRA and the standard's requirements ▸ determination of the importance of the differences ▸ determination of resolution for important differences

EXPERT PANEL

- PRA results may be integrated into the decision-making process by an expert panel
- Expert panel may be used to evaluate the importance of missing risk information
- Specify the necessary elements of a expert panel process
  - Decision-making process
  - Technical information bases
  - Incorporation of non-PRA Modeled Components
  - Identification of Limitations
  - Panel Member Qualifications
  - Documentation
- Identify the needed characteristics and attributes for each element

Element	Required Characteristics and Attributes
Decision-making Process	• decision-making process appropriate • appropriate information available • evaluation of risk significance represents appropriate consideration of issues
Incorporation of non-PRA Modeled Components	• evaluate in a systematic manner the safety significance of components not modeled in the PRA but affected by a proposed application
Identification of Limitations	• process applied by the licensee to overcome limitations of PRA is appropriate • decisions made that do not follow straightforwardly from the PRA require a technical basis that shows how the PRA information and the supplementary information validly combine to support the finding, and • no findings contradict the PRA in a fundamental way

Key Short-Term Milestones

- Discuss general approach with RILP — June 1
- Discuss approach, draft Commission paper with PRA Steering Committee — June 15
- Commission paper to EDO — June 27