# DISCLAIMER

UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

July 9, 2008

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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554TH MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

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WEDNESDAY,

JULY 9, 2008

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The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, Rockville, Maryland, at 8:30 a.m., WILLIAM J. SHACK, Ph.D., Chair, presiding.

MEMBERS PRESENT:

WILLIAM J. SHACK, Chair

MARIO V. BONACA, Vice Chair

SAID ABDEL-KHALIK, Member-at-Large

GEORGE E. APOSTOLAKIS

J. SAM ARMIJO

SANJOY BANERJEE

DENNIS C. BLEY

CHARLES H. BROWN, JR.

MICHAEL L. CORRADINI

OTTO L. MAYNARD

DANA A. POWERS

MEMBERS PRESENT (Continued):

HAROLD B. RAY

MICHAEL T. RYAN

JOHN D. SIEBER

JOHN W. STETKAR

I-N-D-E-X

I-N-D-E-X (Continued)

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

14) OPENING REMARKS BY THE ACRS CHAIRMAN

1.1) OPENING STATEMENT

CHAIRMAN SHACK: The meeting will now come to order. And it's a minute early. It's actually three minutes early. This is the first day of the 554th meeting of the Advisory Committee on Reactor Safeguards. During today's meeting, the Committee will consider the following: stretch power uprate application for Millstone Power Station, Unit 3, selected chapters of the safety evaluation report associated with the ESBWR design certification application, some safeguards and security matters, and preparation of ACRS reports.

Portions of the sessions related to the stretch power uprate application for Millstone unit 3 and ESBWR design certification application may be closed to protect proprietary information applicable to these matters pursuant to 5 USC 552b(c)(4).

Also, a portion of the session on safeguards and security matters will be closed to protect information classified as national security information as well as safeguards information pursuant to 5 USC 552b(c)(1) and (3).

This meeting is being conducted in

accordance with the provisions of the Federal Advisory Committee Act. Mr. Sam Duraiswamy is the designated federal official for the initial portion of the meeting.

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

We have received no written comments from members of the public regarding today's sessions. We have received a request from Ms. Nancy Burton, Connecticut Coalition Against Millstone, for time to make oral statements regarding Millstone unit 3 power uprate. Also, we have received a request from Jim Riccio, Greenpeace, for time to make an oral statement regarding safeguard and security matters.

1.2) ITEMS OF CURRENT INTEREST

CHAIRMAN SHACK: I will begin with some items of current interest. I point out to the members you might want to look at the items of interest. In particular, there is a speech by Commissioner Lyons, in which he refers to some ACRS letters on digital I&C.

We would like to welcome aboard Mr. Harold

Ray and Dr. Michael Ryan. We are now full statutory strength of 15 members of the ACRS. Our new members are official members, and welcome aboard.

MEMBER RAY: Thank you.

(Applause.)

CHAIRMAN SHACK: I would like to welcome some new staff people to the ACRS. Jessica Marsden, a summer intern who came on board recently, is a senior at the University of Delaware studying sociology with a concentration in social welfare. She may understand the dynamics of the Committee.

She plans to attend the University of Maryland, Baltimore to work towards a Master's degree in sociology. I think she's --

(Applause.)

CHAIRMAN SHACK: Michael Lee Benson graduated with a Ph.D. from the University of Tennessee at Knoxville in May 2008. His major was material science and engineering.

Michael has performed experimental work in his thesis in the areas of fatigue, fracture, and mechanical behavior of metallic materials. All right.

Under the Nuclear Safety Professional Development Program, he has joined the NRC ACRS as a general engineer on July 7th, 2008. Welcome aboard.

(Applause.)

CHAIRMAN SHACK: And it is with regret that I also want to make an announcement about the departure of Frank Gillespie. This will be the last ACRS meeting for which Frank is the Executive Director of the ACRS.

Frank has been an Executive Director for a relatively short time compared to our usual range of Executive Directors, but I think he has done some important things to get us ready for the onslaught of what we hope will be applications for new reactor licenses. And I think he has left us well-prepared.

He has had a long and illustrious history at the NRC. Just in the time I have been on the ACRS, I have seen him here wearing so many hats it's hard to keep track of. But Frank has been a pioneer in risk-informed regulation and license renewal work. And, as I say, I think he has done an excellent job in the time that he has been with the ACRS.

And I know we wish him well in his new job with a vendor, Mitsubishi, working on the APWR reactor.

(Applause.)

CHAIRMAN SHACK: He will be back on the other side of the table.

Our first topic this morning is a stretch power uprate application for the Millstone Power Station Unit 3. And Jack Sieber will be leading us through that.

MEMBER SIEBER: Thank you, Mr. Chairman.

2) STRETCH POWER UPRATE APPLICATION FOR MILLSTONE POWER STATION, UNIT 3

2.1) REMARKS BY THE SUBCOMMITTEE CHAIRMAN

MEMBER SIEBER: Yesterday, we had the subcommittee meeting on the Millstone 3 stretch power uprate, at which ten members were present. So this will be a review for those ten, and five members were not here. So these will be new presentations for them.

At yesterday's meeting, we decided that we would concentrate our efforts today on the stretch power uprate overview, fuel and safety analysis, and the containment analysis due to the limited time that we have.

What I would like to do is to introduce Joseph Giitter, who is Director of the Division of Operator Reactor Licensing in NRR, to introduce the topics and the speakers this morning.

MR. GIITTER: Thank you, Dr. Sieber.

2.2) BRIEFING BY AND DISCUSSIONS WITH

REPRESENTATIVES OF THE NRC STAFF, DOMINION NUCLEAR CONNECTICUT, INC. AND ITS CONTRACTOR

MR. GIITTER: Good morning. I'm Joe Gitter. I've only been in my job for about a week, so you are going to have to pardon me. I can tell you based on my interaction with the staff that this is an area where the staff has been working very hard.

The staff has focused on providing products that are technically excellent. And today you're going to hear in a little more detail what the staff has done in their review of the stretch power uprate for the Dominion Nuclear Connecticut application.

The licensee submitted a license amendment request for an approximately seven percent stretch power uprate on June 13th, 2007 for Millstone Power Station Unit 3 and the proposed SPU would increase the maximum authorized power level of Millstone 3 from 3,411 megawatts-thermal to 3,650 megawatts-thermal.

By memorandum from Frank Gillespie, Executive Director of the ACRS, to Luis Reyes, then the Executive Director for Operations, it was -- the memo was dated April 23rd, 2008, the ACRS decided to review the proposed SPU for Millstone 3.

As I said earlier, I believe you are going to hear the results of a thorough NRC staff review of the application submitted by DNC. One thing I will add is that we had frequent communications with the licensee that involved conference calls, letters, meetings, and we believe that substantially facilitated an effective and efficient review.

Finally, there were several rounds of requests for additional information, or RAIs, issued to the licensee. The RAIs were submitted as they were developed, allowing the licensee as much time as possible to review and respond to the RAIs in different technical areas.

The most challenging review area that you are going to hear about in the next couple of hours is the fuel and core design analysis. As presented in the safety evaluation, which was provided to the ACRS in June 11th, 2008, there are no current technical issues open in the staff's, NRC staff's, review of DNC's proposed SPU.

In summary, I am pleased with the thoroughness of the review conducted by the NRC staff. And I am also very pleased with the effective and extensive interactions with DNC on a number of diverse technical issues.

At this point I would like to turn the

discussions over to our NRR Senior Project Manager to my left, John Lamb, who will introduce the discussions.

MR. LAMB: Good morning. My name is John Lamb. I am the Senior Project Manager in NRR assigned to the Millstone 3 stretch power uprate.

The staff's primary concern is safety. Our purpose is to convince you over the course of the next couple of hours that the staff's safety evaluation, or SE, for the Millstone Power Station Unit 3 SPU provides reasonable assurance that the health and safety of the public will not be endangered by operation of the proposed SPU. We hope that you agree with this and reflect this in your letter report.

Before I go over the agenda, I would like to present some background information related to the staff's review of the proposed Millstone 3's SPU.

Millstone 3 is a Westinghouse four-loop pressurized water reactor, or PWR. The proposed SPU would increase the maximum authorized thermal power level from the current licensed power level of 3,411 megawatts-thermal to 3,650 megawatts-thermal. This represents an approximate seven percent increase from the current licensed thermal power. On January 31st, 1986, the NRC licensed Millstone 3 for full power operation at 3,411 megawatts-thermal.

Millstone 3 has a renewed license. The ACRS reviewed the Millstone license renewal during the 525th meeting and wrote a letter report dated September 22nd, 2005 recommending that the license renewal be approved.

Millstone 3 license renewal was approved in October 2005 under NUREG-1838, titled, Safety Evaluation Report related to the license renewal of the Millstone power station units 2 and 3. The Millstone 3 renewed operating license now expires November 25th, 2045.

Per the Millstone 3 SPU, the staff used RS-001, which is the renewed standard for extended power uprates, as guidance along with an internal document titled Power Uprate Guidance, provided by memorandum from Christopher P. Jackson to the NRC to the Special Projects Branch of the NRC dated February 6th, 2006 as well as the experience gained from previously approved Westinghouse SPUs, such as Indian Point 2 and 3 and Seabrook.

The review standard includes a safety evaluation template as well as matrices that correspond to the maintenance areas that are to be reviewed by the staff as well as specific guidance and the acceptance criteria that apply to those review areas.

Provided ACRS writes a letter report that states that Millstone 3 SPU should be issued, DNC has requested that the staff issue the proposed SPU amendment by August 15th, 2008. DNC plans to implement the proposed approximately 10 percent Millstone SPU after completing the Fall 2008 refueling.

Basically DNC's application followed the guidelines of the review standard for extended power uprates. DNC applied for an SPU amendment by letter dated July 13th, 2007. There were 33 supplements. The majority of these dealt with responses to the 107 requests for additional information, the staff questions.

The staff spent a great deal of time reviewing the fuel and safety analysis. After I conclude my remarks, DNC will provide an overview of their licensing approach as well as their modifications required and their implementation schedule. This will be followed by presentations from the licensee and the staff on the fuel and safety analysis and containment analysis.

This concludes my presentation as far as an introduction. I would like to turn it over to Mr. J. Alan Price, DNC site Vice President for Millstone Power Station. This is a position Mr. Price has held since January 2002. Mr. Price has approximately 29 years of experience in commercial nuclear power operations. Here is Mr. Price.

MR. PRICE: Good morning. Mr. Chairman and Committee members, I appreciate the opportunity to come before the full ACRS Committee today and discuss the proposed power uprate for the Millstone unit number 3.

Just by way of background for how Dominion has approached our power uprate project on unit number 3, we opted to not outsource this to a third party. We maintain responsibility in-house.

So we put together a specific project team comprised of a significant number of Dominion personnel. And then we engaged some 15 to 20 outside vendors to help us, including a number of our original equipment manufacturers, including Westinghouse as well as General Electric.

Early in the process, we established an executive oversight committee to provide oversight for the project monitoring major milestones, expected project deliverables, as well as a margin management and the different potential modifications that we would have to make to our facility. I generally chair that executive oversight committee in my capacity as a site vice president.

Just in way of background for myself, I did hold a senior reactor operator's license at Surry for about five years. That's where I began my career. I've held a number of positions, including Director of Nuclear Safety and Licensing at Surry, held Director of Nuclear Engineering for Virginia's plants, the Surry and the North Anna plants. I was plant manager for Millstone unit number 2. And I have been in my current capacity for the last six and a half years.

Some of the other members of our project team include Mike O'Connor, who will be talking later today. Mike previously was a shift manager on unit number 3, held a senior reactor operator's license for about five years, currently holds the position of engineering manager.

Paul Russell, currently one of our operating experts on a power uprate project, the unit supervisor on unit 3, also holds a senior reactor operator's license.

Mike Kai, who will be one of our principal speakers today, holds a position of a principal engineer within our company. Mike is the recognized expert across the Dominion fleet in the areas of safety analysis and fuel performance.

And another member that I would like to bring attention to is Mr. Dave Bucheit. Dave is our recognized expert in the area of PRA. He is also recognized in Region I, Region II, and Region III, where our reactors reside.

Yesterday we covered in detail with the subcommittee comparisons and analyses for pre-power uprate and post-power uprate for Millstone unit number 3. Through the discussions and questions and answers with the subcommittee, we discussed the areas of performance for fuel, safety analysis, radiation effluents, radiation doses, containment performance, environmental qualification, and other areas.

The discussions led to a number of comparisons and deltas between Millstone unit 3, Millstone unit 2, Beaver Valley, Indian Point, Zion, and a number of other power stations.

What became clear, at least to me, is while there were differences in licensing bases and design bases for a number of the plants that we discussed yesterday, ultimately we all have a responsibility to meet the statutory regulations.

Today our focus is going to be on the analyses that we did and the conclusions that we have reached with regard to unit number 3 power uprate and do we meet regulatory requirements, whether there are margins that remain, and how will we maintain those margins.

We will maintain those margins through a variety of ways. One way is we are doing physical plant modifications. One of the physical modifications that we will be performing is a replacement of the steam turbines for our main feed pumps. We could have done a weld overlay for the first stage turbine blades. That would have given us adequate margins. We have elected, instead, to replace the turbines to give us additional margins, additional conservatism.

Another way that we will go about maintaining margin and enhancing margin on the units is through setpoint changes and through scaling changes. These will be hard wire, logic changes.

Another way that we will maintain margin or gain margin is by making hard-wired logic changes in our Emergency Core Cooling System. We call that permissive P19. It is a new permissive for Millstone unit number 3.

We think it significantly enhances the safety of the unit. And we would have pursued this change, whether we pursue the power uprate or not. And Mike Kai and Mike O'Connor will be happy to talk about this in detail during their presentation.

The other way that we are gaining margin and managing margin is through incorporation of new, recognized and more modern analysis, analytical tools and analysis techniques. So you will hear about that in some of the other presentations also.

Feedback from yesterday, as the Chairman has already indicated, is that we should focus on fuel, safety analysis, and containment.

We did take some time last evening. We restructured some of our overheads. You should have copies of those in front of you. And that will help us focus on the topics of interest today.

If you kept notes, those of you who attended yesterday, those presentation slides still remain valid. And if you would like to refer to those, we will just direct you to the correct slide to help us through our discussion today.

We are prepared to talk about any of the other areas of interest that the full Committee may have. And that completes my prepared remarks. Do you have questions for me before I turn it over?

(No audible response.)

MR. PRICE: Okay. Thank you very much.

PARTICIPANT: Good morning. I'll start off by saying thank you for giving me the opportunity to present the work that we have done on fuel and safety analysis. We had a full and a frank discussion yesterday and addressed a number of issues.

As Alan said, we are going to focus on the areas of meeting our regulatory requirements and what we have done to maintain margin, safety margins, in our plant. We'll start with the fuel.

The key factor in our evaluations and analysis is that the we are not making any fuel design changes. We are using exactly the same fuel that is in our core today. When we do the uprate, implement the uprate, we will have a core that is 100 percent, 17 by 17 RFA2 fuel assembly, fuel type. We have the advantage of not having to address any mixed core issues in our analysis.

We will achieve the uprate by increasing the feed size. Things like burnup will remain. Limits will be the same. Boron concentration limits will be the same. No changes in that, those areas.

We are reducing the peaking factor design limits to increase the NBR margins.

MEMBER CORRADINI: Can I ask you a question there? So if I were to see how you operate the fuel under the extended power, the shape of the flux will change? I'm looking at your last bullet and interpreting that to mean that you are lowering, you are taking from some shape like this and flattening the core shape a bit.

MR. KAI: Keep in mind we're talking about limits and not the actual -- I mean, obviously the actual power distribution when we designed the core will be below that limit. So what we are doing is -- yes.

And there will obviously be some minor changes. I don't expect very major changes in terms of the power distribution. We are reducing the design limits our core designers have to live with, a lower limit in design limits in power distribution.

So I think -- I mean, obviously you are right; we are putting more feed in there that the power should be somewhat flatter.

MEMBER CORRADINI: Okay. All right. That's what I get by the fourth bullet. I wanted to make sure I understood that. Thank you.

MR. KAI: This slide just gives you some information about what the --

MEMBER BROWN: Let me -- I missed something, maybe yesterday, that I don't understand. You are putting the same fuel design back in. You've got that. You've got more burnup. And you've got a higher power level.

So intuitively, I would think you have to put more fuel in. Is that right? And I thought I heard yesterday that you were going to put more clusters or something like that, more --

MR. GUERCI: I'm John Guerci, Manager.

I think I can answer that question. The batch fraction is increased by approximately eight fuel assemblies. So we are going from a feed batch of 76 to approximately a feed batch of 84 assemblies.

MEMBER BROWN: So that is what you put in when you refuel?

MR. GUERCI: Correct. And that is how we will take on the additional energy. Our burnup limits, our boron limits, and everything else are essentially the same.

MEMBER BROWN: But there is volume there to do that? I just think there's --

MR. GUERCI: Well, we are placing --

MEMBER BROWN: We've got space in the reactor vessel.

MR. GUERCI: Our normal feed would be 72 to 76 assemblies, fresh assemblies. Normal feed will be increasing to 80 to 84 assemblies. So we will feed more fresh assemblies during --

MEMBER BROWN: You take more old stuff out?

MR. GUERCI: That is correct.

MEMBER BROWN: So did you have dry fuel storage?

MR. GUERCI: At Millstone 3, we do not. Right now our pool is large enough to accommodate our storage capacity.

Okay? Any other questions?

(No audible response.)

MR. KAI: This slide just reemphasizes and actually provides some more detailed information about our fuel. Like I said, we have 17 by 17 RFA-2 that will be going forward in the SPU design, our entire core, integral fuel, burnable poison IFTHA. We will be adding more IFTHAs to offset the increased reactivity of the additional fuel.

We do have annular pellets in axial blankets. That's unchanged.

MEMBER CORRADINI: Are we allowed to ask in an open session? Is this gadolinium? Or add coating onto the pellets?

MR. KAI: That is correct. It is a standard Westinghouse product.

And the maximum enrichment is unchanged.

We will talk a little bit about initial conditions. That's a key factor when you do uprates. We currently are analyzed for a single nominal temperature at 100 percent power. And we do not have any analysis that allows us to do a temperature close-down at the end of the cycle.

When we went into this uprate, we wanted to give ourselves some more operational flexibility. So we have done the SPU analysis with an 8 degree nominal temperature bound at 100 percent power. And we have also done the analysis, including a 10-degree coast-down capability, temperature coast-down capability.

So, really, if you look at our safety analysis that's done over a much wider range of temperatures, we use both extremes. And we find the limiting condition for all of the transient analysis at either end of the temperature bound. This allows us to have fully analyzed anywhere within this bound to give operational flexibility.

We have decided, however, to operate with the same nominal temperature as current. And obviously when you do uprates, one of the concerns is issues such as stress corrosion cracking, which can be caused by higher temperatures.

So by maintaining the same nominal temperature, we minimize the increase in hot leg temperature and the temperature that we see. We show -- if you think about this when you operate with the same T-ave with a higher power level, that the hot leg temperature will increase, modest temperature increase.

We have shown some small impact on the life of tubes and Alloy 600 components on the hot side. On the cold side, with the same T-ave, we will have a slightly lower T-cold and, therefore, perhaps get some minor benefit. And those Alloy 600 components include bar-mounted instrument tubes and the upper head penetrations.

The other key factor in initial conditions is pressurizer level. And this is a balance between what we need for operational margin and what we need for design basis transients.

Obviously as you raise the pressurizer

level, at which pressurizer level you will reduce your margin to pressurizer overfill for transients that we analyze, and most notably the inadvertent ECCS actuation.

On the other hand, you need to also maintain, take into account that you will get more shrinkage from a normal reactor trip, and so you need to maintain operational margin so that the low and routine reactor trip may not result in such actions as let-down isolation and heat.

So we had to make a compromise. We are raising the pressurizer level slightly. It's going from 61 and a half to 64 percent at 100 percent power.

MEMBER BROWN: Well, on the subject of margins, you talked about margin management. At some point -- and I don't want to get off on a tangent here now.

But the margin available during transients, like loss of feed bar, to overfill came up yesterday, but it really wasn't discussed significantly. If we have time, I would like to revisit that.

MR. KAI: Okay.

MEMBER BROWN: Let me add one note to that. In the context of this request, since that one was tight and I brought the subject up, it would be nice if we could get just a couple of statements as to what it would take to open that up again, instead of having the plant modifications or the operational procedures, whatever it is, such that under the loss of feed, instead of hitting 1,731 out of 1,800 cubic feet, you can push that back down.

That was a major change going from 1,000 to 1,700 cubic feet of volume, over 1,700.

MR. KAI: I understand that. Next couple of slides.

We will talk about the safety analysis in general first. And then we will talk about the slight pressurizer overflow.

One thing I would like to point out is that when we went into this uprate, we decided to essentially redo all of the accident analyses from scratch, even those that were not necessarily affected by uprate.

We went through, and we revalidated every input into the analyses to make sure that they are current and applicable at the uprate conditions. So we did an extensive effort to essentially establish brand new calculations for all of our accident analyses.

Obviously when you do uprate, margins are a key factor. We wanted to make sure that when we came out of the uprate, that we would still have substantial margins for operation.

As you can see in a short listing of the margins that we have, I believe that we have achieved that. We have maintained about 12 percent DNBR margin. The LOCA PCT calculations are quite low. And we have margins on containment pressure.

MEMBER CORRADINI: I wasn't here yesterday, but I think I understand. I just want to make sure I understand that besides the stretch power, you also changed the method of analysis.

So two things changed. One, you went up seven percent. And then your method of analysis went from I'll call it Appendix K traditional to your best estimate with uncertainty?

If you are going to come to that later, that's fine. I just want to make sure I understand the two pieces.

MR. KAI: Yes. We have done that, correct. But in general, what we're relying on for margins is the modifications and not analysis methods. And luckily on most event trees, it's not really LOCA-limited in terms of being close, currently, to the limits.

You know, in my opinion, I'm pretty sure that we could have shown acceptable results with the old methods. It's just that when we're talking about redoing everything at uprate, we want to go posture ourselves to go forward into the future. So we really just said, okay, what is the best technology available? We weren't looking necessarily for margins.

MEMBER CORRADINI: So you're not LOCA-limited? Are you store heat-limited for the DNBR?

MR. KAI: Yes. DNBR was one of the areas that we need to look at. There are two major areas of concern. There was one: DNBR. And the other was the margins of overflowing pressurizer.

MEMBER BANERJEE: Well, I have a remark. If they had stayed with appendix K for the large break LOCA, they had come up fairly close to the limit.

MEMBER SIEBER: Yes.

MR. KAI: Yes, right.

MEMBER BANERJEE: So the best estimate plus uncertainty, which they did 124 runs or something, with the 95-95 is combine them.

MR. KAI: The arcing margin, you're

correct. We probably -- you are right. We would probably be close to the limit.

MEMBER BANERJEE: It would become a LOCA-limited plant with appendix K.

MEMBER SIEBER: No. You're --

MEMBER BANERJEE: It's pretty close. Pretty close. I can do it by hand more or less looking at the --

MEMBER CORRADINI: I understand, but I guess the way this listed out and the way you answered it, you're still now, or were and now still, CHF or DNBR-limited.

MR. KAI: You are correct that if we had not done that, that you're right. We probably would be pretty close and may, in fact, have been limited. But, like I said --

MEMBER BANERJEE: It's fine what you did. I mean, I have no issues with that.

MR. BUCHEIT: This is Dave Bucheit, Manager of Safety Engineering.

Just to emphasize that the older, large break LOCA methods are not phenomenologically based as the ASTRUM is. There are a number of issues with --

MR. KAI: Okay. And the last thing I will do, obviously the bottom line is that we have -- we are assuring the health and safety public. we meet all of the dose requirements for all of the trends. All the calcs were redone at the SPU conditions.

The SPU actually has a very small impact on the radiological analysis for the currently licensed radiological analysis.

As we stated yesterday, we have a margin management program. We have had that for a number of years. And it was the focus of our SPU program to look at margin. And we identified early on in sensitivity studies to determine where we would need to increase margins. DNBR was one of the areas.

As we stated yesterday, we currently have very little DNBR margin in terms of analysis because we put the available margin into operational flexibility, raising the OPD TLT set points to address potential spurious trip alarms due to spiking that we occasionally see at the beginning of the cycle.

Currently we have very little DNBR margin. We could not obviously live with that situation going forward. And, really, to me the solution is not methods. Action makes some modifications to correct the situation where the instrumentation is susceptible to these spikes.

MEMBER CORRADINI: The spiking is noise?

The spiking? I didn't understand. Maybe you said it in detail and I didn't --

MR. KAI: It's called an upward trend anomaly. And we had a long discussion about this yesterday.

It is an interesting issue. And obviously so our solution in this case is not to use methodology changes but to actually make a hardware modification.

Our limiting DNBR event is a steam line break with coincident rod withdrawal because we have to postulate in a steam line break, the rods in the withdrawal because of rod control system is not EQ-qualified or category one.

So we assume currently that the rods will withdraw in the steam line break exacerbating the power increase. That's our limiting DNBR event. We have also met a mod there and changed the control system to eliminate the capability for the rod control system to automatically withdraw the control rods.

So, like I said, our goal here was to de-establish the integral knowledge not by methodology changes per se, but to actually look at the hardware changes that will give us margin going that will be effective for many years to come.

These hardware mods in the end, that were based on some preliminary studies that we did early on in our margin management program in SPU and the final analysis shows that, really, we have restored our margins, as you can see on the previous slide, with these changes.

MEMBER BANERJEE: What's the second limiting after that?

MR. KAI: Well, we did discuss this briefly, but there really are three DNBR events that tend to be limiting. At 100 percent power, it is the loss of flow. The fill pump goes down. That's the next limiting.

We do also have the rod withdrawal from subcritical. That is a limiting transient that is looked at that we looked at in our sensitivity studies.

One of the things that we showed yesterday was that the SPU conditions, we can actually show except for the results with two pumps. Shutdown conditions, our current limit is three. We still maintain the requirement for three. That's how we maintain margin for that transient.

MEMBER BANERJEE: And the cold stone, the 100 percent?

MR. KAI: Loss of flow? That is the basis for this number that is given in here as well as the -- the other -- right. Yes. Thank you.

For loss of flow, a current DNBR, I mean, is about 1.7. These numbers, they're about 1.7 that affect the limit, where we have significant margin for loss of flow.

The other event that is limiting at partial power is the rod withdrawal at power. That is the limiting event if you consider the full power range.

And that, if you remember yesterday, we are using some generic margin of our margin management program to assure that we meet the safety analysis limit.

MEMBER BANERJEE: Yes. We couldn't see those numbers because there were -- some numbers were proprietary yesterday I remember. At some point it would be interesting to see the real numbers.

I don't know what you do about it right now. You don't want to close the session now, but we would like to see those numbers.

MR. KAI: The results are not proprietary. The margin part is. And that's the --

MEMBER CORRADINI: So just to repeat so I get it right, there is a number of different transients that bring you about to the same place. You mentioned one, and then you gave us the other three. But they're all in the same ballpark that as you -- things may reorder themselves, but they're still in the same ballpark.

MR. KAI: Right. And we did the studies almost a year, two years ago. Those were the four events that we looked at to make sure that we had margin. And, in fact, the analysis, in fact, showed about what we expected.

MEMBER CORRADINI: So let me ask you a different question about that. So, since you are slightly changing the power shape, that's, therefore, the location of where this is occurring, this changing. Is it occurring at more locations simultaneously? Are you still moving the hot rod location that's occurring at a spot and the spot has migrated?

MR. KAI: No. It has not changed. I mean, keep in mind we are changing the limit. Okay? Everything when we do analysis, we do it at the limits so the actual core design --

MEMBER CORRADINI: Where I could hit the limit is changing, though, I guess.

MR. PRICE: We lowered the F-delta-H

slightly to gain margin. We lowered the peak F-delta-H requirement for the core design to gain some margin. The core design is still relatively similar. I mean, the batch track is a little larger, but in general our core design strategy, you know, hasn't changed a whole heck of a lot.

MEMBER CORRADINI: Okay. Thank you.

MEMBER BANERJEE: It's just a flatter core.

MEMBER CORRADINI: Yes. But if you do that, though, that means you are going to get close to wherever your factor -- let's just use factor of safety since that's general. Whatever your factor of safety is, that minimal factor of safety is moving about. That's what I'm trying to understand.

MR. PRICE: It's a possible option since if you think of the shape of that, the roll-off of that could be slightly different.

MEMBER CORRADINI: Okay. Fine. Thank you.

MEMBER BANERJEE: The minimum flow requirement is going up. They have to.

MR. KAI: Okay. We'll get pressurizer overfill. As I said before, given initial pressurizer load, that's a balance. Raising the level will make events, like, as you mentioned, loss of feed. The results would be closer to pressurizer overfill. One thing to keep in mind is that on Millstone 3, we do have large PRAs that are qualified for water as well as steam.

For the loss of feed, obviously we were concerned. We did initial studies with loss of feed. And we believe that with our current capacity, we would show acceptable results. And we do.

This is probably the one area where we need the -- it's already included in our margin management and will be an area to look forward to as you pointed out, that this is probably the biggest change in margin.

Why this occurs is because if you think of this as a pressurizer overfill in a loss-of-feed event, the key factor is, how long does it take you to match decay heat with the loss of feed that you had.

When you raise the power level, obviously that time will be extended. And decay heat, once you get past the first 10 or 15 minutes, it still changes very slowly. So that the time to match at the extended power level can be significantly longer.

And, as you showed yesterday, it results in a slowly increasing pressurized load over a much longer time period and results in, like you said, an area of concern in terms of making sure that, going forward, we manage margins.

Now, the limiting case is loss of feedwater with off-site power available because we assume -- with off-site power available.

So we assume that the reactor coolant pumps continue to run throughout the whole transient. And, if you remember, what I said is that we have a very conservative amount of assumption from pump heat. It's actually comparable, even more at the end, to the decay heat. So that is another key factor of why these results are so conservative.

One obvious, if you're talking about operational thing, action that had been taken, is to reduce the number of RCP running where we assume all four are running.

MEMBER BROWN: Just to reduce the heat?

MR. KAI: Just to reduce the heat.

MEMBER BROWN: You commented there were like 16 megawatts or something inside one of your pages that is a reactor coolant pump.

PARTICIPANT: If you were to do two of the four, you have a tremendous savings in pressurizer level. Well, we don't credit any of these types of operator actions.

MEMBER BROWN: But you don't have those in your procedures, per se, for that circumstance? See, the concern here, obviously, is that we'll have --

MR. RUSSELL: My name is Paul Russell. I am a unit supervisor at the Millstone 3.

In regards to our procedures for loss of feedwater, we do have in there procedures to secure the reactor coolant pumps. So we do have procedure guidance in that respect.

MEMBER BROWN: And how much time into it?

MR. RUSSELL: I believe it's step four into that procedure. We would be into that within ten minutes, five to ten minutes. It's very early into the event.

MEMBER BROWN: Well, so you're almost down to the step, kind of that slower decay after the initial --

MR. RUSSELL: Right. And that's a huge impact on this analysis. Now, we decided we're not going to take credit for that. So those again are --

MEMBER BROWN: If you turn off the pumps, how much would it reduce?

MR. KAI: We didn't quantify that.

MEMBER BROWN: Is it possible to do that?

I mean, obviously it's possible to do that. I mean, does it go from 1,731 to 1,650 or does it go from 1,731 to 1,200, just a ballpark number? I mean, that's --

MR. RUSSELL: That would be --

MEMBER BROWN: It's like getting close to -- I mean, why initiate a loss of coolant potential, you know, when you're that close to being filled? It just doesn't make -- it just looks uncomfortable. That's all.

MEMBER BLEY: I was looking for that. Maybe I can ask the gentleman over here. What is the indication range on the pressurizer? In other words, are you off-scale? High at what volume?

MR. KAI: That's for the top indicating range. It is before 1,800 cubic feet. Our percentage is zero to 100 percent. I'm not sure exactly what the top of the range is. I'll have to get back to you.

MR. O'CONNOR: Good morning. I'm Michael O'Connor.

The 100 percent level, there's approximately 900 gallons of water space available after you hit the 100 percent mark to fill the pressurizer.

MEMBER BROWN: Okay. Well, it's 1,731

cubic feet. I realize we're going back and forth here. It's a little confusing. I'm just trying to get an idea of what the operator sees as this transient takes place.

You lose indication and the level in the pressurizer at what point, do you know, relative to where you go on this loss of feedwater transient?

MR. O'CONNOR: That will just take a minute.

MEMBER CORRADINI: What you just said is there are about 120 cubic feet of delta remaining, right? Nine hundred divided by 7.8 is 120?

MR. O'CONNOR: Correct, yes, roughly.

MEMBER BROWN: 7.8 is not --

MEMBER CORRADINI: Well, he gave us a delta in gallons.

MR. O'CONNOR: Yes. It's approximately 900 gallons.

MEMBER BROWN: But it's not cold water.

MEMBER CORRADINI: I mean, it's 122 feet. It's 7.8 gallons.

MR. O'CONNOR: So what an operator would see is the level approaching 100 percent and then above the 100 percent range would see whatever indications in pressure or PORV cycle time after that.

MEMBER BROWN: Okay. I understand your answer to be that he would still have a level indication in the pressurizer at the peak of this transient I think is what you're saying.

MR. KAI: I'm not sure about that.

MR. O'CONNOR: I think the peak has about 500 gallons left in the space. So I think you would be above.

MEMBER BROWN: You would be above the indication range.

MR. O'CONNOR: I believe you would be --

MEMBER BROWN: Okay. What do the procedures call for the operator to do when you go off scale high?

MR. KAI: From a procedure standpoint, we're geared toward restoring feedwater. Pressurizer level goes off scale high. We understand we have lost the indication. We're watching the cycling of our pressurizer PORVs.

MEMBER BROWN: By then, you --

MR. O'CONNOR: For the particular procedure set that we have to use for loss of aux feed, increasing pressurizer level due to core temperature increases would cause us to immediately shift over and go to the feed-and bleed-method to initiate once-through cooling to the core.

MEMBER BLEY: Even if you have aux feedwater?

MR. O'CONNOR: If you don't have aux feedwater, that is what is causing this.

MEMBER BLEY: Okay.

MR. O'CONNOR: If you do have aux feedwater, that's correct.

MEMBER BROWN: How much time does it take to get to solid under that transient? So you gave that for the ECCS operations.

MR. O'CONNOR: Two to three thousand seconds.

MEMBER CORRADINI: Less than an hour.

MR. KAI: Two thousand, three minutes.

MEMBER BLEY: Can I add? We've gotten you off track here, I realize. I think you'd better pick up again. I guess the question still remains, just trying to think through the transient as it unfolds viewed from the operator and what actions he is taking when the noise is level. That is what I am trying to do.

MR. O'CONNOR: Well, I guess what I could tell you is this happens in the two to three thousand-second time frame. So as level is increasing in the pressurizer, we are already shifting to a mode to take the other actions I have described, which are not accounted for in this transient analysis.

MEMBER BROWN: Okay. I hear that. I'm just trying to process it all. And I'll just leave it for now.

MR. O'CONNOR: Okay.

MEMBER SIEBER: Why don't we go forward?

MR. KAI: the limiting overflow event is the inadvertent ECCS actuation at power. Currently in this event, we show that we will fill the pressurizer on the order of ten minutes.

And, like I said up here, these are qualified for water relief. So in that situation, the PRVs will be cycling on the water relief until the operator can terminate the event.

The PRVs are qualified as well as the downstream piping. Analysis has been done currently to show that that is acceptable. That is our current licensing basis.

As Alan mentioned, this has been an issue that we have been looking for solutions for a number of years. This is a challenging event for the operators. And we want to use this opportunity to try and eliminate any operator burns that we can.

We have come up with a modification to the ECCS system. It's called a permissive. It's P19. What that does is it uses the reactor trip signal on low pressurizer pressure as a permissive to open the charging injection valves and the charging injection valves only.

So if you have an ECCS signal, what would happen -- and you have an event like this where you have inadvertent SI -- what would happen is that you get all the other ECCS actuations to start, you get all the pumps to start, and then you hit the low pressure safety injection and charging in the ECCS mode, but the charging injection valves would not open if the pressure is above the RPS low pressure set point.

We actually had an event like this in 2005. And if we had the system in place, it would have prevented the pressurizer overfill.

MEMBER CORRADINI: Is this permissive P19 in other Westinghouse plants and it just wasn't here historically or is this a permissive that's unusual?

MR. KAI: This is not in anybody else's plant, no.

MEMBER SIEBER: It's new, right?

MR. KAI: It's new. It's a brand new

concept that we're putting in.

MR. BUCHEIT: Yes. This is Dave Bucheit.

As we discussed yesterday, we're very committed to risk management throughout the Dominion fleet. And we do take an active role in trying to see where we can use PRA techniques to reduce risk in the plant.

We believe this was an excellent example of an opportunity to reduce risk for effectively eliminating a real transient by putting this permissive in.

The only down side is a slight increase in the failure probability because of the additional logic path.

MEMBER CORRADINI: So the next logical question is, are you going to investigate this for Surry and North Anna?

MR. BUCHEIT: Yes, sir.

MEMBER CORRADINI: Okay. And then the delta probability of failure for ECCS is what you are comparing to?

MR. BUCHEIT: Yes.

PARTICIPANT: Are we going to hear -- well, maybe we won't hear anything. So what is the change in that probability because of this permissive?

MR. BUCHEIT: We did a qualitative assessment and compared essentially eliminating an increase in transient frequency, reducing the frequency of general transients with a small increase in failure probability of a logic path, which is $10^{-3}$ is kind of the number. And that washes out when compared with the hardware failures that are already accounted for in the failure analysis.

PARTICIPANT: Okay.

MR. BUCHEIT: But we believe this is accurate.

PARTICIPANT: Okay. Thank you.

PARTICIPANT: I believe I heard you say yesterday that the charging pumps are still available. That signal can be overridden if the operators really need to charge?

PARTICIPANT: It's a manual action now, manual.

PARTICIPANT: You can always manually open the valves.

PARTICIPANT: Okay. Thank you.

PARTICIPANT: By "manual," you mean remotely?

PARTICIPANT: It won't matter.

PARTICIPANT: Remote? That means you're

not going to --

PARTICIPANT: You're not going to -- manually by pushing it.

PARTICIPANT: Okay. And it's failure-proof. It meets all of the regulations in terms of design. Now, we think it's a significant improvement.

PARTICIPANT: Next is the feedwater -- loss of feedwater transients. What is the capacity of your aux feedwater pumps?

MR. O'CONNOR: Mike O'Connor.

About 300 gallons per minute per generator. So that's 1,200 gallons per minute total.

PARTICIPANT: Okay. And what is the value of the aux feedwater flow that was used in that analysis?

MR. O'CONNOR: Pardon?

PARTICIPANT: What is the value of the aux feedwater flow that was used in that analysis?

MR. O'CONNOR: We're checking.

PARTICIPANT: The number he gave you is slowly at one point.

PARTICIPANT: Right. I understand. I fully understand.

MR. O'CONNOR: He's checking. He's

checking that.

PARTICIPANT: I'm trying to assess whether or not that scenario is real.

MR. O'CONNOR: Right. And, like I said, and what we are assuming obviously on the secondary side is that the steam generator pressure is at the sinking of set point with three percent currently.

PARTICIPANT: Please continue.

MR. BUCHEIT: In terms of all the other design basis events, they were all redone, as we said. In general, SPU has a small impact on the results, as was pointed out in terms of LOCA, we did gain margin by going to ASTRUM.

But in general for the other transients, like rod injection, et cetera, the safety analysis margins are essentially the same with so many things, significant margins to all of the regulatory limits.

In terms of radiological consequences, one fact to note is that we submitted alternate source and got it approved in 2006. When we did that, we tried to anticipate what hierarchy we would go to.

We have done those analyses at six and a half percent and came out to seven. So unfortunately, we're half a percent off. And then subsequently we did all of the calculations for the increased source term associated with that half a percent power increase.

As a result, as you can see, there would be a very small change in terms of radiological consequences.

MEMBER POWERS: Can you explain to me again how you recalculated your gap inventories?

MEMBER SIEBER: State your name, please.

MR. AKIN: Bill Akin from Dominion.

The new core inventories were calculated based upon an analysis that considered both high and low burnups and high and low enrichments. As far as gap fractions, we used the suggested values from the regulatory guides.

And for fuel handling, like we discussed yesterday, where we exceed the footnote criteria for burnup, we proposed new gap fractions for the fuel-handling accident.

MEMBER POWERS: And are you going to tell us what those are?

PARTICIPANT: They would like to know what you do in a fuel-handling accident.

MR. AKIN: Oh. For the fuel-handling accident, we determined that no more than 66 percent of the rods exceed the criteria of the burnup as specified in the reg guide.

And for the alternative gap fraction assumption, we proposed and have been accepted, as it has been done in the industry, to use the Reg. Guide 1.25 assumption of the 12 percent iodine?

MEMBER POWERS: That's pretty conservative.

MR. KAI: What I've got, to answer your question about aux feed, what I have is current margin for aux feed from our nominally calculated aux feed flow rate.

So we are assuming aux feed that's 12 percent lower than the number that Mike O'Connor gave you in terms of the -- at that point. Obviously that is a curve. So it's all 12 percent lower.

Okay. I think what we have done, I have tried to summarize in as brief a time as possible the extent of analysis that we have done to demonstrate that our plant is safe and meets all of the requirements, regulatory requirements.

So if there is anything else I can answer?

MEMBER SIEBER: Are there any questions?

(No response.)

MEMBER SIEBER: If not, thank you very much.

And we'll ask the staff now to go through their review of the applicant's submittals. Good morning.

MR. PARKS: Good morning. My name is Benjamin Parks. I am with the Reactor Systems Branch in the Office of Nuclear Reactor Regulation.

I am joined this morning by Sam Miranda, who is also in the Reactor Systems Branch and helps me out with the transient analyses. He's on the side if we get into any questions that affect his area of review.

Basically the scope of our review included those things listed in our purview in RS001, the review standard for extended power uprates, which is how we reviewed this. So it included the fuel system nuclear design, thermal hydraulic design, transients analysis, over-pressure protection LOCA ATWS. And we also added a review of the implementation of RETRAN and VIPRE.

As I said, we followed the guidelines for the EPU standard. We also considered our past experience with stretch power uprates. And we looked at the licensee's report, which is based on NRC-approved methods, methodologies, and computer codes.

The licensing report itself in terms of the fuel system and nuclear design presented several different types of evaluations and considered different types of fuel assemblies.

The licensee is putting in RFA2 fuel. And the most, I would say the majority of the analyses, were based on the RFA and RFA2 fuel assemblies. So that's how we did our review, based on that.

The effects of the uprate will be a slight increase to the linear heat rate and a slightly less heat core design to speed this up.

PARTICIPANT: Just on that point, now, the application included analyses for the old vantage fuel. Maybe some of that is in their pool.

MR. PARKS: That's correct.

PARTICIPANT: Would they be limited or prevented from using that fuel in the future if they had some --

MR. PARKS: Basically --

PARTICIPANT: -- because you didn't analyze?

MR. PARKS: -- in terms of my review, I accepted that they used RFA and RFA2 fuel. And what I'm talking about here is the appropriateness of the thermal hydraulic methods.

I did not evaluate whether that would apply to the vantage five. They're DNB correlations, and whether that would apply to the vantage five fuel. That may be the case.

If they were to reinsert vantage five fuel, they would have to use, I guess, the 50.59 process to make sure that their analyses actually cover that fuel.

PARTICIPANT: And submit that in a reload licensing?

MR. PARKS: Right. And that's the caveat that I was trying to make on this evaluation.

PARTICIPANT: Okay.

MEMBER SIEBER: And there would be a reload safety analysis report that accompanied that, which the staff would review for an anomaly such as you're talking about.

MR. PARKS: I'm glad that you asked that question. That was the point that I was trying to make here. Thank you.

Basically, there are evaluations, as is typical for a power uprate, on reference core design that's not necessarily the design that they are going to use when they go uprate. I mean, we're not planning out core designs 20 years into the future here.

So what we're doing, as Mr. Sieber just said, was we're reviewing the reference core design. And they're going to use their NRC-approved reload process to confirm that they're within that footprint core, reanalyze or reevaluate as necessary.

So for accidents and transients, we followed those topics covered in matrix 8 of RS001. That is our section. In yesterday's presentation, to give you a sense of the review that we performed, I covered three of the interesting transients that we covered. I'm going to step through those quickly at this point to save time and invite your questions if we need to move slower.

So basically we reviewed over-pressure protection. And we asked them some questions about what trips they were analyzing. We then reviewed the implementation of the P19 permissive, which is associated with the inadvertent ECCS actuation. The staff's opinion in that regard is that the P19 is a prudent implementation. We agree with it. And so we were satisfied with that.

And then, finally, we looked at the rod withdrawal at power. We had some questions over how they dispositioned some potential for low-power events. But after our questioning and some further sensitivity studies on the part of the licensee, we were satisfied.

This is the type of approach we took for our review. You know, we find anomalous things in the licensing report, we ask questions about it.

PARTICIPANT: Okay. Well, you got too far before I had a chance to ask.

MR. PARKS: Okay. I'm sorry. He was trying to move slow, and I --

PARTICIPANT: Yes.

MR. PARKS: So let's go back.

PARTICIPANT: Well, the issue here continues to be the observation that you make here about basically if you lift a primary relief valve, there is a small break LOCA potential. It's on one of your slides here. Inadvertent actuation ECCS can develop into small break LOCA, top of the pressurizer of a PORV sticks open.

MR. PARKS: Right.

PARTICIPANT: That's the traditional --

MR. PARKS: I guess the assumption --

PARTICIPANT: Sure, yes. And we're relying on the PORVs, the power operated relief valves, being qualified for water relief and therefore, that they won't stick open.

MR. PARKS: Right. That's the idea.

MEMBER SIEBER: And there's a block valve.

MR. PARKS: There's a procedure to make sure that the block valves are open.

PARTICIPANT: Is the actuation circuitry for these things fully safety grade?

MR. PARKS: I'm going to defer the question to Sam behind you.

MR. MIRANDA: Yes. The actuation circuitry is qualified. It's part of qualifying the porous water relief, can't predict equipment to mitigate an accident almost at safety grade. And this is part of making it safety grade.

PARTICIPANT: And you do have block valves, do you not, for your PORVs?

MR. MIRANDA: Yes, sir.

MEMBER SIEBER: Actually, the pressure protection only --

MR. MIRANDA: It sticks open when you shut it and terminate the loss-of-coolant accidents.

MR. PARKS: Okay.

PARTICIPANT: It's a block valve.

PARTICIPANT: Yes. I understand that.

MR. PARKS: I'm sure I'm not moving too

fast.

PARTICIPANT: Yes. I'm trying to understand what would be an unacceptable transient from your standpoint relative to overfilling the pressure. What would qualify as a too small margin in the pressurizer? This is ECCS but on a loss of feedwater flow accident? Are there --

MR. MIRANDA: I have some thoughts on that. The criterion of not filling the pressurizer is an easy way to demonstrate that they -- AOO, such as the loss of feedwater or an inadvertent actuation of ECCS, will not develop into a more serious accident because you will not be in a position of relieving water to the PORVs.

This plant and five other plants in the U.S. have water-qualified PORVs. So that criterion does not strictly apply. They can -- as long as they have the PORVs available, as long as the block valves are open, they can credit the action of those PORVs to relieve water.

So they don't have to rely on this shorthand method of showing that the more serious accident does not develop by filling the pressurizer.

PARTICIPANT: So there isn't really -- I don't want to put words in your mouth. But there really isn't any unacceptable margin for pressurizer level?

MR. MIRANDA: For this plant, I don't think so.

PARTICIPANT: Excuse me. Did you say only five plants in the U.S. are what are called --

PARTICIPANT: That's what I'm asking.

MR. MIRANDA: There are six in total. There is Millstone. There is Salem, Diablo Canyon. I think those are the six, yes.

PARTICIPANT: Yes. Wolf Creek.

MR. MIRANDA: No, not Wolf Creek.

(Laughter.)

MR. PARKS: All right. The third transient that we discussed yesterday was the rod withdrawal at -- I'll skip that entirely if nobody is interested. Okay.

Finally, of high interest to the ACRS and the staff as well is the loss-of-coolant accident analysis. As the licensee stated, they implemented the ASTRUM method, which would be a change from the BART/BASH appendix A method.

They evaluated small breaks using NOTRUMP, which was no change from the previous. The small break LOCA results that should be noted had significant margin to the regulatory limit. The limiting break size was four inches. And these are the results that we looked at in terms of small break and large break LOCAs.

MEMBER SIEBER: Now, there is a topical report for each of those codes that --

MR. PARKS: NOTRUMP is. That's correct.

MEMBER SIEBER: -- where the staff approves the code and the limits on the methods of use. Is that correct?

MR. PARKS: That is correct. NOTRUMP is --

MEMBER SIEBER: So we're not blazing new ground here?

MR. PARKS: No. And we have reviewed the ASTRUM method. We have reviewed WCOBRA/TRAC, which is the modeling tool on which ASTRUM was based. And we have also reviewed a predecessor to ASTRUM, the code qualification document methodology. ASTRUM is from 1999. So as you can see, they met the acceptance criteria.

And so, in summary, we reviewed the transient and accident analyses. They demonstrated acceptable results. Where we weren't reasonably assured that they demonstrate acceptable results, we asked questions to make sure that we could assure ourselves or requested further analysis.

We saw that the fuel design remains acceptable to support the uprate. And we concluded that the methods were implemented acceptably.

PARTICIPANT: Is the 2,200 number a number identified by Westinghouse for that fuel design or is that generated, that --

MR. PARKS: That's our regulation.

PARTICIPANT: Okay. So that's your baseline material and all the other type of stuff that goes into --

MEMBER SIEBER: On the acceptance criteria 1.73.

MR. PARKS: Forty-six.

PARTICIPANT: Okay.

MEMBER SIEBER: Okay. Is that it?

MR. PARKS: That concludes the staff's presentation. Are there any questions?

PARTICIPANT: I'll ask one thing. You are going to talk about containment analysis in a few minutes. But I noticed this is -- we didn't quite discuss it yesterday. I just had a curiosity. The SER makes -- it's clear that this is not a risk-informed application.

MEMBER SIEBER: Right.

PARTICIPANT: And the SER is very careful in a few places to emphasize that fact, that you didn't base your review on any types of risk information presented by the applicant.

The SER also makes absolutely no comment regarding the PRA or the risk information provided in the application.

And that's fine. I mean, it's not in there. I guess there's no requirement to do that. There was one area where there were some qualitative conclusions drawn that were -- I reread some of the stuff last night and that the applicant made a few semi-qualitative, semi-quantitative risk-informed arguments.

And you very, very carefully said your decisions were based solely on licensing deterministic defense-in-depth types of issues. That, in particular, was the reduced margins in the available volume of the DWST and the CST for auxiliary feedwater for makeup to the steam generators.

Under SPU conditions, the volume of water required in the tanks is going to be the same, but because the decay heat is a lot higher, the relative volume for the time to steam generator dryout or time to drain the tanks is reduced substantially.

And you basically accepted the reduction on the argument that diverse methods of makeup to the tanks were available from some portable diesel-driven pumps because the licensee and I guess Westinghouse has agreed that they don't want to put service water in the steam generators.

It's a long introduction to what is the source of that makeup water for the little portable diesel-driven pumps?

MR. PARKS: I believe you are referring to sections of the safety evaluation that reactor systems didn't compose. I don't think that I am qualified to answer your question.

PARTICIPANT: Somebody should.

PARTICIPANT: Is anybody here who can or can licensee answer the question about where does the water come from or what is the source of the suction for those low diesel-driven pumps?

MR. RUSSELL: Yes, I can answer that question for you. My name again is Paul Russell from Dominion.

It's going to be from a firewater system. We have our firewater storage tanks.

PARTICIPANT: Is that basically service

water?

MR. RUSSELL: No, it is not service water. It comes from New London. It is domestic water.

PARTICIPANT: Okay. So it's city water.

MR. RUSSELL: Yes.

PARTICIPANT: Okay. Thanks. Thank you. I was hoping that was the case. Never mind.

MEMBER SIEBER: Well, it's not dirty water.

MR. PARKS: Any other questions?

PARTICIPANT: I didn't mean to blindisde anybody from --

MR. PARKS: I understand that. Notwithstanding, thank you very much for your time.

MEMBER SIEBER: Thank you very much for your presentation.

I would like to call on Dominion now to begin their containment analysis.

MR. KAI: I would like to talk about what we did in containment analysis. We have the containment methodology for current standards. By "current standards," I mean the most recently approved methodologies are available. We are using, actually, our in-house methodology that got recently approved using GOTHIC.

As I said before, particularly in containment analysis, we haven't done this for margin. We have done it because we want to posture ourselves going forward with the best methods that we have available today that are approved for doing these types of analyses. That includes not just the containment analysis but the mass energies that feed into the containment analysis.

As I said before, we have significant margin. And remaining from SPU we have approximately 3.6 psi containment margin. Our profiles are essentially unchanged. There is no impact on the current NPSH analysis.

As we stated yesterday, the minimum containment pressure calculations are unaffected by SPU. And we have shown there is some compartment analysis that remains down on the compartment structure will remain within the design limits.

We have made a couple of modifications to the RS pipe supports to assure that we meet our required stress and ASME code allowables.

PARTICIPANT: What's the design pressure?

MR. KAI: Forty-five psig.

PARTICIPANT: Okay. Thank you.

MR. KAI: Past energy releases have been

redone since the initial licensing. And since that time, there have been enhancements made to those methodologies. They are improved methods.

We went looking for margins and methods. We thought we used the up-to-date methods now for calculating mass energy releases. That was all redone. We use in-house containment methodologies.

And as such, we repeated every sensitivity study that was originally done and then expanded to a lot more sensitivity space. We did a very extensive containment analysis to assure that all of the issues that we have to address for containment analysis, these requirements are met.

We have actually expanded the range under assumed initial conditions to give some operational flexibility. So actually, we are using a broader range of conditions. And we are selecting the limiting from things like initial containment pressure, temperature, humidity. And for each of the different concerns, obviously we have the different and that would be limiting.

So we did an extensive sensitivity study to combine to determine the limiting conditions over this wider range of initial conditions. There are a number of different things that are looked at in containment analysis: minimum, maximum design pressure; the containment liner temperature, which we discussed yesterday; maximum pressure and temperature profiles here; equipment qualification; sump temperature for the recirculation pumps or NPSH calcs; and various combinations of minimum and maximum temperature for the pipe stress evaluation done for containment spray, recirc spray, and ECCS.

We have selected the bounding assumption.

MEMBER CORRADINI: Is this the right place to ask? I wasn't here yesterday, but I have some numbers in front of me. You went up for your LOCA and small break LOCA by two or three psi. Is that more of the input energy and flow rate that changed it? Is it the stored energy that went in with it or is it the way the containment was modeled or is this an itty bitty bit of all of those?

MR. KAI: We'll ask Albert Gharakhanian. Albert actually did most of the containment analysis.

MR. GHARAKHANIAN: Yes. What we did is, like Mike mentioned, we changed our methodology to GOTHIC. GOTHIC topical report was submitted. I believe it was approved in '96. And its first application was Surry and North Anna. So the bottom line is, to answer your question, the changing pressure. I say approximately a two psi change in the pressure came because of the methodology change alone.

MEMBER CORRADINI: So you went from something to CONTEMPT to GOTHIC?

MR. GHARAKHANIAN: Actually, it was LOCTIC. It's a containment analysis tool.

MEMBER CORRADINI: Okay. Fine. And then GOTHIC you use in distributor parameter mode or lump parameter mode?

MR. GHARAKHANIAN: Lump parameter modeling.

MEMBER CORRADINI: And what is used in the break calculation for the heat transfer to the cold surfaces? Is it Uchida?

MR. GHARAKHANIAN: The original analysis used Tagami-Uchida. That was done by LOCTIC. In the transition to GOTHIC, our methodology that was approved by NRC was based on the DLM, diffusion layer model, condensation option, which is in GOTHIC.

MEMBER CORRADINI: Okay. All right. So two psi is that alone?

MR. GHARAKHANIAN: Two psi alone was the penalty of going to GOTHIC and using DLM.

MEMBER SIEBER: Right.

MEMBER CORRADINI: All right. Thank you.

MR. KAI: Now, as we said before, there's a number of concerns and issues addressed in the containment analysis. The bounding condition changes depending on what we are looking at. We made sure by covering both ends of the spectrum for all the parameters that we have fully bounded each of the different concerns.

In terms of subcompartment, probably the biggest impact is that the cold leg temperature actually drops, which results in, actually, a higher flow rate at the break. That is probably the biggest impact on the subcompartment analysis. And that's been evaluated.

So as I said before, in terms of containment analysis, fully bounded, the analysis results are the same as before. In terms of subcompartment analysis, we have taken credit of the fact that we are qualified and approved for leak before break.

Now, we did not take advantage of that completely when we originally licensed and in order to avoid and to not have to do those calculations and limit our work, we are crediting for leak before break for, for example, in the steam generator compartment, where we have the big hot leg and cold leg piping.

We have reevaluated because of the higher mass and energy races. The other compartments, our original analysis had built in a ten percent margin already into the mass energy. Is it arbitrary that it was done at initial licensing? We used that margin to offset the seven percent increase in the uprate.

And in some instances, we have actually looked at new analyses done, for example, for the service line break in the pressurizer cubicle and showing that all of the structural requirements are met.

PARTICIPANT: And you do not take credit for the leakage of the pressurizer sewage line, though, do you, or do you?

MR. KAI: Correct. We do not. That applies to the GOTHIC piping.

PARTICIPANT: I heard your discussion, but I want to make sure I get it right. So you selectively used it where you -- you could have used it in a number of locations, but you chose to use it mainly in the subcompartment analysis for the steam generator and only there. Is that correct? I just want to make sure I got it right.

MR. KAI: We are approved to use the leak before break where it's used. And it's primarily for piping interactions. Okay?

PARTICIPANT: Okay.

MR. KAI: That's the limit of the GEC.

PARTICIPANT: Okay. Thank you.

MEMBER SIEBER: Now, you've analyzed a lot of accident conditions. What is the peak pressure that you achieved in containment for the worst accident?

MR. GHARAKHANIAN: That was presented yesterday. For the LOCA, our peak pressure is 41.4. For steam line break, it was 38.15.

MEMBER SIEBER: Okay.

MR. GHARAKHANIAN: And those are psi gauge.

MEMBER SIEBER: Okay. And that's all below the design pressure?

MR. GHARAKHANIAN: Below design pressure, 45 psi gauge.

MEMBER SIEBER: Now, is design pressure the containment relies on the operation of cont. spray and recirculation spray?

MR. GHARAKHANIAN: For loss-of-coolant accident, we do take credit for cont. spray and recirculation spray or obviously for steam line break, we only credit the cont. spray, actually.

PARTICIPANT: Just to expand upon that, these pressures are early in time before sprays are on. You're getting a double spike. You're getting a spike and then another spike, And the sprays take you and help on the second level, where this one is strictly by loss of energy addition, right?

MR. GHARAKHANIAN: For the LOCA, that is correct.

PARTICIPANT: Okay. Okay.

MR. GHARAKHANIAN: Peak occurs first 20 seconds or so.

PARTICIPANT: Right. That's what I was trying to understand.

MR. GHARAKHANIAN: That is a true statement for loss-of-coolant accidents.

PARTICIPANT: I'm still --

MEMBER SIEBER: The important thing is to stay below the code limit at all times.

PARTICIPANT: Right. And I think the plots shown here yesterday are available overlaid on topics of the number of accidents we analyzed for, the number of runs that were done for different, as Mike said, initial conditions and other system interactions. So they all were bounded by the pressure.

MEMBER SIEBER: Okay.

MR. KAI: So, in conclusion, I think we have done a very comprehensive container analysis to assure the containment design requirements are all met. Any other questions about containment?

PARTICIPANT: I have a quick one.

MR. KAI: Yes?

PARTICIPANT: I recognize that you are meeting your containment requirements. In your summary, you state you have 3.6 psi pressure margin. I guess that's for your most limiting accidents. What is it right now? Even using the old methods, what's that number, just for comparison?

MR. GHARAKHANIAN: Our previous analysis of record, the design pressure for LOCA analysis is 38.3.

PARTICIPANT: Compared to the SPU, what would it be?

MR. GHARAKHANIAN: SPU we went to 41.4. I don't know whether you have yesterday's --

PARTICIPANT: Yes, I have it. I just didn't remember it quite. So you have lost some margin?

MR. GHARAKHANIAN: Right.

PARTICIPANT: But then, those were the old methods? And if you used comparable methods for comparable accidents, you believe that is about the same or --

MR. GHARAKHANIAN: About a psi. You would have seen probably about a psi increasing pressure because of an outbreak. Because of the methodology change, you lost more.

PARTICIPANT: As I understand what you said, this is a case where actually going into a different methodology, you took a penalty as opposed to a --

MR. GHARARAKHANIAN: That is correct. About two psi.

PARTICIPANT: One is a result of SPU, and two is a result of a methods change.

MEMBER CORRADINI: So I guess nobody asked the question. Maybe they did yesterday and I wasn't here. So your temperature went down in the liner?

MR. GHARAKHANIAN: Correct.

MEMBER CORRADINI: Why?

MR. GHARAKHANIAN: I can explain why. The original method that was used by Dexter used a LOCTIC methodology. They applied the -- well, they did an independent calculation using the LOCTIC code. And they used four times Uchida as the heat.

MEMBER CORRADINI: So they did an inconsistent calculation. They added more energy to the liner --

MR. GHARAKHANIAN: That is correct.

MEMBER CORRADINI: -- for the heating than they did for the condensation?

MR. GHARAKHANIAN: That is correct. And so what we did, then, then we used GOTHIC. Our approved methodology that we licensed within RCM96 had indicated that we would be using the diffusion layer model, DLM, 1.2 multiplier. So that is really the difference between the liner.

MEMBER CORRADINI: So what is the thickness of your liner? Half an inch?

MEMBER SIEBER: Not quite.

MR. GHARAKHANIAN: I think it's probably less than that. We can look that up.

MEMBER CORRADINI: That's fine.

MEMBER SIEBER: Three-eighths.

MEMBER CORRADINI: So in the modeling of GOTHIC, just one last question, I am intrigued by this two psi. This has got me interested. So in this for this less than half an inch, have you investigated? I mean, that's a five percent uncertainty. So that's not really very much, but it comes close to your limit. Have you investigated sources of that or you have kind of left it as it is?

MR. GHARAKHANIAN: You are talking about the difference?

MEMBER CORRADINI: Yes.

MR. GHARAKHANIAN: Why we lost the methodology? Like I said, the methodology was developed originally in '96. And when we were developing the methodology, we found some scoping studies. My first application was for Surry. And when we applied that to Surry, we noticed that we were gaining margin.

And so bottom line is that the reason we lost margin is that every time you transition, I mean, I think everybody has seen this before. Every time you transition from a Tagami-Uchida to DLM, you end up losing margin. You also end up gaining by the petitioning of the energy at the break.

As you know, GOTHIC has a droplet field model. So you really don't use this pressure flash or temperature flash that was used in the old codes. So that's where the credit was originally coming from.

Then we went for the analysis on Millstone 3 because Millstone 3 containment is a lot larger and we have more surface areas that hit from the DLM with substantially higher than the benefit that we got on the petitioning of the energy.

MEMBER CORRADINI: Right. But one last point, and then I will stop. The petitioning of the energy I don't think is it. The Tagami model has a varied velocity. And the DLM method has no velocity. It is a natural convection.

MR. GHARAKHANIAN: That is correct.

MEMBER CORRADINI: That is the key difference. You are essentially assuming a staying in volume when you are blowing stuff down to 20 seconds. That is the fundamental difference is you have essentially a convective flow that you have ignored.

MR. GHARAKHANIAN: Right. That is correct. And what we have done is once we notice that we obviously should do a lot of investigation, we do a white paper. And, if you like, I have that white paper. I'll be more than happy to pass it --

MEMBER CORRADINI: I just was wondering when the industry is going to talk to the staff about considering the fact that convective flows in the first minute are real and have major margin.

MR. GHARAKHANIAN: That is correct. That is a true statement.

PARTICIPANT: So the new code is more

conservative --

MR. GHARAKHANIAN: Yes, yes.

PARTICIPANT: Yes. I understand that from that standpoint, how you treat one of their factors.

MR. GHARAKHANIAN: That is correct.

PARTICIPANT: Okay. Thank you.

MEMBER SIEBER: Now, the free volume of containment is about two million cubic feet?

MR. GHARAKHANIAN: 2.26 is the minimum.

PARTICIPANT: And that's a lower bound?

MR. GHARAKHANIAN: That is the lower bound. That's like ten percent lower.

PARTICIPANT: Are there any other questions?

MR. BUCHEIT: Let me just make a quick comment. This is Dave Bucheit, Manager of Safety Engineering.

I think you have seen from the interchange between Mr. Gharakhanian and Dr. Corradini the wisdom of the decision of our senior management to do this work primarily in-house and to update all of our methods to new and improved methods.

It certainly wasn't the low-cost approach, but it did allow us to do a lot of extra work that we're able to do in-house and gain a lot of understanding about how our plants operate.

Thank you.

MEMBER SIEBER: Do you have anything else?

MR. KAI: I thought I would have Mike O'Connor wrap up and give a concluding statement.

MR. O'CONNOR: I hope we were able to answer your questions this morning. If there are any others, we are certainly available to answer them. We have spent a considerable amount of effort in gaining that understanding that Dave just talked about to make sure that we know what our power station is going to look like at an increased power level.

And we specifically aimed at the beginning of this project to maintain operating margin and to have a better plant operate at 107 percent power than we do right now today. So that was our goal. I think we've met that.

We appreciate your time here today. Thank you very much.

MEMBER SIEBER: Thank you very much.

PARTICIPANT: Can I ask --

MR. O'CONNOR: Yes, sir?

PARTICIPANT: Do you think you will be able to get an answer to if you take credit for the pumps going off from the loss of feed?

MR. O'CONNOR: Yes. We will get the information for you.

PARTICIPANT: That number goes from 1,730. How far down does that go?

MR. O'CONNOR: Absolutely.

MEMBER SIEBER: I ask the staff now to present their review of the containment analysis.

MR. ELBEL*: My name is Richard Elbel. I'm a senior reactor systems engineer in the Containment and Ventilation Branch.

I was not the reviewer for this stretch power. And I confess I haven't even read the SER. The reviewer is out getting his knee repaired today.

PARTICIPANT: He was here yesterday.

MR. ELBEL: Yesterday.

PARTICIPANT: We give him that hard a time?

MR. ELBEL: So I'm going to try to just go through things and answer general questions. Hopefully you got the details, the numbers and things, from the licensee and I can just --

MEMBER SIEBER: Okay, guys. Go get him.

MR. ELBEL: -- talk about how we do the review.

So, starting, the first side is just a

list of the things that are normally reviewed from the standard review plan and RS001. Primary containment functional design includes the calculational methods.

And the licensee did use approved methods. The application of GOTHIC was just recently approved by the NRC for Dominion plants.

The subcompartment analysis is something that we look at. The increase in the mass release that the licensee was talking about is typical of power uprates.

Mass and energy release methods already input to the containment analysis. And the licensee used approved methods for that. And we look at that in some detail during the reviews. Combustible gas control. The licensee is meeting the requirements of the new regulations, the new 50.44.

Containment heat removal covers several areas, but the one of most interest, I guess, here is the fact that they didn't take credit for containment accident pressure for NPSH.

We also look at the position in the standard review plan that the pressure containment, accident pressure, is reduced by half in 24 hours. And that's of use to the people who reviewed the dose analyses because there's a reduction in the leakage that's assumed if the pressure is reduced in half.

Let me just go on. I think I pretty much covered all this. Summary of staff review. All the analysis methods were approved. We asked a considerable amount of questions and got satisfactory responses back from the licensee.

The amount of questions isn't necessarily an indication of the quality of the licensee's submittal but more in some cases of just the way things are written and what the particular reviewer is looking for.

All the GDCs were satisfied. We list the GDCs that we look at in the SER going through the regulations. It's usually GDCs 4, 16, 38, and 50 are the ones that apply to containment.

The functional design, like I say, includes a review of the analysis methods. The licensee used all approved methods. And we would look at the values that are calculated to see that they are less than the design values for pressure temperature, liner temperature, EQ envelope, and those kinds of things. And they were all satisfactory for this review.

Subcompartment analysis. Like I say, a cooler cold leg temperature is typical. That results in more mass release, and we would look at that. Licensees typically invoke leak before a break for power uprates and -- because they do have more mass coming out. So a leak before break is applied only for subcompartment analysis. I'm not sure that was clear from the last presentation.

The only place in containment analysis that leak before break is used is for the subcompartment analysis. And that's described in the statement of considerations for the change to GDC4 that was made to include a leak before break.

It's allowed for all compartments that are not adjacent to the containment wall. You're allowed to use leak before break. And the licensee's margins -- I'm just stating what's here in this slide were satisfactory. Like I say, I didn't do the review.

The mass and energy methods for the primary and secondary were the usual Westinghouse mass and energy-approved methods that have been used for years or the Dominion methods for the post-reflood.

What that means is after the Westinghouse methods are used for the blowdown and the reflood portion, the GOTHIC code is used to calculate the mass and energy release post-reflood. And that was approved in this topical report.

That is getting to be a more and more usual application of GOTHIC by the industry to use GOTHIC to calculate the post-blowdown and reflood when dynamic effects aren't significant and the power is only the decay heat and residual heat, residual stored energy, which is well within the capabilities of GOTHIC.

Let's see. Impossible gas control. Like I say, the licensee's analysis was consistent with the new rule, 50.44, or the new revision to the rule.

The containment analysis for heat removal was acceptable, met GDC38. The GOTHIC code was used for that. The available NPSH requirements were met without taking credit for containment accident pressure.

I am not sure that this came across either, but I think there were some questions at one time. So let me just mention Millstone considers themselves -- they still call themselves a subatmospheric containment. But the criteria that they meet aren't the subatmospheric containment criteria anymore. They're the criteria for a large dry containment.

The criteria for a subatmospheric, they would have to reduce the pressure down below atmospheric pressure within an hour and stay below that for the rest of the transient.

And the subatmospheric containments are allowed to take credit for containment accident pressure for the injection phase of the accident. But even though they're still called the subatmospheric containment and they operate at some vacuum, they're meeting the criteria of a large dry containment.

And one of the things that we normally look at on the slide, Generic Letter 96-06, since the conditions in the containment atmosphere can be more limiting, closer to limits, for temperature, we always ask licensees about compliance with Generic Letter 96-06, which is the fact that when you isolate the containment and close the containment isolation valves, in some cases, you can have liquid caught in between the two valves.

And one of the things generic letter 90.06 asked licensees to look at was over-pressurization of that piping between the closed isolation valves. And that is a standard question that we ask in the extended power and stretch power reviews is to make sure that the analysis that was done is still applicable under increased power conditions.

And in general the licensees analyzed this in such a conservative way that usually doesn't take any changes when licensees go to stretch power, extended power.

So the licensee used approved methods, followed the regulatory guidance, and satisfied all of the design licensing criteria.

MEMBER SIEBER: Any questions for Mr. Elbel?

CHAIR SHACK: The question yesterday that sort of came up with, you know, how does the staff choose to do or not to do a confirmatory calculation? You know, you didn't do a confirmatory calculation for the containment that you did for some of the fuel systems? Are there criteria?

MR. ELBEL: Well, there are sort of criteria. They aren't written down, but basically -- well, it has to do with the capabilities of the staff, too, and they're improving.

We've obtained the GOTHIC code. We have the CONTAIN code, which is an NRC code, which practically nobody in my branch uses if we need a containment -- a contained calculation done, we ask the research people to do that.

And they have done that. In fact, for another review, we did do an independent calculation.

And we found a major error in the way the vendor was modeling things in the GOTHIC code.

So in that case -- well, let me back up to state we look at things like are they using all approved methods.

CHAIR SHACK: Well, I mean, that's a no-brainer.

MR. ELBEL: That's right. That would be the first thing. And then if they're using all approved methods, is there something that looks strange in what they're doing? If maybe they're very, very close to a limit, you know, the limit is 45 and they calculate 44.9 or something, that might --

CHAIR SHACK: Trigger.

MR. ELBEL: -- tell us to either ask a question or do an independent analysis.

MEMBER SIEBER: You reviewed the inputs and the outputs?

MR. ELBEL: We reviewed the inputs always. And we look to see that they are conservative. Yes. That might be another indication if a licensee used an input that wasn't as conservative as what other people use or what is used in the past.

A lot of what we do is kind of a build-up of knowledge from one licensee to another if everybody assumes that in a certain analysis, they have to maximize the service water temperature and this licensee didn't maximize the service water temperature. That would prompt a question and maybe an independent analysis.

It's sort of difficult for us to do an independent analysis. It takes time. We're not really set up to do it. The other thing you have to realize, too, for containment, which isn't as true in the reactor systems area, is that we don't have the capability. We're trying to get the capability now of doing the mass and energy release part.

So when we do a containment analysis, we're taking the licensee's mass and energy. So that's a big part of the analysis that isn't in the audit. When we do a so-called independent analysis, we're using the licensee's mass and energy input almost always.

MEMBER SIEBER: And you can compare that to other plants, where you have a similar --

MR. ELBEL: We can do that, but that is hard to do because other plants could have different power levels or other assumptions. And so, anyway, we look at the input. We look for trends. We look to see if -- you know, it's really the judgment of the reviewer. If a reviewer is used to seeing two peaks and the licensee has one peak or licensee has three peaks, you know, that will prompt the question.

We are going to try to do more independent analysis. And we are going to try to get the capability to do the mass and energy inputs ourselves.

The other thing you have to realize --

MEMBER BANERJEE: What would you need to get the capability to get the mass and energy input?

MR. ELBEL: Well, a couple of things. It is having somebody who is knowledgeable enough to do it and we are doing that. We have got that now to a point.

The other thing I didn't mention, too, for mass and energy is we have lead responsibility, but if there is a real question in the mass and energy part that we have trouble with, we go to the reactor systems people. And they're the people who do more of the LOCA and steam line break analysis. And they help us out if we have a question or a new type of analysis or something, too.

But we are getting the capability to do mass and energy. We have the capability with GOTHIC and with research to use CONTAIN to do the calculations. So the other thing is having the --

MEMBER BANERJEE: You have to run a systems code, right, --

MR. ELBEL: Right.

MEMBER BANERJEE: -- to get that?

MR. ELBEL: Right, right. And we're going to try to use RELAP now within our own group to do that. But, then, you have to understand, too, that we're not the licensee. We don't have all the detailed information the licensee does. So we have to get this information from somewhere. And the somewhere is the licensee.

MEMBER SIEBER: Right.

MR. ELBEL: So that's another area where, you know, we can say we're doing an independent or an audit calculation, but a lot of the input is coming from the licensee.

So, really, we're not doing so much independent analysis as what we look at mostly is sensitivities. The licensee used such and such a model. For example, the licensee used the -- in GOTHIC, the licensee calculated revaporization of the condensate into the vapor atmosphere. He used the GOTHIC way of doing that, which is more of a physically based approach, mass and heat transfer, as opposed to the staff has a NUREG that says, use a fraction of eight percent.

Well, if the licensee says, you know, they're going to use the GOTHIC approach, we may do a calculation with the eight percent just to see what the difference is between what the licensee did and what would happen if they used the staff approach.

On another review, we just did the --

MEMBER SIEBER: Can we just sum up?

MR. ELBEL: Yes. Well, yes. I could go on forever. Okay. I hope that gives you some idea of --

MEMBER BANERJEE: Can you please comment on one thing that was raised yesterday that this plant has a small volume-to-power ratio? Is that true that it has a small volume-to-power ratio?

MR. ELBEL: I don't know offhand.

MEMBER BANERJEE: Okay.

MEMBER SIEBER: 2,200,000 cubic feet containment?

MR. ELBEL: The licensee can probably answer that. I don't know offhand.

MEMBER SIEBER: And the highest accident pressure is less than the design pressure. That's what you look at to determine whether the containment is too small or not.

MEMBER MAYNARD: Plus, you can't just say contains the volume versus power because each of the containment systems are different. You can have very small containments with certain systems or you can have a very large dry containment that you don't have to have some of the various spray systems, hot condensers, stuff like that.

So you have to look at the entire containment system to really draw a comparison.

MEMBER SIEBER: Okay. Thank you very much.

And I just wanted to -- There's one item from Mr. Brown that he asked the Licensee and I think the Licensee needs to clarify what they're going to be able to clarify --

MR. O'CONNOR: Yes, Mr. Chairman. I'm Michael O'Connor. If I might take a minute to try to give you some insight on Dr. Brown's question regarding the --

MEMBER BROWN: I appreciate you upgrading my academic credentials. I'm just a little Masters' degree. Okay.

MR. O'CONNOR: You work for a living.

MEMBER BROWN: Small "m."

(Laughter.)

MR. O'CONNOR: We can't provide you the exact cubic feet, but what Westinghouse has done this study for other utilities and it's about 100 cubic foot credit.

PARTICIPANT: It goes from 1731. If I use that instead of -- you would be 1631.

MR. O'CONNOR: Correct.

PARTICIPANT: Still off-scale.

MR. O'CONNOR: Near the top of the indicating range.

(Simultaneous conversation.)

PARTICIPANT: Is that reactor coolant pump or what's -- Four down to --

MR. O'CONNOR: Four reactor coolant pump. Four down to zero.

PARTICIPANT: Okay, and that is part of your procedures. Is that correct? It's part of this.

MR. O'CONNOR: Our procedure is set for a loss of feed.

PARTICIPANT: Okay. Casual loss of feed. One of the operator actions is to -- and whatever the process is, it's to stop --

MR. O'CONNOR: Stop reactor coolant pumps.

PARTICIPANT: -- reactor coolant pumps.

MR. O'CONNOR: Right.

PARTICIPANT: Somebody said it take ten minutes to do that. The plants I'm familiar with, it took about 30 seconds.

MR. O'CONNOR: No, to actually be in that procedure, you probably land there in under two minutes.

PARTICIPANT: Okay.

MR. O'CONNOR: For a normal reactor trip in transition to the loss of heat sync pressure.

PARTICIPANT: Okay. Thank you.

MEMBER SIEBER: Thank you. Any other questions?

PARTICIPANT: No, that's it for me. Thank you.

MEMBER SIEBER: Okay. We've had a request for public input and the time allotted for that is ten minutes and the representative is Ms. Nancy Burton of the Connecticut Coalition Against Millstone. So if you could ask Ms. Burton to --

CHAIRMAN SHACK: Mr. Gundersen is going to do it.

MEMBER SIEBER: Who is?

CHAIRMAN SHACK: Mr. Gunderson.

MEMBER SIEBER: Okay.

CHAIRMAN SHACK: Ms. Burton couldn't be

here today.

MR. GUNDERSEN: Thank you. Ms. Burton could not make it. She asked me to speak. Ms. Burton presented earlier comments by Dr. Thurnglass and members of the community -- and I don't pretend either support or not support any of that. I just don't know.

CHAIRMAN SHACK: Could you state your name?

MR. GUNDERSEN: My name is Arnold Gundersen with an S-E-N. I was hired by Citizens Against Millstone to take a look at the containment. And thank you for your probing questions of the staff today based on information I provided yesterday. I appreciate that.

We learned yesterday that there are 24 other Westinghouse reactors -- reactors, and we heard staff say that even though Dominion applied for a stretch it was treated as an extended power uprate. Mr. Solomon said that there was no independent confirmatory analysis by the NRC yesterday and I think I heard that confirmed today.

I looked at RS-0001 and I found -- I looked up the calculations and I found 45 hits requiring that the NRC do calculations. So my concern remains that on the issue of this containment because it is so small and if you go on the NRC's web pages, it's the only reactor, only four-loop Westinghouse reactor in the country with a subatmospheric containment. The volume stated in the initial licensing report was 2.38 million cubic feet and today or yesterday it went down, it went on a diet I guess, lost about 100,000 cubic feet. It's down at 2.26 million cubic feet compared to other Westinghouse four-loops of 2.5 to 2.9 million cubic feet.

MEMBER SIEBER: But they are not subatmospheric.

MR. GUNDERSEN: They are not subatmospheric. Correct.

MEMBER SIEBER: Right.

MR. GUNDERSEN: So when you compare to the large dry containments that are out there which it really is considered because it doesn't go subatmospheric immediately after an accident. In fact, its energy to volume ratio is at the extreme. I would agree on the comment about mitigating systems having to be taken into account but not for that initial 20 seconds to a minute which is my concern.

Specifically in the area of subcompartment pressurizations, this is very small containment and

I'll go back to the Dominion side. It was No. 5 before and they said for most scenarios the stretch power uprate mass and energy release is abounded by the ten percent margin provided in the current analysis. If I pump seven percent more energy, now I have a three percent margin.

But I think you also have to look at the operating history of Millstone last year. They had a power surge while they were doing a test. The two minute average for that power surge was a couple percent, two percent, but within that was a four percent peak. So if you take the seven percent for the power uprate and the operating surge that's real, we're not talking about a theoretical margin here, we're talking about an operating surge of four percent. Well seven plus four is eleven and at a ten percent margin. It tells me that there is little or no margin on the subcompartment pressurizations.

And I guess really what I'm asking for is it appears because this is treated as a stretch not an EPU, the staff didn't have the time it would have if it had done an EPU. I know that this group only had 26 days to review the application because Dominion would like an answer in August so that they can perform an outage in October. But what's the rush?

And let me just refer to one comment in RS-001. I was able to pull down last night the December '03 revisions. I'm sure these words may not be exact, but the staff is required, this is step three paragraph six of the Technical Review Guidance in RS-0003 and it's page 15, to do audits or independent calculations and they should consider the following and there are a series of bullets. One of those bullets is "to compare the available margin versus the level of uncertainty in the analysis" and to me if you had a ten percent margin and that's pretty cool, I wouldn't be here if there's a ten percent margin, but the ten got eroded to three with the seven percent uprate and the three really based on operating experience with this two percent spike is less than one and even maybe a negative one.

So I guess what I'm asking you is to ask the staff to do a confirmatory analysis not of the long-term for the whole containment. I think the mitigating systems are probably more than adequate to drop the containment pressure. But in the area of subcompartment pressures on containment that's incredibly small, I ask that the staff do a more thorough independent analysis of those calculations. Thank you.

MEMBER SIEBER: Thank you very much.

Any questions or comments by the members?

(No verbal response.)

If not, Mr. Chairman, I turn it back to you.

CHAIRMAN SHACK: Thank you. I thank the staff and the Licensee for their presentations and I think it's time for a break until ten of. Off the record.

(Whereupon, a short recess was taken.)

CHAIRMAN SHACK: On the record. It's time to come back into session. Our next topic is the selected chapters of the Safety Evaluation Report associated with the ESBWR design certification and Dr. Corradini, if he stands up so I can see him, will lead us through that.

MEMBER CORRADINI: Right.

(Off the record comments and laughter.)

GEH PRESENTATION OF CHAPTER 2 OF DCD

MEMBER CORRADINI: Thank you, Mr. Chairman.

So, for the members just to remind everyone, we are going through on a chapter-by-chapter or group chapter-by-chapter basis of the ESBWR design certification document and the staff's SER, the evaluation of it. We're going to discuss today Chapter 3 which is a very big group of topics on Design and Structures, Components, Equipment and Systems. I'll turn it over to Amy Cubbage to kind of kick us off and then she'll introduce our speakers from GE.

MS. CUBBAGE: I'm Amy Cubbage. I'm a Lead Project Manager for the ESBWR Design Certification. We've briefed the subcommittee for two days or I should say a day and a half in June on this chapter, a lot of topics coming out of that discussion. There were a few topics that the subcommittee felt that would be good to elaborate on here for the full committee.

First will be GE this morning and we're going to be discussing selected topics including seismic classification and quality group classification, seismic design issues and also EQ and I'll introduce Jeff Waal from GE Hitachi to begin the GE presentation.

MR. WAAL: Thank you. Good morning. My name is Jeff Waal from the Regulatory Affairs staff of ESBWR project GE Hitachi in Wilmington, North Carolina. As Ms. Cabbage said, we're here to discuss selected topics on Chapter 3 of the ESBWR DCD.

With me today, I have Mr. Jerry Dever who is the Lead Chapter Engineer for Chapter 3 of DCD and also Tech Lead for the ESBWR Engineering Team, Ai-Shen Liu and David Hammond who are with the Engineering Staff at GE Hitachi.

Two weeks ago, we presented a detailed presentation to the ACRS Subcommittee on Chapter 3 which, has already has been mentioned, is a pretty detailed list of items that were discussed in that and, as a result, they asked us to come back and talk about some selected topics to the full Committee. Chapter 3 covers a wide range of issues relating the qualification of systems, structures, components and equipment and they include the classification of equipment, wind and tornado warnings, flooding, seismic design, environmental and seismic qualification of equipment, the ASME Code classification, the ASME Code analyses --

The first subject that we were asked to provide additional details on was Section 3.2 Classification of SSEs and for that I'm going to turn the discussion over to Mr. David Hammond.

MR. HAMMOND: Okay. When it comes to classification of equipment, at GEH we start out first by looking at the 10 CFR 50.2 which defines safety-related and what constitutes a safety-related structure, system and component. So it's basically those components that are needed to ensure the integrity of reactor coolant pressure boundaries, components that give you the capability to shut down the reactor and maintain it in a safe shutdown condition and then components that you rely on to prevent or mitigate the consequences of accidents such that you limit the total offsite releases. From that we go through each of the components and assign them to either safety related or non-safety related.

We then have a safety classification where we take the safety related components and break those into three subclasses based on the type of function that they perform. Those components that are involved in the reactor coolant pressure boundary integrity are assigned to Safety Class I. Safety Class II is for mechanical components that are primarily involved in functions like containment isolation functions that aren't part of the reactor coolant pressure boundary isolation and also functions such as ECCS and residual heat removal functions. And then Safety Class III is for all other safety related structures, systems and components and it also includes all the electrical and safety related components. The non-safety related components we assign a Safety Class N to those and then the safety class is then very closely related to the quality groups A through C that I'll discuss in a few minutes here.

Once we get the safety classification defined, that establishes a minimum set of requirements that apply to each of these structures, systems and components. If it's a Safety Class I component, it gets assigned to Quality Group A and has to be Seismic Category I. If it's Safety Class II, it has to be a minimum of Quality Group B and it's assigned to Seismic Category I and, similarly, if it's Safety Class III, it's assigned as a minimum to Quality Group C and also the safety classification is used as an entry point to our Quality Assurance Program under 10 CFR 50 Appendix B.

Okay. Having done that, we now look at seismic qualification or seismic classification. This is based on -- This is from the DCD Section 321 and it's based on Reg Guide 1.29 and also on the SRP 3.2.1. All safety related SSCs are required to be Seismic Cat I. That's consistent with the definition in 10 CFR 50 Appendix S for equipment that has to be designed to withstand an SSE. We assign Seismic Category II to those structures, systems and components whose failure could degrade the performance of safety related SSEs and, also from the PRA analysis, there's a certain set of SSEs that are non-safety related but follow what's called Criterion B which means they're used for long term heat removal after 72 hours after the pass of safety systems that perform the front line work and for those we apply Seismic Category II to anything that falls within that category if it's not already Seismic Category II or above.

There are also some situations where specific regulations, reg guide, SRPs, etc., say that certain non-safety related SSEs have to be Seismic Category I. One example of that is on the makeup sources of water for the spent fuel pool. There are requirements in the Reg Guide 1.13 and the associated SRP that says that needs to be Seismic Category I.

And then once we'd gone through all those requirements and decided what needed to be upgraded the remaining SSEs are assigned to what we call Seismic Category NS which basically means there's no additional seismic requirements over and above what's in the standard building codes that apply to the design.

And then there's also Reg Guide 1.143 that applies special seismic requirements to radioactive waste handling systems. So those are taken into account as well in the seismic classification.

CHAIRMAN SHACK: Why isn't there fire protection?

MR. HAMMOND: Well, that's part of -- Anything that's needed for fire protection falls into the definition of safety related. So that's covered through that. If it's fire protection -- Fire protection is one of our design events for figuring out what's safety related or non-safety related to begin with. So anything that's needed to ensure core cooling and then functions like that for fire protection is already going to be classified safety related and therefore it would be Seismic Cat I.

MEMBER APOSTOLAKIS: If we go back to the previous slide. I guess what this means there is that the PRA is used to add the seismic category to this.

MR. HAMMOND: Yes, as it turned out, I think there are only about two or three components that got upgraded because of that. Most of them were already Seismic Category I or II for other reasons.

MEMBER APOSTOLAKIS: Why? Maybe the staff can answer this. We have passed this risk informed classification SSEs. Why can't that be useful? I mean when South Texas finds that more than 90 percent of the safety related SSEs are of low risk significance, it seems to me that's a pretty serious finding and yet we keep doing the traditional stuff. Is the Licensee -- I mean, the future buyers of the ESBWR expected to come back to us and request that the classification be risk informed later? Why can't it be done now?

MR. COLE: This is Bob Cole for the staff. I'm involved in the review of Chapter 19 of the ESPWR design certification. I guess let me say two things. One is it's not this particular classification here of where he said additional SSEs were brought to Seismic Category II. It's not the PRA that's bringing that in.

MEMBER APOSTOLAKIS: That's what it says.

MR. COLE: Well, it's not the PRA. It is a criterion from witness, but the criterion has to do with equipment, SSEs, that are required to ensure a certain set of safety functions in the period between 72 hours and after the safety systems are no longer, well, in the period between 72 hours and seven days and it's not falling out of the PRA. It's simply falling out of what is equipment that's needed during that period.

And something I would say in answer to your question why aren't we using the risk-informed categorization process that's applied for maintenance rule and for special treatment, I believe, and this is my opinion, that I think it's a regulatory issue. I don't think we're there yet in terms of risk informing the regulations.

MEMBER APOSTOLAKIS: But there is a --

MR. COLE: Except there is a definition of safety related in the regulations and there's a history on how you decide what goes in there. It's still basically within the design basis criterion, what's in the design basis and what's required for design basis accidents. It's not usually in the PRA. The regulations are not quite there yet, I believe, for making these determinations and what's safety related and not safety related.

MEMBER APOSTOLAKIS: But 50.69 is a regulation.

MR. COLE: But it's not a requirement. It's a voluntary regulation.

CHAIRMAN SHACK: But it says they may voluntarily require with the requirements in this section as an alternative.

MEMBER APOSTOLAKIS: So they could do it.

They just chose not to do it. Is that what you're saying?

CHAIRMAN SHACK: As I'm reading the regulation, it appears -- "An applicant for a construction permit, operating license or an applicant for design approval, a combined license or manufacturing license under Part 52 may voluntarily comply with the requirements in this section."

MEMBER CORRADINI: Sure. They just chose not to.

CHAIRMAN SHACK: They chose not to. Now I think it's probably less of a problem for them because they have their passive safety system, and so their number of safety system components is a lot less in many ways than it is -- I mean, that's the reason you have a passive safety system among others is to get down the number of safety related components.

MEMBER APOSTOLAKIS: I thought the answer was going to be that you really need the complete PRA, not the design certification.

CHAIRMAN SHACK: That may be, too.

MEMBER APOSTOLAKIS: It's pretty significant. I mean, we're not talking about removing a few. Now, admittedly, you know, it's a different design. But having more than 90 percent of the safety related SSEs declared as being of low risk significance --

MEMBER POWERS: It seems to me the more troublesome finding is that they found systems that did not fall in the safety related category that were less significant.

MEMBER CORRADINI: Exactly.

MEMBER APOSTOLAKIS: Yes. They also found about 650 at one point that were elevated.

MEMBER CORRADINI: That's right. That's the problem.

MEMBER APOSTOLAKIS: So that would -- Well, it's not a problem now.

(Laughter.)

MEMBER CORRADINI: Well, it can be a problem, George.

MEMBER ARMIJO: It depends on what they are.

MEMBER APOSTOLAKIS: It depends what they are, but I think the overall finding was that what we declare safety related SSEs may not be the wisest. But if you chose not to do it, that's fine. But I thought the answer would be PRAs -- I mean, you really have to wait until you get the plant and to have the -- and all that stuff.

MEMBER ARMIJO: For the uneducated, finding a whole bunch of stuff that had previously been considered higher risk, I guess, and now being considered --

MEMBER APOSTOLAKIS: Safety related.

MEMBER ARMIJO: -- safety related/high risk, now being safety related but low risk which changes the effort, I guess, that you have to apply to them or does it safety related --

MEMBER APOSTOLAKIS: Yes.

MEMBER ARMIJO: Well, I don't -- He's shaking his head no.

MEMBER CORRADINI: Not when you go into the maintenance rules standpoint.

MEMBER APOSTOLAKIS: They go to risk free which is a new category --

MEMBER ARMIJO: They go to what?

MEMBER APOSTOLAKIS: It's a new category.

MEMBER CORRADINI: Risk free.

STAFF BOB: You guys just keep making this stuff up.

(Laughter.)

MEMBER APOSTOLAKIS: Category IV is safety related and risk significant.

(Simultaneous conversation.)

For those, all the requirements that are mentioned here remain intact. For safety significant but of low risk, there's a new category called Risk Free.

STAFF BOB: Okay.

MEMBER APOSTOLAKIS: And for that one, the requirements are reduced and there is a --

(Simultaneous speakers.)

MEMBER CORRADINI: -- in terms it's kind of like the --

CHAIRMAN SHACK: -- is a lot like -- Conceptually, it's like --

MR. HAMMOND: There's like five different categories under -- and we're only picking the Criterion B one here to upgrade the seismic on because those are the more significant ones that come out of it.

PARTICIPANT: So you contrasted that now with those. I guess Harold did.

PARTICIPANT: Yes, you upgrade some.

PARTICIPANT: You don't upgrade others.

PARTICIPANT: There's a bunch that were upgraded.

MEMBER CORRADINI: Yes, you can't -- There's are two sides to it.

MEMBER APOSTOLAKIS: There are two sides but the first side wins.

MEMBER ARMIJO: You mean the low risk wins.

PARTICIPANT: Why does that win when the other --

(Simultaneous speakers.)

PARTICIPANT: I'm trying to work on that one.

MEMBER APOSTOLAKIS: There may be few of the other ones.

PARTICIPANT: I think there's 600.

PARTICIPANT: I think the witness --

MEMBER APOSTOLAKIS: -- 22,000 to be categorized.

MEMBER CORRADINI: I think we're going to have this as a lunch discussion, he and I.

(Off the record comments.)

MEMBER APOSTOLAKIS: Lunch is a priority.

(Laughter.)

MS. CUBBAGE: I would just like to offer that --

MEMBER CORRADINI: Let them get back on track.

MEMBER APOSTOLAKIS: I got my answer.

They chose not to do it.

MS. CUBBAGE: They chose not to do it, but if there are any concerns about non-safety systems that should have been elevated the RTNSS process for passive plant I think addresses that. They did a thorough evaluation of all the non-safety equipment and elevated any that were risk significant through the focus PRA process and that as far as any systems that are safety related that are not risk significant as Dr. Shack mentioned there with passive plant, they don't have any safety related pumps. There are not a lot of components in this plant that you could consider downgrading.

MEMBER APOSTOLAKIS: It doesn't seem to me obvious that one safety risk significant component is going to picked up.

CHAIRMAN SHACK: Well, C and D and RTNSS won't get you.

MEMBER APOSTOLAKIS: I don't know.

(Simultaneous conversations.)

CHAIRMAN SHACK: C and D are related to under power operating shutdown conditions to meet safety goals of CDF and LERF and functions needed to meet containment performance goals.

MEMBER APOSTOLAKIS: I'm sure it makes up most of it.

MEMBER MAYNARD: Do COL applicants have to comply or conform with the classification used in the DCD or can they revise the classification at that time?

MEMBER APOSTOLAKIS: That's a good question.

MR. COLE: As of right now, the ones that have been submitted have just incorporated the DCD by reference, although they do have the option to declare a deviation and ask for that to be reviewed.

CHAIRMAN SHACK: So you're making the declaration and then they -- let me make sure I understand. It's not impossible upon them -- a plant. They can come and say we're not going to do this and we don't accept that --

STAFF BOB: Well, they can ask the staff to review --

(Simultaneous conversations.)

MS. CUBBAGE: I could speak to that. Ultimately, when a combined license, should it be issued for any ESBWR it will incorporating by reference the ESBWR design certification which will be a regulation. The design certification becomes a rule as an appendix to Part 52 and any combined license applicant or holder that wants to deviate from anything in DCD has to follow a change process ranging from a 50.59 like process all the way up to an exemption depending on whether it's Tier 1, Tier 2 star, Tier 2, tech specs, etc.

CHAIRMAN SHACK: It's not undertaken lightly.

CHAIRMAN SHACK: I'm just trying to get a handle on what --

(Simultaneous conversation.)

MR. HAMMOND: They don't make that decision. NRC does. Because that's what I'm saying. You all set the standard.

CHAIRMAN SHACK: Right.

STAFF BOB: It's accepted by NRC. I mean, we may be consulted by the license or by the -- afterwards of what they're doing. But it's ultimately their choice and the NRC's test it, review it and approve it or decide whether to approve it or not.

MR. HAMMOND: Okay. The other part of the classification is quality group classifications which are in DCD Section 3.22. These are based on Reg Guide 1.26 and SRP 3.2.2 and they're used to -- basically, the quality group is then used to define what design codes have to be used to design the pipes and valves and various types of components.

The Quality Groups A, B and C here, in general, the definitions line up almost identical to what we used for safety classification earlier. The main difference is that the quality groups put in some extra words that say these are pressure retaining portions of systems and also there are some words in there that say they're for water and steam containing systems. So if a system doesn't contain water or steam or it doesn't retain pressure, it really technically doesn't have a quality group designation.

Quality Group A is for the reactor coolant pressure boundary pressure retaining portion. So that's like your reactor pressure vessel and your attached systems out to the isolation valves. Quality Group B is for pressure retaining portions that are not part of Quality Group A that perform safety related contained isolation, ECCS and residual heat removal functions. And then Quality Group C picks up the other safety related functions that aren't included in Quality Groups A and B. And then there is a special Quality Group D that's for systems or components that may contain or that contain or may contain radioactive materials. So this can be some portions, the non-safety part of the systems, that actually handle some of these radioactive material and they get a Quality Group D designation and apply special rules for design based on that.

Okay. Just as a summary or conclusion of our classification, our classification system is consistent with previously license designs. We are basically using the same system we did for the ABWRD DCD and an earlier BWR designs. We determined safety related structures, systems and components.

MEMBER ARMIJO: Can we go back for a minute?

MR. HAMMOND: Yes.

MEMBER ARMIJO: What's the difference between a B and C? B is pressure related, pressure retaining portions and sometimes not include a safety related containment isolation, ECCS, residual heat removal and then C is pressure retaining portion, the same words, and supports, same words.

MR. HAMMOND: Yes.

MEMBER ARMIJO: For other safety related functions not included.

MR. HAMMOND: Right.

MEMBER ARMIJO: Why aren't they all of equal importance relative to how you treat them between them? It seems like a very thin line.

MR. HAMMOND: Part of where this comes -- Part of where this is divided is somewhat by the type of pressures that these things are exposed to during the life. The reactor coolant pressure boundary sees the largest pressures and therefore is designed to face that. When you get down into ECCS and RHR systems, they typically operate at maybe 20, 25 percent or less of the full reactor pressure and so --

MEMBER: Is is magnitude?

MR. HAMMOND: Yes, it's really magnitude of pressure they have to retain plays a big role in that.

MEMBER ARMIJO: How you divided that.

MR. HAMMOND: Yes.

MEMBER ARMIJO: So C would be even less --

MR. HAMMOND: C are things that are barely marginal above atmospheric pressure typically. They're not usually very --

MEMBER ARMIJO: That's like faucets in your bathrooms and things like that.

MR. HAMMOND: Yes.

MEMBER ARMIJO: I'm being facetious.

MR. HAMMOND: Yes, I can understand that.

MEMBER CORRADINI: So, for example, for C can you give us an example of C?

MR. HAMMOND: Let's see. One I'm familiar with is the discharge lines for the safety relief valves. They're in containment, but they're normally not pressurized. They only become pressurized when a safety relief valve would operate.

MEMBER CORRADINI: Okay. So down the stream of a valve.

MR. HAMMOND: Yes.

MEMBER CORRADINI: But they are still probably -- They're still a very low pressure.

MR. HAMMOND: Okay. So like I said, this classification system is nothing new that we invented for ESBWR. It's essentially the same as we've done in the past with just a few tweaks for the RTNSS type category.

Safety related structures, systems and components are determined based on the definition that's in CFR 50.2. We then use safety classification to establish minimum requirements, further classifications, and this also serves as our entry point to our QA program. These minimum seismic and quality group classifications are then upgraded as required by SRPs, reg guides and design practices from the past. So there are situations where there are non-safety related components that have higher quality groups than they would ordinarily have just due to the function they perform and requirements in various reg guides and SRPs.

The PRA analysis to some extent we're involved in determining SSES are required upgraded seismic design requirements in terms of figuring out what components are important for long-term heat removal from the system. And these seismic and quality reclassifications establish the primary basis for the NRC review under SRP 3.21 and 3.22. It's not essential in the NRC's review that they endorse our safety classification because it's not covered by any of the regulations specifically. But it's a starting point to get us into the seismic and quality reclassifications and we only build on increasing the requirements as we go rather than subtract anything at that point. So they can concentrate their review on the seismic and quality groups and perhaps our QA program.

Any other questions?

MEMBER CORRADINI: If I might just interject for the Members, by your direction and comments of the Subcommittee Meeting, they're going to now move on and pass through as I see here your next set of slides directly to 3.7 for seismic. So we're not going to discuss here anything to do with wind, water, missile, etc.

MEMBER MAYNARD: Floods.

MEMBER CORRADINI: Right. Based on us wanting to take the time to talk about that. Sorry.

MEMBER APOSTOLAKIS: So does that mean the Subcommittee was happy?

MEMBER CORRADINI: We're never happy.

(Laughter.)

MEMBER CORRADINI: We were adequately pleased.

MR. HAMMOND: Now I would like to turn it over to Dr. Liu to discuss --

MEMBER BANERJEE: So you didn't have to consider tornadoes.

MEMBER MAYNARD: Yes, they considered it.

MR. HAMMOND: We do but not specifically the classification. That goes into how you design after you've classified the stuff.

MR. LIU: Okay. The CDC Section I would like to discuss today 3.7 for seismic design. The specific topics I would like to cover is the design of the -- we have to use for the ESBWR standard plant.

The so-called CSDRS which stands for certifies seismic design response -- will follow Reg

Guide 160 spectra and the North Anna ESP -- specific spectra at high frequencies. North Anna spectra is representative of most severe rock site in the U.S. in the Eastern U.S. and we also noted that low recorded seismic event contains simultaneously very high/low frequency and a high frequency motion. Therefore, the CSPRS we have considered for early -- is very conservative.

As we define the spectra --

MEMBER POWERS: A low recorded seismic event, most of the seismologists thought that there were not high frequency components and feared recorders didn't support them. That doesn't mean they weren't there.

MR. LIU: Based on all the available records, we have not really seen the particular record to show that particular --

MEMBER POWERS: But if they recorded a thing up to beyond about 50 Hz, then it doesn't mean it wasn't there. I mean, I agree with you. I --

MR. LIU: At least on the previous knowledge, you know.

MEMBER POWERS: Yes, there is very, very little high frequency data out there.

MR. LIU: Right.

MEMBER POWERS: But that's only because they didn't bother to record it.

MR. LIU: Then the high frequency did really affect the design compared to low frequency, it's true. For some more stiff structures which have a higher frequencies, yes, higher frequency will effect the response of the structure. Therefore, for some massive concrete structures, no. It tends to respond in the low frequency range. So that lower frequency -- is very important.

CHAIRMAN SHACK: Will effect relays and stuff like that, little stuff. Relays and things like that.

MR. LIU: Yes. Some electric equipment.

MEMBER BANERJEE: So the high frequency, yes.

MR. LIU: Yes.

MEMBER BANERJEE: Because the very severe earthquakes like in Japan and all have a very high low frequency.

MR. LIU: Right.

So once we've determined the spectra itself, then for the purpose of -- we have generated the artificial time history which we meet the NUREG CR 67.28 criteria which is the most current requirement.

The next few slides I would like to get into more details on how we derive this CSDRS. Like I mentioned earlier that the low frequency component will follow Reg Guide 160. The time history of that spectra is shown in the figure below which has a 0.3G peak --

This slides shows that that the high frequency ground motion of North Anna looks like that's represented by this right curve. As you can see, that above 10 Hz really has a higher peak, you know, much higher than the Reg Guide 160, you know, should. And an associate time history for this high frequency ground motion is also shown below which has a 0.492 peak --

Then we merged the two and -- the two for design consideration. So we rounded off that 0.492 PGA of North Anna slightly to this 0.5 value for RDR. The chart shows below is the associated condition.

This chart shows how our design compared with the recent Japan earthquake, you know, records. What I have shown here is that the blue curve is the response backdrop at the reactor -- baseline elevation calculated from the soil structure interactions with -- motion I mentioned earlier so the ground motion, double hump ground motion movement. You can see not only we have this low frequency peak which is controlled by the Reg Guide 1.60 low frequency input. We also have high frequency content which is controlled by the North Anna high frequency.

But in comparison the two top of the line, the dash line, those are the recorded motion at the Kashiwazaki site. That is Unit 1 and Unit 2.

(Off the record comments.)

As you can see that this particular Japan earthquake is very rich in low frequency as you mentioned earlier and the high frequency there is really not much input at all.

MEMBER POWERS: But that depends on what it's transmitting through.

MR. LIU: That particular site is a soil site.

MEMBER POWERS: Well, from the epicenter to the site is what's controlling the high frequency part and if that's broken up ground, it gets dissipated. But if it's in solid shield and it was on the East Coast of the United States, then you get much more transmission of the high frequency part.

MR. LIU: Right.

MEMBER BANERJEE: Was this epicenter out in the sea?

MEMBER CORRADINI: Off the coast, yes.

MEMBER BANERJEE: Yes, it was off the coast and they got that.

MR. LIU: This is recorded motion at the basement.

MEMBER BANERJEE: At the basement.

MR. LIU: It's not in the ground. It's in the structure at the basement level.

MEMBER: At the basement though.

MEMBER SIEBER: So there are adjacent units.

MR. LIU: Just two, I guess. The total is seven units at that site. This particular comparison we showed to you --

MEMBER BANERJEE: Just a question or a curiosity. This was beyond the SSC, wasn't it?

MR. LIU: Beyond their design basis.

MEMBER BANERJEE: Yes, right.

MR. LIU: Much higher. But it's low frequency. It's very low frequency which really has no significance as to the structural response itself.

MEMBER ARMIJO: Structures normally have frequencies that are much higher. Therefore they don't get excited by the low frequencies.

MEMBER BANERJEE: There is no resonance.

MEMBER ARMIJO: That might explain why there wasn't more impact --

MEMBER MAYNARD: Little damage.

MEMBER ARMIJO: -- or damage at these sites.

MR. LIU: This slide shows a somewhat different curve which I would like to briefly discuss because this is one of the -- discuss, plus we released it at the Subcommittee meeting --

MEMBER CORRADINI: This is Chapter 3 or is this --

MR. LIU: This is related to Chapter 19 PRA.

MEMBER CORRADINI: I was afraid of that. Okay.

(Laughter.)

MEMBER CORRADINI: It's interesting.

MR. LIU: A question was raised that, you know, we had considered this double hump in our spectra in the design and that's the spectra we should consider in the model evaluation and this slide provides that illustration hopefully.

But the black curve shown in the chart is double hump design. The blue curve is intended to represent a bounding spectra for soil sites among the

28 sites considered in EPRI study excluding -- so those are intended to be represented of bounding spectra for soil sites. As you can see, the amplitudes, you know, how much lower than what we would consider in our design. The green curve, it is the part all the way up to about 9 Hz, really is the North Anna rock site curve and above 9 Hz we follow the same curve, what we have considered in the design, because in the design that high frequency hump was derived from this curve.

MEMBER BANERJEE: So now suppose that for a specific site, they find, let's say, the low frequency part is higher than what you have due to various studies that they do and, let's say, the high frequency part is lower, just as an example. Now would they handle that since this certification -- suppose this wasn't a bounding -- this -- was not bounding in some region, then the --

MR. LIU: Then there has to be a site specific analysis, seismic response analysis, to show that, at least. But the responses in the structure in the formal response spectra are still below the design spectra we have considered in the standard design.

MEMBER BANERJEE: But this is not the -- the black curve is not the design.

MR. LIU: The black curve is the design.

MEMBER BANERJEE: But suppose it's exceeded in a site at some frequency, what would they have to do to -- I mean, they are trying to reference your design and --

MEMBER CORRADINI: That would be a departure.

MR. LIU: That would be a departure. Then they have to provide the separate -- calculation to show why that accedence has no consequences under the design of the standard plan.

MEMBER BANERJEE: But suppose it has consequences. You have to deviate from your standard design.

MR. LIU: Then I have to look at it by a case-by-case basis.

MEMBER ARMIJO: Well, could you build an ESBWR with this spectra at the Kashiwazaki site? Go back to page 16.

MEMBER CORRADINI: What would you have to do to build it at that site? That's what Sam is asking.

MEMBER ARMIJO: Which I think is what Sanjoy was asking.

MR. LIU: I don't think that --

MEMBER CORRADINI: -- slow moving --

MR. LIU: Let me put it this way. I don't think that -- I think for this one we -- you know, we --

MEMBER BANERJEE: It might be okay for this one because --

MR. LIU: The calculation is to be performed.

MEMBER CORRADINI: Sure.

MEMBER ARMIJO: But if you would be at this low frequency, at least, you could get through it.

MEMBER CORRADINI: Right.

MR. LIU: I don't think you affect the design at all.

PARTICIPANT: We're asking a lot of what if questions. The bottom line is if they don't meet the design spectra then it's a deviation of -- go back for NRC --

MS. CUBBAGE: Right, and specifically the curve is a Tier 1 requirement. So it would be an exemption. It would be a pretty heavy issue.

MEMBER POWERS: But, in fact, it's better that a licensee has to look and see if the seismic it has matches up with the design spectra.

MR. LIU: Right.

MEMBER POWERS: And when there are deviations, he's going to do something about that.

MR. LIU: Right.

MEMBER POWERS: Say something about it.

MR. LIU: Yes.

MEMBER POWERS: Plead his case big. But he's going to do something and there is no reason to think a spectra design done on the basis of U.S. earthquakes is going to match very well to one in Japan. It's different.

MS. CUBBAGE: Right.

MEMBER POWERS: It's a different seismic center.

MS. CUBBAGE: And the staff reviews their proposed spectra to make sure it's reasonably representative of sites in the U.S. and then GE Hitachi would strive to make their curve as bounding as possible for any of their potential clients.

MEMBER CORRADINI: Keep on going.

MEMBER BANERJEE: Well, let me ask one more question. Would Diablo Canyon fall under that black curve?

MEMBER CORRADINI: No is the answer.

MR. LIU: I'm not really familiar with

Diablo Canyon.

MEMBER CORRADINI: That's a good answer for now.

CHAIRMAN SHACK: No is the answer. It's two-thirds -- three-quarters at some point.

MR. LIU: We didn't really consider California.

MEMBER BANERJEE: But GE doesn't think anybody will ever build a plant in California again.

MEMBER SIEBER: I hope we don't have to address potential site.

MS. CUBBAGE: Not every potential site and, you know, if --

CHAIRMAN SHACK: The answer is if it doesn't match this you have a problem and we can move on.

MR. WAAL: Yes. We basically have to go back and relook at the building design and reassess a whole bunch of stuff.

MR. LIU: In order to use this kind of stuff -- using the design and analyze the soil site -- so we decided to do this margin curve on an analog basis as well. So as a result, we have this blue curve -- below collecting up to the -- at a higher frequency and we use this lower curve for the second margin evaluation regarding --

MEMBER CORRADINI: Which is a different discussion.

MR. LIU: Right.

MEMBER CORRADINI: Let's move on.

MR. LIU: Okay. The next topic I would like to discuss is assessment and design of a proposed structure -- pools -- this chart shows -- core and -- pools in the reactor -- located -- the green areas are the upper pools, you know, the ICCS, isolation condenser pools. Then the blue pools in the middle are the GDCS pools. Then the blue pools near the bottom is a suppression pool. So those are the major pools we have in our design.

In terms -- pool water for seismic consideration, we follow the standard practice by considering the water or fluid in the pool into two components. One is the -- or sometimes known as the sloshing which is shown as the upper circle in the sketch below. That is represented by a mass, a screen system, showed to account for the vibration of the water near the surface of the pool.

Another component of the pool water is so-called the impassive, sometimes called the rigid component, which is represented by a lower mass in the sketch which basically they follow the motion of the pool structure. It's rigidly attached.

MEMBER CORRADINI: Is WC and WI a function of the shape of the pool?

MR. LIU: Yes. It's the mass of the pool that is a function of the geometry of the pool.

MEMBER CORRADINI: So the L/D of the pool as well as the mass of the pool goes into choosing the WC and WI?

MR. LIU: Yes.

MEMBER CORRADINI: But yet 1,000 metric tons of water and it's a shallow pool, it's a different WI and WC than if I have 1,000 metric tons and it's a tall beer can.

MR. LIU: You're correct and also the associated high would be different, the HC and the HI.

MEMBER CORRADINI: I understand the high part. But I wanted to understand the fraction that is rigid and the fraction that's removable. Does that change?

MR. LIU: Yes. In general, the taller the pool is the more contributions from the rigid part.

MEMBER BANERJEE: Right, the free surface will be less. Right?

MEMBER SIEBER: Right.

MEMBER ARMIJO: How do you handle interconnected pools?

MR. LIU: Interconnected pools?

MEMBER MAYNARD: Where they're connected.

MR. LIU: You know, we consider -- we calculate the mass of each pool. Then we added this mass to the pool --

MEMBER ARMIJO: If the pools are interconnected through smaller openings than the cross section of the pool itself, how do you handle that?

MR. LIU: At the smaller openings, I don't think it would have any effect on the global response of the pool. We account for the overall response of the pool structure due to the presence of water.

PARTICIPANT: Typically, our interconnecting pools are connected by piping. They're not openings and walls -- A lot of them are closed in operation.

PARTICIPANT: Some of your cartoons on the suppression pools look like they had openings.

PARTICIPANT: Well, the suppression pool is one continuous pool.

MR. LIU: It's a continuous pool. It's a circular pool because --

PARTICIPANT: The ones that are

interconnected are up at the top, the PCCS and IC pools. I don't know how big they are but I would think there would be very little transfer of water between one and the other during a seismic event.

MR. LIU: No.

MEMBER CORRADINI: So back to my question. So let's just take my example. So I have 1,000 metric tons and I have a shallow one and I have -- so you're telling me that if in the shallow one it would be 50/50 and the beer can it might be 25/75.

MR. LIU: Right.

MEMBER CORRADINI: And there is -- And you quoted from, I can't remember, the Corps of Engineers that there's a series of empirical design rules on how this splits out.

MR. LIU: Also ASC has, you know.

MEMBER CORRADINI: And it's also a function of the height of above ground.

MR. LIU: Yes. The water -- the depth of the pool.

MEMBER CORRADINI: Okay.

MR. LIU: The dimension of the pool.

MEMBER BANERJEE: But is eight C roughly the height to the free surface?

MR. LIU: It's slightly less.

VICE CHAIR BONACA: Slightly less, yes.

MEMBER ARMIJO: How is this information generated? Is it empirical?

MR. LIU: Well, this is -- This is kind of -- it dates back to -- this was first delivered by Dr. Hausler in the early '50s.

MEMBER APOSTOLAKIS: Hausler.

MR. LIU: Right.

MEMBER APOSTOLAKIS: It must be right.

(Laughter.)

MR. LIU: He came out with this simply kind of mechanical in the one mass, screen mass, mechanical simulation. And then after that there are so many testing and additional studies by various researchers, you know.

MEMBER CORRADINI: I guess the reason I'm asking all these questions is I guess I was left at the Subcommittee that the fraction was fixed independent. So maybe I misheard. So it is variable.

MR. LIU: Variable. It depends on size.

So the sloshing component which is upper most in the sketch action typically did respond in very low frequency and that's 0.5 Hz. It did not have a structure -- if vibration exists. So very localized.

Impassive components on the other hand, they responded in unison with pool structure and its effect is treated as added mass. The total mass is maintained. There is a sum of the dose convective mass and the impassive mass.

MEMBER CORRADINI: So can I ask one other question since I'm on a roll here. So I'm going to put the PCCS heat exchanger in the middle of a pool. Does that change the WC and WI?

MR. LIU: For the mass calculation, we ignored the -- exchanger. So --

MEMBER CORRADINI: But I'm asking the question -- I'm trying to understand --

MEMBER BANERJEE: Does it effect the sloshing you're asking?

MEMBER CORRADINI: Well, I'm trying to understand where the damage would result if you did this. Where you would miscalculate if you did this incorrectly from the empirical design rule? But the empirical design rule as I understood it was for a pool without anything in it.

MR. LIU: Yes.

MEMBER CORRADINI: So I'm asking how do you modify the design rule when I put a PCCS heat exchanger in the middle of the pool and that's the most elevated pool for the isolation condenser and the PCCS and it starts wiggling. I have something in the middle of it.

MR. LIU: But for the structure --

MEMBER CORRADINI: How do I expect it to be deviating from the design rule?

MR. LIU: Okay. The bottom line is associated mass of evaporated water. Okay. For the design of the pool structures, okay, in the -- ignoring the presence of the heat exchanger, it's conservative because we capture the additional mass which is occupied by the space of the heat exchanger. But for the exchanger design itself, we still consider the added mass of the surrounding pool of the surrounding water.

MEMBER BANERJEE: But the added mass would only be there at relatively high accelerations. Right? The added mass term, it's a function of the acceleration rather than the velocity. So the added effect would show up in the higher frequencies, whereas what I think he's asking is now you have this structure in the middle. I don't want to paraphrase you but --

MEMBER CORRADINI: You're doing fine. Keep on going.

MEMBER BANERJEE: You have sloshing going on. The sloshing is not a added mass effect. The sloshing is a free surface motion.

MR. LIU: Right.

MEMBER BANERJEE: I mean, the added mass has nothing to do with that.

MEMBER CORRADINI: Where I'm going with all of this is that I understand now. I misunderstood what you said a few weeks ago. So I got that right. But now the next thing that was going through my mind is I am putting essentially a steel structure in the middle of a pool and I'm using it a design rule that doesn't have it there and I'm trying to decide does that underestimate the effect, overestimate the effect. I'm still struggling.

MEMBER BANERJEE: It was. I mean, this wave load on the structure, we see this in North Sea all the time and the wave load on the structure can be enormous. So how do you calculate that wave load? Now you have a structure stuck in the pool. Right? It's like --

MR. LIU: Yes, like I said. The motion near the surface is a sloshing component. It's a wave. It's very low frequency.

MEMBER BANERJEE: And it's hitting the

structure. Right? The wave?

MR. LIU: Right.

MEMBER BANERJEE: How do you calculate that structural load?

MR. LIU: So for the purpose of seismic modeling, we considered a mass effect. Because sloshing, even though it's very low in response in frequency, still has associated mass. The impassive mode which responds in a high frequency together with the structure has its function its own share of mass.

MEMBER BANERJEE: Yes, we understand that.

CHAIRMAN SHACK: He's worried about the dynamic load of the slosh on the components.

MR. LIU: Yes.

MEMBER CORRADINI: So let me --

MR. LIU: We have which I will get into in the next slide. We did compute the hydrodynamic pressures on the wall from both sloshing component and the impassive component as a local load effect on the pool for the stress calculation.

MEMBER BANERJEE: Let's then move onto --

MEMBER CORRADINI: Sorry. Okay. At least, we're communicating as to what we're thinking about.

MR. LIU: So like I said, the total mass

is still maintained by summation of the two components. So given that, you know, for our calculations we considered the entire water mass of the pool as impassive mass originally attached to the structure to maximize the inertia effect under seismic citation.

MEMBER BANERJEE: But it's not very easy to calculate the added mass for complex structures, is it?

MR. LIU: Our geometry really basically is still rectangular, a rectangular pool. So geometry, geometric wise, it's still not that complicated. The equations are available to compute those quantities.

MEMBER BANERJEE: Is it also available if you have a structure in the middle? Well, I guess you would model as a cylindrical structure or something?

MR. LIU: Right.

So we considered all the pools in the models. Therefore, the effect of the pools interaction is automatically accounted for.

MEMBER BANERJEE: Has somebody actually looked at what you've done here in any detail to figure out -- I mean, an independent?

MEMBER CORRADINI: You're going to ask that question of the staff obviously.

(Laughter.)

MEMBER BANERJEE: Has somebody actually looked at this?

MEMBER APOSTOLAKIS: Yes.

MS. CUBBAGE: We'll be presenting this afternoon.

MEMBER CORRADINI: They'll be ready for us after lunch.

(Laughter.)

They'll be poised.

MEMBER MAYNARD: I didn't really hear an answer though to what you, Sanjoy, asked.

MEMBER CORRADINI: No, we haven't heard it yet. But we're going to get there.

MEMBER MAYNARD: Two different questions about the same thing. One is the effect of the sloshing on the heat exchangers you put in there. The other is the effect of the heat exchanger effecting the sloshing and basically putting --

MEMBER CORRADINI: Yes, what I guess I'm -- since I'm not a structural sort of guy, but I view this as a multi-load problem. So you have this thing wiggling and you have something inside wiggling. You have something inside of that wiggling and I'm asking the question by the way you've modeled it have you missed some point where they all resonate together and you get a bigger load than you would calculate and I'm hearing that you thought about it. But I'm not hearing that you have analyzed it.

MEMBER BANERJEE: Well, he was saying that he was going to show us in the next slide.

MEMBER CORRADINI: Okay. Sorry.

MR. LIU: So this is the model we have for the stress analysis of the pool. It's a three dimensional model. So in the model we included each structure, pool structure, exclusively.

MEMBER MAYNARD: So how would you --

MEMBER BANERJEE: What's happening to the pool itself is part of a model.

MR. LIU: It's part of a model.

MEMBER BANERJEE: So the pool is within this model.

MR. LIU: Right.

MEMBER BANERJEE: The water.

MR. LIU: Right. The pool -- not water. The water is not experienced in the model as water. Okay. Water is a model as a pressure load. Okay. This only included the pool walls and pool slaps, the boundary of the wall.

MEMBER CORRADINI: So what do you do with

WI and WC? I think that's what he's asking.

MEMBER BANERJEE: Yes.

MEMBER CORRADINI: Is it there?

MR. LIU: They are there in the form of a pressure loading.

MEMBER CORRADINI: On the wall.

MR. LIU: On the wall. On the walls.

MEMBER CORRADINI: That's just hydrostatic pressure.

MR. LIU: No, hydro --

CHAIRMAN SHACK: Frequency dependent.

MR. LIU: The dynamics. The maximum dynamic pressure.

MEMBER CORRADINI: I'm sorry. Okay. Excuse me.

MEMBER BANERJEE: But you calculate the dynamic pressure separately.

MR. LIU: Yes, separately.

MEMBER BANERJEE: You do the mass -- thing or whatever.

MR. LIU: This has a closed form equation. You know, those are equations -- Again, this is - Professor Haulser did.

MEMBER BANERJEE: So you have the dynamic pressure separately or inputting it into the --

element and all.

MR. LIU: Yes. As a boundary condition.

MEMBER BANERJEE: As a boundary condition. Time dependent boundary condition.

MR. LIU: So maximum value. There's a maximum value.

MEMBER ARMIJO: What do you mean?

MEMBER BANERJEE: Well, that's strange. Then you can't get resonances. Right?

MR. LIU: No. The resonances effect are already accounted for in the certain response, dynamic response calculation, which I described earlier. So this part of the discussion is for was with the mechanical loads from the seismic analysis, how we apply those loads into the final item of the building to calculate the stresses in the structure. This as a two step calculation in our structure design. Okay.

MEMBER BANERJEE: So you don't take a time varying load and fit it into this. You just put some sort of an upper bound load.

MR. LIU: In the maximum load.

MEMBER BANERJEE: So there is not a transient finite element analysis.

MR. LIU: This is not a transient finite element analysis because like I indicated earlier is that we performed this transient finite element analysis for seismic -- using the seismic model first.

MEMBER BANERJEE: So then Mike's question holds. He's asking you whether you can excite resonances based on the dynamics on the sloshing and things like that.

MR. LIU: But the dynamic effect are really accounted before in the first step, seismic calculation, which is a dynamic event.

MEMBER BANERJEE: And just how do you do that because the -- I guess let's start from the beginning. You've run an earthquake spectrum using this fluctuation and you have some horizontal acceleration on the ground. This doesn't enter directly into this finite element.

MR. LIU: Not directly.

MEMBER BANERJEE: Okay. So that would be the first step.

MEMBER CORRADINI: And you account for it -- and can you just repeat for our edification? You accounted for it how? How did you account for it to get rid of the time variation that Sanjoy was asking? You said you accounted for it. Remind us how you did. I guess I should have --

MR. LIU: Okay. There was an earlier

slide.

MEMBER BANERJEE: We probably missed this.

MR. LIU: This slide shows how we consider pool water in the seismic response calculation. This is the first step before we do the finite element stress calculation.

CHAIRMAN SHACK: No, but he's missing your seismic stick model to get the whole dynamic response of the structure before you go to the finite element model.

MR. LIU: Right.

MEMBER BANERJEE: Yes, we're missing something.

CHAIRMAN SHACK: It's in that fourth bullet. He has a mass, but he also has a whole seismic stick model of the whole structure.

MEMBER BANERJEE: Okay.

CHAIRMAN SHACK: Which is all dynamically loaded.

MEMBER CORRADINI: But just so you can see where our question is and then we move on so that -- What we're going to ask the staff --

MEMBER APOSTOLAKIS: What is the problem? You have modeled the pool.

MR. LIU: The problem I have with this

calculation is there global response backdrop by equipment design, the forces and moments, accelerations, we use for the structure design itself.

MEMBER CORRADINI: So let me just interject. So then that is the thing. The reason we're asking the question is I'm worried thinking on how the water interacts with the heat exchangers and the pool supports. If you're telling me the empirical design rules have taken care of the pool supports, my next question goes back to the structure of the heat exchangers that are in the middle of this little sea that's wiggling about and I want to make sure that they're not going to -- they're properly accounted for.

MR. LIU: Yes. For the heat exchanger design, we do consider the surrounding -- the water, the effect of water on --

MEMBER CORRADINI: But you see where our question is coming from. I'm sorry.

MEMBER APOSTOLAKIS: So the way I understand it is you do this calculation first and then you go the finite element model.

MR. LIU: Yes.

MEMBER APOSTOLAKIS: So what is the product of this analysis that is input into the finite analysis?

MR. LIU: That the maximum -- and the maximum moments at each elevation of the --

MEMBER CORRADINI: So you do this as you call it, stick model, and you get something like this and you take exactly --

MR. LIU: The maximum value.

MEMBER CORRADINI: You take the maximum value and then watch the bending and the deformation.

MR. LIU: Right.

MEMBER APOSTOLAKIS: But then that's a varied question. The finite element model is static.

MR. LIU: It's static analysis.

MEMBER MAYNARD: But is there anything different about this analysis methodology than what was used for, let's say, the ABWR design.

MR. LIU: No.

MEMBER CORRADINI: Right. The reason I'm asking all this though is that that the one difference is I have elevated pools with structures inside of it which have to perform after the event. That's my problem here.

MEMBER MAYNARD: Other structures in pools with slosh have been analyzed before.

MEMBER APOSTOLAKIS: Right.

MEMBER CORRADINI: But you're right. The wet well, all of that, this is standard operating procedure.

MEMBER APOSTOLAKIS: All that.

MEMBER ARMIJO: How is it intuitively obvious that when you take the peak loading values from a transient load and apply them in a steady state mode that that's conservative?

MR. LIU: We take all the peak value and we apply all the peaks values simultaneously, so it has to be conservative.

MEMBER BANERJEE: Let me give it back to you the way I understand it. The frequency of the sloshing which is the primary dynamic load in the system is much lower than the natural frequency of the structures. So this applying sort of extreme loads gives you, you know, they decouple the problem. That's how I understand it. I may be wrong, but the sloshing frequencies are very low. That's what they're saying.

MEMBER CORRADINI: That's correct.

MEMBER BANERJEE: And whatever is the high frequency stuff is added mass terms and all that are taking care of it and it's just transmitting and that they keep, the solid part. But the sloshing part is low frequency and they decouple it. That's how I understand it. Correct me if I'm wrong.

MR. LIU: No, sir. That's basically what I said. The first bullet, basically keeping the sloshing mode really is insignificant. But we still --

MEMBER BANERJEE: But you take the extremes though.

MR. LIU: Yes, we still did not discount the mass. We still considered the associated mass as a total mass.

MEMBER CORRADINI: So you have to move on. I understand that, but just to make you see --

MEMBER BANERJEE: But I think Mike's question still stands.

MEMBER CORRADINI: Yes.

MEMBER BANERJEE: Don't forget that question.

MEMBER CORRADINI: And the one thing you said that I thought was intriguing. You must have done it with and without sloshing because you said the sloshing effect is insignificant. I thought you just said that.

MEMBER APOSTOLAKIS: Because of its frequency.

MEMBER CORRADINI: Is it because of its frequency or because of the magnitude what's sloshing?

MR. LIU: The frequency.

MEMBER CORRADINI: The frequency. Okay. So what Sanjoy said. Excuse me.

MR. LIU: Yes, frequency.

MEMBER CORRADINI: Okay.

MEMBER BANERJEE: You don't necessarily have to buy into it.

(Laughter.)

MEMBER CORRADINI: But I understand at least. Okay. Sorry.

MR. LIU: This slide pretty much I have discussed somehow earlier.

MEMBER APOSTOLAKIS: So what does it mean? Twenty-two, let's go back to 22.

MEMBER CORRADINI: They just showed you what they have.

MEMBER APOSTOLAKIS: It just shows what you analyzed?

MR. LIU: Right. That's the model we have.

MEMBER BANERJEE: Tell me how difficult is this to do a transient analysis. Is it just a lot more time consuming or once you've set it all up like this? I mean, you set it all up. Right?

MEMBER CORRADINI: I don't think it's easy.

MEMBER BANERJEE: Well, I'm asking.

MR. LIU: The computation is extensive, particularly that one.

MEMBER BANERJEE: If you converge to some sort of steady state, you have to go through iterative process. Right? I mean it's like --

MR. LIU: Like I said, when we developed the stick model, we recognized is stick model is approximation. So we compered the stick model to the finite element model to make sure --

MEMBER BANERJEE: This is an elliptic problem you have. Right? This boundary condition? So I mean you can't solve an elliptic problem directly especially if you have any non-linearities in there. Why is it so much more expensive to do a transient analysis of this?

You have many cycles of elliptic process, which I think is the answer to the question.

MEMBER BANERJEE : No, but to convert to solution, you have to go through it anyway. I don't know. Anyway, that's all.

MEMBER APOSTOLAKIS: So whatever you

decide from this model, the thing is safe. What is the output and you compare it to what?

MR. LIU: The output possessing over here. So the output really serves as an input to this finite element amount.

MEMBER APOSTOLAKIS: Right, and the output of the finite element model is what?

MR. LIU: Stresses.

MEMBER APOSTOLAKIS: Okay. All right.

MR. LIU: Then we compare the stresses with current levels.

MEMBER BANERJEE: If it doesn't break, it's okay.

MEMBER APOSTOLAKIS: Where in the picture on 22, where do you expect the maximum stress? Where does it occur?

MR. LIU: From a stagnant point of view, the highest stress areas are the base.

MEMBER APOSTOLAKIS: The base.

MR. LIU: The base, yes.

MEMBER APOSTOLAKIS: Good. Thank you.

MEMBER BANERJEE: So new buildings basically break at the base in earthquake?

MEMBER SIEBER: Yes, from shaking.

MEMBER BANERJEE: If you observe the

buildings, do they break at the base or does the top fall off or what happens?

MR. LIU: We want to make sure they won't operate.

(Laughter.)

MEMBER BANERJEE: When they do break, I mean, a building, does it break --

MEMBER SIEBER: The first floor disappeared and the rest came down.

MR. LIU: So a kind of self-story for the typical commercial building, self-story, big openings. There is a soft spot.

MEMBER APOSTOLAKIS: So the base is the problem?

MR. LIU: Right, the base. That's all I have.

MEMBER CORRADINI: So are we all set? So let me go back to my question because we're going to ask the staff next. So just so you understand our question, our question is not so much -- I think finally you or at least I finally got it. I had missed it in the subcommittee on how you put this together. I guess I'm just still open in my mind about the interaction between the pool, the heat exchanger, and the associated structure, and if you captured in your fourth bullet of slide something or other, your Slide 21, if you've captured since you're taking the peaks, if you've captured the peaks and all of the peaks. That's what I guess I'm -- still ruminating about.

Okay. Other questions from the subcommittee members or from the Committee?

MEMBER BANERJEE: I think we need to revisit at some point your point, which is --

MEMBER CORRADINI: Well, the staff will fill us in. Okay. Mr. Chairman, we're in good shape. Can I bank this for later on when I'm in trouble?

CHAIRMAN SHACK: No, no.

MEMBER APOSTOLAKIS: That is a principle of conservation, I believe.

MEMBER POWERS: But you could have a longer lunch. You're now a gentleman of leisure. You can go to Addie's for lunch.

(Laughter.)

MEMBER CORRADINI: Mr. Chairman, are we on break?

CHAIRMAN SHACK: We're on break.

(Whereupon, at 12:00 p.m., the meeting was recessed for lunch, to reconvene at 1:15 p.m., the same day.)

AFTERNOON SESSION

(1:15 p.m.)

CHAIRMAN SHACK: If we could come back into session, I think we're going to resume our discussion of the ESBWR, and Dr. Corradini is in charge.

DR. CORRADINI: Thank you, Mr. Chair.

So we'll turn it over to Mr. Patel, Dr. Patel, as the one who will lead us off this afternoon.

MR. PATEL: Thank you very much.

MEMBER CORRADINI: There's enough of us here. Just keep on going.

MR. PATEL: All right. Good afternoon. My name is Chandu Patel. I'm the lead project manager for FFE review. I have Richard McNally. He will make a presentation on 3.2, and Dave Jeng, he will make presentation on the seismic issues.

Before we go into the details, let me set the stage and give you some general idea about Chapter 3. As you know by now, there are so many sections of Chapter 3 covering very, very diverse issues, and there are about 20 reviewers for reviewing this chapter. I have the names just to give you some idea of the number of people in all, and plus the contractors.

We issued a lot of RAIs, and I understand our numbers don't mean so much, but I think this will give you some idea of the scope and how much we were involved in.

We saw about 583 RAIs, and as of now there are about 57 open, and when they are open in like structural areas as we have been discussing lately, and the second highest is the vehicle internals and the steam drier issues, and then the five per week for protection area. That's it.

Now, before we go into detail, I would like to give you a little bit more background. There are a couple of general questions from the subcommittee, and I would like to discuss this in a little bit more detail.

The first question is how does Chapter 3 fit into the rest of the chapters? You know, what's the relation between the other chapters and Chapter 3? And my understanding is, okay, Chapter 3 is really the meat -- they say, "Where's the beef?" -- for all of the plant design considerations. If you look at Chapter 3, they start with what are the GDC criteria and then goes to the classification of each system and component, and then it goes to all the issues which are like protection of the plant from outside, you know, I would say, tsunami, outside events, like hurricanes, tornadoes, all the protection for whole plant from outside sources.

And then it goes into the seismic design, capture design, and then it goes into the internal components, and then in-service inspection and testing area, and then equipment qualifications.

So if you look at -- and also piping design considerations. So basically like I generalize, how can we disable? If it doesn't fit anywhere else, they put it in Chapter 3.

(Laughter.)

MR. PATEL: Actually, it really very, very good information. If you want to know about any system, look at Chapter 3.2 and you will know how it is classified, what criteria, what kind of modes they have used, you know. That was in Chapter 3.

So in general, it's really the main meat of the whole plant design description.

Last, the other question, in general, how much detail did you guys review this chapter's design? And I'll characterize this thing as I think we really reviewed in fairly good details, and just to give you the idea, as I said, there were 483 RAIs, but in addition to that, we really had so many audits in different areas, and we also made confirmatory analysis, just to give you a few examples, in like Chapter 3.7. We had confirmatory analysis for the source chapter interactions. We did use the GE methodology.

The same thing for piping design. They picked one system and tried to verify how GE has done the analysis, and the same thing for the structure area.

So we really tried to verify, you know, to the extent possible in certain areas, and I would like to say we have made some really a little impact on the design consideration, and I will give you some examples, but these are not the average building that GE wanted to design for something like 300 hour-feet, and then we noticed they really wanted to 330 miles per feet for tornado loading. We had to make them change if they want to classify. Otherwise it becomes an issue, and so they did change it.

The same thing in IST, in-service testing program. We asked about 50 question before we got the things which we really wanted in the CD. You know, I'm finally there on all open items.

So, in short, we have really looked at in quite a bit of detail, and in that, you know, if there are no questions, we would like to go into the details with you.

So, Rich.

MR. McNALLY: Okay. I'm Richard McNally with Division of Engineering, Engineering Mechanics Branch, and this is a follow-up, I guess of the brief presentation given to the subcommittee.

From what I understand there are questions from the ACRS regarding how RTNSS was applied and the risk informed process to classification process.

So briefly, this is an overview of the staff's Section 3.2 review, and this summarizes the regulatory basis for our review and briefly describes how the classification process considers risk insights. This topics is interrelated to DCD Section 17 on quality assurance and Section 19 on the PRA, and Chapter 22 of the FSER for regulatory treatment of non-safety systems, or RTNSS.

The classification structure systems and components is important in order to define the quality standards that insure the integrity and reliability of importance to safety SSCs. For pressure boundary items and their supports, the ASME code has always applied a graded approach to quality. It is necessary to define ASME code classes since the ASME code and 10

CFR 50 regulations do not entirely do this.

Part 50.55(a) specifically defines the code class that applies to Quality Group A for reactor coolant pressure boundary, whereas code classes of other quality groups are defined once those quality groups are defined based on their safety function.

GDC-1 and GDC-2 that you see here are really the foundation for establishing quality standards and seismic requirements for important structures, systems and components. I don't expect you to read the fine print, but I have underlined some of the important aspects of this relevant to the classification process.

One of the things I wanted to point out is in regard to a common term that is sometimes misunderstood, is that important to safety that is used in the GDC is broadly defined as SSCs that provide reasonable assurance that the facility can be operated without undue risk of the safety of the public.

Safety related is a more limited definition that applies to three specific important safety functions.

Next slide.

This slide summarizes the classification process. Deterministic approaches apply NRC guidance, industry practices, and judgment, such as the expert panel. The classification approach for safety related SSCs is based on this approach rather than the optional risk informed approach, the categorization process that's defined in Reg Guide 1.201 that was issued for trial use, and that was brought up at this morning's presentation.

This approach applies to defining both safety related --

MEMBER APOSTOLAKIS: I thought it was a rule. It's not just a relation.

MR. McNALLY: It's 50.69, a rule, but the Reg Guide 1.201 is a method of characterization for risk one, two, three, and four. That's issued for trial use. It's been used for operating plants, and I think we're waiting for feedback before we'd be ready to apply it to new reactors.

But in any case, all of the applications have come in using basically a deterministic approach.

MEMBER APOSTOLAKIS: If there is a rule and somebody follows the rule, you have to accept it. You review the method. What the department guide is for prior use is an inconvenience, but it's not something that discourages people from doing it.

So they chose not to do it. We accepted that.

MR. McNALLY: It's certainly optional.

Okay. Risk informed approaches consider the PRA to define the risk significance of a particular component or system. This also applies to both safety related and non-safety related SSCs, but for ESBWRs primarily used for identifying RTNSS SSCs. RTNSS is the process by which we consider the relative risk and includes special treatment for non-safety related SSCs that are important to safety.

Although the ESBWR application is, in general, consistent with the Reg guides, there are a number of open items to be resolved, including seismic classification of the turbine building, seismic qualification of non-safety related SSCs, quality standards for RTNSS SSCs, and design changes affecting equipment needed post 72 hours.

The PRA and RTNSS process established the scope of risk significance and also treatment of those important, non-safety related SSCs. Scope of the RTNSS SSCs is being addressed under DCD Section 19 and Chapter 22 of the FSER. There are a number of open items regard scope that need to be resolved and reconciled in various documents.

MEMBER BLEY: Excuse me. Depending on who has been talking over the last couple of months, I think, I've heard -- and maybe it's just the way I heard -- the PRA identifies RTNSS events. The PRA has absolutely nothing to do with them.

Can you be a little definitive on what the role is and how it's used?

MR. McNALLY: Well, I'm no the PRA specialist, but I can give you my perception of what it does, is that it helps define what systems are important, and that's used in the RTNSS process. Probably Mark can fill you in more on the details, but primarily up until the recent revisions, the list of risk significant SSCs were identified in Chapter 19 as part of the RTNSS process, and although this can quantify the relative risk for each system or even each component, it's still up to a classification process in order to put that into an appropriate category.

But Mark can certainly answer any specific questions you have on the RTNSS process and how that is qualified in relation to the risk significance.

MARK CARUSO: I'll try and be brief and to the point. There are five criteria that are used to determine which of the non-safety SSCs should be covered under the RTNSS process or given some sort of regulatory treatment, and some of those criteria involve using the PRA and some don't. Criteria A has to do with looking at are there any safety SSCs that are used to mitigate an ATWS. Are there any things that are used to mitigate station blackout?

If the answer to those questions is yes, those systems, those SSCs are in scope for RTNSS.

Category B has to do with providing long-term safety. In the period between the 72 hours and the seven days it identifies safety functions including core cooling, heat removal, decay heat removal, post accident monitoring, controling habitability, and looks at what SSCs are required to achieve their safety functions in that period.

And those SSCs are then within the scope of RTNSS. There's no looking at their risk significance or calculating their worth. It's just they're relied upon for those functions therein.

There's also some additional design requirements for that equipment that are imposed, the most significant of which is seismic requirement that they be Seismic Class 2.

The third category does involve the PRA. The third category says let me look at how important the non-safety systems are with respect to risk, and it does a focused PRA where it takes all of the non-safety systems that have been modeled in the PRA and assembled in the PRA out. It says they're not there and looks at what happens to core damage frequency, what happens to large release frequency.

And then it starts adding them back in looking at how important is this particular non-safety system with respect to changing core damage frequency and looks primarily at is there anything in there that can really cause you to -- you know, is very significant with respect to the safety goals.

In fact, the way they do it is they put the non-safety stuff in backwards, look at what they get for core damage frequency, and then see if they take something out would it take you below the ten to the minus four, below the ten to the minus six, and there are a few functions in each BWR, which that was the case, which have to do with digital control system functions.

There are redundant safety actuations in the non-safety digital control system for a number of key safety functions, and because of the treatment, the way digital control systems were treated with PRA, it shows up as a very significant complement, the digital instrumentation system.

So do you arrange redundant functions which are non-safety functions, in the non-safety digital control system? They show up as very important. So they're included.

MEMBER BLEY: With the analog control systems?

MARK CARUSO: Sure.

MEMBER BLEY: Not digital.

MARK CARUSO: No, it could be analog, sure. Whatever non-safety you look at how it plays out.

MEMBER BLEY: Full system. It's electrical control system.

MARK CARUSO: Right.

MS. CUBBAGE: It just happens that in the case of ESBWR when they did this exercise what became significant was the diverse protection system, which is a digital system.

MEMBER BROWN: Just because it is, but it could have been analog, the first system, and you would have had --

MS. CUBBAGE: If it had been in the plant and been significant and came out of the process, yes.

MARK CARUSO: Right. If you had an analog system that was providing the diverse, non-safety backup for the main system, and in this particular case the safety grade digital control instrumentation system is showing up as very significant because a common mode failure in software, these additional redundant functions can become very important.

In addition, we also look at this particular part of the criteria. They look at thermal hydraulic uncertainty and consideration, thermal hydraulic uncertainty. They look at different systems that can provide backup, and in this particular case, they identified FAC. This is very important because it provides a backup for the cooling system. So that was included under this category.

Category D has to do with containment performance, and similarly, it looks at the containment performance goals, you know, conditional containment failure probability of less than .1 and large early risk frequency, and looks at anything that could significantly impact those and identifies that go in scope.

And the last criterion is E, which looks at any non-safety systems that are important in or provide a function to prevent system interactions, interactions between non-safety active systems that perform safety functions and the passive systems. So it looks for any systems that have been added to specifically prevent any interaction between the active systems and the passive systems. It's really geared towards the active system/passive system interface.

MEMBER BLEY: Okay. Thanks, Mark.

Would it be fair to say that even for Categories A and B and maybe E that the PRA provides a systematic way to identify some of those or are there other systematic ways to identify the things that fit in those categories?

MARK CARUSO: Well, the ATWS analysis, the analysis of the ATWS events and the analysis of the station blackout events are covered in other chapters, Chapter 8 and Chapter 15, and it's really looking at, you know, what it takes to mitigate the ATWS. It's not looking at the failures to get the ATWS. I'm sure there are insights from the PRA because it's modeling the PRA, but there is a specific ATWS analysis that's done by the applicant that postulates I have transients. I don't have any shutdown. Do I have enough safety valve? You know, do I meet these criteria -- I forget -- Criteria D or whatever it is from the code?

So it's almost like a Chapter 15 analysis, but it goes beyond that, and it looks at what's been designed into the plant to satisfy the criteria.

MEMBER BLEY: Thanks.

MEMBER APOSTOLAKIS: So is it also fair to believe that in this context PRA is only to add to the safety related group?

MARK CARUSO: Yes.

MEMBER APOSTOLAKIS: Thank you.

You will see my comments.

MR. McNALLY: Okay. In regard to risk considerations that we've applied to the classification process in regard to RTNSS SSCs, this summarizes briefly what we've done here. The risk significance of a safety function is important in the identification of RTNSS SSCs. The staff review considers risk significance by applying risk insights documents that risk inform the SRP process. Some of these documents were issued after we began the initial review of the ESBWR, but we do consider it in the review of components.

MEMBER STETKAR: Excuse me. Those right insights documents, since they're called risk insights, must be derived from available PRAs that have been performed for currently operating plants; is that correct?

MR. McNALLY: They're derived from PRAs. Whether it's operating plants or new reactors I'm not sure.

Mark, can you add?

MARK CARUSO: What was the specific question again?

MEMBER STETKAR: The reference is made to risk insights documents that were used, I guess, as some input for this decision process. My question was since they're characterized as risk insights documents, are those insights derived from PRAs that have been performed for currently operating plants, currently operating plant designs?

The question is: what is the relevance of risk insights from evaluating a currently operating plant design relative to potential risk or contributors to the risk from a rather different plant design that relies very heavily on systems that haven't been modeled before, like digital INC and passive design features that basically don't come into play in any existing plant?

MARK CARUSO: Well, I'm a little confused. The risk insights that were used in the RTNSS process for ESBWR come from the ESBWR design PRA. Now, the existing code plants that I know passive --

MEMBER STETKAR: That's correct, but I just heard that --

MARK CARUSO: There's no RTNSS process for current plants.

MEMBER STETKAR: I understand, but I just heard that there are a set of, quote, I believe you called them risk insights documents.

MARK CARUSO: Correct.

MEMBER STETKAR: Which lead me to believe that there is some sort of written guidance or written information that you can go look up and say, "Oh, this is important. So I should pay attention to this," or, "This is not important. So I should not pay attention to that," based on all of our accumulated insights and experience from all of these risk assessments. And I'm trying to understand what those risk insights documents are and where do they come from and really how are they used since they've been mentioned as something that's apparently used in the process.

And if they're not used, why are we talking about them?

MEMBER APOSTOLAKIS: Clarification. This reference to this document, the RTNSS sites, is in the context of the ESBWR or is it a broader?

MR. McNALLY: It's in context with ESBWR. We have them for each type of new reactor.

MEMBER ABDEL-KHALIK: So it's part of the PRA?

MARK CARUSO: Oh, I know what he's talking about.

(Laughter.)

MARK CARUSO: Now I know what he's talking about. The NRC staff has taken upon themselves to examine for the new designs, whether or not they be passive or not, what risk insights can we identify for this design that would be important for other reviewers to have when they're doing their review to help them focus their review and identify appropriate scope and depth, to do smart reviews and risk informed reviews.

We have a document. I would assume -- I can't say for sure, but I believe -- it's been discussed with you, but it's a process document on how you identify these insights and how you map them to the various sections of the SRP.

The identification process is really related to the design PRA for the particular design. So we've taken information from the ESBWR PRA, from the AP-1000 PRA, and looked at those PRA documents and many PRA documents and identified from them risk insights. We've had obviously tremendous help from the designer because it's their PRA, and they've done a lot to identify insights in the PRA.

We then take that set of insights. These systems are very important, these systems are very important, these are not, and then tried to map that information, and where does it apply in the rest of the staff's review of the design? Can it help you figure out in SRP 5., 6.-whatever that says look at all of this stuff? Can it help you say here's the stuff that's really important, and maybe you should really focus your review or your limited review resources here as opposed to here.

We've generated risk insight documents for each of the designs and published them for the staff to use and they're available in the NRC Web so that you can go look at them if you like. You can look at the process document that describes how we do it and how we map the various insights to the different SRPs and how we treated -- you know, there are a number of SRPs and sections in the plant that have equipment that's not modeled. How do you deal with that?

So I'm sorry. I didn't think I knew what you were talking about, but that's what we're talking about.

MEMBER BLEY: That helps, but if somebody would make sure we get the process document. Maybe we already do, but I don't remember seeing it.

MS. CUBBAGE: That was not something you would have received as part of this review.

MEMBER BLEY: But if you could get a URL for it.

MS. CUBBAGE: Yes, we absolutely can do that.

MEMBER BLEY: Thank you.

CHAIRMAN SHACK: Thanks.

Let's move on. They're running out of time.

MR. McNALLY: Okay. Non-safety SSCs with high risk significance are identified in Section 19, but on other design certifications, such as AP-1000 can be included in Chapter 17 under the reliability assurance program.

Right now Appendix 19(a) for ESBWR has undergone extensive revision. So I'm not positive the list of written SSCs still resides there. It may also be in a NIDA report that is being reviewed independently.

Section 3.2 does not currently identify

which items are special class, and this is an open item, until each item that is classified as special class is so designated. RTNSS SSCs will receive special treatment beyond commercial codes and standards in terms of seismic and quality requirements so that GDC-1 and GDC-2 are satisfied. These SSCs are expected to have supplemental requirements in the design and operational phases that are intended to insure the reliability assumed in the PRA. These include design considerations, as well as inclusion in the design reliability assurance program, or DRAP, maintenance program and QA program.

As previously identified in regard to RTNSS, there are open items that relate to defining the scope and special treatment of RTNSS SSCs. You may refer to last month's subcommittee meeting on the topic, and Mark has offered some insights today.

So if there are any questions, I'd be happy to address them.

MEMBER STETKAR: Just a quick one because things are still quite obviously in a state of flux, especially with respect to the status of the PRA and in some cases the status of the design. I mean, we heard about, you know, a new building that popped up between Rev. 4 and Rev. 5 of the DCD. What is the plan or what is the schedule to kind of come to closure on a stable list of RTNSS equipment and the agreement on the criteria that were used to select that? Is Rev. 5 of the DCD that point or --

MS. CUBBAGE: The list of criteria as to what gets into RTNSS and whatnot, that's established by Commission policy. That's not something that's up for debate on this review. There's an established process and policy that's being followed in this review.

As far as the list, I mean, there are still some open RAIs, but I think the list is stable as far as DCD Rev. 5 goes. It's possible through the review process something could change, but I don't expect that GE will be making any changes to that unless it's in order to resolve an RAI.

MEMBER STETKAR: Okay.

MS. CUBBAGE: But I am not aware of any significant open RAIs at this point in the RTNSS review that would impact that list. It's more of some specific clarifications on the treatment of any particular SSC that has been scoped into RTNSS.

MARK CARUSO: I think in Rev. 5 they actually addressed, I think, most, if not all, of the major concerns that we had with the RTNSS in Rev. 4, and we're doing that right now, and we're anticipating if we have anymore RAIs, which I would doubt but I can't say for sure, if we get those out in August and we get answers back in 45 days from GE, I think we've committed to try and finish up Chapter 22 by November.

MS. CUBBAGE: In other words, we're on the home stretch in this particular area.

And you know, you referred to the building that was added. The addition of that building was to house new diesels, and those two additions addressed a lot of the open RAIs.

MEMBER CORRADINI: Move on.

MR. PATEL: Okay. The next topic is your topic. David Jeng is going to make a presentation on seismic design issues, but before he starts, I'd just like to point out some administrative things, please.

I guess we have to have three more pages from the package, what you have before following the questions in the morning. So out of that you have three pages extra beyond the package you got. Everybody should have a copy of three pages.

But the thing is two of the pages are numbered 21. So the one with the table is 21 and the one with the write-up is 23. The other one is 23. When they discover, I point it out which one is which.

MR. JENG: I am David Jeng, and I'm the staff full review of the Section 3.7.

Today I would like to address the two topics which you indicated you were interested by this Committee, and I try my best to clarify and help you address them more thoroughly. And as a result of this morning's discussion, I list here several questions which are sort of not totally answered, and I will try to answer these three questions.

How does the effect of the impulse transfer into the complete analysis model and how does it meet the final design of the buildings that revise in the thickness of the liners and so on?

The second item is what about the equivalence that's been in the pool the U.S. consider the effect of that interaction between the equivalent and the surrounding water, so forth, root subsequent action, and how does the applicant and the staff address this kind of stuff? That's the second item.

And third item, I would like to explain the process from the seismic analysis, so the first microscopic analysis through the finite analysis, and work with design level.

Dimensioning of the rebar size, number of rebars, that's the third page, 23. I just put this up after the meeting so I could help you make it more clear.

Go to the next one.

Okay. On the two issues, the first issue is the design grand motion using seismic design of ESBWR plants. I think this issue was almost clearly addressed quite right by the GE presentation this morning, but I just want to go through quickly the staff perspective regarding this one.

The bottom line is the double hump curve, GE has mentioned, was very conservative, one, and which includes two segments of our knowledge, and in the low frequency range, which is the copy of Reg. Guide 1.60 spectrum anchored at .30g, and this is really the major area of concern because the structures, the way they are designs and constructed, are going to respond very sensitively to this range of motion input.

Lately, because of our knowledge enhancement in the seismology areas, the seismologist has determined that in the eastern U.S. there are new information that high frequency motion would be of importance. And in addition to this concern, we have also requested to consider what are we going to do about this new knowledge.

And in response to that request, the industry has proposed to develop that portion of the knowledge, and that is shown in the most site specific ESP, that one response specter, and in my slides Figure 1 is the regular 1.60 low range, and the Figure 2 -- this is Figure 1, in which shows our convention of very important range of input and structure response to aspect notion.

But Figure 2 --

MEMBER CORRADINI: Before you go to Figure 2, yesterday somebody asked if we had a tutorial. You may have been there, but you don't need to be tutored. I'm trying to understand how I take a velocity frequency and transfer it back to an acceleration. I want to understand that.

So can you briefly?

MR. JENG: Yes, yes. This is several tripartite, you know, diagram which covers the given points or gives us the information, acceleration, velocity, and displacement. Okay? And we used this one for ES, but the way we are doing the analysis, these three countries are rated by omega, by the frequency omega. So it's a simple linear relationship.

So you can pick up at one point and go to the appropriate axis to determine the number.

Does it help you? Does it answer your question?

MEMBER CORRADINI: Given that we're running behind, it helps.

CHAIRMAN SHACK: It's just a mass spring oscillator. So you can relate the velocity to the acceleration with Omega.

MR. JENG: This was Figure 2. Figure 2 is, again, different way of presentation of that high frequency spectrum which is part of included in the application DCD, and this shows the sequence 110 Herz to 100 Herz. That's for the spectra radial far exceeds dose observed in 1.60 growth between spectra. That's why we are going to include that in our overall design consideration.

Let's go to Figure 3. This is a sort of double hump design response spectra, certifies seismic design with the spectra. This is a reference design for which they are designed and they exert our standard plan in the scope such as are able to take whatever motion whose spectra stays in this bundled envelope.

So this is a reference spectra. If any applicant cannot demonstrate their structure can reduce the motion, whose spectra exceeds any point of this one, then they have to take exception or departure approach in the four of the rules in the radiations to demonstrate that they are properly taking a look after and taken care of.

But in general, this is very conservative one and in all situations, we expect this to be conservative to cover all the potential sites.

Bottom line, the double hump spectra is very, very conservative, and we have review authority, and we consider GE's application is adequate and in ample margins.

I will next go to the next subject. There is interest in the last meeting of the subcommittee that they want to know more about how the pool effect is accounted for in the seismic analysis, and this morning GE presented some of it, and I'm going to supplement their presentation with the following.

Basically the design in two concepts. One is to assume rigid bundling of the tank. Another one is to consider the flexibility of the tank, but basic approach is assuming those portions, water mass, which is going to move in unison with the containment tank and the other part is those which doesn't, you know, fluctuate.

But the sum of the full masses is where the total mass is. Okay. That's one concept.

And then we also had to consider the upward motion of the earthquake component, as well as that gentle components, and in GE's application they have taken the conservative approach where they apportion more, that portion that move together with the tank. They are saying we are going to apply 100 percent of the mass and apply conservative to get the maximum response.

So that's one approach, too, and we together looked at that one, and we consider that is acceptable for the first microscopic analysis.

The third point is design water tanks and fuel pools are consistent with Section 3.7 and 3.8 of SRP, which this other acceptance criteria and guidance, and just guidance is based on the body of information in engineering technologies, interim testing, interim analysis of, you know, derivations. So I would further enhance data.

Okay. Let's go to the next one.

Okay. This is a copy of the GE suggested quality. There are 3 water tanks in their design. It means that water tanks in this particular design. The most important one, the higher you go the effect is more. So on the upper level tanks, I'm showing the green and second level tank is the gravity driven cooling system tanks. I think they are A, B, C, three tanks, I guess, quite huge ones, very massive. Okay? That's the second level.

And the third level is the blue one, is the separation pool. So these are basic concepts where the masses are, and I want you to have a good impression. There are quite a few heavy masses in the different floors.

Let's go to the next one.

Okay. I'm presenting a conceptual modeling, which is a bit more detailed than GE's this morning. I am on the top one in the case of a tank that is rigid, very much rigid wall, and I think we have two more. One is the impulsive mode at the lower level mass, Mi. Okay?

And which is connected to the other direct with the rigid bar. That's why it's called the rigid approach. The top mass --

MS. CUBBAGE: Do you want to point to that? You can only get up if you use this though.

MR. JENG: I see. Okay.

CHAIRMAN SHACK: You have to be electrified, amplified.

MR. JENG: Okay. Again, this is the rigid model conceptualization. This is the effective model. Now, our approach, we divide the mass into two parts. One is Mc, and this is 13 more mass, and this is Mi imparting more mass. The sum of Mc and Mi should be called the total mass. Okay?

And then the technology exists that we have learned how to determine the ratio of these masses, and then when they have configuration and material of the tank and foundation type and we can also define what kind of spring ought to be and what fractions of this and this between them. Okay?

And also, when we come to the case of the GE application, we are using this approach. So they figure total mass of water and dump into the adjacent points on the stick model. I will show you later the model.

But in another approach, if you have the tank which is made of thin steel shell like three-quarter inch, they are quite flexible compared to the concrete tank having five foot thick. Okay? In this case, this kind of approach, insulation is justified and may be needed. Okay? This just give you the general idea of how that engineering science approach this issue.

Next one.

Okay. Again, this is the stick model which GE used to represent reactor --

MEMBER CORRADINI: Is this your last slide?

So when I have the heat exchanger in the middle of the pool, how does that --

MR. JENG: I will come to.

MEMBER CORRADINI: Okay.

MR. JENG: So this one is the very complicated picture. Each line doesn't mean just simple one line. It could mean three locations and three specimens. So for six-by-six metrics, okay, each line in general mean that kind of situation. Okay?

And then this is the stick model which represents from the basement to the reactor building, the roof, okay, and this is another one representing the reactor vessel and there is the support, and this is the sump water tank model, and this is the fuel tank.

So it's very complicated, just to show you for your general impression. Any one of these nodes could imply many original oscillators like is shown here, this is needed to --

MEMBER APOSTOLAKIS: Excuse me. Did the agency develop its own model for these things?

MR. JENG: No.

MEMBER APOSTOLAKIS: Just reviewed what GEH put up?

MR. JENG: It set the guideline, SRP, how the minimum level detail modeling has to be done under the acceptance criteria shown in the SRP. Industry experts following our guidance understand our level of detail needs have developed another method, approach, bundling review, and we'll be turning their other questions. The detail level is adequate and we desire to accept the level and going to enhance and modify.

MEMBER CORRADINI: So that instead of doing a separate model to check, you reviewed and audited.

MR. JENG: We did in this case.

MEMBER CORRADINI: Did you do spot checks?

MR. JENG: Yes. Since this is the ESB that was standard of design, in the last presentation I indicated we made a point to do a comparative analysis of selected items, and I reported earlier that we did in the case of control building.

MEMBER CORRADINI: I see. Okay. Thank you.

MR. JENG: Okay.

MEMBER APOSTOLAKIS: And you didn't find that?

MR. JENG: We did find general agreement. That's important in the adjustments, telling about we are convinced they're adequate within - they did a safe job.

MEMBER APOSTOLAKIS: Good.

MR. JENG: Okay. Let's go to the next slide.

This is the stick model which covers the control -- the reason I wanted to show this one is that this is system where there's a building in the center and both sides there's a huge water tank. Okay? And this water tank is the type of water tank calls for use of what I call flexible model, and specifically, this particular representation that was a soil spring. This is the impulsive mode. We talk about impulsion. And this 60 is the convective mode, and in this particular model they are specifically represented through 100, to that effect. Okay?

Let's go to the next one.

Okay, and the following two pages are just a statement of what we have shown in the SRP, Section 37.15, our acceptance criteria. What is the minimum standard thou shall follow and achieve in doing this kind of analysis, and I do not want to spend time to go through this. This is part of SRP exception. Tell them in detail how we shall conceal a certain analysis modeling, et cetera. Okay?

So let's go to next please.

MEMBER ABDEL-KHALIK: There was a torsional spring on the previous document?

MR. JENG: Yes, torsional spring, yes.

MEMBER ABDEL-KHALIK: Where do the constants for that come from?

MR. JENG: Okay, and then you go to the next table to show you. Okay?

Could you go to 21? Yes. Yes, 21 table, okay, okay.

Earlier this morning I think some of the members indicated, how do you convert this convective mode into numbers which you're getting to complete your analysis. My answer is that is large volume of information, knowledge, still surviving. Academic peoples over the last 30 years, and they have condensed this information, how to, into a, quote, representation and the most popular report our U.S. application is the ACRS 350.3 in a table, Case 21, and that gives you detailed guidance of water tank, how you should really determine the mass ratio, the damping, and how to complete source detect for input in the computer.

So I do not intend to spend your time any way in the detail both of these codes, and I can provide these codes to anyone who are interested, you know, but these two details is too much engineering. Okay? But they are by the knowledge, which is very competent, tested, time tested. Okay? So I think we can trust this practical approach.

MEMBER CORRADINI: Somewhere in there there's an empirical design tool, that tells me when I have a structure in a water pool with a wall how to do it?

MR. JENG: How come, yes, of course, but I have been providing you a certain item, yes.

MEMBER CORRADINI: I am single minded.

MR. JENG: I will come out there. Besides our main codes, there are other codes.

CHAIRMAN SHACK: Don't point up to that screen.

(Laughter.)

MR. JENG: Besides our main code here, other quotes, this is our main time code, main time American Waterworks Association. They are more commercial type people. So this is more rigorous. Okay?

MEMBER CORRADINI: ACI stands for what, just so I remember?

MR. JENG: American Concrete Institute.

MEMBER CORRADINI: American Concrete.

MR. JENG: Yes, that's the number one.

Okay, and I want to point out the European Community, they have issued the Eurocode 8, and this I didn't mention is available, but we believe our codes are superior.

Okay. Let's go to the next page.

And just for interest, there was concern about how do you figure the sloshing height, the water up and down with that wave of that water shoots the cover off the tank and cause some trouble, and the answer is, yes, that has been considered. It's part of the analysis

And then I'm listing just the codes and how they tell you how to figure the sloshing wave height, and this is expression here which gives you guidance how it should be, how much water would come up, okay, given the dimension. Okay.

MEMBER CORRADINI: Just so I understand since you showed us this, I want to understand it.

MR. JENG: Okay.

MEMBER CORRADINI: So Ac times R is units of meters squared or seconds squared. So how do I get the sloshing wave height?

MR. JENG: Okay. You know, out of the radius of tank.

MEMBER CORRADINI: Yes, that figures.

MR. JENG: The tank is in feet. Then you apply fraction. Ac is the fraction. Okay? So we give you the height.

MEMBER CORRADINI: Yes, it says at the bottom it's the convective acceleration. So meters per second squared. I just want to -- you just simply showed it to me. So now I want to understand it. So I've got meters squared per seconds squared. How do I get a height out of that?

MR. JENG: In the --

MEMBER CORRADINI: Is there a table somewhere that says --

MR. JENG: There must be some conversion factor.

(Laughter.)

MR. SHUAIBI: You've got to divide by G or something. It's a ratio of the exploration of gravity.

MR. JENG: Oh, it's a ratio. It is the ratio. Okay. It is a fraction.

MEMBER CORRADINI: So this is not conventional. Thank you.

MR. JENG: Yes.

MEMBER CORRADINI: Thank you.

MR. JENG: Okay.

MS. CUBBAGE: For the record, that was Mohammed Shuaibi of the staff.

MR. JENG: The next one is the third point I'd like try to answer the question, but this is the last slide, 23. I would like to answer Dr. Corradini's main question, very important question.

Okay. When we do the seismic analysis, of the building and the fuel building, we call that the primary consideration. We're talking about the water over hundred of tons. Okay?

So in our modeling we see this first order consideration. So with the modeling we explain to you how to deal with the lump mass stuff and going to get the response that each mass point acceleration, displacement, rotation. Okay?

This is what I call the first order of magnitude analysis. Compared to that, given heat exchanger, maybe one ton, two ton, somewhat in this huge 50 by 150 pool. Okay? It's to me the second tier consideration. Okay. After we are done with my cross-analysis, we will know how the equipment this morning because of the first analysis through the acceleration is a function of time, displacement, and this is becoming small time equipment. It's maybe ten by ten, ten tons. Okay? Submerged in water.

And there it looks bad in dimension with experiments, and tell people, engineers, competent ones, how to use this information to figure out what kind of forces that equipment is going to be subjected to, knowing the equipment is supported by a floor moving at a certain functional time. Okay? Knowing that input and knowing that water surrounding that equipment, then there's a way to determine what type of force that equipment has to be desired, yes, to retain that centrifugal support and function.

Okay. So this is basically conceptual, first order, second order consideration. Once you have resolved first order basic information, applicant information work with second localized analysis, and that where it quotes and experience to tell people how to do adequate job to design that one.

MEMBER CORRADINI: And that was done and you reviewed it. Let me say --

MR. JENG: Okay.

MEMBER CORRADINI: So I didn't sense that what I asked was done.

MR. JENG: It was done in other people's section, not my section.

MEMBER CORRADINI: Oh.

MR. JENG: We provide a motion on the floor supporting that equipment and 3.10 people fix up, yes.

MR. LIU: We have done that calculation for the heat exchanger.

MR. JENG: Yes, we did.

MEMBER CORRADINI: Where did that come from?

MR. LIU: Three, point, eight, 3.8.

MEMBER CORRADINI: And so the fact of coupling it because there's water movement doesn't affect it?

MR. LIU: We were saying that the first order of effect in the form of floor acceleration and the displacement.

MEMBER CORRADINI: Right.

MR. LIU: So those are traded as the motion to the heat exchanger model.

MEMBER CORRADINI: Okay.

MR. LIU: Due to the fact of the heat exchanger is emerged in the water, so we consider additional mass, of displaced mass as added mass to the heat exchanger.

MR. JENG: And the idea is to imagine some type of a water right next to equipment. This is mostly defined by the support of the equipment because we know that, the time function which is --

MEMBER CORRADINI: But the point, just so we're clear, and then I'm going to stop and think some more. We won't want to beat this to death just yet. What I guess I'm saying is if you're saying it's totally in phase, there's three ways to think about it. One is there's air between them. So I have low density fluid. So I wiggle the outside. I wiggle the inside. They're totally decoupled.

The other one is I put in arrow gel or -- I don't know, something rigid enough that they're totally in phase, and I wiggle them, and so now they're in phase. But water is in between the two, and part of it is in phase because it's deep, and part of it is out of phase because it's sloshing, and I'm asking by the very fact that it's sloshing, sometimes it's in phase and sometimes it's out of phase so it can amplify. And I'm asking where can I look for the analysis so I feel comfortable that this is a small effect.

MR. LIU: In our design, the heat exchanger is, you know, totally immersed in the water.

MEMBER CORRADINI: That I got, but the other part --

MR. LIU: But sloshing mainly is a service effect.

MR. JENG: So you'll never see this.

MEMBER BANERJEE: How deep is it? How deep is it with all this stuff?

MEMBER CORRADINI: So let's just play the game. I've got a 1G acceleration. So 1G over 1G is one. The radius is five meters. That means according to your model I should down five meters deep. So, I mean, that's what I just heard is the design rule of how to break it up.

So if I take a 1G acceleration at low frequency, 1G is somewhere on your curve, half a G, something of that order. So I've got half a G divided by one is .5 times the radius of the pool, which is a few meters, means I go down significantly into the pool.

Am I off base somewhere here?

So that means that thing is wiggling, and that essentially could be out of phase with the heat exchanger motion. According to the design rule I think I did it right.

MR. LIU: But please keep in mind, you know, that the contribution from sloshing really is not as significant. The basic mass, the impulsive mass really, you know, is controlling it.

MEMBER CORRADINI: But I'm happy that I understand what you did.

MEMBER BANERJEE: How deep is the heat exchanger below the surface?

MR. JENG: We can find out from the scale of that. It's probably --

MR. DEAVER: This is Jerry Deaver, in Electric GEH.

Let me clarify that the PCCS pool, it is fully immersed, but the IC pool, the water only goes up to a certain level, but top piping is actually exposed.

MEMBER ARMIJO: So that will be impacted by the slosh.

MEMBER BANERJEE: But in the PCCS pool, again, how deep is it?

MR. DEAVER: It's at least 20 feet.

MEMBER CORRADINI: Let's just look at the size so I understand.

MR. DEAVER: I don't know that exactly.

MEMBER ARMIJO: But you know that you're going to have to deal with it.

MEMBER CORRADINI: You've helped me understand. I don't know if I'm in phase with you, but I understand. The only reason I'm focusing here is it's the one piece of new equipment with an interesting interaction that I want to make sure is --

MR. JENG: There's a system. We're trying to do the analysis in the system requirement here. So we should trust with this group and stop with the group reviewing the analysis.

MEMBER CORRADINI: I'm happy. I understand.

MR. JENG: And also I want to discuss I think this gentleman asked given the seismic analysis, how do you bring on to the point of the total design? So I want to know. I tell you, first, my first seismic analysis, and each mass point inflict the impact and influence of the mass in the adjacent label.

So when do you get out of it from the seismic analysis? Acceleration is function of time. Sheer forces, the spring shut forces, and even the fission, then you talk all these things will be available as a function of time in the given mass location.

And we mentioned earlier how about that transient time aspect? My answer is that first class time dependent analysis is accounting for the transient consideration.

MEMBER BANERJEE: What you are doing there is a sort of a modal analysis.

MR. JENG: Right, right. Modal is one way. That could be done out of scope as well. The model must come down. Okay?

MEMBER BANERJEE: Right.

MR. JENG: But the point is the tangential consideration is a conflict in the first microscopic seismic analysis.

MEMBER BANERJEE: Yes, it's in the frequency domain.

MR. JENG: It is.

MEMBER BANERJEE: But it's not a finite -- I mean, when you have finite amplitude effects, it's very hard to do modal analysis.

MR. JENG: Modal analysis, there are modal analysis. There are direct time integration approaches. That's two approaches generally speaking.

Okay?

MEMBER BANERJEE: But I was asking because the amplitudes are fairly large. Therefore, one would expect that you'd have to integrate the equations.

MR. JENG: Yes, we do integrated the equations, yes.

MEMBER BANERJEE: The reason I was asking it is the whole system. You know you can integrate the equations using finite element techniques, you know. But how do you get the spatial resolution?

MR. JENG: Okay. Let me answer the question that the codes used in this particular case is Sashi and also VACC and Core.

MEMBER BANERJEE: Is that approved by the NRC?

MR. JENG: The NRC do have these standards of how to review proposed core analysis and how to verify their veracity and how -- maybe I'll get -- but we live in a system with very fine -- the codes produced by the applicant.

MEMBER BANERJEE: Well, we have a process here.

MR. JENG: Yes, we do.

MEMBER BANERJEE: You can submit a topical or whatever.

MR. JENG: Yes, yes, that --

MEMBER BANERJEE: And that has been done.

MR. JENG: Right. That's the process.

MEMBER BANERJEE: These are approved or accepted codes.

MR. JENG: Yes. This is all core registration standards requirements in 3.7, 3.8, which tells that a given four perforce has to be examined any time there are course 1 solution comparisons. There are test verification and there's documentation, and there's a process requiring a viewer to review when they first come in and come to conclusion. They like our standards before they can accept it.

Once they accept it, they will be accepted thereafter, but the answer is yes. It's their interest to review, accept or reject codes proposed by applicant.

MEMBER BANERJEE: And I know that, and it's simply asking whether the codes used have been approved. They have been, I admit.

MR. JENG: But they make 202(c) standards. By that revision, we are approved, yes.

MEMBER BANERJEE: Well, you aren't answering my question.

MS. CUBBAGE: I think you're thinking of

the thermal hydraulics world where we get a topical report and we approve it. This is a different forum. This is a different world. Basically there are SRP criteria that the codes need to be validated and, you know, I don't know if --

MR. JENG: I'm talking about how to review codes and determining whether they are definable and they are reliable and they are acceptable.

MEMBER CORRADINI: Fine. Other questions by the members?

(No response.)

MEMBER CORRADINI: Okay. Thank you very much.

MR. JENG: Thank you.

MEMBER CORRADINI: All right. Mr. Chairman, you can have back your 15 minutes you gave me earlier.

(Laughter.)

CHAIRMAN SHACK: Okay. We're going to take a break for ten minutes.

(Whereupon, the foregoing matter went off the record at 2:32 p.m. and went back on the record at 2:43 p.m.)

CHAIRMAN SHACK: If we can come back into session.

Our next topic is the meeting on the aircraft impact rulemaking, and Mario will be leading us through that.

MEETING ON AIRCRAFT IMPACT RULEMAKING

VICE CHAIRMAN BONACA: Okay. Mario Bonaca, chairman of the ACRS security and cyber-safeguards subcommittee. Ms. Maitri Banerjee is the designated federal officer for this time of the meeting.

The purpose of the meeting is to hear representation from the staff regarding the draft primary rules for security safeguard areas and aircraft impact assessment.

The ACRS today is not formally reviewing the draft guides at this meeting. We will be reviewing the guidance documents at a later time when everybody becomes available.

We will provide you a copy of the draft rules, final rules, from a few days ago, and so if there are significant changes, in accordance with the time, I would appreciate it if you would let us know at the end of the presentation.

We expect that there will be no changes.

MEMBER APOSTOLAKIS: So we are going to comment but it's not final.

MR. BANERJEE: Are we going to write a

letter?

VICE CHAIRMAN BONACA: Yes, we do have a letter. It would be nice, the letter, that - but I believe that the rule right now are final from what I heard.

MS. SCHNETZLER: Actually, the EDO's office just signed it today, and so it is going to the commission today.

VICE CHAIRMAN BONACA: And we have verified that the later addresses the final rules.

Now the ACRS interest is mainly in four areas of rulemaking: contingency mitigative measures for security events; cybersecurity; safety and security interface, and I believe that those are the areas you'll cover under the general rule.

And finally, aircraft impact rulemaking, which is separate rulemaking, but this happens to be occurring at the same time.

The first part of this meeting is open to the public, and is being transcribed. It includes the staff presentation. And then we allocated 10 minutes to allow Mr. Riccio of Greenpeace to make a statement upon his request.

After Mr. Riccio's statement we will take a 15-minute break and reconvene in the Room T8E8 upstairs in a closed session to allow discussion of security-related information that needs to be protected from public disclosure.

For this reason I ask the members to hold such questions to the later session, and the staff to not discuss and identify the issues that cannot really be discussed here. I think you are more informed than we are about the sensitivity of the issues, so you if get a question that is not proper at this time, please hold the answer we do not want to --

As the first part of the meeting is being transcribed, I request that participants in this meeting use the microphones located throughout the meeting room when addressing the subcommittee. And participants should first identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

As I said before, we will plan to review guidance documents as they become available to us, either as part of the subcommittee work or as part of other committees, for example, cybersecurity may be under the Digital I&C committee.

With that, I'll turn to Ms. Holohan.

MS. HOLOHAN: Okay.

Thank you very much. I'll introduce

myself first. I'm Patricia Holohan. I'm the division director of the Division of Security Policy, for those of you who don't me, in the Office of Nuclear Security and Incident Response Response.

With me at the table is Mr. Tim Reed from the Office of Nuclear Reactor Regulation, and Ms. Bonnie Schnetzler, sorry, from my office. She's actually from the Division of Security Policy. And they are going to be doing the presentations.

But I'd like to open it up by saying that we appreciate the opportunity. We appreciate the ACRS working with us and - because this rule has been expedited as you know. They came in and briefed to us once on the status of it, and we appreciate all the efforts you have put into it so far, and we hope you - as we are going to talk about the final rule requirements for Section 50.54(hh), which is the mitigative strategies and enemy attack.

And then 73.54, which is cybersecurity, and then 73.58, which is safety security interface. As Bonnie said, the EDO signed it today and it's heading up to the Commission as we speak, for the Commission to consider it.

So we'd like you to provide a letter to the Commission with any recommendations on the draft rule language this month, and the opinion on the acceptability on the final rule language.

VICE CHAIRMAN BONACA: I'd just like to interject one thing, for those members who have been here a short time, this rulemaking includes a number of endorsement in the regulations of reviews that we have performed already, significantly over the past six years. The committee has been engaged in most of the steps that went into the incorporation of these rules. So we although we have seen the four month framing of the rule recently. We are quite familiar with what went into them. So that's an important communication, and we have been involved very much.

MS. HOLOHAN: Yes, as Dr. Bonaca said, we'll talk about the guidance as it's developed, and the - we are working to continue to finalize the guidance. So we are not looking for guidance on the guidance. But we'll come back to you for that, and we'll expect further interaction with the ACRS on the guidance as it's developed.

So with that I'd like to turn it over to Bonnie for the presentation - oh, before she starts, as Dr. Bonaca said, we're not addressing the aircraft impact rule. That is going to be a separate group coming up afterwards.

So we are only going to talk about the power reactor security rule.

MEMBER APOSTOLAKIS: Afterwards today, tomorrow, next year?

MS. HOLOHAN: Yes, today, yes.

MS. SCHNETZLER: Thank you, and good afternoon. We are here to discussion sections of the power reactor security rulemaking.

As Trish delineated, we have three parts of our rulemaking that need ACRS review: mitigated strategies and response procedures; digital equipment and communication systems and networks; and safety security interface requirements for nuclear power reactors.

We - although we have provided some of the guidance that has been published in draft form, we are not here today to discuss that guidance specifically, and we would, as the Doctor said, be prepared to come back at a later date when the guidance is finalized and we have our comments incorporated so that we can have a good dialogue on that part of this rulemaking, the guidance part.

And the part is, the first part of this is 50.54(hh) mitigated strategies and response procedures for potential or actual aircraft attacks.

MR. REED: Okay, this is Tim Reed from NRR through 50.54(hh) first. It reflects for those of you familiar with the ICM order of 2002, sections B.5.a and B.5.b of that order, B.5.a being - called aircraft is on the way, B.5.b the aircraft has hit large areas are lost due to explosions and fires.

The staff believes in fact that 50.54(hh) is implementing the rule requirements although of course it's implementing - it's reflective of what we've learned since 2002, so it certainly goes beyond the explicit language in B.5.a and B.5.b, but in fact in our view, consistent with the intent the Commission had in those, so we think we were in line with the order requirements.

This was in the proposed power reactor security rule it was actually in Appendix C, which contains the response measures, and that was an inappropriate place for it to be since these really aren't security requirements, these are global fault response requirements, operations, fire-fighting, emergency requirements and those types of actions.

So we removed that comment; we moved it to Part 50. We re-noticed it as a supplemental proposed rule for 30 days. We did all that. Got all those comments. We rolled it back in, and now they are in the final rule stage, and it's just signed two hours ago.

So the first paragraph of this line again is B.5.a portion. It is what you do in terms of preparing for - preparatory actions in the event that you have a potential aircraft attack. At a high level if you have the rule language, the rule language I do believe is exactly the same. We've made no changes in the rule language I think you will still find.

In fact, I think in all the areas before the committee there's been no changes in the language. There's been changes in other areas, but they don't concern this committee, in these particular pieces.

These I think it's seven detailed actions you will find in 50.54(hh) --

VICE CHAIRMAN BONACA: You moved that slide. Can you go back?

MR. REED: Sure.

VICE CHAIRMAN BONACA: At the bottom you talk about exposure from beyond-design basis events.

MR. REED: Right.

VICE CHAIRMAN BONACA: Okay, that's an understanding I had of this function. And yet how does that go with the fact that these actions are necessary for adequate protection? Could you explain that? I'm confused.

MR. REED: We - and this is why I closely link it to the the order, the order was issued under adequate protection. The Commission judged that these, B.5.a and B.5.b were adequate - required for adequate protection, and it's why when I was saying in the very first part of this slide that we believe we're consistent with that order, and we're saying that consistent with the adequate protection, the justification the Commission placed on the order, we believe it's still adequate protection even moving into Part 50.54(hh).

So that's basically where we stand on that issue.

MEMBER-AT-LARGE BROWN: I didn't understand that at all. I mean this is - it's already hit, the place is up in flames, and we are now beyond - there is no protection. I mean you are there. It's toast. Did I say that wrong?

VICE CHAIRMAN BONACA: The reason why I'm asking these questions for the simulation, all the needs. So we are making very clear, for example, in the aircraft impact rule that this is beyond design-basis events, and I believe that the committee probably would deliver that.

But when it comes down to mitigating actions we are talking about, it is necessary for all plants for reasonable and adequate protection. And that seems to be an inconsistency to me.

MS. SCHNETZLER: Let me defer to Jason Zorn for a minute while I collect my thoughts, and he's our legal counsel that has guided us through this rulemaking.

MR. ZORN: I'll do my best to add a little bit of explanation to this, the way I understand that to work.

Again, my name is Jason Zorn. I'm an attorney at the Office of General Counsel, and I advise the staff on this rulemaking.

The concept I believe is for the mitigating strategies measure is, it was intended to be an adequate protection measure. The way that interrelates with the aircraft impact assessment is, they are supposed to work together. So as far as adequate protection is concerned, if the facility has been hit by, or is subject to a large fire or explosion, the concept of the mitigating strategies is to prevent any release and to mitigate those effects.

That's where the adequacy - the adequate protection of public health and safety comes in.

VICE CHAIRMAN BONACA: Okay, I understand now.

MEMBER APOSTOLAKIS: Adequate protection is defined by design basis, is it not? If you meet the design basis, then there is adequate protection by definition.

MS. SCHNETZLER: Right, but you still have the design basis threat also, which is applicable to Part 73.

MEMBER SIEBER: This is beyond design basis.

MEMBER APOSTOLAKIS: What is beyond the design basis?

VICE CHAIRMAN BONACA: The aircraft impact.

MEMBER APOSTOLAKIS: And then you said - and I saw it too - that it addresses adequate protection issues, even though it's beyond design basis.

MR. ZORN: Dr. Apostolakis I will add something here that is not going to address your technical issue. But I will say that in terms of current licensees, okay, this is not a back fit, because it's already in place. It's a forward fit for new reactors, and of course, 50.101 doesn't apply.

So in terms of back fit space, we in fact believe we are consistent with the orders. Now that doesn't address reasonable and adequate protection, and I understand that. I understand exactly what you are saying.

MEMBER MAYNARD: Well, I think that would be fair in the legal perspective. But we're I think mixing some things up here.

When we talk about design basis, we are talking about what rules and what you get prepped for. When you go beyond design basis, that doesn't mean the world falls apart and you can't provide adequate protection. You have some different rules applicable to you as to what you could use, what to take credit for, what mitigation you might do, and stuff like that.

VICE CHAIRMAN BONACA: I think Otto is right. I mean this entails today is that mitigative action which can mean as orders or the Commission are required for adequate protection.

MEMBER BROWN: I mean if you put a hole, if something comes and puts a hole in the reactor building -

VICE CHAIRMAN BONACA: But the event must be beyond design basis.

MEMBER BROWN: That's beyond design basis.

What mitigation would take place, would you throw a tarp over it. I mean if you put a hole, if something comes in and puts a hole in the reactor building -

(Simultaneous speaking)

MEMBER SHACK: First of all, we need to be careful when you start talking about the mitigating strategies and what we can do and can not do.

MEMBER BROWN: I'm just trying to get a -

(Simultaneous speaking)

MEMBER POWERS: - analyses done that you are not going to be able to discuss the results of those analyses in the meeting.

(Simultaneous speaking)

VICE CHAIRMAN BONACA: The work that you have done, you have done work that sets expectations for impact preparation for response.

CHAIRMAN SHACK: But to answer George, if you meet all the design basis things, clearly you have adequate protection. If you go beyond the design basis, at present meaning that you don't have adequate protection.

MEMBER APOSTOLAKIS: I thought you were going to say - yes, if you meet the design basis, the licensing basis, not design basis, the licensing basis, then you have adequate protection.

I guess what we are doing now is that we are utilizing some bases. There is a design basis envelope, plus other things. And we are adding to the other things; that's really what we are adding.

MR. ZORN: I think we should proceed.

MEMBER APOSTOLAKIS: But what is the legal distinction, though?

MR. ZORN: Well, it -

MEMBER APOSTOLAKIS: It was beyond design basis. What does that mean? That what? If it's initial adequate protection.

MR. ZORN: I think that the conflict here is whether or not the licensee would be required to provide adequate protection against a particular threat.

MEMBER MAYNARD: Licensees, for the design basis event, you have to be able to take those considering only your safety related equipment basically and they can save single failures and such, and not taking credit for other equipment, other procedures, other things that you may or may not have available to you to take care of -

MEMBER APOSTOLAKIS: It's like the station blackout rule.

VICE CHAIRMAN BONACA: Yes, and here

particularly there is the direction that says you should - if you have an issue with respect to a certain issue then you should take care of it. And there are certain indications on what expectations are. In the old bill that was sent through, I think it was debated by the industry. The old bill comes under adequate protection requirement. And whatever, you know, that may be beyond design basis, as far as reaction. That falls under adequate protection.

MEMBER APOSTOLAKIS: I think the difference is that if you declare something as related to adequate protection. We don't need to go back to the cost-benefit.

VICE CHAIRMAN BONACA: That's right.

MR. REED: From a regulatory analysis standpoint, there were no costs associated, because this was already imposed. So based on our regulatory analysis was the old one.

MEMBER APOSTOLAKIS: Very good. It took us 15 minutes.

MR. REED: Okay, getting on to the next slide, to the first paragraph which are the actions you take when you have a potential aircraft threat. It's broken down into seven subitems there in terms of what you are required to do, and the procedures. That basically requires you to develop procedures to do these things, authenticate threat sources, maintain communication with those threat sources, contact your on-site groups as necessary and off-site response organizations; take actions that you hope will in fact mitigate, will be helpful in mitigating an impact should it occur; reduce your visual discrimination of your facility as appropriate; and disperse equipment and personnel, then recall the personnel that are key, taking actions after the event.

So I can go into more detail. Actually I probably wouldn't go into more detail; I'd have my guy over here that might go into more detail. But that's at a high level.

MS. SCHNETZLER: This is a kind of a good place to say that in the original proposed rule, this part particularly wasn't fleshed out as well, and so this was one of the major reasons that it was renoticed this year in April, I think it was April $10^{th}$, this part of the regulation was renoticed for a couple of reasons. One is that we thought it would better fit 50.54 as we've said instead of Appendix Charley of Part 73.

The - what the licensees have done currently is already a part of their condition of license, so we thought this was a better fit for it. That's one reason for renoticing, and that fell in line with the comments that we had received from the public and the stakeholders on the proposed rule.

And the second part was that we thought this needed clarification. It wasn't clearly delineated in Appendix Charley in the proposed rule. So this was an opportunity to clearly lay out our expectations, and then receive comment on it.

And I think it's noteworthy that the comments that we received were indeed on this part, Part, you know, number one, and really we received I think more comments on the second part.

MEMBER POWERS: You use in this some terms of art that perhaps deserve some explanation. For instance you say authenticate source and maintain communication with source, a word that needs clarification.

You also say, reduce visual discrimination. Again, a term of art. Is there some explanation?

MS. SCHNETZLER: I need to make sure we are not stepping into sensitive information.

MR. CUBELLIS: Page 106 of the FRN should have some more clarification on the visual discrimination piece. This is Lou Cubellis insert. And then if you look on pages 103, 104 -- there are actually open source clarifications for this. The slide is a little misleading. Actually the first and second bullets should read, authenticate threat notification source. Actually, authenticate the threat notification itself, and there is a security advisory 07 -

MEMBER POWERS: This is not going to step on anybody's security requirements by writing things in English.

It is against most classification rules to try to obfuscate via language.

MR. CUBELLIS: Agreed. I think it's fairly clear in the actual FRN. We do - we do authenticate - you asked the power reactor licensees to continue what they are doing with regard to Security Advisory 07-01 Rev. 1. It is a publicly available document, and in one of the comment responses we actually gave the ML number so the public can actually pull that security advisory and see the three pages. It outlines the process by which power reactors authenticate threat notifications.

MEMBER APOSTOLAKIS: So if you put the word, authentication -

(Simultaneous speaking)

MR. CABELAS: And then you don't maintain communication with the source of the threat.

(Simultaneous speaking)

The communication with the source is not the actual threat source, is the notification source.

(Simultaneous speaking)

MR. CUBELLIS: Correct. And again, there is detailed language in the FRN that will discuss that for further clarification. But it's not the actual source of a threat. It's the notification source.

MEMBER APOSTOLAKIS: How about visual discrimination.

MR. CUBELLIS: Visual discrimination refers to making it harder to target particular locations inside the protected areas, and we go into some discussion. It's essentially extinguishing lights, or in some cases, dependent on ambient lighting, actually illuminating different parts of the site to blend better with their surroundings.

Because for instance Waterford is in a heavily industrialized area. If they would turn off some lights, they could actually highlight the areas based on darkness. They'd be the only dark spot on the horizon.

So depending on how - and I can't really go much more into detail on that particular piece here, but it's essentially lighting actions that the sites take so that they try to blend in with their surrounding environment.

MS. SCHNETZLER: There are times during their - there are times when a site, depending upon its locality, locally, that it may be prudent for them to turn off their lights, or turn off certain lights. And there may be times when it's prudent for them to turn all their lights on, just to blend in to the specific physical area that it resides in.

MR. CUBELLIS: One example, a comment we got from an outside source was that planes can be equipped with GPS units. I mean is this really necessary. And the response that we wrote was, yes, we concede there can be GPS units on board, or you could bring a portable one. But that only gets you so close; I mean it gets you to the actual site. But what it cannot do is let you discriminate where within the site, within the protected area, that you need to strike.

Even with the technical knowledge that we assume the adversaries have, they still need to be able to discriminate where within the protected area, and this addresses that particular circumstance.

MEMBER APOSTOLAKIS: I'm also curious about an earlier slide.

MS. SCHNETZLER: Okay.

MEMBER APOSTOLAKIS: How - you are addressing that digital stuff and the safety and security interface.

MS. SCHNETZLER: Right.

MEMBER APOSTOLAKIS: Is there some overarching model somewhere else that says these are the threats one has to worry about when we are talking about security and this rulemaking addresses these three?

MR. REED: No, actually, those are the three pieces of the power reactor security rulemaking that have some nexus with normal - anything that is non-security. In other words, cyber involves digital equipment, okay. Safety and security obviously involves safety, and aircraft, this is not really security, this is can I operate as a whole, for aircraft. So the rest of it exterior to the rulemaking is entirely security in terms of physical security, training qualifications, contingency response, it's all security.

So this community doesn't involve itself with early security. So these are the three pieces where we have a - we touch upon safety, and that is this committee's purview to address that.

MS. SCHNETZLER: But there is - there are security regulations, their underpinning basis is 73.1, which delineates a design basis threat. And that gives the baseline for the security program and the protective strategy and what it's geared up to do and what requirements it needs to meet.

MR. REED: But this is kind of what goes out -

MEMBER APOSTOLAKIS: Well, Tim just said that we are looking at - I mean there is a bigger security rule. They are bringing to us only the stuff that is related to safety and my question is, is an aircraft attack the only threat that is related to safety?

VICE CHAIRMAN BONACA: Yes, that's why I had all of these rules that specifically addresses large fires and explosions whatever the source may be.

MS. SCHNETZLER: I'd say one thing that would maybe answer that is that 73.1 clearly delineates a cyber threat as it reflects to everybody. It's also, you know, we bring it here because it also touches on operational parts of the facility. But we need to look at that part of the safety picture, as well as the security picture. So they overlap one another.

MEMBER APOSTOLAKIS: How about the inside of the plant.

MS. BANERJEE: Can I interrupt, please? Maitri Banerjee. They are discussing 50.54(hh)(1), which is potential or actual aircraft attack. When they go into 50.54(hh)(1), they are going to be talking about whatever the source is, source of attack is. How you are going to mitigate a large fire?

MR. REED: That's actually the second paragraph.

VICE CHAIRMAN BONACA: We already provided recommendations there in that area. Okay, let's move on.

MEMBER APOSTOLAKIS: So somebody has the real big picture.

VICE CHAIRMAN BONACA: And I will tell you one thing, to look at all the paper we got and to try to sort out some logic it was a real challenge, because we have seen pieces, and we haven't seen other pieces and we need to know, so we can't just see the boundary between all these things is confusing. Let's move on.

MR. REED: Any more questions on 50.54(hh)(1) requirements specific to --

Like I said, in all cases, Dr. Powers, I took the rule language and I truncated, went to something - slide language. So they will see that across the board.

(Simultaneous speaking)

MEMBER ARMIJO: When the draft guide becomes - will that be a public document?

MS. SCHNETZLER: No, sir, that will be security related. It will not be safeguards, which is a different requirement. It will be security related.

MEMBER ARMIJO: Well, just for -- please note this, I'm not particularly comfortable that this isn't a closed meeting right now even at this level, because I don't know why we have to - I'm guarded about what I feel I can ask, and I don't see any need for this to be in a public forum. But with that said -

MEMBER APOSTOLAKIS: And I don't see any need to actually be classified.

MEMBER ARMIJO: Recall personnel. If I was a terrorist I'd find out exactly who your key personnel was and I'd interfere with that. I mean there are all sorts of -

(Simultaneous speaking)

MEMBER APOSTOLAKIS: I mean they cannot figure it out without the slide.

(Simultaneous speaking)

MEMBER APOSTOLAKIS: I think we are over-classifying, but that is not my business.

MEMBER ARMIJO: I made my point. Let's move on.

MS. SCHNETZLER: And if there are questions that we can answer in a closed session, we'd be happy to do so.

MEMBER APOSTOLAKIS: Yes, we will do that.

MR. REED: So the second slide is a bit of what Dr. Apostolakis was going into in terms of the B.5.b and the mitigating measures requirements. This is the requirements to develop guidance and strategies principally to maintain and restore, quote, cooling, maintain and restore containment, maintain and restore spent fuel pool cooling. Okay, and you are looking at the loss of a large area of your facility due to explosions and fires. And we don't say aircraft here. This obviously came from Section B5 of the ICM order, but aircraft is not in there anymore. So go broader than that. The Commission's opinion is that these mitigating measures, which I think are typically reaction mitigation guidelines or extreme damage mitigation guidelines, would work, and they would. They would work for loss of any - no matter how you got to that end state, there would tend to be good things to apply.

So that was the idea. They fall into three general areas in terms of fire-fighting. Obviously you are trying to put out the fire. At the same time you are trying to put out the fire, you are trying to do things to limit ultimately the release of fission products. And that's always, you know, core cooling back, it is because your product barriers are in place, and those kinds of things, okay, and that's what this goes to, fire-fighting operations to mitigate fuel damage and actions to minimize releases.

B.5.b, okay, contained a license condition that is in everybody's license today, every operating licensee has 14 strategies specifically in their license, as a license condition they are required to meet. So those 14 strategies map exactly into these three. And we go - we explicitly say in the SOC that supports 50.54(hh)(2) that they are in full compliance.

MEMBER-AT-LARGE ABDEL-KHALIK: Are these mitigating measures, which in a big picture, like functional restoration guides?

MR. REED: The mitigating measures, Dave. Dave Nelson from NRR, he's our B.5.b expert.

MEMBER-AT-LARGE ABDEL-KHALIK: Are these provided in the formal function restoration guidelines?

MR. NELSON: I don't know that I'd use that term. They are in the form of trying to achieve functions for things like spent fuel cooling, core cooling.

(Simultaneous speaking)

MEMBER-AT-LARGE ABDEL-KHALIK: To achieve functional objectives that have to be maintained with available means.

(Simultaneous speaking)

MR. NELSON: It could be we are getting hung up on the semantics. The mitigating strategies at the existing power plants cover things like spent fuel pool cooling, reactor core cooling and containment cooling.

MEMBER-AT-LARGE ABDEL-KHALIK: Bill, what I'm getting at is that if you give people big picture functional restoration guides without being overly prescriptive, there are a lot of ways to restore the functions.

MR. NELSON: That may be true. These mitigating strategies assume that all those installed systems may not be available. That's consistent with functional restoration.

MS. SCHNETZLER: Right, and one of the reasons to put this into regulation now is that when the orders were issued, the orders are issued individually to each licensee. So going forward for us to be able to apply that to new reactors, we'd have to individually issue them licenses, an order for that particular license.

So this is a good way to -

VICE CHAIRMAN BONACA: To put this into application.

MS. SCHNETZLER: Yes, precisely.

VICE CHAIRMAN BONACA: The way I understand it from what we have seen. Because we have reviewed these orders before we had commented on early steps. Really, as I have said before the main benefit is that you have a requirement in a rule, and that rule there is consistent application.

MS. SCHNETZLER: Right. For new reactors this lays out what we think is - are reasonable steps to make a licensee think about some things that they should do in extreme circumstances ahead of time.

MEMBER BROWN: So if somebody hits the spent fuel cooling, fuel, whatever, then they would have had some thought process go in on that, recognizing it's a nasty situation, but what can you do, and that the damage may be far enough apart that you may have stuff stored off site in a warehouse - you made a comment about somebody - all the resources may not -

MS. SCHNETZLER: That's exactly right.

MEMBER BROWN: So is that the kind of thought process --

MS. SCHNETZLER: Exactly. It's really to get your licensee to think ahead of time about extreme situations, and think about things that could be done, think about how you might evacuate people that are on site if you have enough time to do so; think about how you are going to bring in the people you may need or the resources you may need.

VICE CHAIRMAN BONACA: Identifying equipment.

MS. SCHNETZLER: Exactly.

(Simultaneous speaking)

MR. REED: I think it's fair to say, Dave, correct me if I'm wrong, that licensees would say they have implemented this. I think we are still in the process of inspecting do we have the specific strategies and procedures.

MEMBER MAYNARD: But it's not a one-size-fits-all.

MS. SCHNETZLER: That's right.

MR. REED: Each plant may have unique issues, items. They have all been done individually. All of them are being inspected, and their individual strategies, what equipment they had, or may have added, whatever, it's all been reviewed on a plant-by-plant basis.

MR. NELSON: Curt, when you do those various audits and sections, when you review 20 of them, you see these 15, gee, they really did a nice job, and these other guys did a - what you call a world level job, but how do you - is there an enforcement version to this?

MR. REED: Absolutely.

MEMBER MAYNARD: You don't get it approved until you -

(Simultaneous speaking)

MEMBER BROWN: She said existing plants supposedly have gotten this this order.

MS. SCHNETZLER: Right. Existing plants have it as a condition of their license, so if you are not meeting that, you are not meeting that.

MEMBER BROWN: Yes, but you haven't set - you have not set specific requirements or procedures or mitigating actions with which they can apply, or reg guides, so therefore they are kind of subject to the whim.

MR. REED: Dave Nelson is actually involved with those inspections. He can tell you exactly.

MR. NELSON: There are - there has - there was guidance developed by the industry for existing plants that laid out the mitigating strategies, and NRR endorsed that guidance. It effectively is the reg guide for the existing plants.

MEMBER BROWN: So this was a licensee-developed kind of potential things they could do, and they kind of agreed universally?

MR. NELSON: There are a lot of - there are many commonalities among the PWRs, the BWRs have different strategies in part. All the spent fuel pools have basically the same sorts of strategies, because they are basically the same.

But it's not a willy-nilly let's figure out what we are going to do on a plant by plant basis.

(Simultaneous speaking)

MS. BANERJEE: Maitrie Banerjee again. If

I may add, staff had like phase one, phase two and phase three inspections and review. And in order to make sure that the licensees are following the orders, they are complying with the orders. Am I correct, Dave?

MR. NELSON: That's correct.

MS. BANERJEE: So through those efforts the staff had made sure that the licensees were meeting the orders, there was that issued to them, regulatory guidance that you may or may not be required to meet.

MR. NELSON: The process of determining what the mitigating strategies ought to be was quite lengthy. We went out and did assessments, two assessments at every plant, every existing plant, one specifically for spent fuel pools, and then one for the reactor core and containment. And from that the industry developed recommended operational mitigating strategies that we reviewed, made comments on and ultimately endorsed. And that is what the existing -

MEMBER-AT-LARGE ABDEL-KHALIK: What criteria did you use to evaluate the adequacy of these mitigating strategies?

MR. NELSON: I'm sorry, I didn't hear the first part of your question.

MEMBER-AT-LARGE ABDEL-KHALIK: What

criteria did you use to assess the adequacy of plant-specific mitigating strategies?

MR. NELSON: We had to work within the confines of the text of the order, which limited licensees to using readily available means.

From that starting point we determined what was readily available. In some cases, well in the end in all cases, the licensees actually provided beyond readily available equipment, and basically we determined what was available and used it to the maximum extent, not knowing at any time what the initiating event actually was.

VICE CHAIRMAN BONACA: And the other way was like a severe accident, beyond design basis.

MS. SCHNETZLER: Okay, other questions on two?

All right, let's move right into cyber. Cyber threat was introduced, included as part of the design basis threat. It was issued actually in March of 2007, not 2008, from the requirements were initially proposed in the proposed rule in 73.55(m), but after we received comments back and reviewed it we decided it would be better placed in a stand-alone section in Part 73.

73.55 is kind of globally physical

security, and we recognize that cyber security is kind of new to the security portion, and it's probably not implemented by the same people that might implement the rest of the security program.

So in another place if we keep this in a separate section and the Commission or staff determines going forward that it should be applicable to other licensees besides power reactors, then it would be already in the right place of the Part.

MEMBER BROWN: What's DBT?

MS. SCHNETZLER: Design basis threat.

MEMBER BROWN: Oh, okay. I missed that.

MS. SCHNETZLER: Sorry. We are requiring the licensees to sit down and think about the - do an assessment. Think about the equipment that needs - you know, identify the equipment that needs to be protected, and develop a plan which will be very similar to the security plans. It will be under the umbrella of security plans. Right now the security plans include a physical security plan, a training and qualification plan, a contingency plan, and now it would also include a cyber plan. That plan would come to the agency for review and approval, and delineate the methodology that the site will use to protect their cyber assets, and what they will do in instances of an attack, and how they will restore the equipment back to its function.

It is basically focused on safety related equipment, security equipment, emergency equipment, and communications equipment.

And as I - I've kind of given you the global picture, but it's - digital equipment for security functions, EP functions, and support systems.

MEMBER BROWN: Analog systems they don't care about?

MS. SCHNETZLER: Not this part of the regulation.

MEMBER BROWN: So there are other parts of the regulation that cover analog?

MS. SCHNETZLER: This part of the regulation focuses really on digital. I'm not saying it doesn't -

(Simultaneous speaking)

MS. SCHNETZLER: But this is focused on digital.

Like I said, it requires an analysis to identify the assets you want to protect, and that you have the program, and that you have defense in depth. You'd be able to mitigate adverse effects of attacks, be able to provide training, risk management, change control requirements, so that if you make changes to the system that you think about it before you do that and the impacts that it may have. And that like I say you have a plan. The plan will be submitted to us. You would have procedures, reviews, and records.

The guidance has been drafted. It has been issued. And we are having a public meeting actually next Friday, and have invited stakeholders to attend.

The guidance is security related, and is pretty thorough in methodologies that you can use to meet the regulation.

VICE CHAIRMAN BONACA: Now the guidance is the DG52?

MS. SCHNETZLER: Yes, sir.

VICE CHAIRMAN BONACA: That came out of NEI-0404?

MS. SCHNETZLER: Yes, it id.

VICE CHAIRMAN BONACA: My understanding is that there is a debate right now between the industry and the staff.

MS. SCHNETZLER: That would be correct.

MR. REED: I think it's fair to say that NEI 0404 is the what, and we are telling them how. This is what you got to do. And then we come out with a reg guide that is pretty substantial. We are saying, we want you to do it. This is how we want you to do it. Industry has not seen it that same way. So I think that is what we are going to find.

VICE CHAIRMAN BONACA: But they are converging the two.

MS. SCHNETZLER: I would not say they are different so much as I think 5022 uses NEI 0404 as a basis, and expands on that and says, okay, this is what's - this is what is in 0404, but here is how we think you can do that.

MR. REED: Okay, I think that will line up programmatically.

VICE CHAIRMAN BONACA: So we will have to plan a review of this document?

MS. SCHNETZLER: Yes, sir.

MEMBER BROWN: We're still in the comment period on the documents?

MS. SCHNETZLER: Right. The comment period closes at the end of July. So we will have to have a meeting with the stakeholders to understand their thoughts about the guidance, but give them time to also put those thoughts on paper and submit them as part of the comment response.

MEMBER-AT-LARGE ABDEL-KHALIK: If I may go back to slide #6. Sorry, slide #5.

How do we define success?

MS. SCHNETZLER: For?

MEMBER-AT-LARGE ABDEL-KHALIK: To assess the adequacy of mitigating measures?

MS. SCHNETZLER: I would define success I think if licensees are doing the current expectations and meeting those.

MR. REED: I guess I'll go back to what Dave said. Dave is saying, I think, correct me if I'm wrong, Dave, but when he said they are successful, is to make sure - they maximally used these readily available and beyond readily available resources. In other words they used them to the best of their ability; we call that success.

MEMBER-AT-LARGE ABDEL-KHALIK: But if you use everything you have, still available, that may not still be success. And that's why I'm asking, you have to define success.

VICE CHAIRMAN BONACA: I think we should talk about this when we go upstairs.

MS. SCHNETZLER: We're focused on the regulatory requirements, if you are meeting the conditions of your license as they are laid out.

MEMBER-AT-LARGE ABDEL-KHALIK: I'm not

disagreeing with you on that.

MR. REED: We are looking at success of using these means in terms of, that's where I focused in my answer as to what the ultimate end result is.

MS. BANERJEE: Maitri Banerjee again. Aren't we trying to protect those three things that they talk about: core cooling, containment?

MR. REED: That's right.

MS. BANERJEE: And spent fuel integrity.

VICE CHAIRMAN BONACA: I am not specifically clear the have to be met.

(Simultaneous speaking)

MR. REED: Pretty tough to put something specifically down.

VICE CHAIRMAN BONACA: That's why you do what you can and then - design basis.

MS. SCHNETZLER: Okay, questions on cyber security? Okay.

VICE CHAIRMAN BONACA: I think that from what I've seen the rule is comprehensive. I think the devil is in the details, so we'll have to look at the regulatory guidance and the comments you are receiving. Do you have any feedback right now regarding comments received as of today? You must have them, because you have upcoming meetings.

MS. SCHNETZLER: The initial feedback from people at the implementing level is somewhat favorable.

VICE CHAIRMAN BONACA: Somewhat?

MS. SCHNETZLER: I'm being guarded. Cyber security people and our technical people they like the specificity of the guidance.

MR. REED: It does very well to protect against cyber attacks. They are different than the airline attacks.

(Simultaneous speaking)

MEMBER POWERS: That is moderately confusing supposing it's okay to train the people to hold up and let's do things. There is not another that's says well in the event that you have been attacked, and in the event that you in fact are impacted, here's the concept. Recovery. I wondered why you -- there may be a reason that you chose to leave that out.

MS. SCHNETZLER: Actually the text language actually does cover that, sir.

MR. REED: Yes, if you go -

MS. SCHNETZLER: The specific language.

MR. REED: Yes, we require that to be described in the cyber security plan. I'll just cite you exactly what we require out of this.

The cyber security plan must describe how the licensee will maintain the capability to timely detection and response to cyber attacks, mitigate the consequences of cyber attacks, correct exploited vulnerabilities, and restore affected system networks and other equipment that were affected by the cyber attacks.

So we require that in the cyber security plan description, okay. And that is something that is coming to us and we review it and approve it. So that's our regulatory control.

MR. SHUKLA: Hi, I'm Girija Shukla from the ACRS. What I heard so far is that for mitigation you say anything in the rule about prevention of cyber attacks. You design your system in such a way that they just cannot happen.

MR. REED: That's an interesting concept. In fact I think one version, as we talked about preventing it, and I frankly went to the cyber people and said, I don't like to put in place a regulation that is impossible to comply with. I can't stop hackers from attacking my plants. I can't prevent attacks. But I can put in place defense in depth methodologies, okay, that are very good in protecting against such attacks. I can see them coming. I can stop the way they're coming. And I can restore the systems, okay. I can manage my cyber risk, and assess the risk, understand what that is, okay. I can make sure that my digital assets that I'm protecting, there are things I'm doing to change them that I am not losing my performance objectives on the cyber.

VICE CHAIRMAN BONACA: But the fact that you are building strategically, lack of access for the outside in.

MR. REED: Exactly, it is very much like the defense in depth approach.

(Simultaneous speaking)

MS. SCHNETZLER: And that term is actually used, defense in depth. And we struggled with that, you know, from a regulatory perspective. We really did struggle about prevention versus recognizing that your system is probably always being attacked in some way.

MR. REED: There's things we can do in the plan, and describing the plan, at a rule - rule level language level, that put in place some of these words. It actually becomes impossible for the licensee to comply with it. So I tried to structure this rule so he's not legally out of compliance but he's doing the right thing.

MEMBER BROWN: If you don't talk to the outside world you don't have to protect yourself other than internally.

(Simultaneous speaking)

MEMBER APOSTOLAKIS: The NEI document that we reviewed and commented upon, the rule ultimately dropped into a regulatory guide, is that the idea?

MS. SCHNETZLER: Our hope is that the regulatory guide takes NEI 0404, makes it better, and adds more information to it.

MEMBER APOSTOLAKIS: So it's regulatory guidance.

MS. SCHNETZLER: Yes.

MR. REED: I think the reg guide - I think it's fair to say it's written very generally. It's not just for power reactors. It's a very general reg guide, where NEI 0404 Reg 1 is specifically for power reactors in these situations.

So there's a little bit of a reach right here.

MR. ZORN: Tim, maybe you should also point out that one of the underlying rulemaking issues was, the long term vision was to have this regulation be capable of being applied to other licensees, not just power reactors.

So that was part of the reason why it was put into a separate piece, and that's where the guidance is written to kind of keep that into account.

MR. REED: I think we - yes, we may have mentioned in the beginning, we made a separate section, Part 73, just for that reason.

(Simultaneous speaking)

MR. SHUKLA: I have one more question.

MS. SCHNETZLER: Oh, sure.

MR. SHUKLA: Is it still either/or 0404 and the reg guide? Or what choice does the licensee have?

MS. SCHNETZLER: The licensee always has a choice. Because at the end of the guidance it says specifically that this is a guide, and you could follow - you could do something else, but our expectation would that you would provide an equivalency of what the guide points are.

MR. SHUKLA: To vigorously follow 0404, not the reg guide, they have the choice?

MS. HOLOHAN: They'd have to modify NEI 0404 to match -

MS. SCHNETZLER: They would have to do a little more from 0404.

(Simultaneous speaking)

VICE CHAIRMAN BONACA: All right, let's move on to safety and security interface.

(Simultaneous speaking)

SAFETY SECURITY INTERFACE

MS. SCHNETZLER: We are now on safety security interface.

Safety security interface addresses in part a petition that we received asking us to consider the interface between operations and security and make sure there were no conflicts.

Overall it's explicit what is already implicit required by regulation. I mean there are several regulations that talk about managing changes at your facility, performing changes -- configuration management, that's the term I'm looking for.

MR. REED: On the safety side, as this committee definitely is well aware, this has been addressed extensively.

(Simultaneous speaking)

VICE CHAIRMAN BONACA: The industry is taking the position, and correctly so I think, the fact that there are so many programs already in configuration that should take care of this interface.

And I would agree 100 percent with that, except that making the point that given the complexity of all the added requirements because of security, it may be appropriate to have some kind of focus around the rule, it says you had to make an interface.

(Simultaneous speaking)

MR. REED: The only thing I would say, that this rule captures that those other programs don't. And the only thing that circulates on the safety side, 50.59, and everything else is going to get, and there is no doubt your normal plant modification process is going to get procedure change modifications are going to get. But this was capturing things that really were not in that, okay. You can have things wrong in the inner controlled area. You could have activities going on in areas that aren't involved in safety related equipment or even equipment safety equipment, okay. That affects security, okay. This is going to capture that for sure.

There is a potential, I guess, you could do things in security that affect safety that the systems may miss, but I personally am - I agree with you, I doubt that will happen at all. So this is a little bit more broader, if you will, and you should be doing this today. You shouldn't be doing things that affect - if you are doing something at some barrier that is sitting in ACI, you are probably violating Part - 73.55 in fact, okay. So that's why she started off saying it's implicit in the regulations you have to do this. Well, we were just making it explicit.

(Simultaneous speaking)

VICE CHAIRMAN BONACA: The other thing is, I think we will have to review the guidance. Because the guidance proposals and then there are questions a la 50.59.

MR. REED: Yes, it does.

VICE CHAIRMAN BONACA: 50.59 was a well organized, consider regulation in a way. I mean you had several questions there, and you had to - and it was closed until it was set. You couldn't go beyond that. The guidance that we have now has I don't know how many. I'm almost believing there was a brainstorm session I guess by which you got all of these questions.

MR. REED: Yes, I think 50.59 of course, as I think you know, is really focused only on systems, structures and competences as described in the FSAR. Now -

(Simultaneous speaking)

MR. REED: It really kind of goes to that.

VICE CHAIRMAN BONACA: Well, I can see how for licensees it's going to be an issue of how many questions are you going to ask. So that, again, we will review these guidance when it comes.

MEMBER BROWN: A comment on this in general, and you don't need to even respond to it. This is all written as though the licensee is generating these changes, and they have to make all these considerations and stuff, when in fact a lot of the changes are coming from new requirements or new things that can happen.

I think that the NRC has an obligation to be taking a look, as they are putting new requirements out that could create a safety-security interface. But they need to make sure - we need to make sure we are not putting out rules or requirements that in fact create the problem.

So it is kind of like saying, hey, we are going to toss up all this, it is to you to sort it out.

(Simultaneous speaking)

MR. REED: As a general rule we try not to put rules in place to make things worse.

(Simultaneous speaking)

MEMBER APOSTOLAKIS: The rules apply to the NRC.

(Simultaneous speaking)

MEMBER BROWN: Where's A? There's a B, C and D up there. Is there an A that we are missing?

MR. REED: It's probably just an -- We can pull that out.

MEMBER BROWN: Each operating nuclear power licensee or the licensee shall comply with the requirements of this section. Shall comply. It doesn't say consider; it says, shall comply.

MS. SCHNETZLER: And that is pretty standard language. And yes, it does say, shall comply.

MR. REED: We all put shalls in the regulation. Again, that's the scope saying who the rule applies to.

(Simultaneous speaking)

MS. SCHNETZLER: Any other questions on 73.71? Okay.

(Simultaneous speaking)

MS. SCHNETZLER: Talked a little bit about the guidance. It's been published. We've had a public meeting on it, and we are in the course of resolving the comments. And when we get to draft final - final draft, then we'll be bringing that here for review for consideration.

So basically we are here today. We've talked about three different parts of our regulation. But this as it's complete and with the EDO, but since this was finalized this morning it has moved from the EDO to the Commission office.

Draft guidance is developed. Work continues to finalize the guidance for 50.54(hh). We expect to be back here to in detail talk to you about the guidance when we get it at a final draft stage.

MEMBER BROWN: Which part do the Commissioners have? I lost the bubble between 72.58, 50.54, 73.54 -

(Simultaneous speaking)

MS. SCHNETZLER: They have the whole FRN for the rulemaking -

(Simultaneous speaking)

MS. SCHNETZLER: I'm sorry, the Federal Registry Notice that is complete with the proposed final draft text.

MEMBER BROWN: But it's just a draft? So they sign it, and print it in the Federal Register.

MR. REED: They give us an SRM. But I'm sure that will cause us to change some things and then we will go through --

MEMBER BROWN: Then there's public comment again?

(Simultaneous speaking)

MS. SCHNETZLER: That's final final.

MEMBER BROWN: So then why do we need to look at it?

(Simultaneous speaking)

MS. SCHNETZLER: It's a process, and we're at the process where the Commission is considering this final rule, and they are awaiting -

MEMBER BROWN: But the EDO has signed it?

MS. SCHNETZLER: Yes.

(Simultaneous speaking)

MEMBER APOSTOLAKIS: We've reviewed. We have not decided.

VICE CHAIRMAN BONACA: We really accepted a process that we normally don't accept, because we had - we had the paper coming in for review and more of a nightmare for most of the month of June. But because this material is coming, and it's changing too. And right now I'm confident that the last, number three was filed.

MS. SCHNETZLER: I am confident of that also.

VICE CHAIRMAN BONACA: The parallel action actually has many more pieces of this thing. It is all over the place, it's complex.

Okay, well, if there are no further questions, we thank you.

MS. SCHNETZLER: Thank you.

VICE CHAIRMAN BONACA: You make the second presentation? Consideration of aircraft impact on nuclear power reactor designs.

MR. RECKLEY: If we can switch gears a little bit, but it's related as we'll see as we go through the presentation.

My name is Bill Reckley, I'm Branch Chief of Rulemaking Guidance and Advanced Reactors in the Office of New Reactors and our group participated in the development of this rule after receipt of the SRM from the Commission in April of 2007. George Tartal will be giving most of the presentation. Nan Gilles and NRO did a lion's share of the work. She's away this week.

Our legal counsel, Gary Mizuno, NRR, helping us coordinate the rulemaking and getting through the process; Stu Schneider, and Syed Ali from the Office of Research were all participants.

The aircraft impact assessment has a history, obviously, following 9/11 up to the point of the SRM to do this rule. George hit on the history a little bit.

We believe in this public session, we'll be able to address any questions about the rule itself.

Now preceding the rule, there was a fair amount of work by both industry and the Office of Research. Most of that, you would have to talk about in closed session following this if you have questions on a particular design.

VICE CHAIRMAN BONACA: We've reviewed that a bit.

MR. RECKLEY: You've had briefings on that over time. And at the same time, NEI is taking the lead to develop the guidance document and we're currently reviewing that guide and most of that is also at an official use only security-related information level that we could address in the closed session.

MR. TARTAL: Thanks, Bill. In 2006, the staff provided a proposed rule to the Commission under SECY 06-0204 on security assessment requirements for new reactor designs. The staff's intent in that proposed rule was to make future power reactors more secure through security design features that reduced the need for operational security programs and that could prevent the loss of safety systems and functions, perhaps reducing the need for mitigative strategies.

In its SRM --

MEMBER APOSTOLAKIS: If this is successful maybe some of what the gentlemen presented a few minutes ago will not be necessary.

MR. TARTAL: Part of that, yes. This role is essentially the B5B part of what actually became, what 50.54(hh)(2).

MEMBER-AT-LARGE ABDEL-KHALIK: And it would be part of the design basis.

MR. RECKLEY: We'll go there with this history.

MR. TARTAL: So in the SRM that the Commission gave us, they directed the staff to determine the security assessment rulemaking and their reasoning was the adequate protection requirements were going to be set in the Part 73 rulemaking which you just heard about.

Instead, the Commission directed the staff to revise the rule, to include aircraft impact assessment requirements in Part 52 to encourage reactor designers to incorporate practical measures at an early stage in the design process.

MEMBER APOSTOLAKIS: When did this happen?

MR. RECKLEY: The SRM was in April of 2007.

MEMBER APOSTOLAKIS: '07.

VICE CHAIRMAN BONACA: We recommended that for new reactors this be done and in fact, we recommended that this be part of the certification process which would imply the threat design basis. Not necessarily, however, we never stated that.

At the beginning, we had the response from the EDO that that would not be considered and then later on there was a change through the SRM whether to do it. So Lou is pretty much in tune with activities that we have been involved with. You remember that.

MEMBER APOSTOLAKIS: We should know not to contradict ourselves.

(Laughter.)

VICE CHAIRMAN BONACA: That's fine.

MR. TARTAL: So in the SRM, the Commission also specified the proposed rule language that was to be used.

The staff implemented the Commission's specified proposed rule language from the SRM and also developed a technical and legal rationale for the rulemaking. That proposed rule was published on

October 3, 2007 for public comment and the public comment period for that rulemaking ended on December 17, 2007.

The NRC received 32 comment letters from the public, including 10 from industry, 2 from government organizations, 12 from non-government organizations, and 8 from private citizens. And of those comment letters, 31 of them were in favor of requiring -- or the idea of requiring aircraft impact assessments on nuclear power plants, although one of them -- excuse me, none of them supported it exactly as we proposed it.

MEMBER APOSTOLAKIS: So there were only 32 or 33 who were in favor?

MR. TARTAL: Thirty-one were in favor of the idea --

MEMBER APOSTOLAKIS: What did the 32nd say?

MR. TARTAL: The 32nd said basically that it was too difficult to fly a major aircraft into the low profile of a nuclear power plant, but we should trust the military and Homeland Security to protect critical infrastructure.

MEMBER APOSTOLAKIS: And you can tell us whether it was a private citizen who said that? Who said that?

MR. TARTAL: That was a private citizen, yes.

In the proposed rule, we included eight specific requests for comments which I've listed here on the slide and of those eight requests for comments, the second one on acceptance criteria was the only one that was directed by the Commission and the SRM, so I'll be focusing on that one.

The others either had very little influence on the final rule or are addressed in slides on the final rule's requirements, which you can see in a little bit.

So on the acceptance criteria, the SRM for the SECY paper directed the staff to request comment on the desirability or lack thereof of adding an additional acceptance criterion in the final rule beyond the proposed rule's practicability criterion. The additional acceptance criterion would have read the application shall also describe how such design features, functional capabilities, and strategies, will provide reasonable assurance that any release of radioactive materials to the environment will not produce public exposures exceeding 10 CFR Part 100 guidelines.

So with that, the responses that we got were negative to using Part 100 since the NRC uses those limits for judging compliance with design basis requirements.

Instead, NEI suggested an alternative to that, based on key safety functions and more specifically, they recommended that we either require that they maintain either core cooling or containment integrity and maintain either spent fuel cooling or spent fuel pool integrity. That was their comment.

The resolution to that was that NRC agreed to not use the Part 100 limits for the reasons that they delineated, but did not agree to include the absolute acceptance criteria. Instead, the practicality criteria remains to be the acceptance criterion in the rule and we clarify in the final rule that the assessment must address core cooling, containment integrity, spent fuel pool cooling and spent fuel pool integrity.

VICE CHAIRMAN BONACA: The rule says that NRC will assess what you have to do with it to implement.

MR. TARTAL: Yes.

MR. RECKLEY: You have to implement what you've found to be practical.

VICE CHAIRMAN BONACA: We'll talk about that. Practicality is an important issue.

MEMBER APOSTOLAKIS: If you meet Part 100? I'm missing something. If you have coolable geometry. If your containment is -- what's the word? The containment should be what?

MR. TARTAL: Containment integrity.

MEMBER APOSTOLAKIS: The integrity is -- I assume you meet 100, no?

MR. TARTAL: We're focusing on a beyond design basis event here and the implication here is that if we tie Part 100 requirements to this rule, then that implies that the as-built impact might be a design basis event.

MEMBER APOSTOLAKIS: So it is just a legal thing?

MR. TARTAL: Again, this is a beyond design basis event. We don't want an implication that this is within the design basis.

MR. RECKLEY: You could go around to meet Part 100. You can also think of scenarios where you could maintain, for instance, containment integrity, but maybe they wouldn't be at tech spec leakage rates. And so you could conceivably with core damage exceed Part 100 limits. I mean -- but it's very possible that you would meet them, but again, the decision was made not to make it such that you needed to do the analyses to actually show the same degree of confidence that we use for design basis accidents, Chapter 15 kind of accidents, that that is confirmed.

MEMBER-AT-LARGE ABDEL-KHALIK: The rules say consider. They don't say assure. Is that correct?

VICE CHAIRMAN BONACA: In fact, let's start with the comments and it would be nice to see the rule. And the rule clearly says -- the rule will require applicants identify and incorporate into the design the design features of functional capabilities that avoid or mitigate to the extent practical and will reduce the reliance on operator action, the effects of the aircraft impact on core cooling, and containment in spent fuel cooling. Now this specifically speaks of identifying and incorporate into the design. Yes, okay. So there's an expectation of incorporating the design, design features.

MR. TARTAL: Those that are found to be practical.

VICE CHAIRMAN BONACA: I understand that, but in the Statement of Consideration, for example, there's a few pages, explaining that practical doesn't mean effective. It speaks of efficiency, effectiveness, et cetera.

You seem to imply that practical means something that I don't understand.

MEMBER ARMIJO: They had the word practicable at one point and it was a big discussion whether that's open-ended. It means infinite expenses.

MR. RECKLEY: What we're trying to make clear here is that the importance of the word practical is to separate it from design basis events that would leave out the word practical and simply say demonstrate that you've maintained these functions. And this rule, the word practical is of some importance that it's there, just as when we were discussing in the B5B discussions it was rather accessible that there were limits to have far we would expect a designer to go in this case or a licensee to go in that case to respond to this particular rule.

MEMBER ARMIJO: The Agency makes a decision of what -- if it's ultimately satisfactory. A licensee says this is what's practical and you guys decide no way, it's not good enough. That's the end of it, isn't it?

MEMBER APOSTOLAKIS: It's not just the word practical. It seems to me there is a lot of latitude in the words avoid or mitigate without specific criteria.

Again, it's up to the judgment of the staff whether they have done enough to avoid or mitigate. That's the difference between design basis events where we actually have criteria that you must obey. It's intentionally vague.

MEMBER ARMIJO: It has to be.

MEMBER APOSTOLAKIS: Why are we discussing this?

VICE CHAIRMAN BONACA: I think it's an important issue, but do we agree with the connotation that it is beyond design basis. Maybe we do, and so -- in the context we need simply to clarify what the words mean. The words there that were in once and were taken out and theN were put back in. So I don't understand what you are attempting to achieve to achieve.

MR. MIZUNO: This is Geary Mizuno in OGC. To be clear, you're kind of confusing a lot of different things and so I just wanted to clarify a couple of things. One is that the importance of not tying part 100 to the rule as a design basis event, obviously, you're saying the Part 100 limits as a specific criterion, but apart from that, you have to remember that from the NRC's regulatory standpoint calling something a design basis event means that, one, the analyses and the descriptions of that event and how the plant deals with that are subject to what we call special treatment requirements and the most important being 10 CFR Part 50 Appendix B. And we do not intend for these analyses or evaluations that aren't going to be accomplished under this rule to be subject to Appendix B. Okay, that's the first thing.

Second of all, to the extent that a design feature or a functional capability is now going to be part of the design we're also indicating that particular feature or design capability is one that may not meet special treatment requirements whatever they may be, EQ, procurement, those kinds of things; okay? That's a very important thing.

And again, the reason why is because the Commission views the aircraft impact as beyond the design basis event and the design for it and to the extent that a feature or a capability is found to be practical it's going to be incorporated into the design, but it doesn't have to meet the highest levels of proof, if you want to call it, a quality that will be required for design basis events.

The second thing I wanted to point out was the practical limitation there was intended to ensure that we do not adopt the concept that you must in every case, in order to satisfy this rule, assure that you've met the success criteria of providing containment integrity or -- the four things that we're talking about which I can't immediately recall, let's call them the four goals, if you want to call them that. Right, the key safety functions.

We achieve them to the extent practical. They are not absolute requirements that you must achieve those objectives. Okay? And practical was used as a term of art consistent with its dictionary recognition to allow the staff -- and for the applicant to decide that some things which are perhaps conceivable that are entirely cost-unjustified or are technically conceivable, but when you try and implement them, they are simply not something that an engineer would choose in the ordinary course of business to adopt. Okay?

It was intended to bring some reality. I mean practicability, if you read the dictionary definition would say if you can conceive of it and if it's possible to actually do it, then no matter how much cost and no matter how technically Rube Goldberg you might have to achieve, okay, that is a practicable solution and that is not what the Commission was looking for.

VICE CHAIRMAN BONACA: I think the direction is very clear on that.

MR. MIZUNO: Okay.

VICE CHAIRMAN BONACA: And that was that the guidance would be as clear. The other question I had was in the text, not in the rule, but in the consideration, there was often a reference to a rigorous assessment. The word rigorous is all over the place except in the rule. Can you comment on that?

MR. MIZUNO: I think that we're trying to stick to the Commission's language that was set forth in the additional SRM as much as possible unless we felt that there was a clear need from the standpoint of ensuring enforce-ability or achieving the Commission's goal. This is not -- this rule's evolution was not your typical rule evolution that the Commission says yes, here's a problem. NRC staff, you go and solve it. The five Commissioners, I think there were five at the time sat around in a room and a great deal of discussion from what I gather was heated. I was not at those things. There was an OGC experience, OGC management attorney advising these five Commissioners and they produced an SRM which said here is the language that we want and here are the concepts that we want. And go out and publish a proposed rule and then come back and tell us what you think.

Now they didn't specifically say hey, you have a lot of latitude, feel free to completely junk our language at the final rule stage and come back with something else. But certainly, I think it was the view of the working group as well as the steering committee that the staff used to guide this rulemaking effort, that we would not depart from the Commission's language unless we felt that there was a clear need for doing so, either from a legal standpoint or from achieving a goal necessary to make something clear.

VICE CHAIRMAN BONACA: Can you explain to me why this departure from Commission language? I don't understand. I just asked the question about the use of the word rigorous.

MR. MIZUNO: Right, so --

VICE CHAIRMAN BONACA: When I read the word rigorous in the same consideration, I was just trying to think in my mind what is meant by that.

Does it mean that you have pedigree computer codes or do you have some latitude in that? I'm not disagreeing, but the issue that this is beyond a design basis event is what you can consider. I'm trying to understand by the word rigorous.

MR. MIZUNO: Right, I think that it was just the general view of the working group as well as the steering committee that we clearly did not want to set forth a level of quality that was equivalent to Appendix B, otherwise you would just call it a design basis accident or event. That is something that at the same time, this couldn't be, and I think this was a concern certainly by OGC at the proposed rule stage, that we cannot have a rule which I call the window dressing rule which is basically a licensee just says I did something and when you actually go out there to see what it is, it is either a paper scribble or, you know, something that, you know, clearly shows a lack of technical review and clear considered reasoning as to why something is or is not practical or practicable in an imposed rule.

MR. RECKLEY: And the other thing to keep in mind is that by the time we were writing this, we had the experience of the industry doing through EPRI, their analysis, our Office of Research doing our analysis on operating plants and on advanced reactor designs. It was generally understood by both us and the industry that that was what the expectation was for a rigorous assessment. It was those kind of things that was already being done, not something less than that.

MEMBER MAYNARD: Also, the NRC staff really has the final say and approval of whether what's done was enough or whether it was practical or not.

MEMBER-AT-LARGE ABDEL-KHALIK: Well, maybe that raised the concern that, you know, you're pushing the NRC staff into a design mode rather than regulatory mode by evaluating connections taken by the designers and the staff would say no, you could have done that, which is no different than what they do today.

But in this case, it would be a design role.

MR. MIZUNO: Well, let me just say this, okay? Maybe it's been years or decades since the NRC staff really looked at significant design, but certainly when I first started here, we had a lot of people who oversaw the design activities of architect engineers, and I from an enforcement standpoint and what OGC would expect the staff to be preparing if we felt that someone was not a, an entity was not complying with this rule, would be largely the same kind of oversight and preparation of documentation that we used to show that a designer was not complying with other regulatory plans in the design stage.

So I don't see that oversight as being any different in kind. I think Mr. Reckley is correct in that the overall view of the staff was that they were on a success path in development of guidance and looking over the shoulders of the vendors and they could, through guidance, accomplish what was necessary in order to show to the industry what was necessary to meet the staff's expectations as to what would be "a rigorous assessment".

Bill, do you want to say anything more about that?

VICE CHAIRMAN BONACA: We need to move on. I don't think you need to go through all the comment resolutions, just the most significant.

MR. TARTAL: That was the significant one for the request for comment that we put in the proposed rule. I had prepared some notes on the other categories of public comments, but if you think in the interest of time, we'll just skip that unless there is something in particular that you want to hear about.

MEMBER MAYNARD: We did get copies of all the comments and resolutions.

VICE CHAIRMAN BONACA: I imagine with discussion, pretty much that you're talking about guidance.. Is there going to be a guidance document developed? Good.

MEMBER MAYNARD: Okay, so you expect the NEI guidance?

MR. RECKLEY: That's the current path that we're on, and it's our hopeful resolution that we reach agreement on their guidance document and they were able to endorse it in a regulatory guide.

MEMBER APOSTOLAKIS: When you issue something like this for public comment, is all the information, relevant information, available to the public?

MR. TARTAL: I guess I'm not understanding what you mean by relevant information.

MEMBER APOSTOLAKIS: Is there anything that is security-related that you don't publish?

MR. RECKLEY: Obviously, we don't publish the information in this particular area that involves information that goes all the way from classified to safeguards to official use only, security-related information which we don't post.

But we don't believe that any of the information that was withheld was actually needed to understand what this rule is requiring and in general how it's going to be done. The sensitive information is in the details that a designer would need or an analyst would need that the public would not need.

MR. TARTAL: We feel that we've given the public enough information to make meaningful comment on the rule.

MEMBER APOSTOLAKIS: By the way, the dictionary definition of practicable and practical are different.

MR. RECKLEY: The proposed rule would use the other word.

MR. TARTAL: The Commission's SRM used the word practicable and we've changed in the final rule to the word practical.

MEMBER APOSTOLAKIS: Seem to me practical --

MEMBER BROWN: From my understanding it's reversed.

MR. TARTAL: There's an item in the Federal Register notice that describes the legal differences between the two words.

MEMBER APOSTOLAKIS: And these are not necessarily the differences --

MR. TARTAL: Right.

CHAIR SHACK: Part 52 when we discuss severe accidents, we don't way anything about practical or practicable.

MEMBER BLEY: It's practicable to have an ground to air missile to shoot down a plane before it gets -- it's not practical to do it.

I'm telling you, as somebody who is there, ground to air missiles was an issue at one point.

MEMBER SIEBER: Now that the SECY amendments are confirmed.

(Laughter.)

MEMBER POWERS: If one were to incorporate design features to mitigate, I would think that this Committee would want to worry a lot about how one makes a trade off between the requirements of this rule and the requirements of the rest of 10 CFR part 50.

And is there anticipated to be some mechanism for doing that? Presumably within part 50 we have a mechanism when we have conflicts that we can use the tools of PRA or something like that. Here it's not obvious to me that we have a tool for making tradeoffs between how I would evaluate the advantage of avoidance and mitigation here against avoidance and mitigation for more stochastic accidents.

Is there something we should be doing here?

MR. RECKLEY: Maybe an example would be helpful. The part 50 requirements are required -- they are requirements and we will use those in the design certification and licensing requirement.

So in the case of, let's say the AP1000 design, if they left out aircraft and said we need or desire to make changes to our sheer burden in order to address this concern. Now they did that in the design.

Now they now have to go back in part 50 and make sure that the addition of the steel plates and the sheer burden doesn't interview with the cooling functions of their passive containment. Now if it did, they would have to consider something else because that would then have to be a practical solution because they're now allowing part 50 hard requirements of -- in order to try to meet the aircraft rules. So the preference is to the part 50 requirements that have to meet those and then what else can they do in order to try to meet this.

In most cases, they actually end up in very complicated --

MEMBER POWERS: I agree with that, but I"m familiar with at least one condition within DOE facilities where the -- the security requirements led to an impossible situation and with respect to safety and it took heroic amount of explanation to a contractor that we weren't going to cure people in the nature of protecting them against a phantom threat.

(Laughter.)

I can see that and it seems to me that this Committee ought to be worrying about that a lot more than whether we use practical or practicable in the language here. It is that interface between safety and security that we're being asked to think about here. I know nothing comes promptly to mind. I'm wondering if anything comes to your mind.

The only clear example we've seen, and some of the Members haven't done these assessments yet is the AP1000 example which is the clearest example and it's pretty much one that we're currently familiar with.

Anything in these rules that would preclude underground siting?

MR. RECKLEY: One thing that I would encourage and for these sites and these designs, I've not heard any discussion to that. As it happens, this branch and NRR has branch reactors and some of the branch reactors being smaller are already talking about that as an option and it would also help address this rule.

MEMBER POWERS: When one thinks about underground siting immediately turns to the issue of fire protection and the problems that you have in responding to fire with underground siting. But that's --

VICE CHAIRMAN BONACA: I think this is a very, very important question when we look at the guidance because that will get you to these kind of sites as the opportunity.

MR. TARTAL: Shall we move on to rule language then?

VICE CHAIRMAN BONACA: Yes, please.

MR. TARTAL: So based on the public comments that we received, we developed the final rule and the next few slides that I'll go through will highlight those requirements.

In this slide we see applicability which is Section 51.50a. It describes who the rule applies to and you see the list here on the screen.

Basically, this does not include current holders of construction permits or operating licenses or to current design certifications, but effectively this will apply to all newly constructed reactors after the effective date of the rule. That's how we've designed the applicability section here.

So questions on who it applies to and why --

MEMBER ARMIJO: So if someone references a certified design making no changes at all, not even a washer, does this rule apply?

MR. TARTAL: Yes, it does. And there are two different cases here. If they're referencing a certified design that has not been amended to address this rule, then the COL applicant must address it in their license. If they're referencing a certified design that has been modified or has been amended to comply with this rule, then that will be done.

MEMBER APOSTOLAKIS: So this is both in 50 and 52 part.

MR. TARTAL: Yes, yes. So this would cover construction permits from part 50 operating licenses from part 50 as well as design certs and COLs from part 52 and I see the others, manufacturing licenses, design approvals, part 52 as well.

MEMBER-AT-LARGE ABDEL-KHALIK: Effectively, this will apply to everyone.

MR. TARTAL: Every new reactor.

MEMBER BROWN: Regardless of whether it's an already certified design or not.

MR. MIZUNO: Right, but I just want to be clear. As long as you're doing it the way that we did it was that it leads to the market as to who is going to bear the cost of complying with this rule.

MR. CLARK: This is Ajitra Clark. I have a question. This is Ajitra Clark from ACRS. When we are looking at this rule, do you consider any lessons learned from the NUREGs for design; those have the design feature for aircraft impact?

MR. TARTAL: Are you talking about the new active designs that we've just received that are supposed to --

MR. CLARK: EPR would have our design for aircraft impact. Are there any lessons learned that will apply to this design to this rule?

MR. TARTAL: I'm not sure there's lessons learned. Again, what I stated a few minutes ago was that per applicability, for a design cert like you're describing there, then the COL applicable does not need to do anything more in their application in terms of complying with 51.50.

MR. CLARK: I understand that, but are there any insights gained from those designs that could be included in the rulemaking?

MR. TARTAL: This is a procedure. The various designers may have already considered this and so they might be one step ahead when they do the actual assessment using the information that the NRC provided that we did not take a design in mind and change the rule to address one over another.

MEMBER ARMIJO: It kind of demonstrated that compliance with the rule is possible. People can design plants to comply with that rule.

MR. ALI: This is Syed Ali, the Office of Research. Maybe I can add something to that.

I think before we talked about one item where the aircraft characteristics are under debate, but there are further details that are in the safeguard documents that -- these are actual designers and that is something that we have derived from our experience and you can say lessons learned.

The other thing, we're going to apply the lessons learned is in lieu of the industry guidance document -- because we have been using those documents for the last several years, and there was a question of whether to do your own reg. guide or approve their guidance document and that's where we will apply the lessons learned.

VICE CHAIRMAN BONACA: Okay, let's move on. We're running out of time.

MR. TARTAL: Now for the good part. On assessment, this is Section 51.50(b)(1). It describes the requirements for performing the aircraft impact assessment. Under this paragraph, the applicant must assess the effects of the impact of a large commercial aircraft on the facility and from the results of the assessment the applicant must identify and incorporate those design features and functional capabilities that avoid or mitigate to the extent practical and with reduced reliance on operator actions, the effects of the aircraft impact on the four key safety functions. And those are core cooling, containment integrity, spent fuel cooling and spent fuel pool integrity.

So let's, I thought I would break down each of the parts of this sub-bullet here, and maybe generate some more discussion on that. By avoid or mitigate, we really referring to the effects of the aircraft impact, and not to the impact itself. That was some of the public comments we got. They wanted that distinguishment in the final rule. Some thought we were trying to actually avoid the impact of the aircraft. We're trying to make clear in the final rule that we're avoiding or mitigating the effects of the impact.

Design features and functional capabilities. That represents design alternatives that could be included in the facility design and refer to system structures of components, their physical arrangement, and heat characteristics. That's what we mean by that term.

To the extent practical, I know we've already talked a little about this, but in the final rule we've clarified that it means what it is realistically and reasonably feasible from a technical engineering perspective. And in this case, the applicant should consider the benefit of potential improvements which are reasonable, efficient, and workable.

Reduced reliance on operator actions means active license operator intervention and initiation for response of action to maintain the key safety functions, that should be reduced to the extent practical.

And then, on the key safety functions,

three of those four were defined in the Commission's SRM to us and as a result of public comments, we added the fourth, which is spent fuel pool cooling.

On the last sub-bullet, NEI, as you have heard, is developing a guidance document to assist the industry in standardizing their approach to the assessment. We at NRC have been reviewing the guidance document and expect to endorse it in a reg. guide and we're also proposing to discuss that guidance with the ACRS in November of 2008.

MEMBER BANERJEE: When you say spent fuel cooling capability, does that include dry casks?

MR. TARTAL: No.

MEMBER BANERJEE: So dry casks are specifically excluded from this.

MR. TARTAL: Any other questions?

MEMBER CORRADINI: Just to follow up at this point. So are they covered in other roles? Cast or dry cast?

MR. TARTAL: I will say that it is outside the scope of this rulemaking, but I can't speak to how it is covered.

MR. MIZUNO: I guess my understanding is that there is an effort to look at that issue, but I am not, you know, I'm not sure exactly how, where it is in the Agency.

MEMBER BANERJEE: Since we have them in Salem and some other places, it's an issue, right?

MR. RECKLEY: It's been brought up in various issues.

(Off the record comments.)

MR. TARTAL: So on aircraft impact characteristics, this is Section 51.50(b)(2). These largely are the characteristics that were given to us by the Commission in their SRM and again, it's looking at a large commercial aircraft used for long-distance flights in the United States, with an aviation fuel loading for such flights. Impact speed and angle of impact considering the pilot experience or inexperience and the low altitude of the nuclear power plant. And the more specific aircraft impact parameters that we have talked a little bit about today will be provided in the guidance document as well. Any questions on the characteristics?

MEMBER APOSTOLAKIS: The obvious question is how can airlines stop buying the European 580 --

MR. TARTAL: I will say that the characteristics have already drawn that line, and the rule states that we won't be considering any further technology improvements in aircraft or anything like that.

MEMBER MAYNARD: I think we're starting to get into closed session stuff when we start talking about the specific nature of the specific point.

MS. BANERJEE: The higher gasoline price would do something to it.

(Off the record comments.)

MR. TARTAL: Let's move to these last couple of slides. On content of application, this is 50.150(c) and it requires each applicant to describe its PSR or its FSR the design features and functional capabilities that were identified in the assessment for inclusion in the design, but also requires each applicant to describe in those documents how those included design features and functional capabilities have already been mitigated to the extent practical the rest of the rule language.

The description should focus only on those design features and functional capabilities that were selected for inclusion in the plant design to address the aircraft impacts in this rule and should be equivalent in detail to the descriptions of design features and functional capabilities addressing other beyond design basis events or severe accidents that are required to be described in license certification or approval applications.

MEMBER SIEBER: Why aren't they considered safeguards features and therefore subject to nondisclosure?

MR. RECKLEY: We had a lot of discussion on that and it is possible that some of the features end up being sensitive information and withheld. Until we get into it, but there's also some very obvious design features that are not going to be sensitive and the containment is going to end up being a design feature and so we thought and we're going to strive to make as much of it public and described in the FSAR as possible, but if we come to that problem, then obviously some of the information could end up be involved.

MEMBER SIEBER: A terrorist could be at the local library looking up the FSAR.

MR. MIZUNO: We have regulations that require the applicant to segregate the information. Even though it's required to be submitted to us in the application which obviously NRC people with the need to know will have access to it.

If there is information which is -- needs to be treated as SGI or something that's protected from the public, they have to segregate it out and so only the public portion of the application would be made available to the general public and the full application would be available to the NRC staff for review.

MR. TARTAL: So in control of changes, this is Section 50.51(d), this paragraph is basically a pointer to other existing regulations on change controls and the objective here is to determine whether the design of the facility as it's been changed or modified avoids or mitigates to the extent practical and with reduced reliance on operator actions, the effects of the aircraft impact.

So basically, we're looking to make sure that if they change or modify the facility that it continues to meet this regulation. And in doing that, they would need to redo that portion of the assessment that addresses the changed feature or capability and it's described how as it's modified it continues to do that.

MEMBER BROWN: And obtain approval?

MR. TARTAL: No.

MR. RECKLEY: Informational report to the NRC. So if you don't like it -- if we don't like it, it's like other beyond design basis, reactor kind of features if they were to change it and we don't like it, then we have a process we don't go in to try to force them to do something else. That's the reality that we're in.

MR. TARTAL: This next slide is sort of a tie between the last rulemaking you heard about an hour ago and our rulemaking. Bill is going to --

MR. RECKLEY: Well, since the discussion last time I'm not sure if there's a clear understanding of the relationship here.

50.54(hh)(2) primarily is what we're talking about here. It is intended to require licensees to come up with largely procedural things. There are some hardware features involved, obviously, but largely procedural things to respond to the loss of large areas due to fire and explosions.

That was decided to be needed just like emergency operating procedures and some other things where you can identify -- we want them to have thing sin place that would address serious accidents or events.

51.50 basically is a rule that says let's not miss an opportunity to consider in the design stages that you might be able to do that would lessen the need to have other procedures in place to respond to such an event.

So 50.54(hh) is the requirement for adequate protection that is there as a backstop and all the discussions we've been having is trying to get the vendors at the most advantageous point to try to consider are there design things we can do to minimize those procedural things that would be in place. So that's basically the relationship and why we consider 51.50 to be an enhancement and 50.54(hh) to be an adequate protection requirement.

MEMBER BROWN: It 50.54(hh) then applicable to existing plants?

MR. RECKLEY: Existing plants and new plants.

MEMBER ARMIJO: Is there a credit for a new plant that's designed with really robust features? Is 50.54 the level of planning and strategies? Is there flexibility -- or is this one size fits all?

MR. RECKLEY: It's possible that you can look at a new plant design and say separation and redundancy is so good in that design that they don't need to have some let's say portable pumps or other measures that are required for the operating plants and may be required for some of the new plants. That that is what's being done now for the new plants. They've been through the assessments, both the aircraft assessments and also the 50.54(hh) requirements and guidance to say based on the plant design is there anything I can do to -- well, two things. To do the plant designs, can I not have some of these mitigating strategies because I don't need them and then on the converse, does my plant design introduce anything that I might need a mitigating strategy for that wasn't identified before. And we're going through that exercise now with the various design centers.

MR. TARTAL: So my final slide just highlights the rulemaking schedule and as you see, we're due to have this rule up to the EDO in the middle of September and to the Commission at the end of September, so what we ask is that the ACRS do their normal process of preparing the letter to the Commission with your recommendations and we ask that you have it available to us in two weeks so that we can move forward at the end of concurrence and get it to the EDO on schedule.

MEMBER CORRADINI: By normal expeditious manner.

MR. TARTAL: That's all. Any other questions, commentary?

VICE CHAIRMAN BONACA: No questions, then.

Thank you for your presentation. We have one more presentation from Mr. Riccio of Greenpeace.

MR. RICCIO: Thank you.

MEMBER BANERJEE: Is that upside down?

MR. RICCIO: Old software.

(Laughter.)

MEMBER BANERJEE: Is that a symbol of Greenpeace?

MR. RICCIO: It's just the header. We have a lot of ships.

MEMBER BANERJEE: Which organization?

MR. RICCIO: I beg to differ.

(Off the record comments.)

MR. RICCIO: Good afternoon. My name is Jim Riccio. I am the nuclear policy analyst for Greenpeace here in the U.S. and I want to thank you for opening up this meeting. I have heard some grievances about being an open session. That's my fault.

The public doesn't get many opportunities to get hear where the Agency is heading before they head there and if you had closed the doors, we wouldn't even have known where the Agency was heading with their final rule. And if some of my comments are a little off point it's because we haven't had the opportunity to review the final version.

I always like being here and participating in this panel too because I get a chance to hear things that I don't normally hear when the staff has gotten before the Commission and you guys grilled them and grilled them hard and I hope you'll do it when you get them behind closed doors.

Unfortunately, it's taken the Bush Administration's NRC seven years to merely propose regulations to mitigate the consequences of an airliner attack. Rather than address the present danger and reduce the risk --

MEMBER POWERS: A question, NRC is an independent agency. We don't belong to the Bush Administration --

MEMBER APOSTOLAKIS: In his view.

(Laughter.)

MR. RICCIO: I would suggest that person that chairs the Committee has a large say in where this Agency is headed, especially when the Commission is writing SRMs that result in proposed rules.

MEMBER ARMIJO: I think we should let him make his presentation.

MEMBER POWERS: No problem.

MR. RICCIO: I expect to be grilled too.

(Laughter.)

In addressing the clear and present danger, the Agency and history have both trafficked in half truths about the vulnerability of nuclear power plants. IN the days and weeks that followed the attack on the World Trade Center, the Pentagon, both the NRC and the industry made claims they later had to retract or correct in terms of the vulnerability.

One of the only nuclear plants actually designed with airlines in mind was Three Mile Island and those improvements were forced upon the industry and the Agency by citizen intervenors.

MEMBER APOSTOLAKIS: Can you go back to the previous slide? The other one.

(Off the record comments.)

MEMBER APOSTOLAKIS: What is that word there, deceive and the next one?

MR. RICCIO: Deceive, inveigle and obfuscate.

MEMBER APOSTOLAKIS: Is that the correct spelling?

MR. RICCIO: Yes.

(Laughter.)

MR. RICCIO: I checked it.

MEMBER APOSTOLAKIS: I know what it means.

(Off the record comments.)

MR. RICCIO: It was 96 percent of 104. I knew that TMI was one of them.

MEMBER POWERS: Seabrook is the other.

MR. RICCIO: I don't know if those were also forced upon by citizen intervenors but --

MEMBER POWERS: Because of the proximity of the airport.

MR. RICCIO: Right.

MEMBER POWERS: All of the proposed sites we have to look not only at what aircraft flight patterns are now, but where they might be in the next 60 years.

MR. RICCIO: The industry and their advocates have rolled out the old Sandia tests. They're pretty impressive. There's only one problem.

The test didn't do what the industry claimed they were showing and when they were finally confronted by it by The New York Times they had to fess up and again, I want to thank Sandia Labs because in those days after 9/11 with all the propaganda floating around it was great to have someone speak honestly about what reactors could and could not withstand.

You can still find these claims on many of the industry's websites. Now in the past, the NRC has avoid dealing with the terrorist threat to reactors by claiming it was too speculative. After 9/11 the threat is no longer hypothetical. The 9/11 Commission has documented the threat.

The lies told by President Bush to bolster his case for the War in Iraq, U.S. Troops never found U.S. power flight designs in the case of Afghanistan.

However, we've known since the first World Trade Center bombing trial in '93 --

MEMBER ARMIJO: Was that the Clinton Administration -- and I was wondering why you don't mention that and the lack of the --

MR. RICCIO: Well, sir, the reason I mention it is that President lied in the State of the Union address saying that nuclear power --

MEMBER ARMIJO: I'm talking about --M R . RICCIO: -- in the case of Afghanistan.

MEMBER ARMIJO: If it's going to be an editorial, I'd like you to show a little bit of actuality.

MR. RICCIO: Sir, bring it on. In fact, that's the --

MEMBER ARMIJO: Waste your time, don't waste mine.

MR. RICCIO: I'm not. Those are facts. If you want them documented, I'll be happy to provide the documents.

Sir, we've known since '93 that terrorists were targeting nuclear power plants in the U.S. It came out in the bombing trial from the first World Trade Center and I'm just wondering how long it's going to take this Agency to act.

It took you ten years to get a truck bomb rule promulgated. You've gone through seven years now and we still don't have a rule in place. We're glad that the Agency is moving in that direction, but still seven years is too long to wait.

The next slide may be all points since I haven't seen the new rewrite of the rule. The way it originally had read, this rule would have exempted the ABWR, the AP1000. I'm encouraged to hear that that at least has been addressed.

That was such an abdication of the NRC's responsibility that even the nuclear industry said that you were on the money with public confidence. It wasn't Greenpeace. It wasn't USC. It was George Vanderhoff of Unistar.

It's truly remarkable that the NRC staff's rule was so devoid of substance and forceful criteria that they actually created a consensus among two Commissioners, many nuclear corporations, and the environmental groups including Greenpeace.

MEMBER APOSTOLAKIS: Jim, you are saying that unless you have the benefit of this meeting, you wouldn't know what the rule was, but didn't they publish it in The Federal Register?

MR. RICCIO: The proposed rule. This is the first time I've heard where the Agency is intending to head with the new rewrite of the proposed rule. It's not been published. It's not been made publicly available, unless I can maybe dig it out of the packet that was presented to you guys.

In the proposed rule they were going to exempt the ABWR and the AP1000 from review and that was so unconscionable that they've at least made those adjustments before they had to come before you guys.

I think it really is remarkable that they're able to find consensus among such a disparate group. Again, it's quite an accomplishment that you can actually bring NEI and Greenpeace together.

Don't get me wrong. We don't agree on the substance. We just agree it needs to be criteria.

NEI still doesn't want too much regulation of the industry, but the call to incorporate appropriate acceptance criteria was almost universal in the proposed, in the comments that were submitted.

MEMBER POWERS: That's not surprising since this has a great potential to be open ended. I mean --

MR. RICCIO: I understand. I understand it cuts both ways, but a rule without criteria isn't much of a rule.

MEMBER POWERS: If you're not careful, you can just pose a bigger airplane or a bigger threat. There's got to be some end to this.

MEMBER APOSTOLAKIS: As a result of today's information, this has been met. They are going to --

MR. RICCIO: They will apply to those reactors. We still don't see and I'm not sure if I'll ever get to see the actual criteria that may be in a guide or in an NEI document.

After 9/11 the NRC was challenged and The New York Times op ed by Bennet Ramberg claimed that the NRC had not learned the lessons of 9/11. Unfortunately, the staff's report clearly demonstrates that nearly seven years later the Bush Administration and the NRC still hasn't learned the lessons.

The only solace the public can take in

that is that in less than 200 days the U.S. will have a new President and eventually a new NRC Chairman.

Hopefully, the next NRC chair will actually learn the lessons of 9/11. If the NRC is going to allow nuclear corporations to build more terrorist targets in America, they damn well better be able to withstand an airliner impact.

I thank the Committee for its time and its consideration of our comments and I beg you to hold their feet to the fire and make sure this rule accomplishes what it was supposed to.

Waiting a decade for the next terrorist attack to occur really is not adequate.

Thanks again.

MEMBER BANERJEE: Is that a real picture, the last one?

MR. RICCIO: No.

(Laughter.)

If it was, you would have heard about it by now.

MEMBER APOSTOLAKIS: Let me ask you, do you think based on what you heard today, the last hour and a half, that the multiple concerns are being addressed?

MR. RICCIO: Again, I still have real

questions as to whether or not there are any enforceable criteria or whether or not -- and actually, some of the things I've heard it can me pause for concern.

If you're going to allow either the designer or the licensee to make the decision about making changes, then there goes standardization. And the likelihood that you'll have multiple different design changes at the licensee level rather than by the designers --

MEMBER APOSTOLAKIS: Do you agree with the overall approach that --

MR. RICCIO: Again, I'm encouraged by the fact that they have at least corrected the most glaring error. Again, I'm going to have to take a look at what the rule actually does to see whether or not there are actually any criteria that would be -- that can be applied and enforceable.

MEMBER CORRADINI: So let me ask you this question, is it your opinion that the criteria should be public?

MR. RICCIO: We have no interest in making it easier for terrorists to attack nuclear plants.

MEMBER CORRADINI: Haven't you just invented a Catch-22 by saying --

MR. RICCIO: No, because for instance in this meeting we have people on our side of the fence who actually have security clearances. They are actually the ones that put up the petition for rulemaking that you addressed in the last session.

Unfortunately, I asked that they be allowed to participate in the closed session and they were turned down because apparently they didn't have a need to know.

They've actually changed some of the rules in a good way. They have commented on this, yet they still don't have a need to know.

MEMBER APOSTOLAKIS: Thank you.

MR. RICCIO: Thank you.

CHAIRMAN SHACK: It's time for a break.

(Off the record comments.)

CHAIRMAN SHACK: Before you take the break, just hold for a minute.

Before we break, I think we want to determine whether we have a need for a closed session.

MEMBER APOSTOLAKIS: What are we going to discuss?

MEMBER CORRADINI: Can I ask is it a question and answer?

VICE CHAIRMAN BONACA: There's a formal

presentation upstairs. There is additional questions on the rule that get into issues as the ones we have been doing for the past two years which is airplane type or --

MEMBER APOSTOLAKIS: It seems to me that the real meat will when we see the guidance.

MS. BANERJEE: Excuse me. We also have a draft letter that Mario --

VICE CHAIRMAN BONACA: Why isn't that letter open?

MS. BANERJEE: We may end up going into the closed session.

MEMBER CORRADINI: I think -- into closed session.

MS. BANERJEE: Yes, that's what we were thinking, that in the closed session we can also discuss the letter.

CHAIRMAN SHACK: Okay, do we need to go to the high security room to look at the letter or can we do it as a closed session here?

VICE CHAIRMAN BONACA: We can do it as a closed session here.

MEMBER APOSTOLAKIS: We have done it before.

MEMBER POWERS: It depends on the level.

MS. BANERJEE: If we don't need to go into classified information --

CHAIRMAN SHACK: I don't see how we're going to get into classified information in looking at the letter.

We're going to finish the transcript now. Go off transcript.

(Whereupon, at 5:00 p.m., the meeting was concluded.)

**CERTIFICATE**

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: Advisory Committee on Reactor Safeguards

Docket Number: n/a

Location: 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.

Toby Walter
Official Reporter
Neal R. Gross & Co., Inc.

# ACRS 554th Full Committee Meeting

NRC Staff Review of Proposed Stretch Power Uprate

For

Millstone Power Station, Unit 3

July 9, 2008

# Opening Remarks

Joseph G. Giitter

Director

Division of Operating Reactor Licensing

Office of Nuclear Reactor Regulation

# Opening Remarks

- NRC staff effort
  - Requests for additional information
  - Supplements to application
- Most challenging review area included:
  - Fuel and core design analysis
- Safety evaluation - no open technical issues

# Introduction

John G. Lamb
Senior Project Manager
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

# Introduction

- Dominion Nuclear Connecticut, Inc. (DNC) is the licensee for Millstone Power Station, Unit 3 (MPS3)
- MPS3 Proposed Stretch Power Uprate (SPU)
  - 3,411 to 3,650 Megawatts Thermal (MWt)
  - Approximately 7% increase (239 MWt)
- Background
  - Licensed January 31, 1986
  - Approved License Renewal – October 2005
  - Operating License expires November 25, 2045
- Method of NRC staff review – RS-001 as guidance
- Schedule and Implementation

# Topics for July 9, 2008

- Introduction and Overview of the SPU application
- Fuel & Safety Analysis
- Conclusion

# Fuel and Reactor Systems Evaluation MPS3 SPU

Benjamin Parks and Samuel Miranda
Reactor Systems Branch
Leonard Ward, Ph.D.
Nuclear Performance and Code Review Branch
Division of Safety Systems
Office of Nuclear Reactor Regulation

# Review Scope

- Staff reviewed the impact of SPU on
  - Fuel system and nuclear design
  - Thermal-hydraulic design
  - Overpressure Protection
  - Accident & Transient analyses
  - LOCA
  - ATWS
  - Westinghouse methods

# Review Method

- Scope of EPU evaluations generally followed NRC-accepted, generic SPU guidelines and evaluations

- Analyses and evaluations are based on NRC-approved methodologies, analytical methods, and codes

- Followed the EPU review standard (RS-001)

# Fuel System and Nuclear Design

- Evaluations:
  - Mechanical based on multiple fuel types
  - Nuclear/Thermal-hydraulic on RFA/RFA2
- Uprate effects:
  - Slight increase to linear heat rate
  - Slightly less peaked core design
- Licensee's evaluations demonstrate that acceptable core design may be achieved at uprated power level
- Cycle-specific analyses and evaluations will demonstrate compliance in accordance with NRC-approved reload licensing process

# Accident & Transient Analyses

- Review included those transients covered in Matrix 8 of RS-001; results were acceptable as noted in staff's SER.
- Several accidents/transients warranted additional staff review:
  - Overpressure Protection
  - Inadvertent ECCS Actuation/P-19 Permissive
  - Rod Withdrawal at Power – Low Power

# Overpressure Protection

- Limiting Overpressure event is Loss of Load/Turbine Trip
- Applicable ANSI Condition II Acceptance Criterion:
  - Limit peak pressure to 110% of reactor coolant system design pressure
- Two trips terminate event:
  - High Pressurizer Pressure
  - Overtemperature-$\Delta T$

# Overpressure Protection Continued

- Pursuant to staff request for additional information, licensee analyzed event crediting only the second (OTΔT) trip.
- Results of sequence crediting either trip were acceptable
- Peak pressure did not exceed 2750 psi (110% RCS Design Pressure)

# Inadvertent ECCS Actuation

- Licensee will implement new permissive, P-19 Cold Leg Injection Permissive

# AOO Acceptance Criterion

- "By itself, a Condition II incident cannot generate a more serious incident of the Condition III or IV type without other incidents occurring independently."
- NRC reminded licensees that this criterion is in the plant licensing bases, and therefore must be met (RIS 2005-29).

# AOOs That Add Mass to RCS

- Inadvertent Actuation of ECCS can develop into a small break LOCA at the top of the pressurizer, if a PORV sticks open.
- In analyses, PORVs that are not qualified for water relief are assumed to stick open after they relieve water.

# Millstone Unit 3 Operating Experience

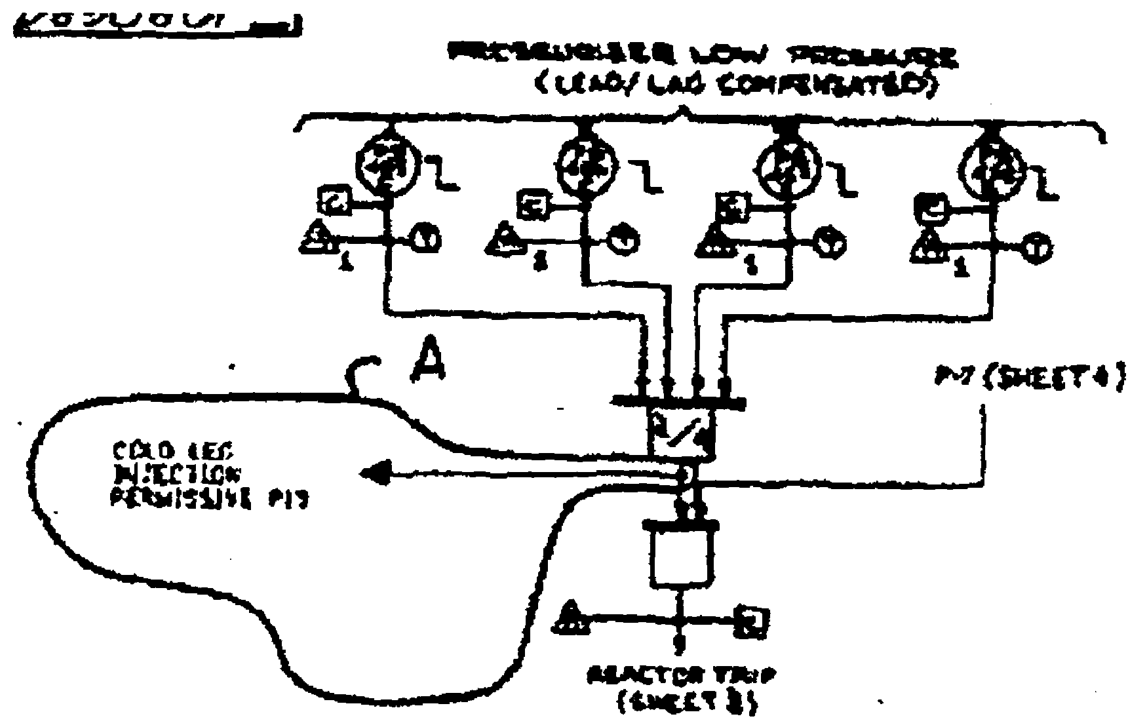
- Inadvertent actuation of ECCS incident occurred on April 17, 2005.
- Resulted in water relief through the PORVs

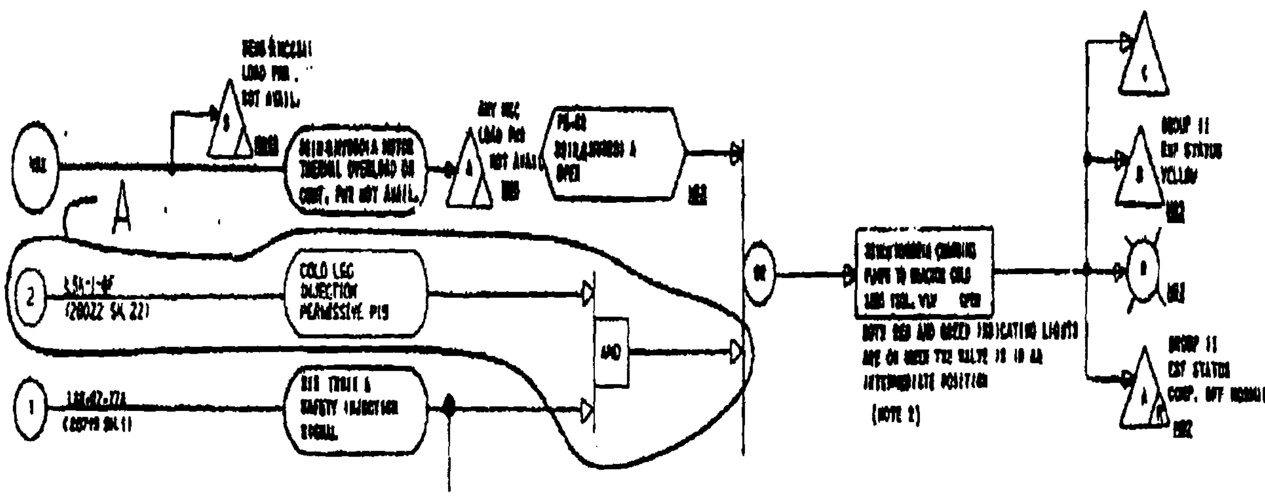
# Millstone Unit 3

- PORVs are qualified for water relief
- P-19 Permissive interlocks the charging cold leg injection valves with a low pressurizer pressure signal coincident with an SI signal.

# P-19 Permissive

- Charging cold leg injection valves do not open unless RCS pressure < low pressurizer pressure reactor trip setpoint and an SI signal is present.
- A single fault does not cause the cold leg injection valves to open. (P-19 would have prevented the incident of 2005.)


PRESSURIZER LOW PRESSURE
(LEAD/LAG COMPENSATED)
A
P-7 (SHEET 4)
COLD LEG
INJECTION
PERMISSIVE P13
REACTOR TRIP
(SHEET 2)



COLD LEG
INJECTION
PERMISSIVE P19
(2802Z SH 22)
AND
OR
A
BOTH RED AND GREEN INDICATING LIGHTS
ARE ON WHEN THE VALVE IS IN AN
INTERMEDIATE POSITION
(NOTE 2)
GROUP 11
ESF STATUS
YELLOW
GROUP 11
ESF STATUS
COMP. OFF NORMAL

# Rod Withdrawal At Power

- Rod withdrawal at power evaluated in Licensing Report with acceptable results
- LR referenced a generic disposition of the potential for RCS overpressurization, given a RWAP initiated at a low power level
- Staff questioned the generic evaluation

# Low Power RWAP – Generic Study

- Westinghouse evaluated the potential for overpressure conditions following a RWAP initiated at a power level where the high neutron flux-low setting can be blocked.
- Evaluation pertained to plants with water-filled loop seals on pressurizer safety valve discharge piping.
- Millstone 3 does not have water-filled loop seals; pressure relief would occur earlier.

# Details of Generic RWAP Evaluation

- Performed for 4-loop Westinghouse plant
- Total power less than Millstone 3 SPU
- Pressurizer level lower than Millstone 3
- Remaining input parameters conservative relative to Millstone 3 SPU

# Westinghouse Study of RWAP at Millstone 3

- Remove seal purge delay on pressurizer safety valve
- Increase core power level
- Increase pressurizer initial water level

# Westinghouse Study of RWAP at Millstone 3 Continued

- Results confirmed that eliminating seal purge delay compensated for increased liquid volume in pressurizer and increased nuclear power addition capability

- Conclusion: Positive Flux Rate Trip terminates transient and Pressurizer Safety Valves mitigate pressurization effects.

# LOCA

- Large Breaks evaluated with ASTRUM Best Estimate Method (Change from BART/BASH Appendix K Method)
- Small breaks evaluated using NOTRUMP (no change)
  - SBLOCA results show significant margin to regulatory limit

# LOCA Results

| | Small Break | Large Break | Acceptance Criterion |
|---|---|---|---|
| Peak Clad Temp, °F | 1193 | 1781 | 2200 |
| Local Cladding Oxidation, % | 0.05 | 3.5 | 17 |
| Core Wide Oxidation, % | 0.01 | 0.12 | 1.0 |

# Summary

- Transient and accident analyses demonstrate acceptable results at uprated conditions
- Fuel design remains acceptable to support the uprate
- Methods implemented acceptably

# Staff Conclusion

- The staff concludes that there is reasonable assurance that the health and safety of the public will not be endangered by the proposed SPU.

GREENPEACE

# Aircraft Impacts & New Nuclear Reactor Designs

U.S. Nuclear Regulatory Commission

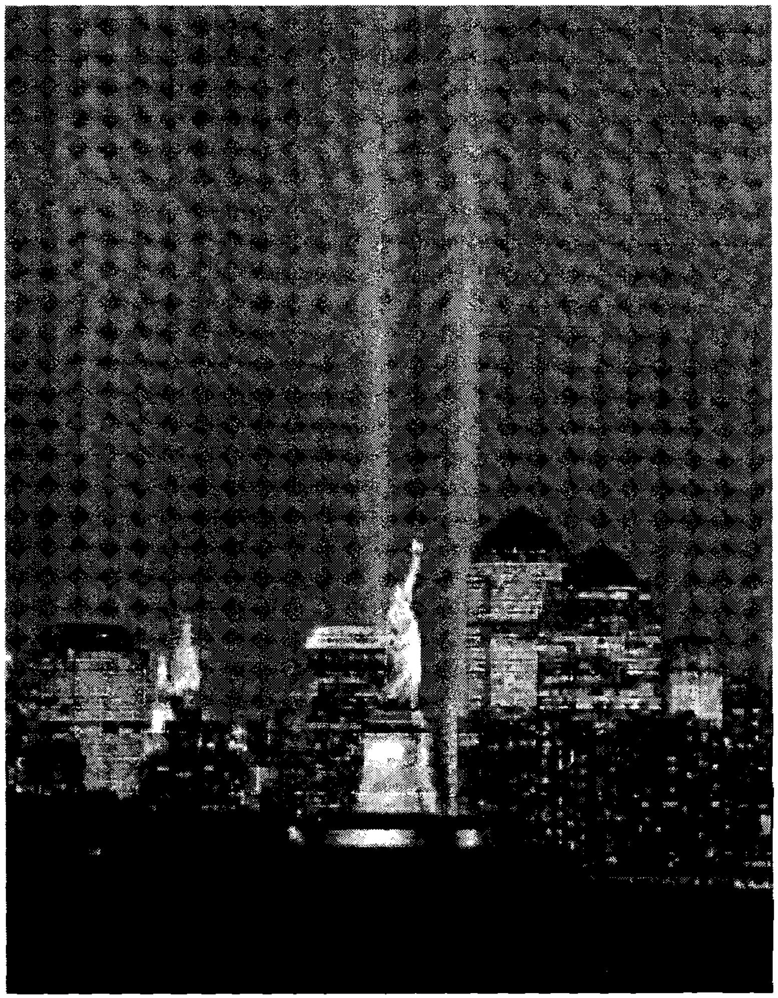
Advisory Committee on Reactor Safeguards

July 9, 2008


Jim Riccio

Nuclear Policy Analyst


# Aircraft Impacts & New Nuclear Reactor Designs

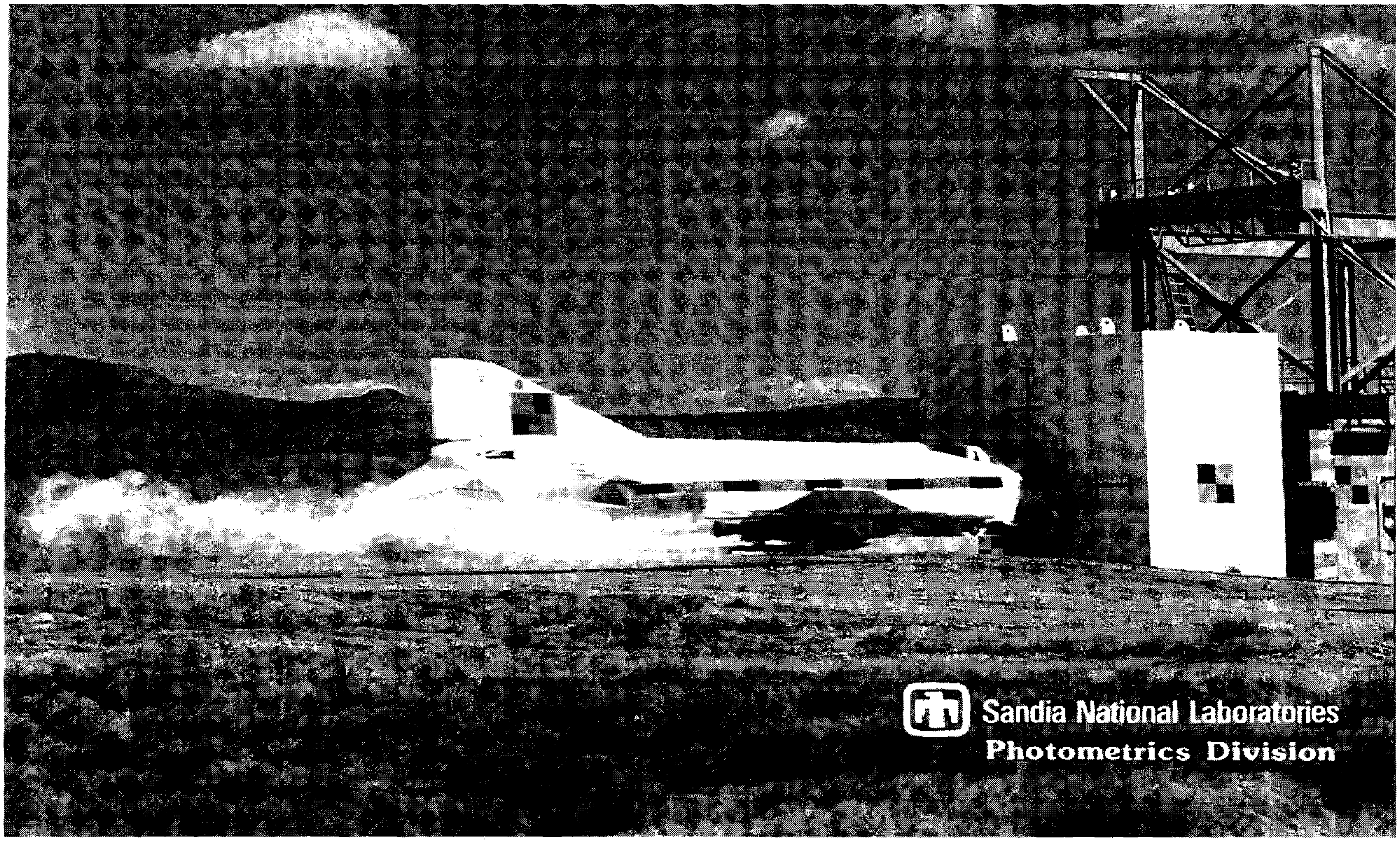


After the attacks of September 11th, the government and the nuclear industry have continued to traffic in half-truths about the vulnerability of nuclear power plants.

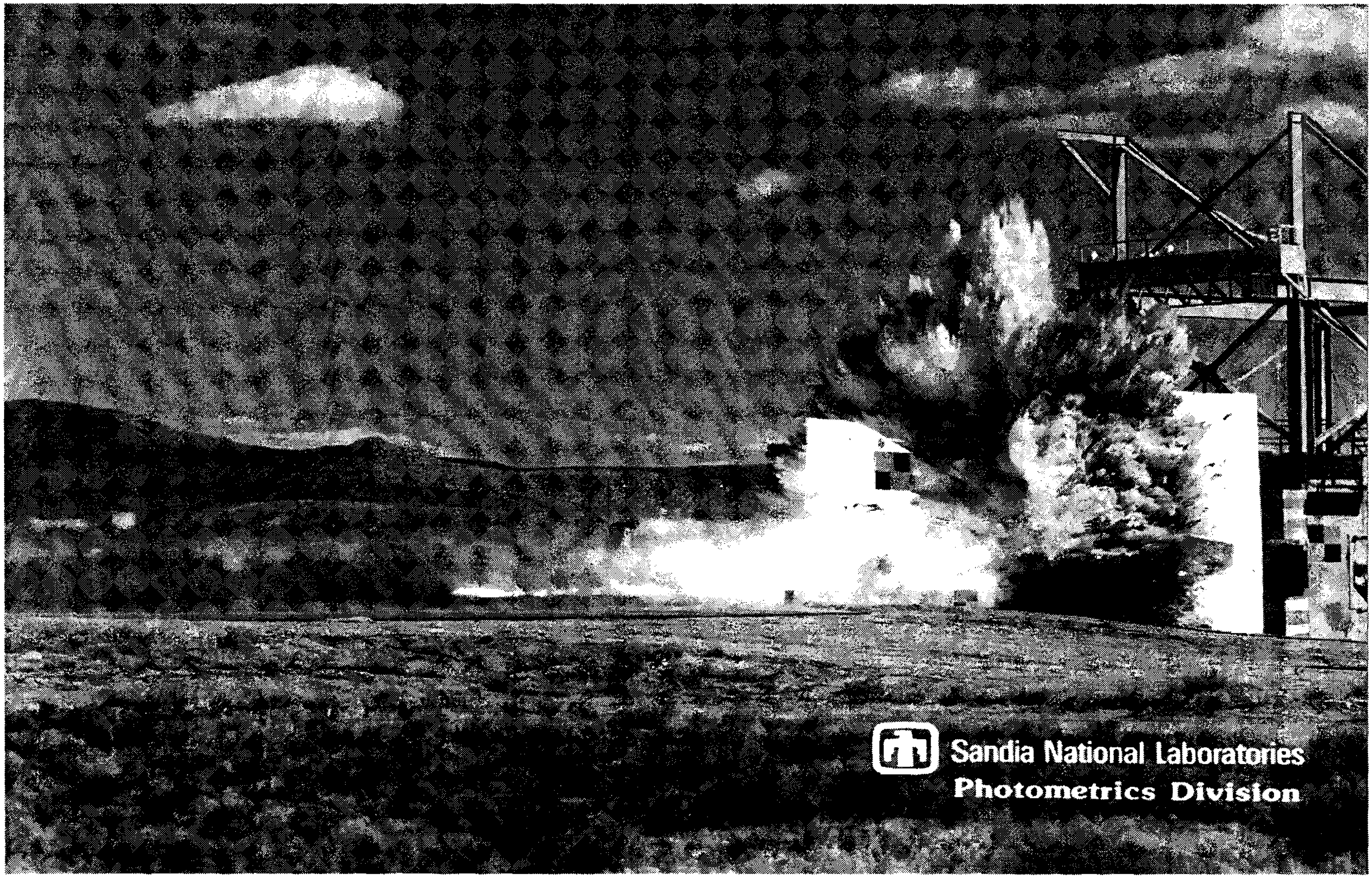
Rather than address the new reality the NRC and the nuclear industry have attempted to deceive, inveigle and obfuscate.

GREENPEACE

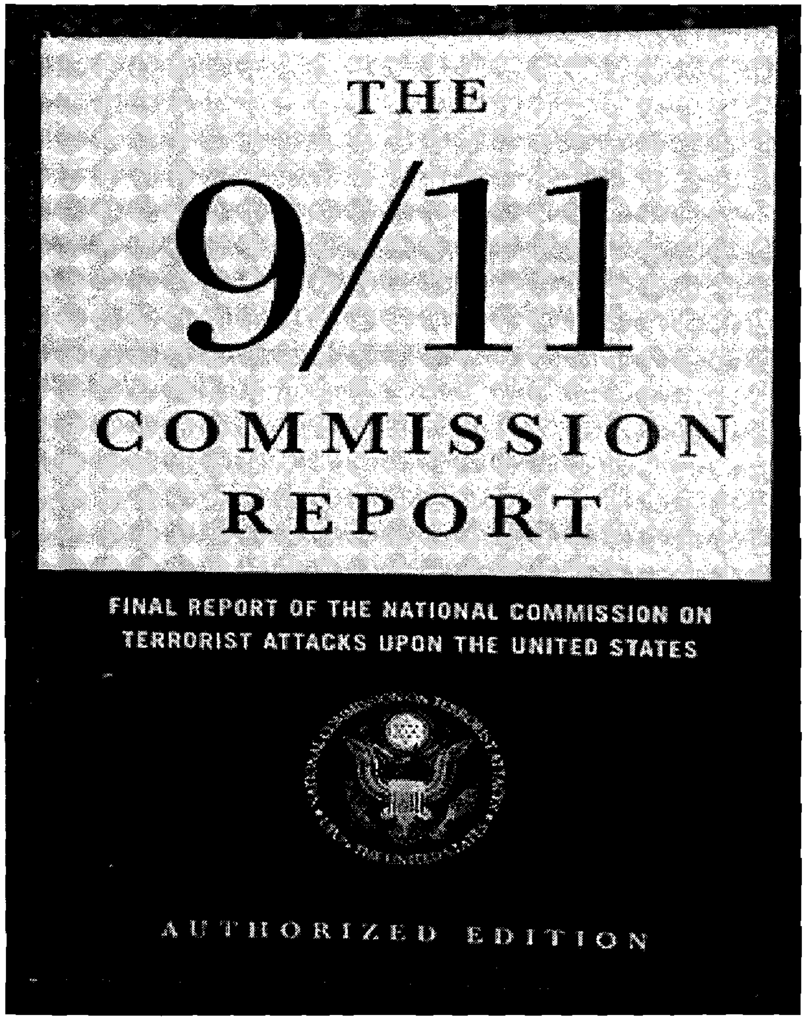
# Aircraft Impacts & New Nuclear Reactor Designs




# Aircraft Impacts & New Nuclear Reactor Designs




# Aircraft Impacts & New Nuclear Reactor Designs




After 9-11, the terrorist threat is no longer hypothetical:

"KSM has admitted that he considered targeting a nuclear power plant as part of his initial proposal for the planes operation….

He also stated that Atta included a nuclear plant in his preliminary target list, but that Bin Laden decided to drop that idea."


# Aircraft Impacts & New Nuclear Reactor Designs

Despite the known threat the NRC's proposed rule will not review these new nuclear reactors to ensure that they can survive a 9-11 type attack:

| Corporation | Design | Site | State |
|---|---|---|---|
| Duke | AP1000 | William Lee Station | SC |
| NuStart Energy | AP1000 | Bellefonte | AL |
| South Carolina E&G | AP1000 | Summer | SC |
| NRG Energy | ABWR | South Texas Project | TX |
| Progress Energy | AP1000 | Harris | NC |
| Progress Energy | AP1000 | Levy County | FL |
| Southern Nuclear | AP1000 | Vogtle | GA |

U.S. Nuclear Regulatory Commission, Expected New Nuclear Power Plant Applications Updated June 4,2008 http://www.nrc.gov/reactors/newlicensing/new-licensing-files/expected-new-rx-applications.pdf


# Aircraft Impacts & New Nuclear Reactor Designs

Commissioner Lyons and the Nuclear Energy Institute have offered up the strikingly similar "high level acceptance criteria."

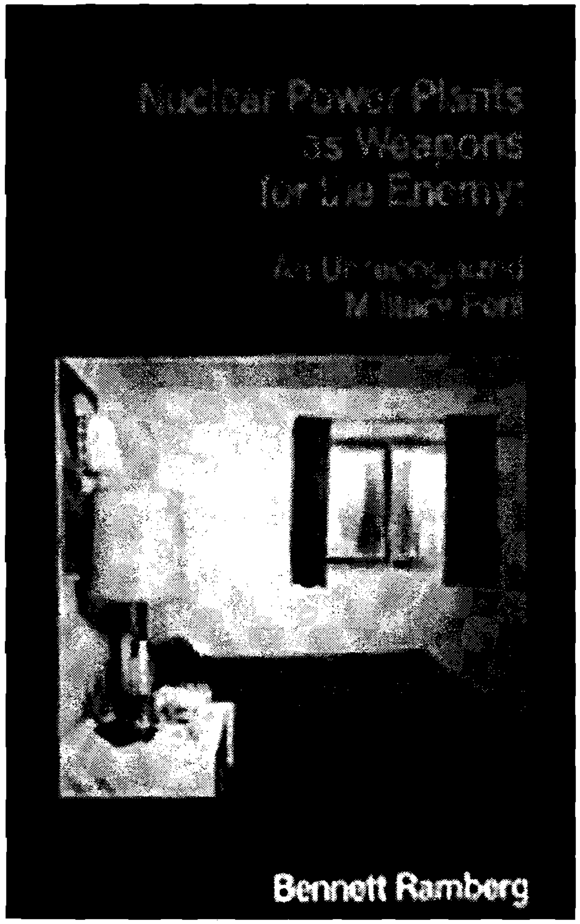
Commissioner Lyons suggested that the industry:

- demonstrate an acceptable dose at the site boundary or
- demonstrate that the core remains cool or the containment remains intact and that spent fuel cooling is maintained.

(U.S. Nuclear Regulatory Commission, Commission Voting Record, SECY-06-204, Proposed Rulemaking - Security Assessment Requirements for New Nuclear Power Reactor Designs, April 24, 2006.)

GREENPEACE

# Aircraft Impacts & New Nuclear Reactor Designs




"Keeping the terrorists guessing about our defenses was presumably one motivation for the secrecy. However, it might also reflect the commission's desire to play down its acquiescence to the nuclear industry's hubristic view that the plants are nearly invulnerable...the commission doesn't seem to have learned the lesson of those attacks."

Bennett Ramberg,
New York Times, May 20, 2003

# LUMPED MASS-SPRING MODEL SEISMIC ANALYSIS vs. FINITE ELEMENT STATIC STRUCTURAL ANALYSIS

- RESULTS OF LUMPED MASS-SPRING MODEL ANALYSIS INCLUDE: NODAL MASS PT. ACCE./DISPL. RESPONSE FUNCTIONS AS WELL AS FLOOR RESP. SPECTRA (e.g., DAC-3N Code)

- DIRECT SPRING (MEMBER) FORCES, SHEAR AND BENDING MOMENTS AND JOINT DISPL./ROTATIONS

- THE ABOVE RESULTS ARE THEN APPLIED TO AN ADVANCED FINITE ELEMENT STRUCTURAL MODEL USING, SAY, ANSYS, OR SAP2000 FOR COMPUTING ELEMENT FORCES, LOCALIZED MOMEMTS AND SHEARS USED IN SIZING THE ELEMENT DIMEWNSIONS INCLUDING REBARS, STEEL PLATE SECTIONS, MEMBER DIMENSIONS, ETC.

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
*Protecting People and the Environment*

# Presentation to the ACRS Full Committee

ESBWR Design Certification Review

Chapter 3 – Design of Structures, Components, Equipment, and Systems

July 9, 2008

# ACRS Subcommittee Presentation
# ESBWR Design Certification Review
# Chapter 3 Sections & Reviewers

Richard McNally
3.2

Mohamed Shams
3.3.1
3.3.2
3.4.2

David Shum
3.4.1
3.5.1.1
3.5.1.2
3.5.1.4
3.6.1

George Georgiev
3.5.1.3
3.13

S. Rao Tammara
3.5.1.5
3.5.1.6

Renee Li
3.6.2

David Jeng
3.7.

Samir Chakrabarti
3.8

John Wu
3.9.1

Jai Rajan
3.9.2

Arnold Lee
3.9.2.2
3.9.3

Andrey Turilin
3.9.4

Patrick Sekerak
3.9.5

Thomas Scarbrough
3.9.6
3.11

P.Y. Chen
3.10

Amar Pal
3.11

John Fair
3.12

# ACRS Full Committee Presentation
# ESBWR Design Certification Review
# Chapter 3 RAI Status

Total RAIs Issued – 583

Open RAIs – 57

<u>Open RAI Details</u>

- 3.8 – 19
- 3.9 – 15
- 3.6 – 8
- 3.11 - 7

# ESBWR Design Certification Review
# Section 3.2 – Seismic Classification and Quality Group Classification

## Regulatory Basis:

10 CFR 50 Appendix A, General Design Criteria (GDC) 1 and 2

*Criterion 1 --Quality standards and records*. Structures, systems, and components important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be identified and evaluated to determine their applicability, adequacy, and sufficiency and shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function. A quality assurance program shall be established and implemented in order to provide adequate assurance that these structures, systems, and components will satisfactorily perform their safety functions. Appropriate records of the design, fabrication, erection, and testing of structures, systems, and components important to safety shall be maintained by or under the control of the nuclear power unit licensee throughout the life of the unit.

*Criterion 2 --Design bases for protection against natural phenomena*. Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (3) the importance of the safety functions to be performed.

## ESBWR Design Certification Review
## Section 3.2 – Seismic Classification and Quality Group Classification

### Classification Process

**Blend of deterministic and risk-informed approach**

- RG 1.26 and 1.29 for quality group and seismic classifications based on safety function
- PRA and RTNSS process establish scope and risk-significance

# ESBWR Design Certification Review
# Section 3.2 – Seismic Classification and Quality Group Classification

## Risk Considerations Applied to Classification Process

### Regulatory Treatment of Nonsafety-Related Systems (RTNSS) SSCs

- Nonsafety-Related SSCs with high risk significance are identified as RTNSS SSCs
- GEH has proposed a new Special Class to distinguish high risk significant SSCs from other nonsafety-related SSCs with low risk significance
- RTNSS SSCs will receive special treatment in terms of seismic and quality requirements
- RTNSS process is described in DCD Section 19 and evaluated in FSER Chapter 22

# ESBWR Design Certification Review
# Chapter 19A (SER Chap. 22)

## Regulatory Treatment of Non-Safety Systems (RTNSS)

### CRITERIA FOR SELECTING RTNSS SSCs:

- Non-safety SSC relied on to meet ATWS and SBO rules.
- Non-safety SSC needed for core cooling, containment heat removal or control room habitability beyond 72 hours post accident.
- Non-safety SSC that provides diagnostic info beyond 72 hours post accident.
- Non-safety SSC relied on to meet Commission's safety goals
- Non-safety SSC relied on to meet containment performance goals.
- Non-safety SSC relied upon to prevent significant adverse interaction with passive safety system.

**ESBWR Design Certification Review**
**Section 3.7 – Seismic Design**

# Discussion Topics:

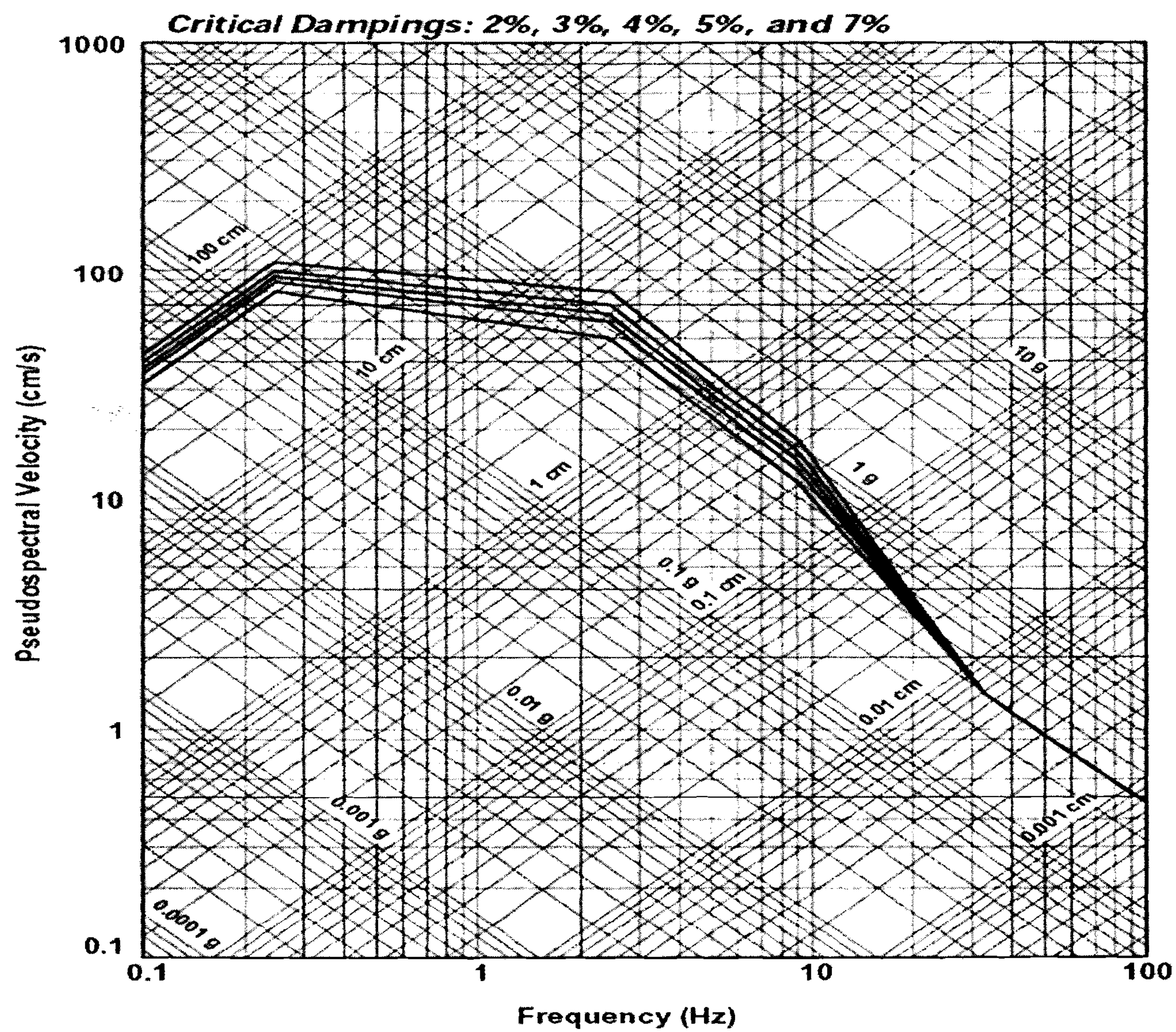
- ESBWR SEISMIC GROUND MOTION SPECTRA CURVES AND THEIR USE IN SEISMIC ANALYSIS
- ESBWR POOLS AND THEIR IMPACT ON SEISMIC ANALYSIS

# DESIGN GROUND MOTIONS USED IN SEISMIC DESIGN OF ESBWR PLANTS

- ESBWR standard plant SSE design ground motion is rich in both low and high frequencies
- The low-frequency ground motion follows RG 1.60 ground spectra anchored to 0.3 g (Fig. 1)
- The high frequency ground motion matches the North Anna ESP site-specific spectra as representative of most severe rock sites in the Eastern US (Fig. 2)
- These two ground motions are considered separately in the basic design (Used DAC-3N Code)
- To verify the basic design the two separate inputs (both low and high frequencies) are further enveloped to form a single envelope design ground response spectra, also termed as the Certified Seismic Design Response Spectra (CSDRS) (Fig. 3)

# LOW FREQUENCY DESIGN GROUND MOTION

## RG 1.60 Spectrum Anchored at 0.30 g (Fig. 1)



# HIGH FREQUENCY DESIGN GROUND MOTION

## North Anna ESP Site Specific Spectrum Anchored Approx. at 0.50 g (Fig. 2)

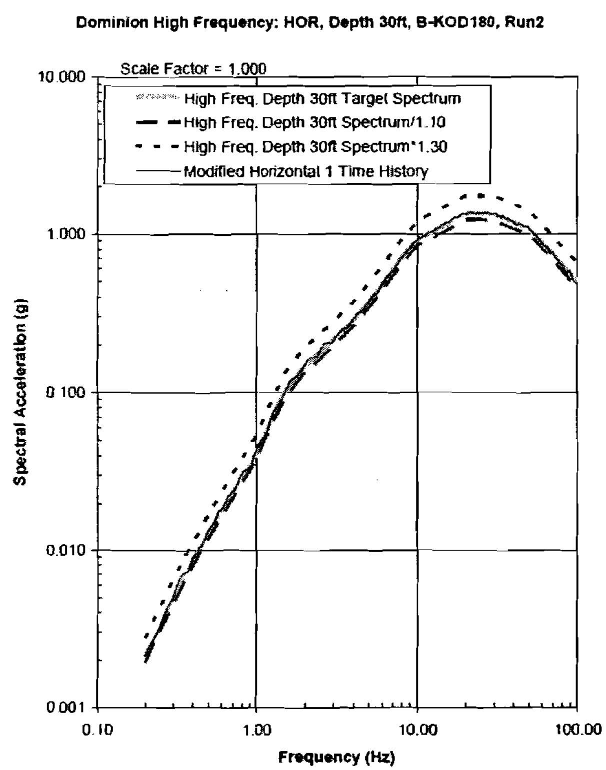
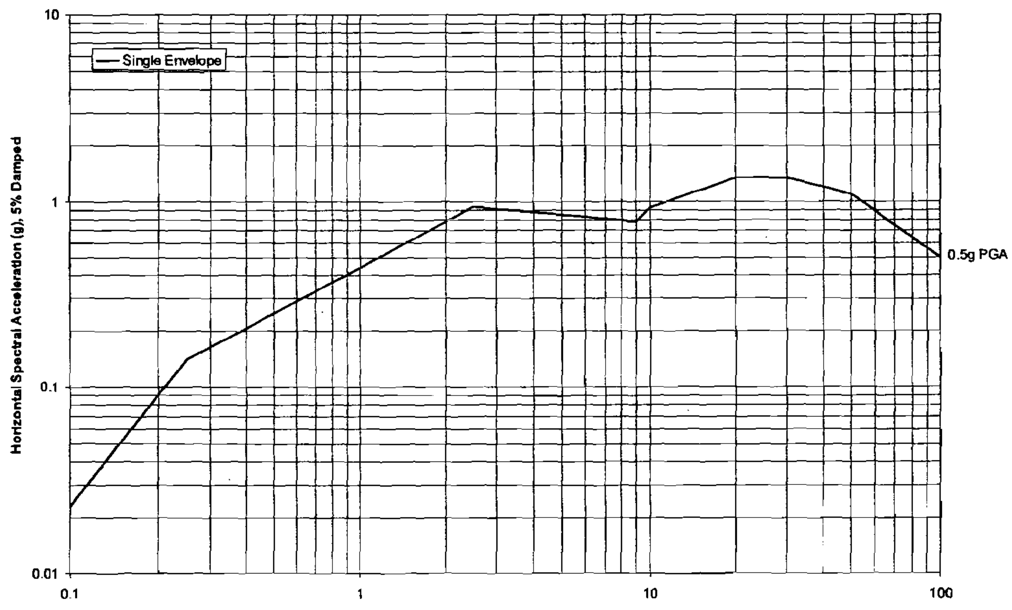
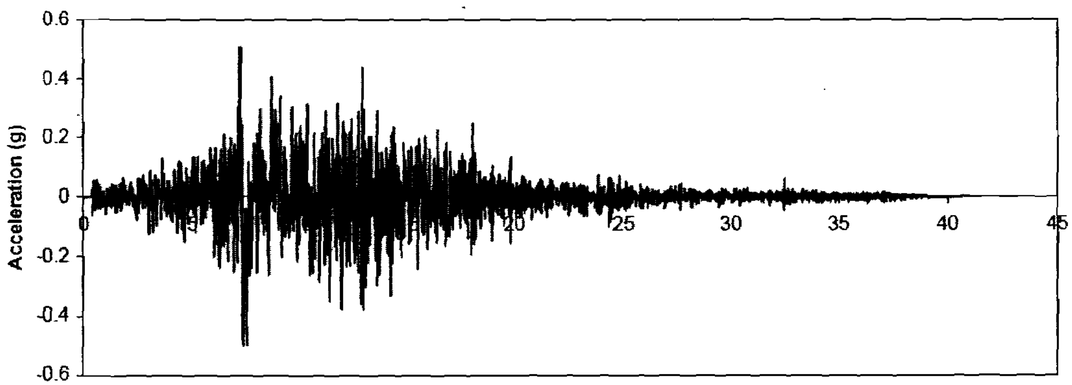



Figure 3.7-24. North Anna ESP Horizontal H1 Target Spectrum at ESBWR CB Base

# ESBWR Certified Seismic Design Response Spectra (CSDRS) (GEH SLIDE) (Fig. 3)

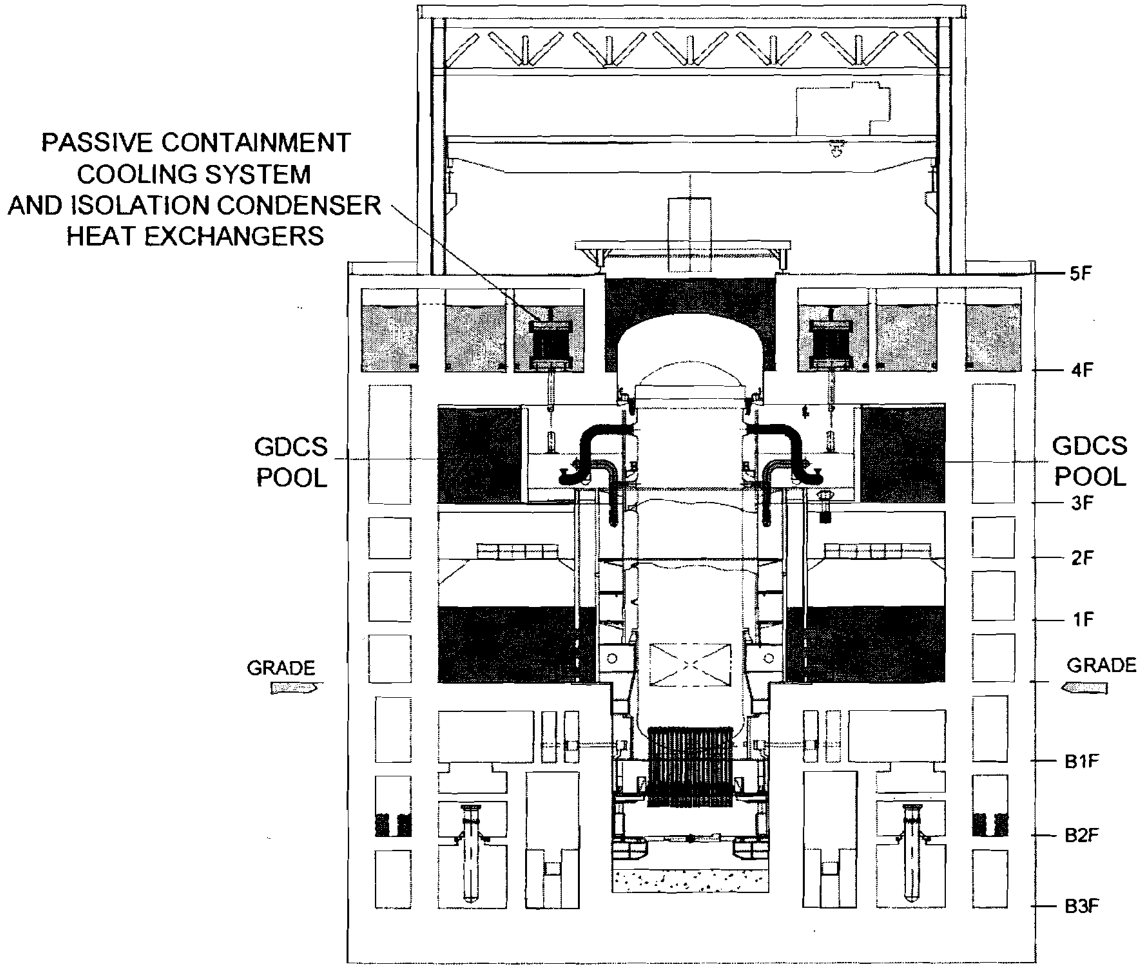


# SEISMIC ANALYSIS OF ESBWR WATER TANKS AND FUEL POOLS

- ESBWR Water Tanks and Fuel Pools including Water Masses are modeled in the Seismic Analysis Models per ESBWR DCD Sections 3.7
- For Global Seismic Analysis Modeling, ESBWR Conservatively Used 100 % Water Mass for the Impulsive Mode analysis
- Design of Water Tanks and Fuel Pools Conforms with SRP Sections 3.7 and 3.8

# SEISMIC ANALYSIS OF ESBWR WATER TANKS AND FUEL POOLS (GEH Slide)




REACTOR BUILDING

# CONCEPTUAL MODELING OF SEISMIC ANALYSIS OF WATER TANKS

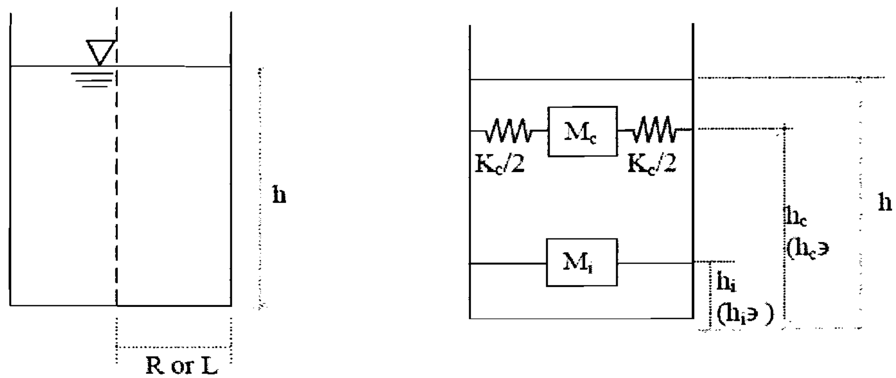



**Figure 1:** Description of tank dimensions and mechanical model

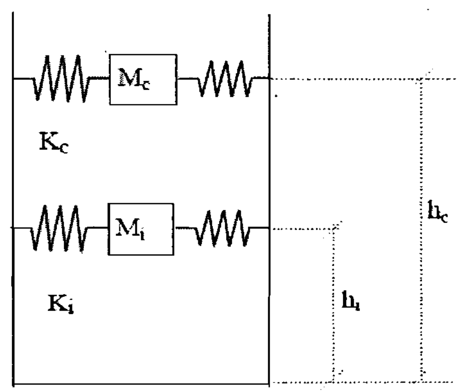
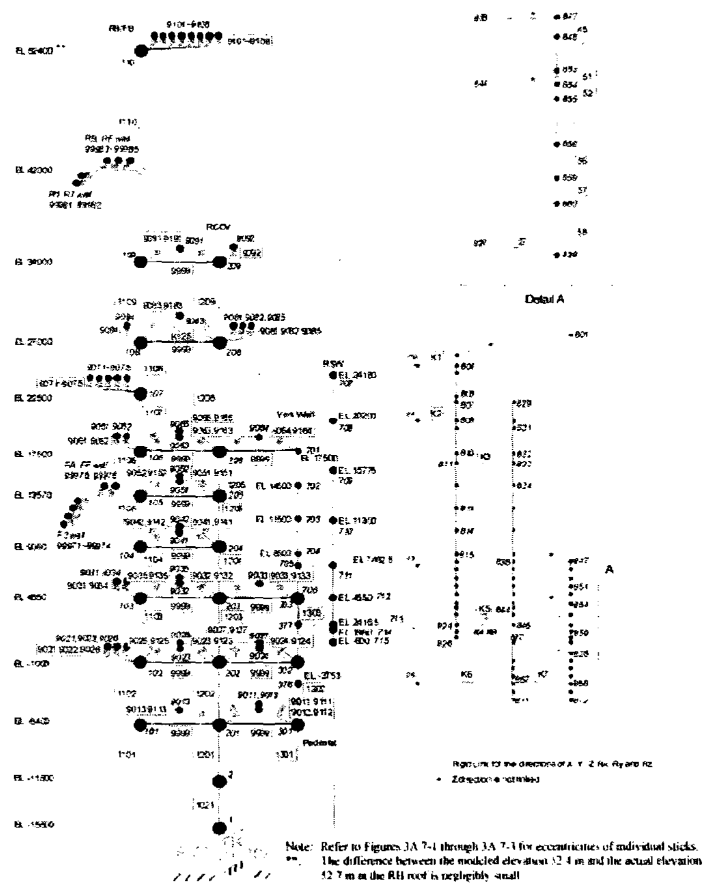



**Figure 2:** Mechanical models for flexible circular tanks (Malhotra et. al., 2000)

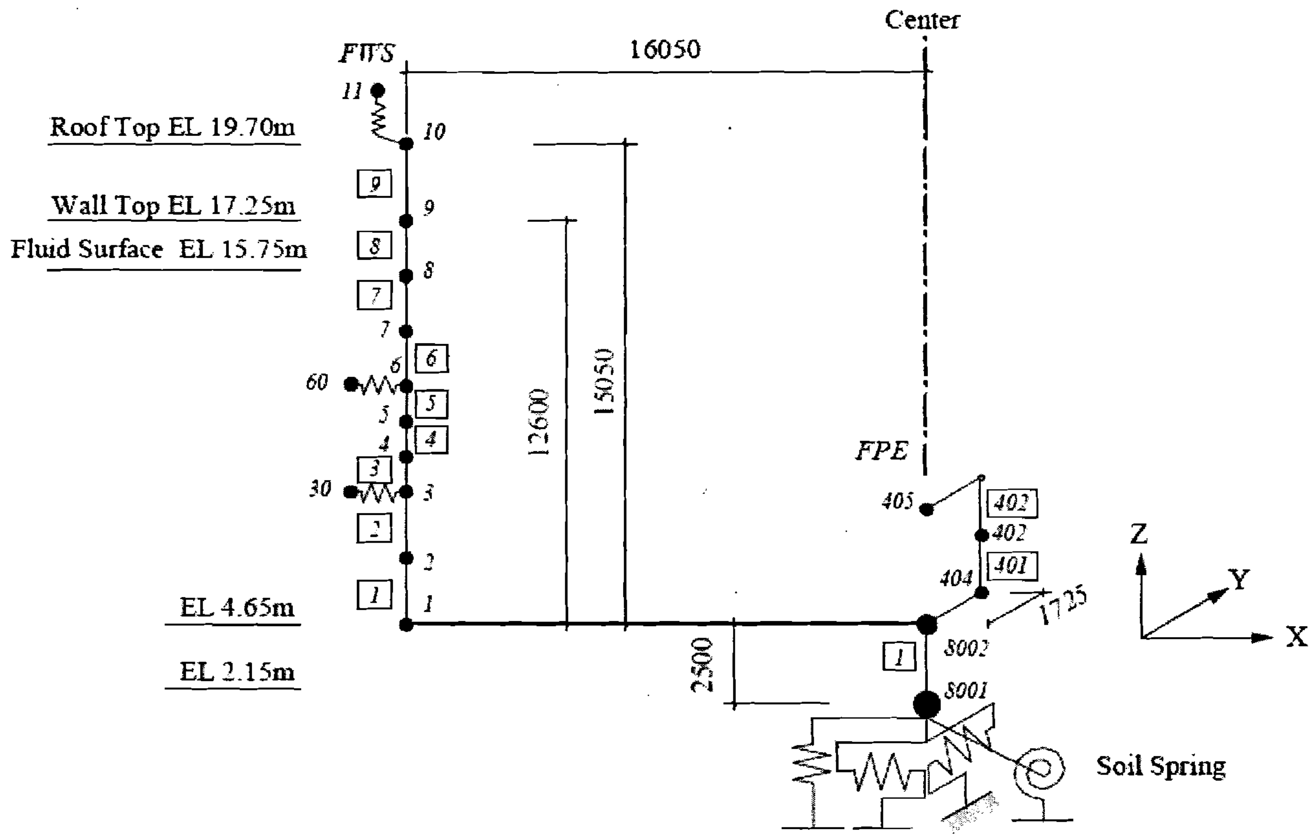
# RB/FB COMPLEX SEISMIC MODEL




Note: Refer to Figures 3A 7-1 through 3A 7-3 for eccentricities of individual sticks.
**. The difference between the modeled elevation 52.4 m and the actual elevation 52.7 m at the RB roof is negligibly small

Figure 3A.7-4. RB/FB Complex Seismic Model

# FWSC SEISMIC MODEL




Mass at Node 30 represents the impulsive mode.
Mass at Node 60 represents the fundamental sloshing (convective) mode.
The model is assumed to be symmetric about YZ-plane including the center line.

# SEISMIC ANALYSIS OF ESBWR WATER TANKS AND FUEL POOLS (Cont'ed)

- The horizontal response analysis includes at least one impulsive mode and the fundamental sloshing (convective) mode. At least one vertical mode of fluid vibration are included in the analysis.

- The analysis models evaluate impulsive and convective masses, time period of impulsive and convective modes of vibrations, hydrodynamic pressure distribution and sloshing wave height.

- Damping values used to determine the spectral acceleration in the impulsive mode are based upon the system damping associated with the tank shell material as well as with the SSI.

- In determining the spectral acceleration in the horizontal convective mode, damping ratio is 0.5% of critical damping.

# SEISMIC ANALYSIS OF ESBWR WATER TANKS AND FUEL POOLS (Cont'ed)

- The maximum overturning moment at the base of the tank and the seismically induced hydrodynamic pressures on the tank shell at any level are obtained by the modal and spatial combination methods.
- The maximum hoop forces in the tank wall are evaluated with due regard for the contribution of the vertical component of ground shaking.
- The hydrodynamic pressure at any level is added to the hydrostatic pressure at that level to determine the hoop tension in the tank shell.
- Either the tank top head is located at an elevation higher than the slosh height above the top of the fluid or else is designed for pressures resulting from fluid sloshing against this head.

# ESBWR Design Certification Review Section 3.11 – Environmental Qualification of Mechanical and Electrical Equipment

- Safety-related electrical equipment in harsh environment will be qualified by test or other methods as described in IEEE 323-1974.

- Safety-related mechanical equipment in harsh environment is qualified using test, analysis or a combination of test and analysis.

- Safety-related computer based equipment in mild environment is qualified by type testing.

- The equipment qualification method (by test or analysis or a combination of test and analysis) will be available during inspection.

# CODES AND APPLICABLE TYPES OF TANKS

Table 1: Types of tanks considered in various codes

| Code | Types of tanks |
|---|---|
| ACI 350.3 | • Ground supported circular and rectangular concrete tanks with fixed and flexible base.<br>• Pedestal supported elevated tanks. |
| AWWA D-100 & D-103 | • Ground supported steel tanks with fixed and flexible base.<br>• Elevated steel tanks with braced frame and pedestal type supporting tower. |
| AWWA D-110 & D-115 | • Ground supported prestressed concrete tanks with fixed and flexible base. |
| API 650 | • Ground supported steel petroleum tanks (Types of base support are not described). |
| NZSEE Guidelines | • Ground supported circular and rectangular tanks with fixed and flexible base.<br>• Elevated tanks. |
| Eurocode 8 | • Ground supported circular and rectangular tanks with fixed base.<br>• Elevated tanks. |

# MAXIMUM SLOSHING WAVE HEIGHT GIVEN BY CODES

**Table 7:** Expressions for maximum sloshing wave height given in various codes

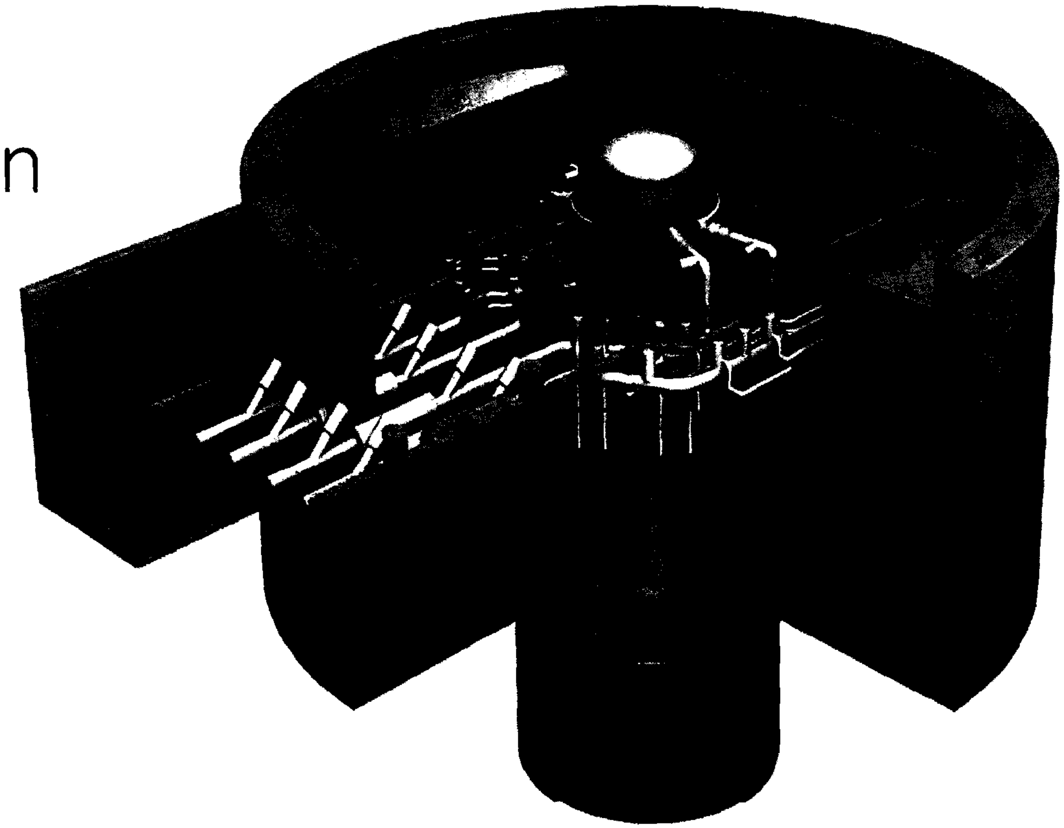
| Code | Sloshing wave height |
|---|---|
| ACI 350.3 | $A_cR$ |
| AWWA D-100 & D-103 | 0.84 $A_cR$ |
| AWWA D-110 & D-115 | $A_cR$ |
| API 650 | Not mentioned |
| NZSEE Guidelines | 0.84 $A_cR$ (Considering only first mode) |
| Eurocode 8 | $0.84A_cR$ |

$A_c$ = Convective acceleration; R = Radius of tank

# ESBWR DCD Chapter 3

Design of Structures, Components, Equipment and Systems

Advisory Committee on Reactor Safeguards



July 9, 2008

## GE Hitachi Nuclear Energy

# Introduction

> Presenters

- David Hamon, ESBWR Engineering
- Jerry Deaver, ESBWR Engineering
- Ai-Shen Liu, ESBWR Engineering
- Jeffrey Waal, ESBWR Regulatory Affairs

# Presentation Content

- Chapter 3 Overview
- Selected Topics
- Summary

# Chapter 3, Overview

- Chapter 3 describes the design of structures, components, equipment and systems.
  > 3.1 – Conformance with NRC General Design Criteria.
  > 3.2 – Classification of Structures, Systems and Components
  > 3.3 – Wind and Tornado Loadings.
  > 3.4 – Water Level (Flood) Design
  > 3.5 – Missile Protection
  > 3.6 – Protection Against Dynamic Effects Associated with the Postulated Rupture of Piping

# Chapter 3, Overview (cont'd)

- Chapter 3 describes the design of structures, components, equipment and systems.
  - 3.7 – Seismic Design
  - 3.8 – Seismic Category I Structures
  - 3.9 – Mechanical Systems and Components
  - 3.10 – Seismic and Dynamic Qualification of Mechanical and Electrical equipment
  - 3.11 – Environmental Qualification of Mechanical and Electrical Equipment
  - 3.12 – ASME Code Class 1, 2 and 3 Piping Systems, Piping Components and Associated Supports
  - 3.13 – Threaded Fasteners for ASME Components

# Section 3.2 – Classification of SSCs

- Safety-Related Definition – 10 CFR 50.2

  > Safety-related structures, systems and components means those structures, systems and components that are relied upon to remain functional during and following design basis events to assure:

  (1) The integrity of the reactor coolant pressure boundary

  (2) The capability to shut down the reactor and maintain it in a safe shutdown condition; or

  (3) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to the applicable guideline exposures set forth in § 50.34(a)(1) or § 100.11 of this chapter, as applicable.

# Section 3.2 – Classification of SSCs

- Safety Classification (DCD Section 3.2.3)
  - > Consistent with safety classifications used in ABWR DCD.
  - > Safety Class 1 – RCPB components and supports.
  - > Safety Class 2 – Mechanical SSCs involved in containment isolation functions not included in Safety Class 1, ECCS and RHR functions.
  - > Safety Class 3 – All other mechanical safety-related SSCs not included in Safety Classes 1 and 2. All safety-related electrical/I&C SSCs are Safety Class 3.
  - > Safety Class N – Nonsafety-related SSCs.
  - > Safety Classes 1 through 3 very closely related to Quality Groups A through C classifications for safety-related SSCs.

# Section 3.2 – Classification of SSCs

- Safety Classification (DCD Section 3.2.3)
  - > Safety Classification establishes minimum requirements for all other classifications (seismic, quality group, QA)

**Table 3.2-2**

**Minimum Safety Class Requirements**

| Safety Class | Minimum Design Requirements for Specific Safety Class | | | | |
|---|---|---|---|---|---|
| | Quality Group | ASME Section III Code Class | Seismic Category[1] | Electrical Classification[2] | Quality Assurance[4] |
| 1 | A | 1 | I | N/A | 10 CFR 50 Appendix B |
| 2 | B | 2 | I | N/A | 10 CFR 50 Appendix B |
| 3 | C | 3 | I | Class 1E | 10 CFR 50 Appendix B |
| N | D[3] | N | II or NS | Non-Class 1E | — |

# Section 3.2 – Classification of SSCs

- Seismic Classification (DCD Section 3.2.1)
  - > Based on RG 1.29 and SRP 3.2.1.
  - > Seismic Category I required for all safety-related SSCs.
  - > Seismic Category II required for nonsafety-related SSCs whose failure could degrade performance of safety-related SSCs and for SSCs classified as RTNSS Criterion B from PRA analyses (DCD Section 19A.3).
  - > Some nonsafety-related SSCs assigned to Seismic Category I when required by regulations.
  - > Remaining SSCs assigned to Seismic Category NS.
  - > RG 1.143 applies special seismic requirements for radioactive waste handling SSCs

# Section 3.2 – Classification of SSCs

- System Quality Group Classification (DCD Section 3.2.2)
  - > Based on RG 1.26 and SRP 3.2.2.
  - > Quality Group A – Pressure-retaining portions and supports for Reactor Coolant Pressure Boundary.
  - > Quality Group B – Pressure-retaining portions and supports not in Quality Group A for safety-related containment isolation, ECCS and residual heat removal functions.
  - > Quality Group C – Pressure-retaining portions and supports for other safety-related functions not included in Quality Groups A and B.
  - > Quality Group D – Pressure-retaining portions and supports for other systems that contain or may contain radioactive material.

# Section 3.2 – Classification of SSCs

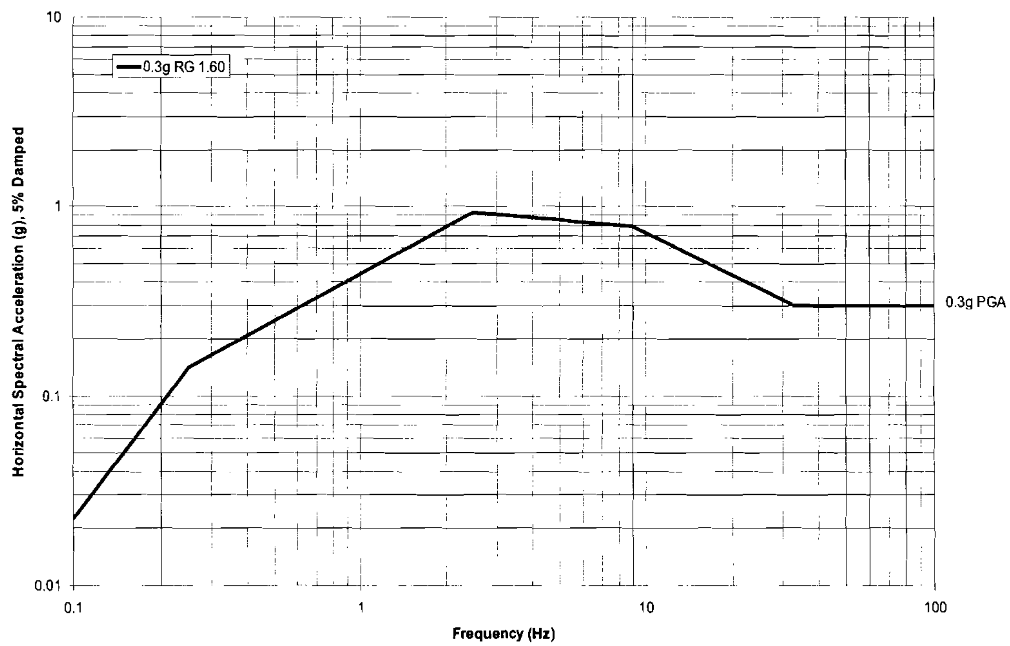
- Conclusions
  - ESBWR classification system is consistent with previously licensed designs
  - Safety-related SSCs are determined based on 10 CFR 50.2 definition.
  - Safety classification establishes minimum requirements for other classifications and serves as entry point to QA program
  - Minimum Seismic and Quality Group classifications are upgraded as required by SRPs, RGs and design practices
  - PRA analyses determine SSCs requiring upgraded seismic design requirements due to RTNSS considerations
  - Seismic and Quality Group classifications establish basis for NRC review under SRPs 3.2.1 and 3.2.2.

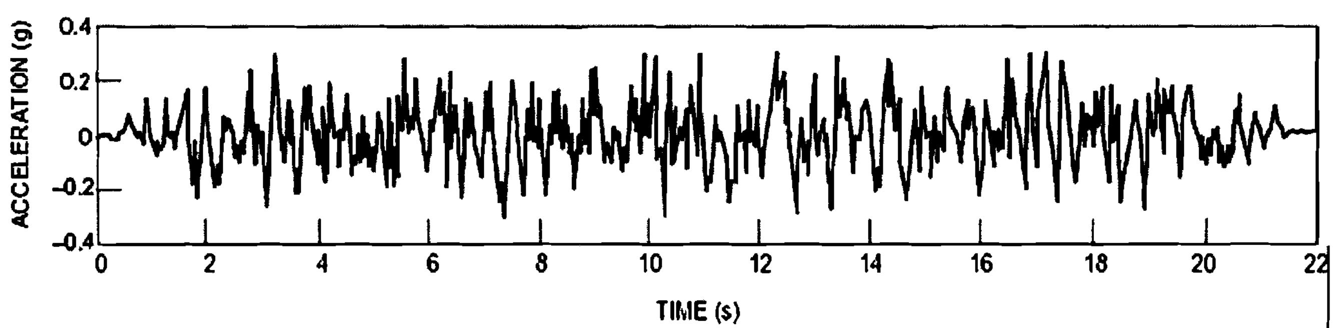
# Section 3.7 – Seismic Design

- Section 3.7.1 provides seismic design parameters.
  - >The CSDRS follows RG 1.60 spectra and North Anna ESP site-specific spectra at high frequencies.
  - >North Anna spectra is representative of most severe rock sites in the Eastern US.
    - Note: No recorded seismic event contains simultaneously very high low-frequency and high-frequency motions. CSDRS is very conservative.
  - >Artificial time histories were developed to match the CSDRS spectra per NUREG/CR-6728 criteria.

# Derivation of CSDRS

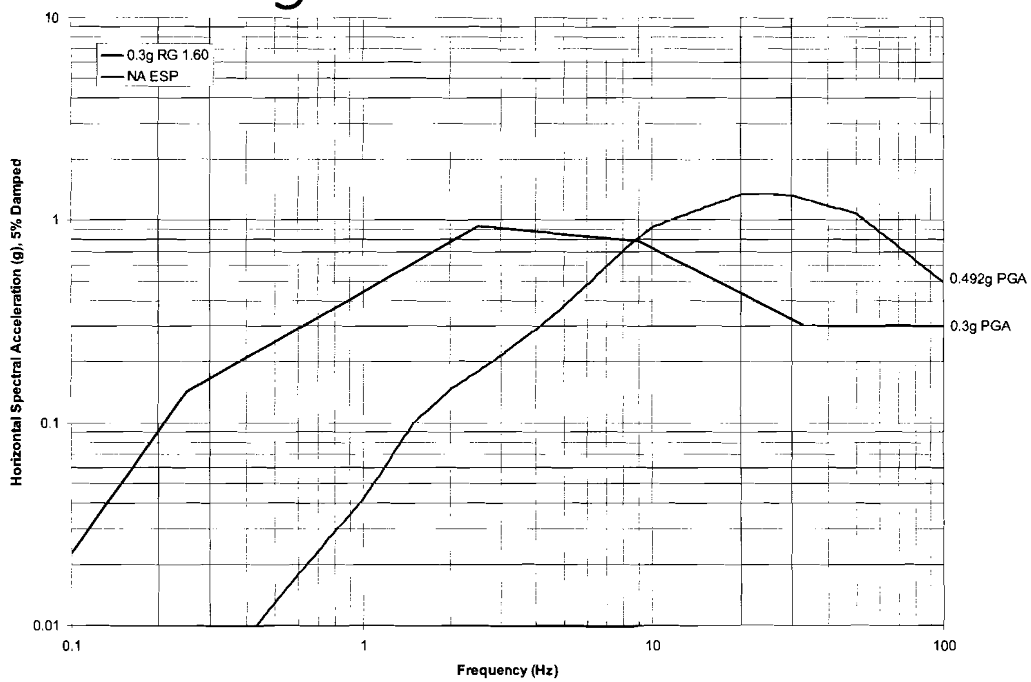
- Low-Frequency Ground Motion follows RG 1.60 with 0.3g Peak Ground Acceleration (PGA).

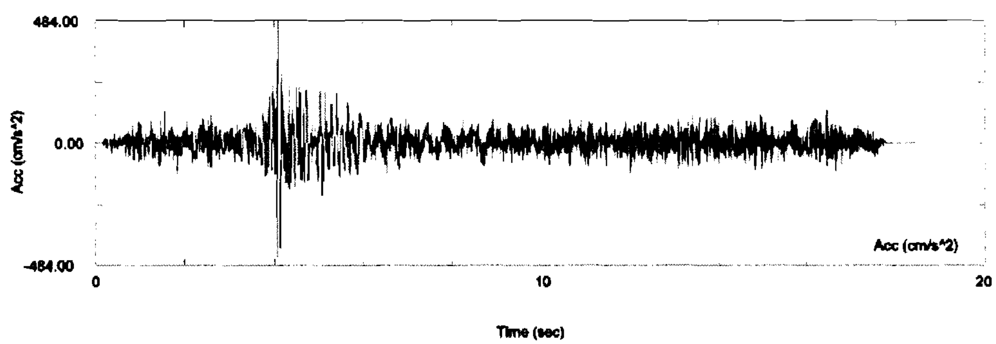


# Derivation of CSDRS

- High-Frequency Ground Motion follows North Anna ESP with 0.492g PGA.

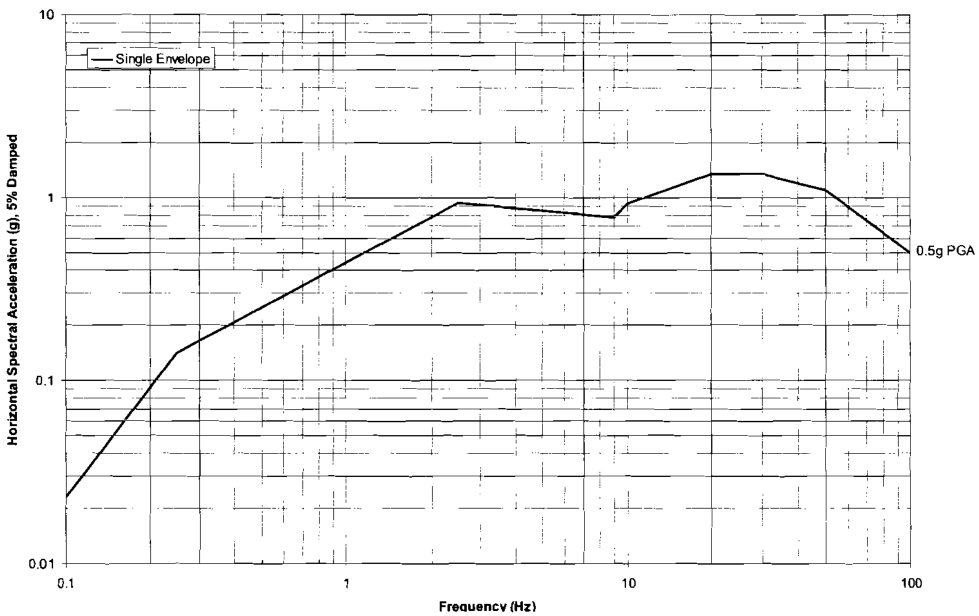


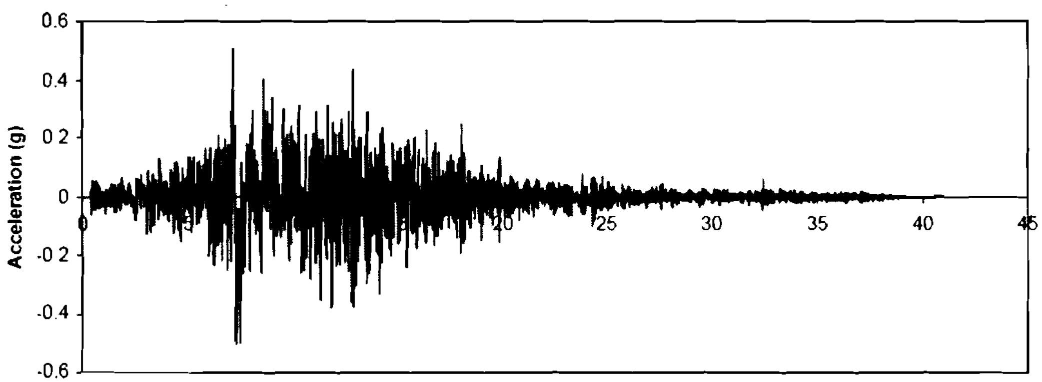




NA Time History

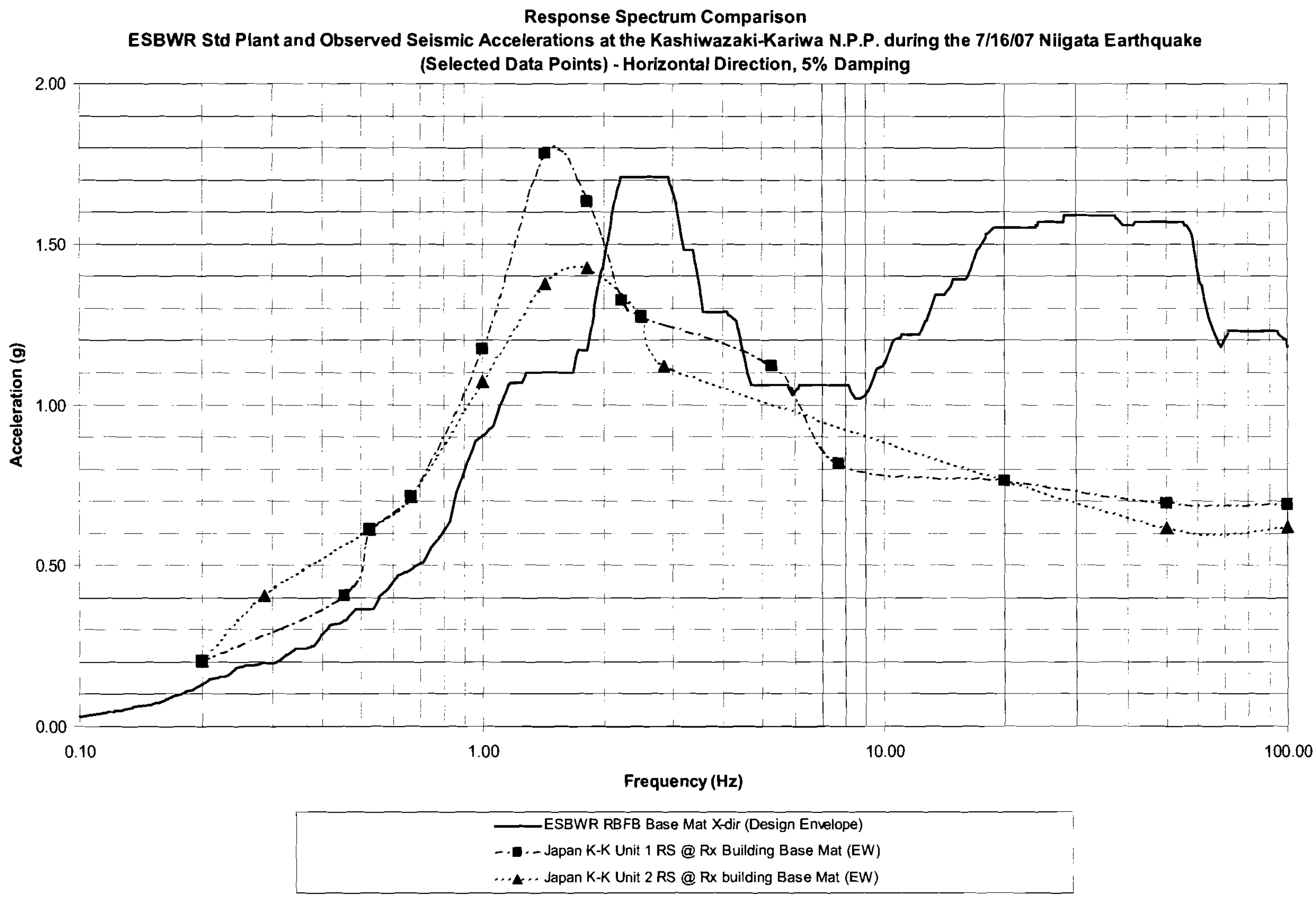
# Derivation of CSDRS

- Design Ground Motion is the envelope of RG 1.60 and North Anna ESP Spectra with 0.5g PGA.



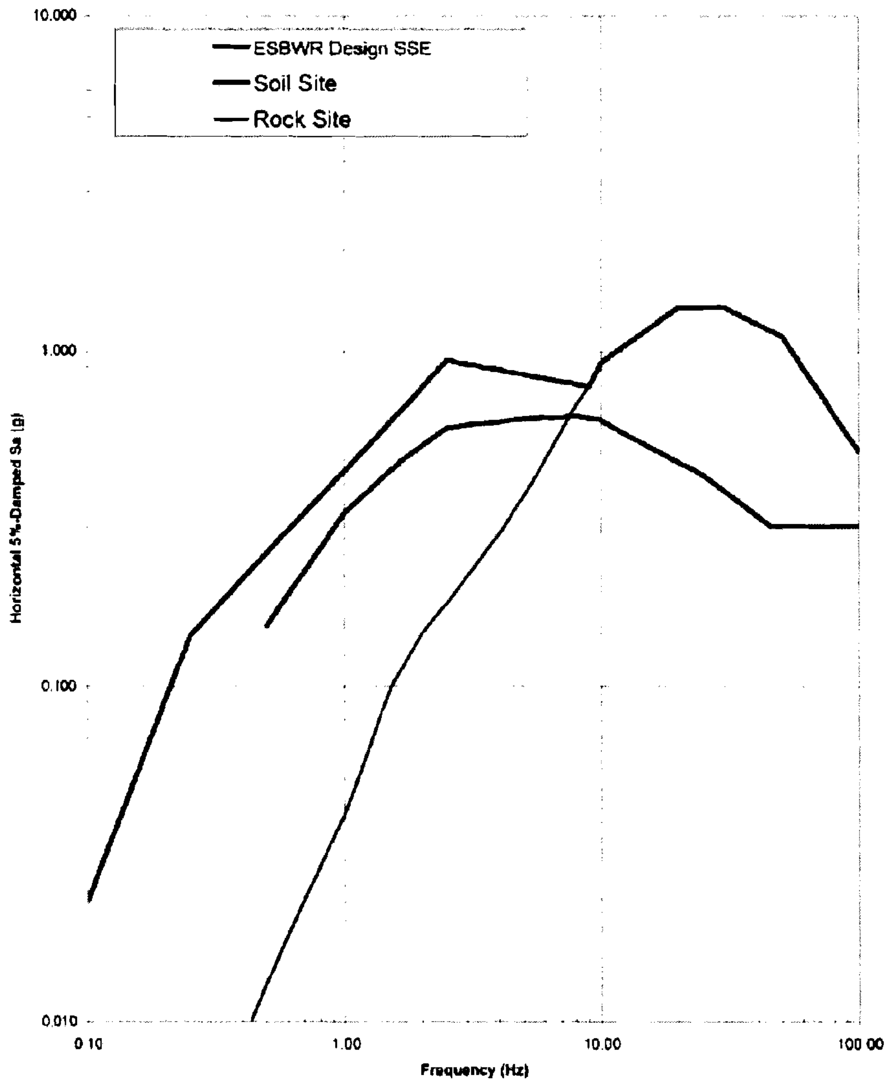
# Comparison with Recent Japan Earthquake



# Ground Spectra Considered in Seismic Margin Analysis

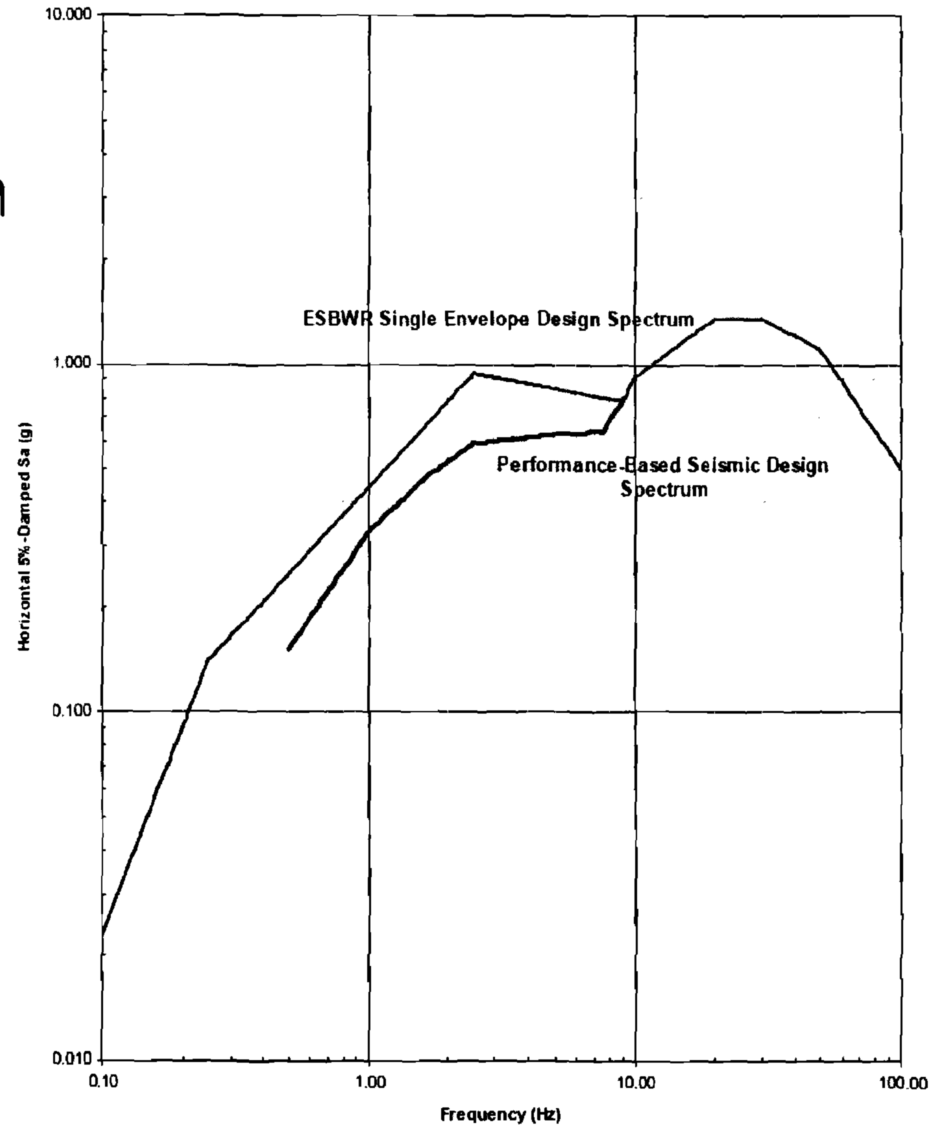
- Soil site spectrum is the bounding SSE spectrum of soil sites among the 28 sites (excluding Vogtle) included in the current EPRI study

- Rock site spectrum is North-Anna ESP spectrum

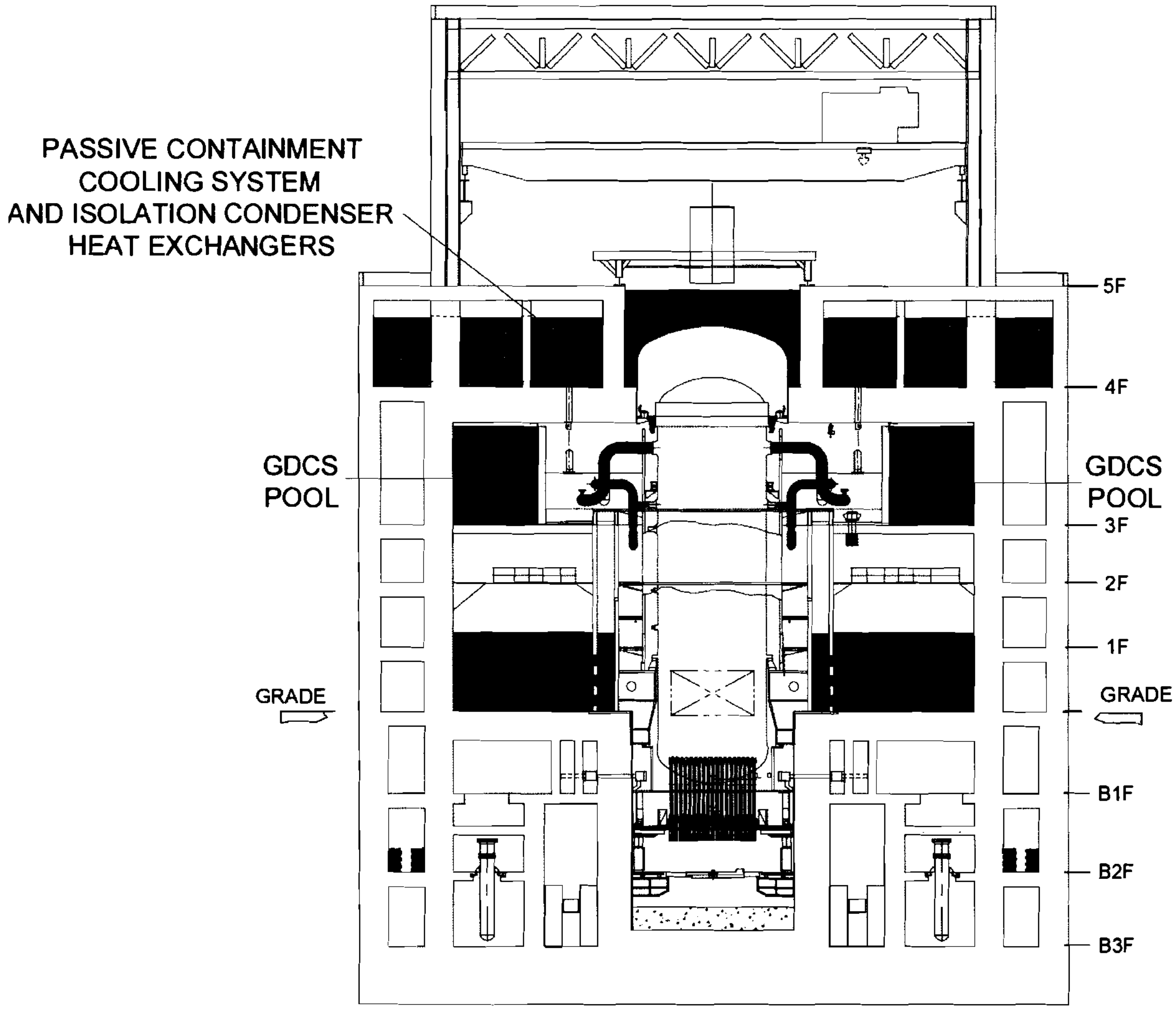


# Ground Spectra Considered in Seismic Margin Analysis

- For consistency with single envelope design spectrum for all sites, performance-based soil and rock spectra are enveloped for seismic margin consideration
- Same 0.5g PGA as design spectra



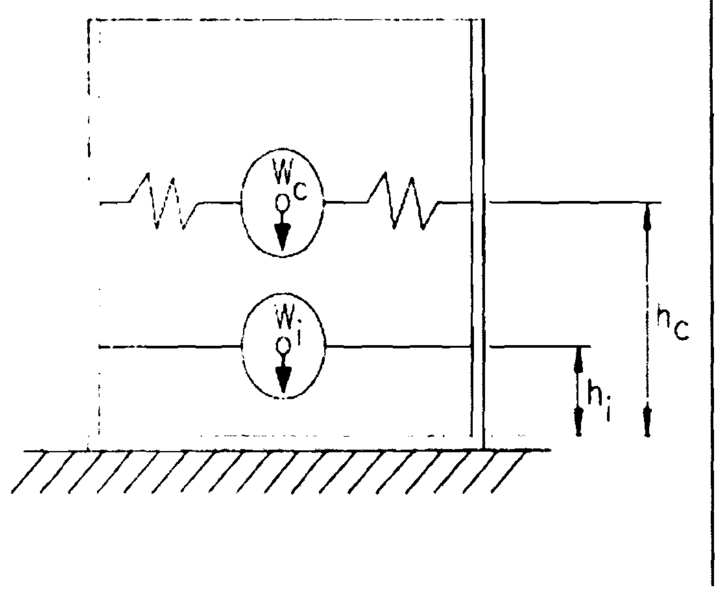
# Pools in Reactor Building




REACTOR BUILDING

# Modeling of Pool Water in Seismic Analysis

- Fluids contained in pools are commonly modeled as mass-spring system made of convective (sloshing) and impulsive (rigid) components.

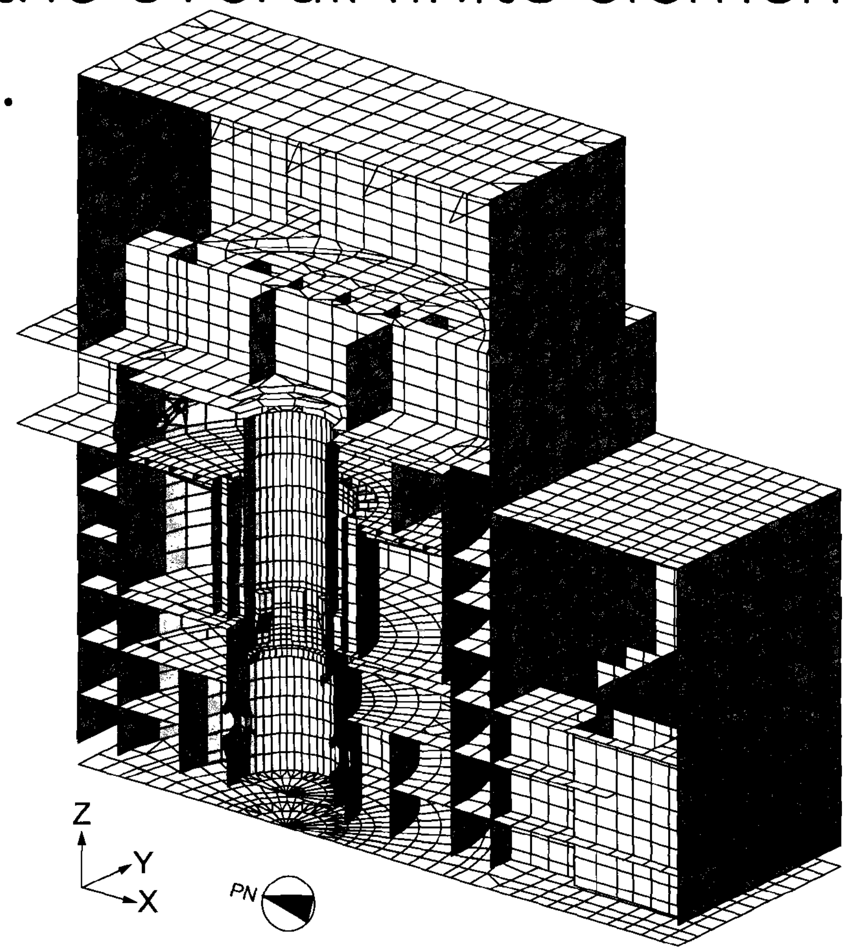


# Modeling of Pool Water in Seismic Analysis

- Sloshing component responds in very low frequencies (typically<0.5 Hz) where no structural modes of vibration exist.
- Impulsive component responds in unison with the pool structure and its effect is treated as added mass.
- The sum of masses associated with each component is equal to the the total water mass in the pool.
- For conservatism, the entire water mass of each pool is considered as impulsive mass rigidly attached to structural nodes in the seismic stick model for predicting overall response of the building structure.
- All pools are included in the model, thus the effect of pool interaction is accounted for.

# Stress Analysis of Pool Structures

- Each pool structure is explicitly modeled and included in the overall finite element model of the building.



# Stress Analysis of Pool Structures

- Input seismic loads consist of
  - Global loads in the form of maximum shear, moment and accelerations calculated from the seismic response analysis.
  - Local loads in the form of hydrodynamic pressures due to convective and impulsive modes on the pool boundaries.
- Resulting stresses are combined with others per required load combinations to meet design code acceptance criteria.

# Summary

- Chapter 3 provides design basis of structures, components, equipment and systems.

Dominion

# *Millstone 3 Stretch Power Uprate*

**ACRS Meeting**
**Containment**

**July 9, 2008**

Dominion

# Analysis Summary

- Containment Analysis Methodology Updated To Current Standards.

- Significant Margin Remains Following SPU.
  - 3.6 psi containment pressure margin.
  - EEQ profiles essentially unchanged.
  - No impact on current NPSH analysis.
  - Minimum pressure unaffected by SPU.
  - Subcompartment analysis remains bounding

- Modifications Made To RSS Pipe Supports To Restore Stress Margins.

# Dominion Containment Analysis

- Current Long Term Mass and Energy release calculations have not been updated since original licensing.
- SPU long term mass and energy releases incorporates NRC approved methodology updates.
- Containment analysis changed to in-house NRC approved methodology.
- Because of changes in both mass and energy releases and containment methodologies, comprehensive sensitivity studies performed to assure limiting conditions identified.
- Original sensitivity studies repeated as well as new sensitivity studies performed consistent with current approved updated methodologies.

Dominion

# Containment Analysis

- Ranges of initial conditions expanded for operational flexibility.

- Containment results used for a number of different component evaluations.
  - Containment minimum and maximum design pressure.
  - Maximum containment liner temperature.
  - Maximum pressure and temperature profiles for equipment qualification.
  - Maximum sump temperature at time of recirculation for pump NPSH.
  - Minimum and maximum temperature combinations for pipe stress evaluations.

- Bounding assumptions are dependent upon the component being evaluated.

- Reduction in cold leg temperature for SPU evaluated for impact on subcompartment analysis.

Dominion

# Subcompartment Analysis

- For Most Scenarios, The SPU Mass And Energy Releases Are Bounded By The 10% Margin Provided In Current Analysis.
- SPU Analysis Credits Leak-Before-Break For Exclusion of RCS Piping Break In The Steam Generator Cubicle.
- New Analyses Performed For The Pressurizer Surge Line Break.

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**Final Rule — Consideration of Aircraft Impacts for New Nuclear Power Reactor Designs**

George Tartal & William Reckley
Office of New Reactors

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U.S.NRC

## SRM on SECY-06-0204

- Proposed rule - security assessment requirements for new reactor designs
- Terminate the security assessment rulemaking
- Part 73 rulemaking "sets the adequate protection standard"
- Include aircraft impact assessment requirements in Part 52
- Commission-specified proposed rule language

2

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## Proposed Rule

- Implemented the Commission's specified rule language
- Developed a technical and legal rationale for the rulemaking
- Published on October 3, 2007 (72 FR 56287)
- Public comment period ended on December 17, 2007

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U.S.NRC

## Public Comments

- 32 comment letters received
  - 10 from industry
  - 2 from government organizations
  - 12 from non-government organizations
  - 8 from private citizens
- 31 in favor of requiring aircraft impact assessments on nuclear power plants
  - None supported it exactly as proposed

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## Public Comments (cont)

- 8 specific requests for comment
  - Inclusion of impact assessment in application
  - Acceptance criteria
  - Records retention
  - Criteria for judging DC amendments
  - Future Part 50 applicants
  - Requirements in Part 50 or Part 52
  - Design approvals and manufacturing licenses
  - Scope of the design to be evaluated

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## Public Comments (cont)

- Overall need to address aircraft impacts
- Applicability
- Adequate protection/beyond-design-basis
- Aircraft characteristics
- Assessment
- Evaluation
- Issue Resolution / Implementation
- Safeguards/Sensitive Information
- Compliance with NEPA
- Other comments

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## Final Rule Requirements

- Applicability – § 50.150(a)
  - New construction permits (CP)
  - New operating licenses referencing new CP
  - New standard design certifications (DC)
  - New standard design approvals (DA)
  - Combined licenses not referencing DC/DA/ML
  - Combined licenses referencing noncompliant DC
  - Manufacturing licenses (ML) not referencing DC/DA
  - Manufacturing licenses referencing noncompliant DC

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## Final Rule Requirements (cont)

- Assessment – § 50.150(b)(1)
  - Assess effects of impact of a large, commercial aircraft
  - Identify and incorporate those design features and functional capabilities that avoid or mitigate, to the extent practical and with reduced reliance on operator actions, the effects of the aircraft impact on core cooling capability, containment integrity, spent fuel cooling capability, and spent fuel pool integrity
  - NRC expects to endorse NEI guidance

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## Final Rule Requirements (cont)

- Aircraft impact characteristics – § 50.150(b)(2)
  - Large, commercial aircraft used for long distance flights in the U.S.
  - Aviation fuel loading for such flights
  - Impact speed and angle of impact considering pilot (in)experience and low altitude
  - More specific aircraft impact parameters will be provided in guidance

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## Final Rule Requirements (cont)

- Content of application – § 50.150(c)
  - Description of design features and functional capabilities identified in assessment
  - Description of how those design features and functional capabilities avoid or mitigate, to the extent practical and with reduced reliance on operator actions, the effects of the aircraft impact

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## Final Rule Requirements (cont)

- Control of changes – § 50.150(d)
  - If licensee changes § 50.150-compliant information included in PSAR/FSAR
    - Redo that portion of assessment addressing changed feature or capability
    - Describe how the modified features and capabilities avoid or mitigate, to the extent practical and with reduced reliance on operator actions, the effects of the aircraft impact

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## 50.54(hh) & 50.150 Relationship

- 50.54(hh)
  - Preparatory actions for potential or actual aircraft attack; Guidance and mitigative strategies for loss of large areas due to fires/explosions (ICM Orders B.5.a and B.5.b)
  - Focused on human actions and operational considerations
  - Necessary for adequate protection
- 50.150
  - Assessment of newly designed facilities to avoid or mitigate the effects of aircraft impacts
  - Focused on design considerations
  - Not necessary for adequate protection

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## Rulemaking Schedule

| | |
|---|---|
| Proposed rule published | 10/3/2007 |
| Public comment period ends | 12/17/2007 |
| Final rule ACRS briefing | 7/09/2008 |
| Final rule to EDO | 9/16/2008 |
| Final rule to Commission | 9/30/2008 |

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# Security Rulemaking for Nuclear Power Plants

ACRS Presentation

July 9, 2008

# Discussion Topics

- Power Reactor Security Rulemaking
  - Currently with EDO (since 6/30/08)
  - Provided status to ACRS on June 4
- Portions requiring ACRS review
  - § 50.54(hh) "Mitigative Strategies and Response Procedures for Potential or Actual Aircraft Attacks"
  - § 73.54 "Protection of Digital Computer and Communication Systems and Networks"
  - § 73.58 "Safety/Security Interface Requirements for Nuclear Power Reactors"
- This briefing focuses on these three pieces
  - Staff requests ACRS to provide the Commission its views on acceptability of these three portions of the final rule package

# 10 CFR 50.54(hh) Overview

- § 50.54 (hh) Mitigative Strategies and Response Procedures for Potential or Actual aircraft Attacks
  - Reflects section B.5.a and B.5.b of 2002 ICM order
  - Staff believes that § 50.54(hh) is implementing the order requirements (i.e., it is not the intent to go beyond order requirements)
  - Initially in noticed proposed App C - moved to § 50.54, "Conditions of License" – re-noticed as supplemental proposed rule (published in Federal Register 4/10/2008)

- (hh)(1) Preparatory actions taken in the event of a potential aircraft attack (i.e., B.5.a)

- (hh)(2) Mitigative strategies for addressing the loss of large areas due to fires and explosions from beyond design basis events (i.e., B.5.b)

# § 50.54(hh)(1) Preparatory Actions

- § 50.54(hh)(1):
  - Authenticate threat source
  - Maintain communication with source
  - Contact onsite and offsite organizations
  - Take onsite actions to mitigate impact
  - Reduce visual discrimination
  - Disperse equipment and personnel
  - Recall of personnel
- Guidance under development – uses existing advisories and information (DG 50XX)

# § 50.54(hh)(2) Mitigating Measures

- § 50.54(hh)(2)
  - Fire fighting
  - Operations to mitigation fuel damage
  - Actions to minimize releases
- These requirements map into 14 strategies in current license conditions for all current licensees
- Current licensees are in compliance
- Guidance under development

# § 73.54 Protection of Digital Computer and Communication Systems and Networks

- Cyber threat was included as part of DBT ( § 73.1) issued March 2008
- These requirements were in proposed § 73.55(m)
- Moved to stand-alone section in part 73
- Required to development and submit cyber plans for NRC review and approval (intro paragraph)

# § 73.54 Cyber Security

- § 73.54(a) – Identifies protected digital assets:
  - Safety-related and ITS functions
  - Security functions
  - EP functions
  - Supports systems
- Protect from cyber attacks that:
  - Adversely impact data and/or software
  - Deny access to systems, services, data
  - Adversely impact operation of digital assets
- (b) Requires analysis to identify assets to be protected
- (c) Program design requirements
  - Protect digital assets identified in (b) – ensure function not adversely impacted
  - Apply defense-in-depth
  - Mitigate adverse affects of attacks

# § 73.54 Cyber Security Cont'

- (d) Provides training, risk mgmt, and change control requirements
  - Cyber awareness training
  - Evaluate and manage cyber risks
  - Control changes to ensure that cyber performance objectives are maintained
- (e) Cyber plan requirements
  - Cyber plan is required – requirements for content
  - Cyber plan must be submitted for NRC review and approval)
- (f) – (h) Procedures, Reviews, Records

- Guidance: DG 5022 Cyber Security Programs for Nuclear Facilities
  - Completed 6/1/08 (OUO)
  - Distributed to appropriate licensees
  - Public meeting in July

# § 73.58 Safety/Security Interface

- Addresses part of UCS petition (PRM 50-80)
- Makes explicit what is already implicitly required by regulation
- (b) Requires licensees to assess/manage potential for adverse interactions between security ↔ safety
- (c) Scope – Planned and emergent activities
- (d) Conflicts – Communicate conflicts and take compensatory and mitigative actions

# § 73.58 Safety/Security Interface

- DG 5021 Safety/Security Interface
  - Published in Federal Register July 24, 2007
  - Public Meeting held; comments received & under consideration

# Summary

- Final rule requirements for § 50.54(hh), § 73.54, and § 73.58 are complete and with EDO
- Draft guidance developed – work continues to finalize guidance
- Expect further interactions with ACRS to finalize guidance (meet with ACRS when finalizing guidance)
- Staff requests ACRS provide its opinion on acceptability of the final rule provisions to the Commission

# Containment Review

Ahsan Sallman
Containment & Ventilation Branch
Division of Safety Systems
Office of Nuclear Reactor Regulation

# Containment Review

- Primary Containment Functional Design
- Subcompartment Analyses
- Mass and Energy Release
- Combustible Gas Control in Containment
- Containment Heat Removal
- Pressure Analysis for ECCS Performance Capability
- Reconsideration of Generic Letter 96-06

# Summary of Staff Review

- RS-001, "Review Standard for Power Uprates," was followed as guidance
- Applied NRC-approved analytical methods
- RAIs were satisfactorily answered
- Applicable GDCs were satisfied
- SRP acceptance criteria were satisfied
- Met 10 CFR 50 requirements

# Primary Containment Functional Design

- Application of GOTHIC 7.2a methodology to MPS3 approved by SE, dated August 30, 2006
- Conservative initial conditions for LOCA and MSLB
- Analyzed a spectrum of breaks for LOCA and MSLB

# Primary Containment Functional Design Continued

- Conclusions
  - Limiting short-term LOCA & MSLB peak pressure & temperature are bounded by the containment design conditions
  - Limiting long-term LOCA & MSLB pressure & temperature responses are evaluated to be acceptable from the standpoint of EQ

# Subcompartment Analyses

- NRC has approved leak-before-break (LBB) methodology for MPS3 contained in the license renewal SE – NUREG-1838
- Used LBB criteria for selection of pipe breaks
- Conclusion
  - Sufficient margin in the differential pressures across the subcompartment walls under SPU conditions

# Mass and Energy Release Analyses for LOCA & Secondary Pipe Ruptures

- Analyzed a spectrum of breaks for LOCA based on NRC-approved methods: LOCA blowdown & reflood (WCAP-10325-P-A & WCAP-8264-P-A) and post-reflood (DOM-NAF-3-0-0-P-A
- Analyzed a spectrum of secondary breaks based on NRC approved methods in WCAP-8822, WCAP-8822-01-P-A, WCAP-8822-02-P-A, and WCAP-7907-P-A

# Mass and Energy Release Analyses for LOCA & Secondary Pipe Ruptures Continued

- Used conservative assumptions and inputs to maximize M&E release
- Conclusion
  - Staff reviewed and agreed with the licensee's evaluation of LOCA M&E release

# Combustible Gas Control in Containment

- SER, dated June 29, 2005, removed hydrogen recombiners & monitoring system from Tech Specs as per 10 CFR 50.44 and RG 1.97
- Conclusion
  - SPU does not impact combustible gas control in containment

# Containment Heat Removal

- Containment accident pressure was not used for calculation of NPSHA for RSS pumps
- Input parameters are conservative or the same as the current analysis
- Used GOTHIC methodology to calculate the maximum sump temperature

# Containment Heat Removal Continued

- Conclusion
  - RSS pumps NPSHA requirement is met

# Pressure Analysis for ECCS Performance Capability

- Used conservative initial conditions for calculating the minimum containment backpressure transient
- Calculated containment pressure transient bounds the transient used in the ECCS performance analysis
- Conclusion
  - ECCS performance capability is unaffected by SPU

# Reconsideration of Generic Letter 96-06

- GL 96-06 states, "Thermally induced overpressurization of isolated water-filled piping sections in containment could jeopardize the ability of accident-mitigating systems to perform their safety functions and could also lead to a breach of containment integrity via bypass leakage. Corrective actions may be needed to satisfy system operability requirements."

# Reconsideration of Generic Letter 96-06 Continued

- Licensee reviewed GL 96-06 for piping system penetrating containment along with its relief valves as a part of SPU system design pressure & temperature evaluation
- Conclusion
  - No hardware changes are necessary for SPU conditions

# Summary

- Applicable GDCs were satisfied
- SRP acceptance criteria were satisfied
- Met 10 CFR 50 requirements

Dominion

# *Millstone 3 Stretch Power Uprate*

## ACRS Meeting
## Fuel & Safety Analysis

## July 9, 2008

Dominion

# Fuel

- ❑ No Change In Fuel Design.
- ❑ Core Will Be 100% RFA-2. There Are No Mixed Core Issues.
- ❑ SPU Achieved Through An Increase In Feed Batch Size.
- ❑ Reduction In Peaking Factor Design Limits To Increase DNBR Margin.

Dominion

# Fuel Design

| Parameter | Current | SPU |
|---|---|---|
| **Fuel Type** | Robust Fuel Assembly (17x17 RFA-2) | Unchanged |
| **Burnable Poison** | Integral fuel burnable absorber (IFBA) | Unchanged |
| **Blankets** | Annular pellets in axial blankets | Unchanged |
| **Maximum Enrichment** | 5 weight percent | Unchanged |

Dominion

# *Initial Conditions*

- Currently Analyzed For A Single Nominal Temperature At 100% Power With No Margin For Coastdown.
- SPU Analyses Performed For A 8°F Nominal Temperature Band At 100% Power And 10°F Coastdown For Added Operational Flexibility.
- SPU Operation Selected At The Same Nominal Temperature As Current Operation.
- Modest Increase In Hot Leg Temperature Will Have A Small Impact On The Life Of SG Tubes And Other Hot Leg Alloy 600 Components.
- Modest Decrease In Cold Leg Temperature Will Have A Modest Improvement In The Life Of Reactor Vessel Head Penetrations And Other Cold Leg Alloy 600 Components.
- Pressurizer Level Chosen To Balance Margins For Operation And For Design Basis Transients.

# Dominion Safety Analysis

- ❑ **All plant specific safety analyses re-analyzed at SPU conditions.**

- ❑ **Significant Safety Analysis Margins Remain After SPU.**
  - 11.7% DNBR margin.
  - 419 $^{o}$F LB LOCA PCT margin.
  - 1007 $^{o}$F SB LOCA PCT margin.
  - 3.6 psi containment pressure margin.

- ❑ **Margins Achieved Through Plant Modifications.**

- ❑ **Methodologies Updated To Current Approved Standards.**

- ❑ **SPU has small impact on currently approved AST radiological analyses.**

Dominion

# DNBR Margin

- Included In Margin Management Program.
- Current DNBR Margin Used To Address Upper Plenum Anomaly.
- Modifications Will Address Upper Plenum Anomaly And Re-establish DNBR Margin.
- Preliminary Analyses Used To Establish Target SPU DNBR Margin.
- Final Analyses Resulted In Small Change To Target SPU DNBR Margin.

Dominion

# Pressurizer Overfill

- Included In Margin Management Program.

- Initial Pressurizer Level Selected To Balance The Margin To Letdown Isolation For Routine Reactor Trips And Margin To Pressurizer Overfill For Design basis transients.

- Current Limiting Event Is The Inadvertent ECCS Actuation At Power.

- Hardware Modification Proposed To Significantly Reduce The Severity Of The Pressurizer Overfill Rate For This Event.

- Modification Eliminates The Inadvertent ECCS Actuation As The Limiting Event. The New Pressurizer Overfill Limiting Event Changed To The CVCS Malfunction Event, Currently Considered Bounded And Not Explicitly Analyzed For Millstone Unit 3.

Dominion

# Design Basis

- All Design Requirements Are Met At SPU Conditions.
- In General, SPU Has A Small Impact On The Results.
- In General, Safety Analysis Margins Are Essentially The Same With Significant Margin Remaining After SPU.

Dominion

# Radiological

- Alternate Source Term Methodology Submitted In 2004 And Approved By The NRC In 2006.

- 2004 Submittal Included 6.5% Power Increase In Anticipation Of SPU.

- Alternate Source Term Methodology Resulted In Significant Increase In Available Radiological Dose Margins.

- For SPU, All Events Have Been Re-analyzed To Take Into Account The Additional 0.5% Power Increase.

- SPU Impact On Radiological Analysis Is Small.