

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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APPLICATION FOR DESIGN CERTIFICATION

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BRIEFING BY ABB-CE ON STATUS OF SYSTEM
80+ APPLICATION FOR DESIGN CERTIFICATION

- - - -

PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Thursday, March 31, 1994

The Commission met in open session,
pursuant to notice, at 2:00 p.m., Ivan Selin,
Chairman, presiding.

COMMISSIONERS PRESENT:

IVAN SELIN, Chairman of the Commission
KENNETH C. ROGERS, Commissioner
FORREST J. REMICK, Commissioner
E. GAIL de PLANQUE, Commissioner

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STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

WILLIAM C. PARLER, General Counsel

JOHN HOYLE, Assistant Secretary

RICHARD SLEMBER, President, ABB U.S. Power Plant
Segment

ROBERT NEWMAN, President, ABB-CE Nuclear Systems

REGIS MATZIE, Vice President, ABB-CE Nuclear Systems
Engineering

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

2:00 p.m.

CHAIRMAN SELIN: Good afternoon, ladies and gentlemen.

The Commission is pleased to welcome representatives from ASEA/Brown Boveri - Combustion Engineering to brief us on the status of the System 80+ Design Certification Program.

It does appear that the hard work of the vendor and of the staff appeared to be leading to a successful conclusion. The staff issued an advanced copy of the final safety analysis report at the last day of February and this contained no open technical issues. There are some confirmatory issues. It's not all over at this point, but there were no open technical issues in that report.

It is also clear that the review effort is a result of a plant design that offers many safety improvements over earlier designs. We're particularly pleased to see the extent to which probabilistic risk assessment techniques were used to enhance the severe accident capability of the design. In fact, it's really quite gratifying to see how clearly you've understood that the severe accident capabilities are probably even more important than the design basis

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1 accident capabilities in doing the evaluation.

2 So, I'm certainly looking forward to the
3 briefing.

4 Commissioners?

5 COMMISSIONER REMICK: Nothing.

6 CHAIRMAN SELIN: Okay. Doctor Slember,
7 would you proceed?

8 DOCTOR SLEMBER: Good afternoon. I want
9 to thank you for your invitation to address the
10 Commission in what has become almost an annual affair
11 at this time of year.

12 I am Richard Slember, President of ABB's
13 power segment and head of the ABB's worldwide nuclear
14 power business area. With me at the table are Robert
15 Newman, President of ABB-Combustion Engineering's
16 Nuclear Systems and Regis Matzie, Vice President of
17 Nuclear Systems Engineering.

18 I would like to also acknowledge in the
19 chair behind me the presence of Sterling Franks of the
20 Department of Energy, which has co-sponsored this
21 design.

22 For the last two years, we have come
23 before the Commission with the current status of
24 System 80+'s design certification application as it
25 has been under review by your staff. Two years ago,

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1 based on the NRC's willingness to commit to schedules,
2 we said we thought that the Part 52 process could be
3 made to work and we publicly committed ABB-CE's full
4 resources to that end. Last year, following the
5 unscheduled September 1992 issuance of the Draft
6 Safety Evaluation Report and an intensive launching of
7 the interaction with your staff to resolve the 6 36
8 open items listed in that report, and despite a
9 schedule adjust of several months, we reported our
10 resolve the complete the job on the new scheduled laid
11 down by the staff in SECY-93-097.

12 In both our meetings, we went away with
13 the sense that the Commission's full support was also
14 behind these advanced light water reactor
15 applications. Furthermore, Mr. Chairman, you gave us
16 a great deal of encouragement when you stated that
17 ABB-CE's application would not be further impacted by
18 the state of progress of the other applications. You
19 said both evolutionary plant applications were being
20 provided separate runways, separate ground crews and
21 separate gates.

22 Over the course of this past year, the NRC
23 staff did its level best under the leadership of
24 Doctors Murley and Mr. Russell and Mr. Crutchfield to
25 live up to that commitment.

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1 Today, I am delighted to report that the
2 NRC staff issued the System 80+ final safety
3 evaluation report to the Commission on February 28th,
4 1994 precisely on the date listed in SECY-93-097,
5 which was a target set over a year ago. Not only was
6 this significant document related on time, but even
7 more importantly it was released without any open
8 items. This had been the goal of the NRC staff and of
9 ABB-CE and it took an extraordinary effort on the part
10 of both teams to accomplish this. Not only were the
11 636 DSER open items closed, but in the course of the
12 review nearly 2,000 additional questions were formally
13 asked and every one was answered.

14 I'm extremely pleased with this
15 achievement and I'm very proud of the effort by ABB-
16 CE's team, which as you know includes both Stone and
17 Webster Engineering Company and Duke Engineering and
18 Services.

19 Mr. Chairman, I'm confident that you share
20 my pleasure in this significant accomplishment and
21 that you too are equally proud of the efforts of the
22 staff. Issuing the final safety evaluation report
23 with no open items means that the NRC staff has
24 completed the safety review of the System 80+ design.
25 It is, for us, a truly significant milestone.

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1 The Advisory Committee on Reactor
2 Safeguards is now in the process of completing its
3 review and that effort also appears to be going well
4 and on schedule or even ahead of schedule. We thus
5 believe that the next major milestone, the issuance of
6 the final design approval of the FDA can be achieved
7 in August of 1994, just as targeted in SECY-93-097.

8 Following the timely issuance of the FDA,
9 ABB-CE and the NRC will address the design
10 certification rulemaking phase.

11 Mr. Chairman, I believe it is imperative
12 to continue to drive for U.S. leadership in both
13 nuclear technology and nuclear regulation. The design
14 certification effort which the NRC and ABB-CE have
15 undertaken will significantly advance both of those
16 goals.

17 I would like to turn over the presentation
18 now to Doctor Regis Matzie who has taken on a new role
19 as Vice President of Engineering and thus has
20 responsibilities for all of the nuclear systems
21 engineering efforts, not only on System 80+ and new
22 +80, but also for our Korean projects and other
23 designs and proposals in the ABB-CE shop. Doctor
24 Matzie will talk about the hurdles and the
25 accomplishments of this remarkable task we have just

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1 completed and he will also address a small number of
2 policy issues which impact the future status of the
3 design certification effort.

4 Regis?

5 CHAIRMAN SELIN: Doctor Slember, I should
6 tell you, you have separate runways and gates, but
7 there's only one air traffic control with this piece,
8 but I forgot to tell you that last year.

9 Doctor Matzie?

10 DOCTOR MATZIE: (Slide) Next slide,
11 please.

12 I will go through the System 80+ licensing
13 and design status and after that then Mr. Robert
14 Newman will talk about future plans for System 80+.

15 (Slide) Next slide. Slide 3, please.

16 The licensing status I'd like to divide
17 into four major sections or topics. I'm going to
18 actually combine the overview and effort remaining
19 together up front and go through then what we believe
20 are the major achievements for our program of
21 certifying the System 80+ design, followed by a
22 dialogue, I hope, on some policy issues which are
23 before us still and I think need resolution before we
24 can actually get the last step of this program, which
25 is the rulemaking, out of the way.

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1 (Slide) Slide 4, please.

2 This next slide shows the long and I think
3 fruitful effort we've made starting actually back in
4 1987 with our first submittal of CESSAR-DC but really
5 kicking off in quite significant and earnest way with
6 the complete application submittal which occurred in
7 April 1989. Since that time, we have answered over
8 4,500 questions relating to requests for additional
9 information, closing open items in the DSER and
10 finally responses to follow-on questions, ITAAC
11 questions, et cetera. We believe this is probably the
12 most thorough review of any application we've been
13 involved with and probably any that the NRC has been
14 involved with thus far.

15 Where we are today is between the two
16 dates and targets of February '94 where we got our
17 advanced copy of the FSER and the April '94 time frame
18 where we will be submitting the next amendment, which
19 hopefully will resolve issues that have come up since
20 the FSER has come out and closing issues that were
21 actually left as confirmatory in the advanced copy of
22 the FSER. I will discuss the upcoming amendments in
23 some subsequent slides.

24 You can see, however, by the schedule that
25 it's a very busy and ambitious schedule between where

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1 we are today and August 1994 where we intend to get
2 the final design approval for System 80+, with the
3 help of the staff and the Commission.

4 (Slide) Next slide, please.

5 Since we last spoke with you in early
6 1993, we have responded to nearly 2900 questions
7 relating to some of the material I've mentioned.
8 We've provided over 25,000 revision pages to our
9 licensing submittal, CESSAR-DC, and we had issued, as
10 has already been said, the advanced copy of the FSER,
11 on schedule with no open items, but with eight
12 confirmatory items which we are currently working on,
13 and I'll review those with you.

14 The NRC review has resulted in agreement
15 on all design features and analysis to resolve all
16 existing and emerging licensing issues including, most
17 significantly, severe accident phenomenon.

18 (Slide) Next slide, please.

19 The confirmatory issues that were stated
20 in the advanced copy of the FSER are listed on this
21 slide. Also shown is the initial Action E for those
22 confirmatory items, some being in our shop at ABB and
23 some being in the NRC's shop. Of course we'll have to
24 mutually agree upon all of the resolutions to these
25 confirmatory issues prior to final closure.

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1 The first item relates to material we
2 submitted after our last amendment, which occurred
3 before the FSER was issued but the staff did not have
4 sufficient time to review the material prior to
5 getting the FSER out.

6 The second item refers to that material
7 which was submitted in January '94 for the certified
8 design material updates.

9 The next item is for us to compare the COL
10 action items against those listed in the FSER and
11 ensure that our licensing document, CESSAR-DC, and the
12 FSER are in agreement on what the action items are for
13 the COL applicant.

14 The next item relates to actually a design
15 detail, but we agreed very late in the structural
16 design to incorporate into our licensing document.
17 That is additional reinforcing detail. So, we are in
18 the process of including that in the next amendment,
19 Amendment V.

20 The next item includes our incorporation
21 of comments that actually came about through the ACRS'
22 review of the ABWR and the staff felt that those same
23 items should be included in our certified design
24 material for System 80+ and we have agreed with the
25 staff on that material.

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1 COMMISSIONER REMICK: Give us a couple of
2 examples of those, Regis, what those matters were.

3 DOCTOR MATZIE: Stan, could you help me?

4 MR. RITTERBUSCH: Two examples are
5 specific description of the piping design details and
6 inclusion of the operational support center as part of
7 tier 1.

8 COMMISSIONER REMICK: I see. Thank you.

9 DOCTOR MATZIE: The next item is actually
10 a consistency review between our certified design
11 material and CESSAR-DC to make sure that the certified
12 design material very accurately and precisely reflects
13 what is in the licensing submittal because of the
14 implications in tier 1 for the future start-up of the
15 plan.

16 The next item is for the staff to complete
17 the technical specifications and this particular audit
18 that's mentioned here is scheduled for April of '94 of
19 the material. We actually believe we've got
20 essentially agreement on the tech specs, but it's
21 going to be an audit of again precise incorporation of
22 those agreements.

23 Finally, we are in the process of getting
24 agreement with the staff on exactly how much
25 additional design verification must be completed on

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1 our design basis safety analysis. That's independent
2 verification. We have met with the staff several
3 times and have a proposal in front of them today.

4 (Slide) Next slide, please.

5 Our major efforts remaining are really the
6 completion of two additional amendments which close
7 out comments by the staff and then subsequently
8 comments by the ACRS and if the Commission has any
9 comments, so that our licensing document is completely
10 up to date and ready for the final design approval in
11 August of 1994. Also besides these submittals, we
12 obviously have to complete the ACRS review which I'm
13 very happy to say is going very well, on schedule, and
14 we anticipate a letter from the ACRS in late May or
15 early June, according to our subcommittee chairman's
16 reckoning.

17 Of course, finally, we have to start and
18 complete preparation of the design control document as
19 part of our application for design certification.

20 (Slide) Next slide, please.

21 We at ABB, and I think the NRC staff also,
22 are very proud of some of our really significant and
23 major accomplishments in licensing System 80+. This
24 is a listing of what we view are the major
25 accomplishments. As you'll see in a subsequent slide,

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1 there are other licensing accomplishments which are
2 significant. I'd like to go through each of these on
3 a subsequent slide.

4 (Slide) Next slide, please.

5 In the advanced control room, human
6 factors engineering area, we have established with the
7 NRC staff an improved human factors engineering and
8 review plan for control room design features. We have
9 exercised this plan and we believe developed a
10 licensable control room. The NRC, in addition to
11 agreeing with us on a process, has approved what we
12 call the basic design features of the plan, the
13 control room layout, our large overview display at the
14 front of the control room and standard panel features
15 which include the data processing system, CRT screens,
16 the discreet indication and alarm system, which is
17 diverse and redundant to the data processing system in
18 the area of alarm tiles, dedicated parameter displays
19 and multiple parameter displays. Finally, our
20 approach to controlling the individual components
21 through the various switch configurations.

22 Our ITAAC includes the process for the
23 remaining panels and verification of the complete
24 control room once it is designed and built.

25 COMMISSIONER REMICK: Anything you can say

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1 about Yonggwang 5 and 6 and whether they'll be
2 incorporating this?

3 MR. NEWMAN: I plan to cover that later.

4 COMMISSIONER REMICK: Okay. All right.

5 DOCTOR MATZIE: (Slide) Next slide,
6 please.

7 An all-digital instrumentation and control
8 system is also a major accomplishment which we are
9 very proud. We've got a complete integration of the
10 protection control and monitoring systems for the
11 entire plant, using proven commercially available
12 hardware, functional segmentation and redundancy.
13 Basically we do not have everything going through a
14 central processor which has led to problems in some of
15 the major computer-based systems we've seen both in
16 the non-nuclear and the nuclear areas in the past. We
17 have on-line self-testing and diagnostics and
18 information processing which we believe dramatically
19 reduces the burden on the operator and therefore makes
20 the likelihood of him taking appropriate action much
21 more probable. We're using programmable logic
22 controllers with very simple software which we believe
23 has very high reliability. We have complete
24 segregation or separation of safety and non-safety
25 systems and complete separation of control and

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1 monitoring. In this way, a failure of any one item or
2 any one area does not significantly impact the safe
3 operation of the plant.

4 (Slide) Next slide, please.

5 In the area of severe accident prevention
6 and mitigation, we've made very significant design
7 improvements to current day plans in the development
8 of System 80+. We resolve severe accident issues
9 without relying on future experiments by demonstrating
10 the very robust nature of the System 80+ design. Some
11 of those major features are listed as sub-bullets on
12 this and the next slide. They include: a steel dual
13 containment with a very large volume that provides
14 protection without the need for venting in an accident
15 condition; a safety depressurization system which
16 ensures that you can have a situation where you're not
17 combating a high pressure core ejection if you are in
18 the midst of a severe accident; a cavity flood system
19 that will cool the core if, in fact, there's a vessel
20 breach; a hydrogen mitigation system that is achieved
21 through igniter system that will burn any evolving
22 hydrogen before it could possibly get to a detonable
23 condition; independent and diverse monitoring and
24 instrumentation equipment that provide backup if a
25 common mode failure of software disables safety

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1 systems.

2 (Slide) Next slide, please.

3 Cavity design that promotes core debris
4 retention and coolability; an analysis and containment
5 strength that shows that we will not exceed ASME Level
6 C conditions for at least 60 hours; a reactor cavity
7 wall design that will even withstand a steam explosion
8 from the core debris interaction with water; and
9 finally analysis that shows with the core on the floor
10 that you would withstand the most severe core concrete
11 interaction without a significant release of
12 radioactivity for approximately eight days. We think
13 these are very significant safety improvements to the
14 plant for the unlikely event of a severe accident.
15 The System 80+ plant design is a robust design.

16 COMMISSIONER REMICK: What codes did you
17 use to analyze the containment if you had severe core
18 concrete attack? What codes were you --

19 DOCTOR MATZIE: We use a number of codes.
20 One is the MAAP code and I think we're using some
21 others, right? CORCON is another code that we're
22 using for that specific interaction.

23 (Slide) Next slide, please.

24 We have completed a full scope level 3 PRA
25 for the System 80+ design using a detailed methodology

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1 including shutdown risk. That methodology and
2 analyses have been approved by the U.S. NRC. They
3 agree with our results. The System 80+ design can
4 withstand an earthquake more than twice the design of
5 the Safe Shutdown Earthquake and that was analyzed
6 with probabilistic methods for a seismic margin
7 analysis of the plant. And finally, the analyses
8 indicate that the System 80+ design reduces core
9 damage frequency by more than two orders of magnitude
10 compared to currently operating plants. Thus, the
11 System 80+ conforms to the original Commission's
12 severe accident policy that said future plants should
13 be significantly safer than currently operating
14 plants. We believe we've achieved that.

15 COMMISSIONER REMICK: I -- oh, please, go
16 ahead.

17 COMMISSIONER ROGERS: Maybe we were going
18 to ask the same question perhaps.

19 Can you point to any specifics that have
20 led to that two orders of magnitude improvement or is
21 it a collection of things --

22 DOCTOR MATZIE: There's a collection of
23 about a half a dozen major things that we've done that
24 you derive the bulk of the advantage and benefit from.
25 I can name a few of them. First of all, the safety

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1 depressurization system to give us an alternate decay
2 heat removal capability from the traditional decay
3 heat removal systems, the very dramatic improvement of
4 the electrical distribution system which ensures
5 reliable power, including things like additional off-
6 site feeders to the plant, the combustion turbine,
7 additional batteries, those types of things, a four
8 train set of safety injection systems and emergency
9 feedwater systems. So, I think those are probably the
10 top set. In-containment refueling water storage tank
11 is another one, integrated with these other systems
12 that really promotes much lower core melt
13 probabilities.

14 COMMISSIONER REMICK: I was going to ask
15 the two orders of magnitude, I assume that's on the
16 basis of internal initiators in both cases?

17 DOCTOR MATZIE: When we look at --

18 COMMISSIONER REMICK: The comparison.

19 DOCTOR MATZIE: We have looked at external
20 initiators too. I think you could almost say that
21 it's the combined ones. We normally quote the number
22 based on internal initiators though.

23 COMMISSIONER REMICK: But you did not do
24 a seismic PRA, you did seismic margin.

25 DOCTOR MATZIE: We initially did a seismic

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1 PRA.

2 COMMISSIONER REMICK: Oh, you did?

3 DOCTOR MATZIE: And shifted approaches
4 after we did that based on guidance from the staff.

5 COMMISSIONER REMICK: I see.

6 DOCTOR MATZIE: (Slide) Next slide,
7 please.

8 Shutdown risk is another area that we
9 explicitly addressed as part of the probabilistic risk
10 assessment evaluation and in a shutdown condition
11 we've reduced the risk by about a factor of 40
12 relative to currently operating plants and we've
13 balanced the principle initiators amongst the various
14 vulnerabilities rather than having the majority of it
15 constituted in loss of RHR during midloop conditions.
16 So, we've done things that balanced it so you were not
17 vulnerable specifically to one thing as the dominating
18 accident.

19 Radiological doses at offsite boundary for
20 the most likely severe accident sequences is only .3
21 rem, which is below the protection action guideline of
22 one rem.

23 COMMISSIONER ROGERS: What is that
24 sequence, the most likely?

25 DOCTOR MATZIE: Loss of coolant accident.

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1 And finally, we believe that there is
2 general agreement between the NRC staff and ourselves
3 on the major or principal insights from the PRA which
4 we intend to carry forward through the design control
5 document as being the important things to pass on to
6 the COL applicant from a risk standpoint.

7 COMMISSIONER REMICK: Could you give a
8 general characterization of the type of thing, but not
9 necessarily specific, but other general type of
10 insights, the nature of them?

11 DOCTOR MATZIE: Well, things like the type
12 of electrical distribution we have set up and the
13 various levels of that and the redundancies. The fact
14 that the in-containment refueling water storage tank
15 takes away the vulnerability of the switchover from an
16 external tank on typical operating plants to the
17 System 80+ where you've eliminated the need for the
18 switchover of safety injection because the original
19 suction of safety injection is the same as the suction
20 in longer-term cooling. So, the --

21 COMMISSIONER REMICK: When you say
22 carrying those over the PRA insights, is that that the
23 PRA has shown that those are very important things?

24 DOCTOR MATZIE: That's correct.

25 COMMISSIONER REMICK: And therefore --

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1 DOCTOR MATZIE: They must be maintained.

2 COMMISSIONER REMICK: Be maintained. I
3 see.

4 DOCTOR MATZIE: That's correct.

5 COMMISSIONER REMICK: Or how about assumed
6 reliabilities in the PRA? Anything like that carried
7 over?

8 DOCTOR MATZIE: Those are built in by the
9 input data bases that we use, which are sort of the
10 generic reliabilities of components. So, they're
11 automatically built in. We don't view those as the
12 insights. The insights are more design-oriented
13 insights.

14 COMMISSIONER REMICK: Okay.

15 DOCTOR MATZIE: Next slide, please.

16 COMMISSIONER ROGERS: Just before you
17 leave that --

18 DOCTOR MATZIE: Yes, sir?

19 COMMISSIONER ROGERS: That second bullet
20 again, the most severe accident sequence could lead to
21 a .3 rem dose at the boundary. What about those that
22 are less likely? What's next on the list? Do you
23 have any? If you know. I'm just curious.

24 DOCTOR MATZIE: Our expert will probably
25 be able to answer this.

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1 COMMISSIONER ROGERS: Is it .2 or is it
2 considerably different?

3 MR. RITTERBUSCH: We analyzed one event
4 and one event sequence. However, upon inspection of
5 that event, it involves the systems that would cause
6 failures for other sequences as well. What this means
7 is that all of them end up with core on the floor and
8 that the event we analyzed is representative of all of
9 the other events that have equipment failures and
10 result in core melt.

11 COMMISSIONER ROGERS: Okay. I guess I
12 understand what you said.

13 COMMISSIONER REMICK: It's my
14 understanding the staff has not independently verified
15 that second bullet. Is that correct? But I assume
16 you're aware that we've asked ACRS to explore that
17 with you. I guess you're meeting with them next week.

18 DOCTOR MATZIE: Yes, sir.

19 COMMISSIONER REMICK: I assume you're
20 aware of the fact we've asked the ACRS to do that?

21 DOCTOR MATZIE: Yes, sir. We've seen the
22 correspondence.

23 COMMISSIONER REMICK: Okay.

24 DOCTOR MATZIE: (Slide) Next slide,
25 please.

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1 We have used a seismic design envelope for
2 the System 80+ design that will envelope the majority
3 of potential sites in the United States. It has a
4 broad range of seismic spectra anchored at .3 gs and
5 the high frequencies. It has a broad range of soil
6 conditions and to these different spectra and soil
7 conditions we performed soil structure interaction
8 analysis and came up with an enveloping input spectra
9 for the analysis. Seismic design envelope is
10 sufficiently conservative to accommodate site specific
11 ground motion accelerations in excess of .4 gs for
12 design basis requirements.

13 Next slide.

14 COMMISSIONER REMICK: Would you run that
15 by me again? .4 g?

16 DOCTOR MATZIE: Yes, sir.

17 COMMISSIONER REMICK: I thought you were
18 going to say .3 g.

19 DOCTOR MATZIE: .3 g within the seismic
20 envelope. However, when you get to specific spectra
21 for a site, you're not having to use the conservative
22 accelerations on all frequencies.

23 COMMISSIONER REMICK: Okay.

24 DOCTOR MATZIE: So, it is much more robust
25 for a single spectrum.

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1 (Slide) Next slide, please.

2 The new source term technology, we have
3 done the first application of this technology for a
4 specific design, the System 80+. We've gone through
5 and used a graded approach for equipment
6 qualification. We resolved related new issues in
7 terms of some pH control and containment spray
8 effectiveness and we believe that the new source term
9 technology both more realistically represents what
10 will happen and actually provides benefits to the
11 design and the future operation of the plant. It
12 results in lower doses predicted during accidents and
13 it allows us to have the potential for revised
14 emergency planning if the staff and the Commission so
15 changes the emergency planning on a generic basis. We
16 believe we've provided the technical bases for our
17 design to fit within a revised emergency plan's
18 scheme.

19 (Slide) Next slide, please.

20 Other significant licensing issues that we
21 have resolved on the System 80+ docket are shown in
22 this slide and I'd like to go through these very
23 quickly also.

24 Diversity of digital I&C, when we started
25 this process, looked like a very large mountain to

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1 climb. However, I believe that through the design
2 features we've mutually agreed upon with the staff and
3 the analysis methods that we came up to analyzing
4 common mode failure, that we in fact have come up with
5 a design that gets rid of this potential problem.

6 In the final analysis, we ended up with
7 approximately 15 hard wired monitoring or parameters
8 that we track and seven controls that are hard wired
9 that bypass the software-based computer systems. We
10 believe that's a rather reasonable accommodation to
11 combat this potential significant issue.

12 COMMISSIONER REMICK: Excuse me. Do you
13 think with experience perhaps that number might be
14 reduced? You're saying it's rational. It seems
15 rational, but --

16 DOCTOR MATZIE: My opinion is, I think --
17 I believe our designers were, that the software-based
18 systems can be at least as reliable as the more
19 traditional systems. But as an intermediate
20 accommodation, it seems like a realistic step to take.

21 Next slide, please.

22 COMMISSIONER ROGERS: Just before you
23 leave that --

24 DOCTOR MATZIE: Yes, sir.

25 COMMISSIONER ROGERS: Could you say just

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1 a little bit more about the successful completion of
2 the accident analyses? What was the problem in
3 completing them successfully? I assume that was a
4 difficult thing to do or what?

5 DOCTOR MATZIE: What we did --

6 COMMISSIONER ROGERS: What's the emphasis?

7 DOCTOR MATZIE: We took a very
8 conservative approach. We assumed that you lost all
9 your safety actuation function. We made that
10 assumption. Even though the design, because of its
11 segmentation, should not have any type of
12 vulnerability like that, we made that assumption.
13 Then we had to analyze each of the design basis
14 accidents to show that either another system, that is
15 a control system, would combat that or that you had
16 sufficient time to allow the operator to recognize the
17 event and take action. So, we went through that type
18 of a reanalysis of design basis accidents.

19 COMMISSIONER ROGERS: Good.

20 DOCTOR MATZIE: (Slide) Next slide,
21 please.

22 Intersystem LOCA. Basically the issue
23 here is the connection of low pressure systems to the
24 reactor coolant system and their vulnerability if the
25 high pressure from the reactor coolant system were to

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1 be placed onto that lower rated system. So, we did a
2 very what I would call systematic evaluation with the
3 staff going system by system, interconnection to
4 interconnection, and we made design changes to
5 systems, including increasing design pressures, adding
6 isolation valves and in many cases eliminating the
7 interconnection by putting the interconnection
8 somewhere else where it could do the same function but
9 was not needed to interact with the high-pressure RCS
10 system.

11 Core damage contribution from intersystem
12 LOCA as a result of this systematic evaluation and
13 change resulted in about a one order of magnitude
14 decrease of the risk due to intersystem LOCA.

15 (Slide) Next slide, please.

16 Containment bypass following a steam
17 generator tube rupture, the potential vulnerability
18 there being a stuck open steam generator safety valve
19 during that transient where you would have a direct
20 connection from the primary system to the atmosphere
21 if that were to happen. The major resolution to this
22 issue was the addition of Nitrogen-16 gamma monitors
23 to the steam lines which give very unambiguous and
24 early warning of a potential primary to secondary
25 leak. And then an analysis using standard techniques

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1 which showed the operator with an unambiguous
2 indication has a very significant time to take his
3 normal, current planned action to mitigate the
4 consequences of that event. So, you can see the
5 amount of time we have for a single tube rupture, up
6 to four hours, and for concurrent multiple tube
7 rupture, 30 minutes.

8 Next slide, please.

9 COMMISSIONER REMICK: How is the rupture
10 of five tubes accommodated for 30 minutes? What is
11 it? Did you have to make a design change or is it
12 just a --

13 DOCTOR MATZIE: With the normal actuation
14 of systems and the normal procedures, if you have the
15 indication where the operator starts taking in his
16 action, that's the kind of time he has. But remember,
17 we have done things to the plant that give it more --
18 we call it thermal inertia, more fluid inventories.

19 Is there anything else you'd like to add,
20 Stan?

21 Okay. And the use of the steam dump
22 system also is a part of the normal systems.

23 COMMISSIONER REMICK: Okay.

24 DOCTOR MATZIE: (Slide) Next slide,
25 please, number 21.

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1 The boron dilution event after a small
2 break LOCA is an event that has come out of Europe
3 that we were asked to address. The issue there is the
4 accumulation of pure water in the cold leg of the
5 reactor coolant system and the subsequent question of
6 what happens if that were to be injected into the
7 core, considering you might have pure water in that
8 event.

9 The resolution we viewed as having a stool
10 with many legs, all supporting this. The first item
11 was that we looked at a realistic evaluation of the
12 amount of condensate that actually could accumulate in
13 the cold leg and we found the volume was not all that
14 much. We looked at the analysis of what happens in
15 the normal filling up of the system when you're
16 recovering from that event and the fact that natural
17 circulation would start mixing that pure water in a
18 rather slow and benign manner and what would happen to
19 the core in that event. We looked at changing and we,
20 in fact, did change the emergency operating procedures
21 to require him to get permission before he could start
22 the reactor coolant pump so there would not be the
23 very rapid injection. Finally, even if he
24 inadvertently and incorrectly started the pump, what
25 would the mixing and the vessel do in terms of

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1 combating this event? We showed that really that
2 mixing precludes criticality. So, we think that the
3 approach to this looked at it from all sides and that
4 the event has been properly analyzed and is not a
5 significant event for System 80+.

6 COMMISSIONER REMICK: I'm not sure I
7 understand the meaning of the first bullet under
8 Resolution. It's talking about adequate core cooling.
9 Is that if the pure water is inserted and if there is
10 a reactivity excursion there's still adequate cooling?
11 Is that what it says?

12 DOCTOR MATZIE: Right. It's a slow
13 excursion because of the slow injection of --

14 COMMISSIONER REMICK: I see. Okay.

15 DOCTOR MATZIE: (Slide) Next slide,
16 please.

17 We have extended leak before break
18 technology beyond that which was previously applied in
19 currently operating plants. Basically the staff had
20 generally approved main loop reactor coolant system
21 piping with a leak before break technology. We have
22 applied the same rigorous methodologies to other
23 systems, safety injection systems, shutdown cooling
24 system, pressurizer surge line and the main steam line
25 and showed adequate response to that piping to the

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1 initiation of cracks and the fact that the leak before
2 break would give us an adequate indication before
3 anything happened.

4 COMMISSIONER ROGERS: Did this lead to any
5 design changes? In other words, from where you
6 originally started out?

7 DOCTOR MATZIE: What this does is allows
8 you to eliminate significant snubbers and pipe
9 restraints which is an important feature from an
10 operation and maintenance as well as a first time cost
11 for the plant. So, yes, it is a significant
12 improvement in future plants.

13 (Slide) Next slide, please.

14 Reactor coolant pump seal cooling has been
15 an issue on and off the agenda for a number of years.
16 We've had two diverse cooling modes for our reactor
17 coolant pump seals. We've now added a very highly
18 reliable third in both diverse and redundant cooling
19 mode and we believe that this, together with other
20 protection we put into the component cooling water
21 system really eliminates this issue as an issue of the
22 future.

23 COMMISSIONER ROGERS: What did you use for
24 over pressure protection for the component cooling?

25 DOCTOR MATZIE: On the reactor coolant

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1 pump seal cooler, we put just a pressure relief on
2 that so that if there was a primary to cooling water
3 leak, that it would be relieved there and wouldn't
4 over pressurize the component cooling water system.

5 COMMISSIONER REMICK: Does the operator
6 have to take any action if there is a loss of power to
7 maintain the pump seal?

8 DOCTOR MATZIE: No. Well, let's see.

9 Is that an automatic start or does he
10 start that with a small pump?

11 MR. RITTERBUSCH: He has to load it
12 manually.

13 DOCTOR MATZIE: Okay. Yes. He has to
14 take action to start that small cooling pump.

15 That completes the technical part of my
16 presentation and I think that maybe some meaty issues
17 now really are the policy issues.

18 CHAIRMAN SELIN: Do you have some
19 technical questions you wanted to ask?

20 COMMISSIONER REMICK: I have one. I
21 assume that the separation that you have in the four
22 systems that you don't have a problem of thermal
23 insulation, that you're going to be required to have
24 thermal insulation to assure separation of
25 instrumentation of control and so forth? No Thermo-

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1 Lag?

2 DOCTOR MATZIE: Yes, sir, that's correct.

3 COMMISSIONER REMICK: Yes.

4 DOCTOR MATZIE: We use concrete wall
5 barriers, very thick concrete walls.

6 COMMISSIONER REMICK: So you will not need
7 that type of insulation? Good.

8 CHAIRMAN SELIN: The general theory is
9 keep talking until somebody stops you.

10 DOCTOR MATZIE: Yes, sir.

11 (Slide) I'd like to bring up three policy
12 issues. They're shown on slide 24. Tier 2*, PRA in
13 the design control document, and the relationship
14 between the design control document and the final
15 design approval.

16 CHAIRMAN SELIN: Let's talk about the Tier
17 2*. Just your list shows that there clearly are items
18 on this list that presumptively have safety
19 significance. The staff has taken a position that has
20 a certain amount of plausibility to it that there's a
21 whole set of issues that are governed by the rule and
22 in order to change would need not only some
23 consideration but would need a rule change or in a
24 particular application a site specific, therefore an
25 adjudicatory hearing.

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1 There's a bunch of stuff on the other end
2 that are below safety significance and instead of
3 pushing everything into tier 1 they're taking the
4 position there are a number of items in tier 2 that
5 clearly have a safety significance that don't pass the
6 50.59 test and nevertheless have a more liberal
7 treatment than tier 1 pieces.

8 What's the matter with it? Not so much
9 from a logical point of view but from a practical
10 point of view. Why not live with that instead of
11 coming up -- see, these all exist in our rules and
12 they all exist in our precedent. If you come up with
13 a new category, which is something called the intent
14 to use 50.59. That's unprecedented. We don't have
15 such an item. Why is that more practical than just
16 calling them tier 2* and treating them in a way that's
17 continuous with our regulatory experience?

18 DOCTOR MATZIE: The current -- and I don't
19 want to use the word "disagreement," but different
20 approaches to implementing the equivalent of a tier 2*
21 is, I believe, the current thinking on the staff is
22 that they would start from the side of saying if you
23 tried to change any of the particular tier 2* items,
24 it would be a priori declared an unresolved safety
25 issue beforehand.

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1 COMMISSIONER REMICK: Not a safety issue,
2 but an unresolved safety issue?

3 DOCTOR MATZIE: Right. And the feelings
4 of the industry are that instead of starting from that
5 a priori basis, we would like to approach it by giving
6 forewarning that we would intend to come in on an
7 issue so that we could come in and have dialogue,
8 allow the review and then the staff would make a
9 determination based on the review, rather than the
10 declaration ahead of time. So, it's really an
11 implementation issue rather than --

12 CHAIRMAN SELIN: I don't see that as being
13 any different.

14 COMMISSIONER ROGERS: I don't either.

15 CHAIRMAN SELIN: Remember, what you read
16 the staff's statement is sort of in the extreme case
17 in which you ignore the wishes of the staff, they
18 would call it an unresolved safety issue. They're not
19 saying that routinely these become automatic
20 unresolved safety issues. They say, "Come in and talk
21 to us before you do them." You said, "We're going to
22 come in and talk to you before we do them." What
23 they're saying is, "If you don't talk to us before you
24 do them, then they will be declared unresolved safety
25 issues." But the expectation is you would come in and

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1 talk and you would present the case that says, "This
2 is why we think it is not a safety issue to make the
3 change in piping design methods," or what have you and
4 they have a chance to look at it before they're made.

5 Remember, tier 1 says you need a rule
6 change. Tier 2, unqualified, says you just do them
7 and the staff would have to come and challenge them
8 afterwards to show. This one says, "We want to know
9 in advance." Now, how is that any different from the
10 industry's proposal? All they're saying is, "We want
11 to know in advance and if you don't tell us in
12 advance, then we will declare them an unresolved
13 safety issue."

14 DOCTOR MATZIE: Your statement of how you
15 think it would be implemented would probably be
16 acceptable to the industry. That wasn't our
17 understanding where it was going. It was more like,
18 "If you make any changes, it will be unresolved."

19 CHAIRMAN SELIN: Without talking to us
20 first.

21 COMMISSIONER ROGERS: Well, yes.

22 DOCTOR MATZIE: That's the issue. It's
23 the implementation. So, I don't think that --

24 CHAIRMAN SELIN: Instead of saying, "Talk
25 to us first" -- well, so, at least there's a

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1 possibility that there's a communications problem at
2 this point.

3 COMMISSIONER ROGERS: Is it the 60 days,
4 for instance? Is that an issue here?

5 CHAIRMAN SELIN: The staff doesn't want to
6 commit itself to 60 days. They want to take the time
7 that it takes to settle the issue.

8 DOCTOR MATZIE: And I think that's fine.

9 COMMISSIONER REMICK: But there is a
10 difference in my mind of declaring an unresolved
11 safety issue --

12 DOCTOR MATZIE: Without having reviewed
13 it.

14 COMMISSIONER REMICK: We're saying, "Come
15 in and I'll hear issues that before you do, come in
16 and talk to us." There is a difference between that.
17 I'm not sure I understand what the staff's position
18 is. But there is a difference in my mind between
19 those two approaches. If you say it's an unresolved
20 safety issue, then you're going to have to go through
21 a safety analysis, an amendment process. In my mind,
22 legally, without discussion, it's an unresolved safety
23 issue. It requires you can't use 50.59, in my mind.
24 But if we -- those are identified as items, let's
25 discuss whether it's unresolved safety issue or you

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1 can do it under 50.59, then I think that's a different
2 matter in my mind. I must admit, I'm not sure of what
3 the staff's position is and that's because I haven't
4 asked them.

5 CHAIRMAN SELIN: I think -- at least I
6 understand what you think would be acceptable to you.
7 I think we'll talk to our own staff and see --

8 DOCTOR SLEMBER: Yes. I think it's a
9 process issue more than it is a substantive one.

10 CHAIRMAN SELIN: Well, I'm not sure it's
11 either. That's what we need to follow-up on. My
12 understanding is all the staff wants is that the
13 licensees don't go and change everything that's not
14 tier 1 without telling them about it in advance, which
15 is far different from the way it's been presented
16 here. Now, let's find out when we talk to our staff
17 if that's certainly true or not.

18 DOCTOR MATZIE: (Slide) The next issue is
19 the incorporation of the PRA into the design control
20 document. I think that this issue had gone back and
21 forth a couple of times of whether it's in or whether
22 it's out. I think the industry's position and at
23 least at one point in time and maybe even today, the
24 staff's position is that you wouldn't include the PRA
25 itself, the specific with all the numbers and that,

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1 but you would include some higher level such as the
2 insights

3 CHAIRMAN SELIN: That's not exactly right.
4 The staff's position, as I understand it, is they
5 really would like the vendors to -- I mean the
6 licensees to keep a living PRA. If they keep a living
7 PRA, then they don't demand a lot of detail. If they
8 don't keep a living PRA and therefore the staff may
9 have to reconstruct five years later a whole set of
10 changes, then again I think this is like the first
11 issue, the staff's real desideratum is a very
12 reasonable one. They don't intend to declare things
13 an unresolved safety issue. They don't intend to
14 require all this, but they're trying to cover the
15 situation in which the PRA is not kept up to date, in
16 which case they would need access to detail. We don't
17 want to go through a design basis reconstitution
18 again. We need to ask the staff that. But if that
19 were the understanding, in other words the expectation
20 that only in the case in which the licensee did not
21 keep the PRA up to date, we would require these
22 details, would that be a problem?

23 DOCTOR MATZIE: I think that basically
24 that's probably where the industry position is. It's
25 again an implementation issue, how that's required.

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1 It seems to me that that needs to be a resolution with
2 the owner/operator/applicant, whatever you want to
3 call him, from an industry bases and not try to put it
4 into a specific design's design control document. So,
5 if the industry and the staff can get together on the
6 future commitment of how it will be used --

7 CHAIRMAN SELIN: See, the rule doesn't
8 require a living PRA. None of us want to go back and
9 change the rule at this point. So, there's no basis
10 for an understanding. There's no document that can be
11 an understanding. But what could be done, and maybe
12 this is the way to do it, is to say that either of two
13 approaches is acceptable. Either the vendor provides
14 enough information so that the original PRA can be
15 reconstructed with whatever changes have been made or
16 conversely the PRA is kept up to date so that at any
17 point there is an up to date PRA. I think it's a
18 little more complicated. I think it's a three party
19 action where we don't want to go back and fix
20 something that maybe we might have done a little
21 differently in the rule.

22 But I think the staff's position is
23 reasonable. I'm not sure that the implementation of
24 it is the most efficient, namely to have all these
25 details, because essentially staff position assumes

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1 that there is not a commitment to keep the PRA up to
2 date and therefore it can be reconstructed. I don't
3 see a vehicle for having a uniform commitment to keep
4 these up to date, unless it's a condition that's put
5 into the actual certification, certification as used.

6 DOCTOR MATZIE: Yes, sir.

7 CHAIRMAN SELIN: Let me go through your
8 position again. Your position is what, Doctor Matzie?

9 DOCTOR MATZIE: Our position is that in
10 the design control document, because of the legal
11 stature of that document, that you don't put the
12 entire PRA in there, which is a ten volume document.

13 CHAIRMAN SELIN: Right.

14 DOCTOR MATZIE: But that you put the high-
15 level presentation of the results, insights, et
16 cetera, and that then some agreement in some vehicle,
17 and I don't know the answer to where that vehicle is,
18 that the requirement of using the PRA in an updated
19 manner by the applicant is a requirement of the
20 future. Now, is that a requirement of the future of
21 all reactors? I don't know. Does that mean current
22 reactors have to have that, just advanced reactors?

23 CHAIRMAN SELIN: We're just talking about
24 your reactor at this point. Obviously there are
25 implications for others. But would you agree to

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1 keeping -- this is not a negotiating session. It's
2 sort of feel out of what's important to you and what
3 isn't. But would you agree that if the ten volumes
4 were not made part of the rule that you would keep
5 these up to date for systematic changes in the
6 analysis? In other words, that even if the ten
7 volumes were not part of the rule but there were
8 change made, tier 1 changes, tier 2* changes, that you
9 would keep the PRA up to date? I mean the generic
10 PRA.

11 DOCTOR MATZIE: From our perspective,
12 we're going to do that for our future plants because
13 it's a design tool that requires as you add detail, as
14 you know more information about components, that
15 you'll keep it up to date.

16 CHAIRMAN SELIN: If there's a way to
17 enforce that across the installations of the System
18 80+, that might be as useful as -- I don't think the
19 staff is desirous of going back and reconstructing
20 this calculation for themselves.

21 DOCTOR SLEMBER: I think you are on the
22 trail of a pragmatic way of addressing that in the
23 sense of one might require when there are design
24 changes to assist them that an evaluation be made of
25 what level of impact those changes might have, for

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1 example, a tier 1 or tier 2, and put a threshold in
2 there that an update must be made, for example, if it
3 impacted a tier 1 because there that goes to be
4 significant. There are certain levels below a
5 threshold that gets to be more drudgery rather than of
6 significance.

7 CHAIRMAN SELIN: Well, by definition, if
8 they're 50.59, they don't affect the PRA within the
9 sensitivity of the PRA. But it might be that an
10 agreement, a commitment to keep the ten volumes up to
11 date and to issue updates might be actually better for
12 the staff than giving them the ten volumes so that
13 they could try to keep these calculations up to date.
14 What they want is an up to date PRA. Whether they get
15 it through having all the machinery or having updates
16 that they can cross check themselves, that's a subject
17 of some discussion.

18 COMMISSIONER REMICK: It's not clear to me
19 because we haven't gotten the staff's position on
20 this, are we talking about the PRA being updated by
21 the vendor or by the potential licensee or one or the
22 other? It's not clear to me.

23 DOCTOR MATZIE: Well, I think the
24 commitment that's being looked for long-term is that
25 it's a living PRA for the life of the plant. That's

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1 my impressions of where this issue would like to go.
2 So, it would include updates as you're finishing a
3 detailed design construction procurement and then,
4 once operational, it would require updates there if
5 what the staff wants is consistent with what's
6 implemented.

7 COMMISSIONER REMICK: But it seems to me
8 that once a plant is, let's say, ordered, that who
9 keeps up the PRA is not completely under your control.

10 DOCTOR MATZIE: That's right.

11 MR. NEWMAN: That's correct. It seems to
12 me it has to be the commitment of the licensee. Now,
13 he may have us do it.

14 COMMISSIONER REMICK: Sure.

15 MR. NEWMAN: But I think it has to be
16 probably a commitment of the licensee.

17 COMMISSIONER REMICK: You could be out of
18 the picture by then, for all we know.

19 CHAIRMAN SELIN: That's true. But you're
20 going to then have the fifth and the sixth and the
21 seventh sales and by then you might have changed the
22 software or made some changes in your design with a
23 rule change if necessary and then the generic PRA has
24 got to be kept up to date as well as the living PRAs
25 for each of the plants.

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1 COMMISSIONER REMICK: Yes. I'm not sure
2 what we're trying to accomplish because we haven't
3 gotten the input from the staff on whether we're
4 trying to get the vendor to maintain and update the
5 PRA for its design --

6 CHAIRMAN SELIN: That's true.

7 COMMISSIONER REMICK: -- or whether we're
8 trying to get a utility to keep an update once they
9 built the plant.

10 CHAIRMAN SELIN: What the staff wishes to
11 accomplish is that each utility's PRA is up to date
12 and this desire to put the ten volumes in the rule is
13 a backup in case they can't get each utility to do
14 that. So, as Commissioner Remick has pointed out, as
15 I tried to point out, it's not entirely within the
16 capability of the vendor to make that assurance.

17 MR. NEWMAN: I think the discussion sort
18 of centers around the mistrust of each side as to how
19 it will be handled in the future and trying to make
20 sure that it gets handled as conservatively as
21 possible. There's a better way to do it than putting
22 it all in here.

23 COMMISSIONER REMICK: Yes. A basic law I
24 like and that is if we have a requirement, it ought to
25 be in our rules and we shouldn't try to do something

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1 through a vendor that we're really trying to get a
2 utility to do. But I'm not sure that's what we're
3 trying to do until we hear the staff's side.

4 DOCTOR MATZIE: My turn to talk again?

5 CHAIRMAN SELIN: Yes, sir.

6 DOCTOR MATZIE: I'd like to just briefly
7 discuss the last item, which is the relationship
8 between the design control document and the final
9 design approval. We have said, I believe at least two
10 years ago, certainly last year and many times in front
11 of the staff, that we believe that the technical
12 review can be closed out with the final design
13 approval and that the design control document is part
14 of the rulemaking process and that there is no need to
15 delay getting the FDA while we really all try to
16 figure out exactly the details of the document that's
17 going to go forward in the rulemaking. We strongly
18 feel that decoupling is the right way to go and also
19 that very shortly definitive guidance on exactly how
20 to write the design control document is the thing
21 needed next so that we can all maintain our schedules
22 from FDA on through design certification.

23 CHAIRMAN SELIN: That is the staff's
24 understanding and that is the Commission's
25 understanding. As you remember at the last staff

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1 presentation, it was an extraordinarily agile attempt
2 to find a little bit of a weasel at the end that
3 should the DCD show up a design issue, then we would
4 have to go back and consider the FDA. But everybody
5 considers that to be extremely --

6 DOCTOR MATZIE: Extremely remote.

7 CHAIRMAN SELIN: -- remote. So, your
8 assumption is one with which the Commission has
9 concurred and certainly the staff has concurred.

10 DOCTOR MATZIE: Thank you, sir. That --

11 COMMISSIONER REMICK: In fact, the SECY's
12 letter would be the result of Commission decision, I
13 assume.

14 CHAIRMAN SELIN: Right.

15 COMMISSIONER REMICK: You're talking about
16 an SRM, I assume.

17 DOCTOR MATZIE: Yes, sir.

18 (Slide) Slide 29, please.

19 I will conclude now by saying that we are
20 very confident that our design has improved public
21 safety, that the issuance of the advanced copy of the
22 System 80+ final safety evaluation report with no open
23 items represents a major milestone for the U.S.
24 nuclear industry. It certainly does for us and I
25 believe it does for the staff also, and that we

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1 believe that the 10 CFR 52 process, to the extent
2 we've gone down that path, is working and working
3 well. But we still have fairly significant procedural
4 issues remaining in front of us and it's time to get
5 those sort of ironed out.

6 CHAIRMAN SELIN: If you've liked it so
7 far, you'll love it from here on out.

8 COMMISSIONER ROGERS: Just before you
9 leave that, I wonder if you'd be willing to comment,
10 since you're saying that the process has worked very
11 well, whether you think that the process has led in
12 any way to less than optimal design features. In
13 other words, do you think in retrospect, after you
14 came out with a design, do you think that somehow
15 through the process not an unsatisfactory design
16 feature but a less than optimal design feature would
17 have --

18 CHAIRMAN SELIN: Remember, you're going to
19 have to sell the thing that's on the table. How could
20 it have been approved if you had done it differently?

21 DOCTOR MATZIE: The way you couched the
22 question, Commissioner, is difficult to answer.
23 Obviously we've added equipment and made the plant
24 more robust because of this process and particularly
25 addressing the severe accident issues. That by its

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1 nature makes the plant more expensive. So, there's
2 sort of a tradeoff here of was that additional
3 protection to the public worth the money? We would
4 hope the answer by the prospective clients or
5 customers is yes.

6 I think that obviously things like adding
7 hard-wired I&C backups to protect against common mode
8 failure added some cost. That particular area wasn't
9 a large cost. It adds extra protection. Was it
10 needed? Well, I think as we implement all digital
11 systems, we'll know in the future. Shifting to four
12 train mechanical trains for safety injection,
13 emergency feedwater, was it warranted? It added a
14 significant amount of safety as analyzed by a PRA.
15 Was it worth it? Possibly. Again I think it will be
16 borne out by our customers, whether they'll buy a
17 plant with significantly higher safety at a somewhat
18 higher price.

19 DOCTOR SLEMBER: I'd like to just add one
20 dimension on that though. Even though we may have
21 added features and equipment and some cost, one of the
22 biggest burdens that this industry has carried is
23 uncertainty. To the extent that you could close out
24 safety issues or eliminate the open question of
25 software-based control systems by putting in some

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1 element of hardwired systems, that has its value also.
2 So, just like everything in life, there's a balance.

3 My feeling is having watched this industry
4 over many years, that I tend to almost think removal
5 of uncertainty has more leverage than actually the
6 cost of the equipment.

7 CHAIRMAN SELIN: That's a very good
8 answer. My view is that by 1998 no reactor in the
9 world will be built that fails to meet the same
10 specifications. The EPR or any other country is not
11 going to be able to say -- they're going to say, "Do
12 you meet the NRC specifications?" If they say, "No,
13 but it's okay," no public will accept that in any of
14 the developed --

15 MR. NEWMAN: You're making my presentation
16 for me.

17 COMMISSIONER REMICK: Before we leave,
18 Regis, I would assume though that your use of four
19 independent trains separate, it's not because of Part
20 52. You had proposed that anyhow.

21 MR. NEWMAN: The process did not do that.

22 COMMISSIONER REMICK: Yes, the process did
23 not do that.

24 DOCTOR MATZIE: That's correct.

25 COMMISSIONER REMICK: It's an improvement

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1 that you thought was important, I think.

2 DOCTOR MATZIE: That was actually an
3 implementation of the EPRI LWR utility requirements
4 document. I think, to be honest though, all of the
5 thinking of the industry since the mid-'80s has been
6 oriented to the future licensing requirements and
7 future expectations that the public would want in
8 advanced reactors.

9 CHAIRMAN SELIN: Mr. Newman?

10 MR. NEWMAN: Let me address that question
11 from a little bit different direction also as I go
12 into my next part, which is really the future plans
13 regarding System 80+.

14 About 80 percent of the way through Doctor
15 Matzie's presentation, Doctor Selin picked up the
16 gavel. I wasn't quite sure what was going to happen
17 next, but I was reminded of the first time I met
18 Doctor Selin. Shortly after he became chairman he
19 made a whirlwind visit to many nuclear sites, if not
20 all nuclear sites, all the vendors and so forth. The
21 first time I met him in Windsor, Connecticut, we made
22 a wonderful technical presentation, showed him the
23 advanced control room, all these things. We finished
24 up and he leaned across the table and he hit me with,
25 in his clear unambiguous way, a figurative gavel when

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1 he said, "That was a wonderful presentation, but I
2 don't think you're serious about certification." I
3 sat there stunned for a minute and then I agreed with
4 him, that I don't think anyone in the United States at
5 that point was serious about certification. The
6 process did not lead to serious nature. He at that
7 time said to me, "If you get serious about the
8 process, I will get serious about the process."

9 I will say going back to what Dick said,
10 I want to say thank you to this Commission and the
11 staff for getting serious about it. Certification is
12 not an academic exercise at ABB. If there weren't
13 something to do with it, we would not be doing it just
14 to please ourselves or you or anyone else. We believe
15 there's a genuine need for a nuclear option and that's
16 why we've done what we are, but it would not have been
17 possible.

18 I believe the process probably helped a
19 lot, in answer to your question, Commissioner Rogers,
20 in the fact that both sides knew that it was serious,
21 it had to get done, but it was not being done in light
22 of we've got to get the -- we're holding a plant up,
23 so therefore we'll give in and do things we shouldn't
24 be doing. We really got the questions out on the
25 table, looked at the cost benefits and I believe came

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1 to some very good decisions with respect to that. The
2 process, I believe, has probably helped us a
3 tremendous amount in getting to where we are today.

4 But the example setting and meeting
5 schedules in getting there, we committed to that a
6 long time ago and that's why we're here today.

7 (Slide) Now, the reason why we did that,
8 if I could have the first slide, please --

9 CHAIRMAN SELIN: It's because you think
10 you can sell some reactors.

11 MR. NEWMAN: You bet. This is obviously
12 not the time to spend a lot of time on the commercial
13 side, but I think it's important to understand why
14 we're doing things.

15 If you look at how we view the markets
16 today, when we started out in 1987 I think probably we
17 all envisioned the return of a U.S. market much sooner
18 than we would tell you today if, in fact, we were
19 going to try to pick a date today. There are a number
20 of factors that have changed that have done that. The
21 fact that when you look at where a lot of the
22 utilities are today, they are getting ready for
23 deregulation. They are looking at the competitiveness
24 of their existing plants. They are focused on that
25 part of the thing and really are not at this point

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1 looking at large increases in capacity though the need
2 is coming very soon.

3 We also have a situation in the United
4 States today where natural gas is basically a very low
5 cost fuel and a very low-risk type of approach. I
6 believe that has delayed the return of the nuclear
7 market here also. We have had for the last three and
8 a half years an advisory committee of the top nuclear
9 executives in the United States. That's how we got a
10 lot of the features and things. We really did want
11 something that people wanted to buy, not something
12 that we could license, okay, if we couldn't get there.
13 That was part of the thing on ITAAC and part of the
14 reticence of the people in agreeing to some of these
15 things because a licensee has to live with this for 60
16 years. So, we had to get his input into the process.

17 One of the things they tell us, by the
18 way, too is that we really have to solve the waste
19 issue in this country before we're going to go back to
20 ordering plants also. So, that's a separate issue
21 also. I believe the environmental effects of other
22 sources of power will also push it in the proper
23 direction soon also.

24 But at this point in the United States, we
25 are not at this point considering new capacity from a

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1 commercial point of view. The one aspect that I would
2 note, the National Academy of Sciences has issued its
3 report on how to handle the plutonium situation in
4 this country and by name System 80 and System 80+ are
5 named as two of the better ways of handling it, from
6 a reactor point of view of handling the long-term
7 plutonium waste problem. That comes from the fact
8 that we really did design System 80 back in the '70s
9 to be a plutonium-burning reactor before we changed
10 the rules in this country. That conservatism, that
11 rod worth is still built into the plants.

12 CHAIRMAN SELIN: And into 80+?

13 MR. NEWMAN: In 80+. No change at all.

14 CHAIRMAN SELIN: I assume that if the
15 market took the point that somebody were to buy a
16 reactor which included plutonium burning as part of
17 its function, it's 80+ you would propose and not go
18 back to a Part 50 approved System 80?

19 MR. NEWMAN: Absolutely. System 80+ loses
20 nothing in comparison to System 80 from that point of
21 view.

22 CHAIRMAN SELIN: Okay.

23 MR. NEWMAN: The place that I think that
24 the present day use for existing reactors and where
25 System 80+ is presently competing in a number of areas

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1 is in Asia, which is on a tremendous growth pattern
2 and does not enjoy the resources, the natural
3 resources that we in the United States have. They
4 lack a lot of the fuel resources that we have. At the
5 present time in the Republic of Korea, there are four
6 System 80 units under construction and we are under
7 negotiation on the next two of YGN 5 and 6. These
8 plants incorporate probably about a third of the
9 features of System 80+. System 80+ is -- they are in
10 the process now of evaluating various options for what
11 they refer to as the next generation reactor, and I'm
12 sure that decision will be coming sometime this year
13 and System 80+ is obviously one of the ones being
14 heavily reviewed with that regard.

15 You asked earlier, Commissioner Remick,
16 about the advanced control room on YGN 5 and 6. We
17 did offer the advanced control on Wolsong 3 and 4, the
18 last two units two years ago. It was not accepted at
19 that time because we were still in the midst of
20 licensing here in the United States. We have again
21 offered it on YGN 5 and 6 now that we have completed
22 the licensing here. It is being seriously evaluated.

23 CHAIRMAN SELIN: Certification. You have
24 completed the certification here.

25 DOCTOR MATZIE: Well, what did I say? I'm

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1 sorry.

2 CHAIRMAN SELIN: Licensing.

3 MR. NEWMAN: I'm sorry. Final design
4 approval is probably the most important feature rather
5 than certification. Certification is a legal thing.
6 I should say final design approval.

7 With regard to that, it is being
8 evaluated. There are definite time savings. There
9 are definite cost savings and there are definite
10 improvements in human factors or the human interaction
11 with the control room. Whether they will choose to do
12 it at this time, that remains to be seen. The next
13 generation reactor will definitely include an advanced
14 control room in Korea.

15 In the Republic of China, we are one of
16 three bids that have been submitted and the bid that
17 we are offering is System 80+ in entirety. It has
18 been well received. It has received high technical
19 marks and one of the major reasons is that the
20 invitation to bid did incorporate about 90 to 95
21 percent of the EPRI requirements. They participated
22 in that program. They have incorporated those
23 requirements and System 80+ was designed to fulfill
24 the EPRI requirements document. So, that has gone
25 well.

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1 COMMISSIONER REMICK: Before you leave
2 that, if you were successful in receiving that order,
3 would your plan still be to reopen the Chattanooga
4 facility?

5 MR. NEWMAN: That is correct.

6 COMMISSIONER REMICK: It is?

7 MR. NEWMAN: We believe that Taiwan really
8 is a key to the rest of the market in Asia. We think
9 it's a very important factor for how many of the other
10 plants in this country will go. But nuclear is being
11 seriously considered now. Obviously the People's
12 Republic of China is going to a nuclear program. We
13 would like the rules to be changed such that we can
14 participate in that. Presently we are excluded, but
15 the Europeans are not. We believe also we are seeing
16 now more serious talks out of Indonesia, Thailand,
17 other places as far as a revitalization of their
18 nuclear programs also.

19 We, as I said in the beginning, did this
20 with a stated purpose of being able to take it to the
21 marketplace and we believe that this is a very
22 important feature here in the United States to have it
23 reviewed and approved in this country.

24 If I could have the next slide, please.

25 COMMISSIONER REMICK: Any plans for

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1 marketing in Europe?

2 MR. NEWMAN: There are a number of places
3 where we have interacted in Europe. We now have a
4 European stirring committee which is made up of 25
5 utilities in Europe which review all of the ABB
6 reactor options, what we're doing. We have had
7 participation by Nuclear Electric, Scottish Nuclear
8 and BNFL in the U.S. committee. That's how it got
9 started and then the rest of them -- EDF also comes to
10 our committee meetings here, but they wanted -- we had
11 so many wanting to come that we formed a European
12 committee also.

13 I think the European market is probably
14 like the United States, still some way off. There are
15 several countries now talking about it. Turkey has
16 reopened their evaluation of nuclear operations and,
17 in fact, I believe have issued an invitation to hire
18 a consultant to come in and work with them to start
19 their program up again. So, there are a number of
20 places like that that are beginning to look again, but
21 I believe that's still, probably like ours, a few
22 years off.

23 COMMISSIONER REMICK: If it's System 80+,
24 is it ABB-Combustion that markets or let's say a --

25 DOCTOR SLEMBER: No, it will be ABB-

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1 Combustion.

2 MR. NEWMAN: It will be us.

3 (Slide) Could I have the next slide,
4 please?

5 The next one really is one that says what
6 should be the U.S. role in doing this? I think this
7 is an important issue. This goes back to what
8 Chairman Selin was saying also. I think the U.S. has
9 been criticized by some of our competitor countries as
10 being in the doldrums, not having done anything for
11 the last 20 years. They've been building plants,
12 therefore they are better off than we are. I don't
13 see that we in the United States have wasted the last
14 20 years. I think some very significant things have
15 happened. I believe with INPO and all the intense
16 interest and work on improving the performance of the
17 existing reactors, it's a very necessary thing they
18 did and a lot of things were learned out of that that
19 have been incorporated in the future designs.

20 I believe the writing of the utility
21 documents, the requirements document, in going through
22 the standardized licensing has been a very valuable
23 use of our time here and something that's very
24 worthwhile. I believe it sets the standard for the
25 world and I believe it will be the level that everyone

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1 will have to come up to.

2 We in this country have a very precise
3 regulatory approval, one that is very thorough, very
4 complete, very different than other countries require
5 of their reactors. They go about it in a different
6 fashion. I believe that what we have been able to
7 accomplish here in this licensing process is to set
8 that standard I believe that is the one that the world
9 will come to. Consequently, I think it's been an
10 extremely worthwhile investment on our part, on the
11 part of our partner DOE, who has helped us, and it's
12 an investment of the time and effort of yours and my
13 staff. I think this is something that will definitely
14 pay dividends. I believe it is the right criteria for
15 what we want to do as a country. It's something where
16 we can maintain a technological advantage. We ought
17 to continue to be the world's teacher and exporter of
18 this technology. It is one that creates jobs in this
19 country, not somewhere else. It's a role that we have
20 earned and we should never give it up as far as I'm concerned.

21 COMMISSIONER REMICK: Bob, I faced that
22 same thing of feeling that the United States has been
23 in the doldrums, but they're amazed to find out that
24 there were 39 plants placed in operation in the last
25 decade in the United States, six in the past five

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1 years. I think we forget about that and most people
2 are surprised to hear that.

3 CHAIRMAN SELIN: Dick, we go back to you.

4 DOCTOR SLEMBER: Okay. I'd like to make
5 a few concluding remarks.

6 For the first time since NPOC announced
7 its strategic plan for the next generation of nuclear
8 reactors in the United States, and for the first time
9 since the NRC issued the regulations which would allow
10 that vision to become a reality, the nuclear industry
11 has reached a major milestone with the issuance of the
12 evolutionary plant FSERs. As Bob has mentioned, I
13 think that this is not only a significant milestone
14 for the United States, but I think will influence
15 nuclear plant design in the international markets.

16 System 80+ FSER represents the culmination
17 of a most intensive safety review ever performed in
18 this country and perhaps the world. Verified that the
19 System 80+ plus not only meets all of the NRC
20 regulations, but has been designed to resolve all of
21 the previously unresolved safety issues and all of the
22 generic safety issues which apply to it. Furthermore,
23 it has many design features which have been put in
24 place to further protect the public in the highly
25 unlikely event that an accident precedes beyond the

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1 plant design basis resulting in severe fuel damage or
2 even fuel melt.

3 The ten volume probability risk assessment
4 has identified the importance of various features and
5 this risk assessment has documented two orders of
6 magnitude of improved safety of this plant over
7 existing plants whose safety record is already
8 remarkable.

9 It hasn't been an easy task for either of
10 our staffs to reach the completion of the safety
11 review. However, they have succeeded and with their
12 success have demonstrated to the world that the
13 United States is still the standard setter for nuclear
14 reactor safety.

15 We at ABB now look forward to completing
16 the process, obtaining our FDA and achieving
17 certification of the approved System 80+ design and I
18 wish to thank you.

19 COMMISSIONER REMICK: You mentioned
20 several policy issues that you feel need to be
21 resolved before going into design certification. I
22 must admit I'm not fully up to speed and heard all the
23 arguments on it, but I would -- certainly if you have
24 additional things that you want to provide for us to
25 consider, please don't hesitate to do so. But

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1 certainly I can assure you that I'll dig into the
2 issues from all sides.

3 Are there other things that you haven't
4 mentioned that you can foresee in the design
5 certification process type of issues that perhaps are
6 going to need to be resolved? Or maybe you haven't
7 thought that far along. But are there things that you
8 foresee in the design certification rulemaking process
9 issues that we should be paying attention to, thinking
10 about?

11 DOCTOR MATZIE: There are several others
12 which I know that Nuclear Energy Institute has been
13 addressing sort of programmatically, things like
14 secondary references, et cetera. I think that all of
15 these issues have to be addressed very near-term if
16 we're to proceed in an orderly manner and not
17 iterate. So, rather than to reiterate those here, I
18 think that the NEI has really been addressing those.

19 COMMISSIONER REMICK: Yes. Okay. I was
20 very pleased to hear you say favorable things about
21 the 52 process. I think those who drafted the 52
22 process on the staff side and so forth deserve a lot
23 of credit, but I think nobody, even those who drafted
24 it, could anticipate some of the issues that arose.
25 But I think it was a good example of industry and the

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1 Agency working together to get some reasonable
2 resolution of those issues. So, I look at it too as
3 a highly successful process and I think the process
4 has borne out the viability of the Part 52 process.
5 Not that it perhaps couldn't be improved and so forth,
6 but I was particularly pleased to hear from your side.
7 I'm sure it's been very painful, a lot of resources
8 and so forth, but I'm quite pleased personally that
9 it's worked the way it has and I think the industry's
10 effort and certain the staff's effort is to be
11 commended. I appreciate your presentation today.

12 COMMISSIONER de PLANQUE: Well, I think
13 your presentation has been very impressive and I think
14 it's particularly interesting to look at the increase
15 in safety that you quote in the material here. I'm
16 kind of curious when you say, for example, on core
17 damage frequency two orders of magnitude safer than
18 current plants, what are you using as the denominator?

19 DOCTOR MATZIE: We performed a
20 probabilistic risk assessment of System 80 design and
21 used that as the denominator by which we then compared
22 the System 80+ using the same methods.

23 COMMISSIONER de PLANQUE: Okay.

24 DOCTOR MATZIE: So it's a comparative PRA
25 by us on both designs.

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1 COMMISSIONER de PLANQUE: On your own
2 design?

3 DOCTOR MATZIE: Yes, sir.

4 COMMISSIONER de PLANQUE: Okay. Fine.

5 DOCTOR MATZIE: Yes, ma'am.

6 COMMISSIONER de PLANQUE: That's okay.
7 Others do that too. I answer to anything.

8 DOCTOR SLEMBER: We like to compare with
9 our competition and say it's three orders of
10 magnitude.

11 COMMISSIONER de PLANQUE: Right. Well, I
12 was just curious exactly what comparison you were
13 making there. Does that apply to the comparison you
14 gave on shutdown risk as well?

15 DOCTOR MATZIE: Yes, it does.

16 COMMISSIONER de PLANQUE: Okay. Well, I
17 too am glad you like the process. I assume part of
18 that is because so much of it is over. But I would
19 also congratulate you on the progress that you've made
20 and especially on keeping with the schedule. I think
21 you've done an excellent job.

22 DOCTOR MATZIE: Thank you.

23 COMMISSIONER ROGERS: We thank you all
24 very much for this presentation. I think we do feel
25 somewhat enthusiastic to see that somehow it has been

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1 possible to get through the Part 52 process. It's not
2 quite completed yet, but it looks as if it is a
3 workable process and certainly I think we've all seen
4 through your presentations to us and our staff
5 presentations.

6 A great deal of very serious effort in
7 trying to solve the problems and move forward. You're
8 absolutely right that this effort and those of others
9 who have submitted designs to us are getting a great
10 deal of attention from the staff and the Commission.
11 The Commission, I think, has clearly been in back of
12 steady progress, trying seriously to see where there
13 might be any roadblocks, particularly on a policy
14 basis. Commissioner Remick emphasized I think a
15 couple of times today that we want to hear about
16 policy issues when they have been identified because
17 we want to see to what extent we can help to see that
18 they are solved. Policy is our business and we have
19 been very much involved. I think the Commission over
20 the years, from the very beginning of the Part 52
21 effort, has -- individual Commissioners have been very
22 involved with it and very interested in seeing that it
23 gets a fair test and that it is a practical way to
24 certify a design for the future and to move forward on
25 some of the standardization questions that we've been

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1 so interested in pursuing here in this country as a
2 change from the past.

3 So, I would say that I personally want to
4 congratulate you for the excellent work that you've
5 done. You're moving along very well. I do think that
6 we ought to keep in mind that every entity that's been
7 involved with this, your competitors as well, have had
8 to try to solve some of these problems in making Part
9 52 work and I think that in a sense while you've been
10 in competition you also have been able to benefit from
11 each other's hard work and experience.

12 So, we feel that we're trying to play here
13 on a very level playing field with all of the
14 interested parties, but we know that there are little
15 things from time to time that come up that have to be
16 solved and when they are solved then everybody
17 benefits from it.

18 So, thank you again for an excellent
19 presentation and we wish you good luck in wrapping
20 this thing up.

21 DOCTOR SLEMBER: Thank you.

22 (Whereupon, at 3:28 p.m., the above-
23 entitled matter was concluded.)

24

25

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CERTIFICATE OF TRANSCRIBER

This is to certify that the attached events of a meeting
of the United States Nuclear Regulatory Commission entitled:

TITLE OF MEETING: BRIEFING BY ABB-CE ON STATUS OF SYSTEM 80+
APPLICATION FOR DESIGN CERTIFICATION

PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: MARCH 31, 1994

were transcribed by me. I further certify that said transcription
is accurate and complete, to the best of my ability, and that the
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ABB PRESENTATION TO NUCLEAR REGULATORY COMMISSION

March 31, 1994
Rockville, MD

ABB

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AGENDA

<u>Topic</u>	<u>Speaker</u>
Introductory Remarks	Dr. Richard J. Slember President ABB Power Plant Segment
Status of System 80+ Design.....	Dr. Regis Matzie Vice President ABB-CE Nuclear Systems Engineering
Future Plans Regarding System 80+	Mr. Robert E. Newman President ABB-CE Nuclear Systems
Concluding Remarks.....	Dr. Richard J. Slember

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SYSTEM 80+ LICENSING OVERVIEW

- ⊙ 2896 questions responses in 1993
- ⊙ 25,000 safety analyses report pages submitted in 1993
- ⊙ Advance copy FSER issued February 28, 1994
 - ⊙ On SECY-93-097 schedule
 - ⊙ NO OPEN ITEMS
- ⊙ NRC review has resulted in agreement on all design features and analysis to resolve all existing and emerging licensing issues - including those related to severe accident phenomena.

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SYSTEM 80+ DESIGN CERTIFICATION SCHEDULE

April 1989	- Application Submitted
October 1991	- Last Requests for Additional Information Issued
April 1992	- Responses to RAIs Completed
September 1992	- DSER Issued
February 1993	- Responses to DSER Completed
March 1993	- Follow-On Questions Initiated
June 1993	- ITAAC Submitted
January 1994	- Responses to Follow-On Questions Completed
February 1994	- Advance Copy of FSER Issued
April 1994	- CESSAR-DC Amendment V
May 1994	- ACRS Letter Expected
May 1994	- CESSAR-DC Amendment W
June 1994	- FSER Publication Expected
August 1994	- FDA Issuance Expected
December 1995	- Design Certification Expected

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SYSTEM 80+ LICENSING STATUS

- **Overview**
- **Major achievements**
- **Effort remaining**
- **Policy issues**

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SYSTEM 80+ FSER CONFIRMATORY ISSUES

- **NRC verify incorporation of CESSAR-DC markups**
- **NRC complete review of Certified Design Material (CDM)**
- **ABB-CE review COL action items in FSER**
- **ABB-CE document additional re-inforcing steel details**
- **NRC verify incorporation of recent ACRS comments on CDM**
- **NRC complete independent review of CDM and CESSAR-DC**
- **NRC complete Technical Specification audit**
- **ABB-CE verify design control practices**

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FINAL CESSAR-DC SUBMITTALS

- ⊙ **Amendment V scheduled for April 30, 1994**
- ⊙ **Documents:**
 - ⊙ **Changes resulting from NRC audit of Technical Specifications and CDM review**
 - ⊙ **Additional information requested by ACRS**
 - ⊙ **Changes resulting from ABB-CE's fourth integrated consistency review**
- ⊙ **Amendment W scheduled for May 31, 1994**
- ⊙ **Documents:**
 - ⊙ **Editorial and Technical Specifications format changes**
 - ⊙ **ACRS review and cleanup**

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SYSTEM 80+ MAJOR DESIGN AND LICENSING ACHIEVEMENTS

- ⊙ **Advanced Control Room - Human Factors Engineering**
- ⊙ **All Digital Instrumentation and Controls**
- ⊙ **Severe Accident Prevention and Mitigation**
- ⊙ **Detailed PRA, including Shutdown Risk**
- ⊙ **Seismic Design Envelope**
- ⊙ **New Source Term Technology**

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ADVANCED CONTROL ROOM - HUMAN FACTORS ENGINEERING

- ⊙ Established an NRC-approved Human Factors engineering review plan for major control room features.
- ⊙ ABB-CE has exercised the plan and has developed a licensable Control Room design.
- ⊙ NRC has approved:
 - ⊙ Control Room Layout
 - ⊙ Large Overhead Display
 - ⊙ Standard control Panel Features
 - ⊙ DPS display hierarchy
 - ⊙ DIAS alarm tile display
 - ⊙ DIAS dedicated parameter display
 - ⊙ DIAS multiple parameter display
 - ⊙ CCS process push-button switch configuration
- ⊙ ITAAC includes the process for remaining panels and verification and validation of the complete control room.

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ALL-DIGITAL INSTRUMENTATION AND CONTROLS

- ⊙ Complete integration of protection, control, and monitoring systems
 - ⊙ proven, commercially available hardware
 - ⊙ functional segmentation and redundancy (not central unit architecture)
- ⊙ On-line self-test, diagnostics, and information processing to reduce burden on the operator
- ⊙ Programmable logic controller with simple software
- ⊙ Complete separation between safety and non-safety systems
- ⊙ Complete separation between control and monitoring systems

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NEW SOURCE TERM TECHNOLOGY

- ⦿ **First application of the new source term technology to a specific design**
- ⦿ **Equipment qualification uses graded approach**
- ⦿ **Resolved related new issues:**
 - ⦿ **Sump water pH control**
 - ⦿ **Containment spray effectiveness**
- ⦿ **Benefits:**
 - ⦿ **Lower doses predicted for accidents**
 - ⦿ **Potential for revised emergency planning**

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SEVERE ACCIDENT ACCIDENT PREVENTION & MITIGATION FEATURES

- ⦿ **Resolved severe accident issues without relying on future experiments (i.e., by demonstrating robust design features)**
 - ⦿ **Large containment volume provides protection without need for venting during an accident.**
 - ⦿ **Safety Depressurization System prevents high-pressure core ejection from reactor vessel.**
 - ⦿ **Cavity Flood System cools core debris.**
 - ⦿ **Hydrogen mitigation capability achieved through igniters.**
 - ⦿ **Independent and diverse monitoring instrumentation and equipment controls provide backup if common failure of software disables safety systems.**

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SEVERE ACCIDENT ACCIDENT PREVENTION AND MITIGATION FEATURES (CONT.)

- ⦿ **Containment overpressure analysis shows that ASME Level C stress limit is not exceeded for approximately 60 hours.**
- ⦿ **Cavity design promotes core debris retention and cooling.**
- ⦿ **Reactor cavity wall analysis shows ability to withstand steam explosion from core debris - water interaction.**
- ⦿ **Analysis shows that reactor cavity structure can withstand the most severe core-concrete attack for eight days without a significant release of radioactivity.**

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DETAILED PROBABILISTIC RISK ASSESSMENT

- ⦿ **NRC has approved full-scope, detailed PRA methodology-including shutdown risk evaluations.**
- ⦿ **The NRC has agreed with analysis of corresponding severe accident performance.**
- ⦿ **The System 80+ design can withstand an earthquake more than twice the magnitude of the design basis Safe Shutdown Earthquake (0.3g).**
- ⦿ **The analysis indicates that the System 80+ design reduces the core damage frequency by more than 2 orders of magnitude as compared to current designs.**

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DETAILED PROBABILISTIC RISK ASSESSMENT (CONT.)

- Shutdown risk has been reduced by a factor of about 40 relative to currently operating plants and risk is balanced among initiating events
- Radiological doses at site boundary for the most likely severe accident sequence is 0.3 rem, (Protective Action Guideline is 1 rem)
- NRC and ABB-CE have agreed on 71 PRA insights to be carried forward in the DCD because of their importance to safety and/or reliability.

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SEISMIC DESIGN ENVELOPE

- Design plant to envelope the majority of potential nuclear sites
 - Broad range of seismic spectra anchored to 0.3g at high frequencies
 - Broad range of soil conditions
- Seismic Design Envelope sufficiently conservative to accommodate site specific ground accelerations in excess of 0.4g for design basis requirements.

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SIGNIFICANT LICENSING ISSUES RESOLVED

- ⦿ **Diversity of digital I&C systems**
- ⦿ **Intersystem LOCA risk reduction**
- ⦿ **Containment bypass following a steam generator tube rupture**
- ⦿ **Boron dilution after a small break LOCA**
- ⦿ **Extension of Leak-Before-Break (LBB) technology**
- ⦿ **Reactor Coolant Pump Seal Cooling**

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DIVERSITY OF DIGITAL I&C SYSTEMS

- ⦿ **Issues:**
 - ⦿ **Methods for analysis of accidents with a common mode failure**
 - ⦿ **Design of diverse hardwired backup controls**
- ⦿ **Resolution:**
 - ⦿ **Hardwired monitoring and control instrumentation added**
 - ⦿ **Accident analysis assuming loss of all safety instrumentation and controls was completed successfully**

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INTERSYSTEM LOCA RISK REDUCTION

⦿ **Issue:**

- ⦿ All low pressure systems connected to the Reactor Coolant System should be reviewed for potential failure due to overpressurization

⦿ **Resolution:**

- ⦿ ABB-CE and NRC performed a systematic evaluation of all inter-connected systems.
- ⦿ Design changes made to increase system design pressures, add isolation valves, and eliminate system interconnections
- ⦿ Core damage contribution from intersystem LOCA reduced significantly

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CONTAINMENT BYPASS FOLLOWING STEAM GENERATOR TUBE RUPTURE (SGTR)

⦿ **Issue:**

- ⦿ Potential for a stuck open steam generator safety valve after SGTR

⦿ **Resolution:**

- ⦿ Added Nitrogen-16 monitors for unambiguous early detection
- ⦿ For a single tube rupture, operator action is not required for 4 hours to prevent safety valve lift
- ⦿ For a concurrent rupture of 5 tubes, operator action not required for at least 30 minutes to prevent safety valve lift.

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BORON DILUTION AFTER A SMALL BREAK LOCA

○ **Issue:**

- Pure water assumed to accumulate in the RCS cold leg due to condensation after a small break LOCA

○ **Resolution:**

- Conservative analysis demonstrates adequate core cooling is provided even if pure water is assumed to be inserted to the core by natural circulation (RCP's are stopped by operators during a LOCA).
- Revised emergency operating guidelines to minimize likelihood of premature RCP restart.
- Realistic mixing analyses demonstrate adequate mixing of unborated and borated water in the reactor vessel which precludes criticality even if RCPs are restarted.

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EXTENSION OF LEAK-BEFORE-BREAK (LBB) TECHNOLOGY

○ **Issue:**

- LBB technology is generally applicable to a variety of piping systems, but previously approved by NRC for only main Reactor Coolant System piping

○ **Resolution:**

- NRC approval obtained for application of ABB-CE's LBB methodology inside containment to the Reactor Coolant System, Safety Injection System, Shutdown Cooling System, Pressurizer Surge Line, and Main Steam Lines.

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REACTOR COOLANT PUMP SEAL COOLING

⊙ **Issues:**

- ⊙ Reliability of seal cooling during a station blackout
- ⊙ Susceptibility to intersystem LOCA from high pressure seal cooler tube failure through the component cooling water system

⊙ **Resolution:**

- ⊙ Two diverse cooling systems normally operating
- ⊙ Added a highly reliable, diverse charging pump which can be powered from either emergency diesels or the combustion turbine generator
- ⊙ Added overpressure protection to the component cooling water system

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POLICY ISSUES

⊙ **Tier 2***

⊙ **PRA in Design Control Document**

⊙ **DCD/FDA Relationship**

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POLICY ISSUE: TIER 2*

- ◉ **Applied 26 times by NRC staff in FSER to the following items:**
 - ◉ **Code editions**
 - ◉ **MOV design, qualification and testing**
 - ◉ **Equipment seismic qualification methods**
 - ◉ **Piping design methods**
 - ◉ **Fuel and CEA designs and analysis methods**
 - ◉ **I&C design, including software**
 - ◉ **Human Factors Engineering design**

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POLICY ISSUE: TIER 2* (CONT.)

- ◉ **Staff proposes a priori declaration of Unreviewed Safety Question if Tier 2* issue is modified by COL applicant/holder**
- ◉ **NUMARC's alternative proposal is to require COL applicant/holder to notify NRC 60 days prior to invoking 50.59 change.**
 - ◉ **Meets staff intent that important design features not be changed without their foreknowledge.**

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POLICY ISSUE: PRA IN DCD

- ⦿ **Issue is the extent to which the PRA is documented in the DCD.**
- ⦿ **Industry proposes a summary which depicts the agreed upon PRA insights.**
- ⦿ **Industry and NRC Staff are actively interacting on this issue.**

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POLICY ISSUE: DCD/FDA RELATIONSHIP

- ⦿ **Changes to DCD allowed after FDA per Secretary's letter of February 14, 1994**
- ⦿ **This enables staff to decouple DCD from FDA**
- ⦿ **ABB-CE concurs with decoupling DCD from FDA so that schedules can be maintained**

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CONCLUSIONS

- ⦿ **Very high confidence of improved public safety including prevention and mitigation of severe accidents**

- ⦿ **The issuance of the advance copy of the System 80+ FSER without any Open Items represents a major milestone for the U.S. Nuclear Industry.**

- ⦿ **10CFR Part 52, to the extent exercised to date, is working very well.**

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ADVANCED LIGHT WATER REACTORS - U.S. ROLE

- ⦿ **Lead the way on design development**
 - ⦿ **ALWR Utility Requirements Document**
 - ⦿ **Specific Vendor Designs (e.g., System 80+)**

- ⦿ **Lead the way on regulatory approval**
 - ⦿ **Established regulatory criteria and review process**
 - ⦿ **Completed reviews of evolutionary designs**

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ADVANCED LIGHT WATER REACTOR - MARKETS

- ◉ **United States**
 - ◉ Deregulation effects
 - ◉ Environmental effects
 - ◉ Economics of alternatives

- ◉ **Asia**
 - ◉ **Present Market**
 - ◉ Republic of Korea
 - ◉ Republic of China

 - ◉ **Future Markets**
 - ◉ People's Republic of China
 - ◉ Indonesia
 - ◉ Thailand

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