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Meeting Title: Brief by ABB/CE on Status of System 80+ Application for Design Certification

Meeting Date: 3/31/94 Open X Closed ____

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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

Location: ROCKVILLE, MARYLAND

Date: MARCH 31, 1994

Pages: 69 PAGES

NEAL R. GROSS AND CO., INC.

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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

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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

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

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

accident capabilities in doing the evaluation.

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

Commissioners?

COMMISSIONER REMICK: Nothing.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Regis?

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

Doctor Matzie?

DOCTOR MATZIE: (Slide) Next slide, please.

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

(Slide) Next slide. Slide 3, please.

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

(Slide) Slide 4, please.

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

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

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

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

(Slide) Next slide, please.

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

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

(Slide) Next slide, please.

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

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

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

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

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

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

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

DOCTOR MATZIE: Stan, could you help me?

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

COMMISSIONER REMICK: I see. Thank you.

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

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

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

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

(Slide) Next slide, please.

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

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

(Slide) Next slide, please.

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

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

(Slide) Next slide, please.

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

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

COMMISSIONER REMICK: Anything you can say

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

MR. NEWMAN: I plan to cover that later.

COMMISSIONER REMICK: Okay. All right.

DOCTOR MATZIE: (Slide) Next slide, please.

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

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

(Slide) Next slide, please.

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

systems.

(Slide) Next slide, please.

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

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

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

(Slide) Next slide, please.

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

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

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

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

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

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

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

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

DOCTOR MATZIE: When we look at --

COMMISSIONER REMICK: The comparison.

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

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

DOCTOR MATZIE: We initially did a seismic

PRA.

COMMISSIONER REMICK: Oh, you did?

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

COMMISSIONER REMICK: I see.

DOCTOR MATZIE: (Slide) Next slide, please.

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

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

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

DOCTOR MATZIE: Loss of coolant accident.

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

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

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

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

DOCTOR MATZIE: That's correct.

COMMISSIONER REMICK: And therefore --

DOCTOR MATZIE: They must be maintained.

COMMISSIONER REMICK: Be maintained. I see.

DOCTOR MATZIE: That's correct.

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

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

COMMISSIONER REMICK: Okay.

DOCTOR MATZIE: Next slide, please.

COMMISSIONER ROGERS: Just before you leave that --

DOCTOR MATZIE: Yes, sir?

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

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

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

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

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

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

DOCTOR MATZIE: Yes, sir.

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

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

COMMISSIONER REMICK: Okay.

DOCTOR MATZIE: (Slide) Next slide, please.

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

Next slide.

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

DOCTOR MATZIE: Yes, sir.

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

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

COMMISSIONER REMICK: Okay.

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

(Slide) Next slide, please.

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

(Slide) Next slide, please.

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

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

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

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

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

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

Next slide, please.

COMMISSIONER ROGERS: Just before you leave that --

DOCTOR MATZIE: Yes, sir.

COMMISSIONER ROGERS: Could you say just

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

DOCTOR MATZIE: What we did --

COMMISSIONER ROGERS: What's the emphasis?

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

COMMISSIONER ROGERS: Good.

DOCTOR MATZIE: (Slide) Next slide, please.

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

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

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

(Slide) Next slide, please.

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

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

Next slide, please.

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

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

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

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

COMMISSIONER REMICK: Okay.

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

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

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

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

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

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

COMMISSIONER REMICK: I see. Okay.

DOCTOR MATZIE: (Slide) Next slide, please.

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

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

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

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

(Slide) Next slide, please.

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

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

DOCTOR MATZIE: On the reactor coolant

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

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

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

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

MR. RITTERBUSCH: He has to load it manually.

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

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

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

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

Lag?

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

COMMISSIONER REMICK: Yes.

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

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

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

DOCTOR MATZIE: Yes, sir.

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

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

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

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

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

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

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

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

COMMISSIONER ROGERS: I don't either.

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

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

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

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

CHAIRMAN SELIN: Without talking to us first.

COMMISSIONER ROGERS: Well, yes.

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

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

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

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

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

DOCTOR MATZIE: And I think that's fine.

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

DOCTOR MATZIE: Without having reviewed it.

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

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

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

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

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

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

but you would include some higher level such as the insights

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

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

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

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

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

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

DOCTOR MATZIE: Yes, sir.

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

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

CHAIRMAN SELIN: Right.

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

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

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

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

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

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

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

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

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

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

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

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

DOCTOR MATZIE: That's right.

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

COMMISSIONER REMICK: Sure.

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

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

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

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

CHAIRMAN SELIN: That's true.

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

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

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

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

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

DOCTOR MATZIE: My turn to talk again?

CHAIRMAN SELIN: Yes, sir.

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

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

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

DOCTOR MATZIE: Extremely remote.

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

DOCTOR MATZIE: Thank you, sir. That --

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

CHAIRMAN SELIN: Right.

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

DOCTOR MATZIE: Yes, sir.

(Slide) Slide 29, please.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MR. NEWMAN: The process did not do that.

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

DOCTOR MATZIE: That's correct.

COMMISSIONER REMICK: It's an improvement

that you thought was important, I think.

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

CHAIRMAN SELIN: Mr. Newman?

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

CHAIRMAN SELIN: And into 80+?

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

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

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

CHAIRMAN SELIN: Okay.

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

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

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

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

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

sorry.

CHAIRMAN SELIN: Licensing.

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

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

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

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

MR. NEWMAN: That is correct.

COMMISSIONER REMICK: It is?

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

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

If I could have the next slide, please.

COMMISSIONER REMICK: Any plans for

marketing in Europe?

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

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

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

DOCTOR SLEMBER: No, it will be ABB-

Combustion.

MR. NEWMAN: It will be us.

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

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

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

will have to come up to.

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

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

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

CHAIRMAN SELIN: Dick, we go back to you.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

COMMISSIONER de PLANQUE: Okay.

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

COMMISSIONER de PLANQUE: On your own design?

DOCTOR MATZIE: Yes, sir.

COMMISSIONER de PLANQUE: Okay. Fine.

DOCTOR MATZIE: Yes, ma'am.

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

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

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

DOCTOR MATZIE: Yes, it does.

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

DOCTOR MATZIE: Thank you.

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

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

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

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

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

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

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

DOCTOR SLEMBER: Thank you.

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

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 transcript is a true and accurate record of the foregoing events.

Reporter's name: Peter Lynch

ABB PRESENTATION TO NUCLEAR REGULATORY COMMISSION

March 31, 1994
Rockville, MD

ABB

abb:nrc31Mar94

AGENDA

Topic	Speaker
Introductory Remarks	Dr. Richard J. Siember 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. Siember

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abb:nrc31Mar94

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 MITIGATIION 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

ABB

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

ABB

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

ABB

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 unaubigious 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.

ABB

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.

ABB

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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