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# NUCLEAR REGULATORY COMMISSION



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# D I S C L A I M E R

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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BRIEFING BY GE ON NEW STANDARDIZED PLANTS

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PUBLIC MEETING

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Nuclear Regulatory Commission

Room 1130

1717 H Street, Northwest

Washington, D.C.

TUESDAY, JANUARY 26, 1988

The Commission met in open session, pursuant to notice, at 2:00 p.m., the Honorable LANDO W. ZECH, Chairman of the Commission, presiding.

COMMISSIONERS PRESENT:

LANDO W. ZECH, Chairman of the Commission

THOMAS M. ROBERTS, Member of the Commission

FREDERICK M. BERNTHAL, Member of the Commission

KENNETH ROGERS, Member of the Commission

STAFF AND PRESENTERS SEATED AT COMMISSION TABLE:

S. CHILK

M. MALSCH

B. WOLFE

D. WILKINS

J. QUIRK

P R O C E E D I N G S

CHAIRMAN ZECH: Good afternoon, ladies and gentlemen. Commissioner Carr will not be with us this afternoon.

This afternoon the Commission will be briefed by representatives of the General Electric Company, led by Dr. Bertram Wolfe, Vice President and General Manager, and Dr. Daniel Wilkins, General Manager of the Advanced Boiling Water Reactor Program.

The presentation by these representatives of the General Electric Company will provide a status on their progress to certify an advanced boiling water reactor.

Today's meeting is a follow-up to a meeting held on April 30, 1987. It is my understanding that since that time the NRC staff has worked with representatives of the General Electric Company to develop a licensing review basis for the staff review of the advanced boiling water reactor final design approval and design certification application.

Additionally, General Electric has begun to submit design information to the staff and the NRC staff have started their review of these submittals.

The General Electric Company, I understand, is continuing to work with the Tokyo Electric Power Company, known as TEPCO, to develop a lead plant, and the Commission will be briefed today on the status of that activity.

This is an information briefing and no formal

Commission vote is anticipated today.

Do any of my fellow commissioners have any opening remarks to make?

[No response.]

If not, Dr. Wolfe, would you like to proceed?

DR. WOLFE: Thank you, Chairman Zech. It is a real pleasure to be here again.

This is our third meeting and I am happy to be able to report that I think the program is on track, that as you indicated, the NRC has produced the ground rules for the review, we have made our initial milestones by submitting the first several chapters to the NRC, and I think you will get a more detailed report on this from Dr. Wilkins.

Let me just, as background, indicate again that we think this is a unique opportunity for all of us to provide a meaningful nuclear option to the United States. It is uncertain in my mind whether new plants would ever be committed under the present arrangements, and this is a way to develop a meaningful option for the United States.

And I think it is fortunate that the timing of this comes at the time that the advanced boiling water reactor is being moved into detailed design in Japan and has been committed by the Japanese for operation in the mid 90's.

That is a design that incorporates the best of the boiling water reactors from the United States, Europe and

Japan.

As you know, we started this in 1978 and we are just reaching now the final detailed design on that project.

There has been some $250 million of development work that has been spent by General Electric and the Japanese in providing the basis for that design.

So, we are very enthusiastic about the design. And in terms of the licensing activities that we are here discussing, it provides a vehicle to license a real plant with substantial detailed technical back-up to it. So, it is not a nebulous conceptual design.

And the timing of this review and the timing of the Japanese licensing is such that, fundamentally, in the 1990-1991 period we will have a detailed design, an establishment permit in Japan, at the same time hopefully that we will be able to have a certified design in the United States.

So, these two programs, I think, will be complimentary, help each other, and build upon the large investment and the detailed work going on in Japan.

I think it supports your policy, as you have indicated, Chairman Zech, on standardization and certification. And I have got to reiterate again that General Electric and I personally believe that is the way to go in this country.

So, just to summarize before Dan provides a more detailed review, we think we are off to a good start. The NRC

has made its schedule in terms of the Licensing Basis Agreement. We have made ours in terms of submissions. We are going to submit our next set of chapters in March, and we think we will make those.

Nevertheless, I should just iterate that I think it is going to take dedication on your part and our part to finish this. It is not a trivial task. We both, from a management standpoint, are going to have to support our people in getting it done.

And I just would end on a note that, as I look at the energy situation, the increased upping of imported oil, the environmental issues with all of our energy sources, the atmospheric pollution, the acid rain, the greenhouse effect, the ozone hole, the question of oil supply, it seems to me we have an obligation to make nuclear a viable option. And I think this program really is the way to do it.

So, with that, if there are no questions, I would turn it over to Dan, who will give you a more detailed review of where we stand.

CHAIRMAN ZECH: Thank you very much.

Dr. Wilkins, you may proceed.

DR. WILKINS: Thank you.

If I may also say, I am very pleased to be here to give a status report on the program. It is always a pleasure to give status reports when the program is basically on track.

And so I am particularly happy today to give you a report.

[Slide.]

As Dr. Wolfe mentioned, we at the present time have no problems and are not looking for any decisions from the Commission. And so, we are here really to give you information on the status of the program and seek your reaction to the work we have done to date and any guidance you would care to give us for where we go from here.

The topics that I will be covering are summarized here.

I will give a very quick background to remind you of some of the things we have reported in the past at these meetings, give you a status on the project in Japan and where we see that going, and then spend the rest of my time on the status of our certification program here in the U.S., the ACRS review.

I know that the scope issue is one that you have a great interest in and I would like to say a few words about that, and then talk a little bit about what may lie ahead of us a couple of years out that I think we need to do some front end thinking on in terms of the design certification process which would follow the review.

[Slide.]

In the way of background, the ABWR is a large plant. It is 1,350 megawatts.

It was put together by an international design team with the mission of bringing together the best boiling water reactor features from the plants in Europe, the U.S. and Japan, and putting the best of the proven features together in a single advanced design.

It has relied very heavily on proven technology and all of the features in the ABWR have either been proven through service in existing plants somewhere or have been thoroughly tested through the testing program that we have carried out over this eight year time period and with the substantial investment.

The objectives of the ABWR were to improve everything at the same time, the operability, the capacity factor, reliability, and at the same time to reduce costs and the occupational exposure and rad waste.

So, we really tackled the problem on all fronts and I think we have been quite successful in making significant improvements over the current generation of plants in all of those areas.

[Slide.]

I won't go over the design today because we discussed it in some detail at a previous meeting. But I have included in your package a diagram of the design.

And maybe I could just highlight that the key new features of this design relative to current generation plants

are the internal recirculation pumps, which are mounted on the vessel, which replace the external recirculation loop on our current plants.

It has a new control rod drive, that we call a fine motion control rod drive, which can be inserted both hydraulically and electrically. So, it has got a diversity of function there which is a significant improvement.

We have gone to the advanced solid state digital electronics for both safety and non-safety systems, to achieve a great improvement in reliability.

The reactor building and containment is a structurally integrated design which provides a greater seismic capability, a much more rigid structure from a seismic point of view.

And we have engineered the plant so that all of the equipment has a planned maintenance plan and the necessary servicing facilities, equipment and service rooms, where necessary, in order to maintain the equipment and carry out the necessary inspections and routine maintenance.

So, those are the highlights. I won't go into the design further here unless you ask specific questions.

COMMISSIONER BERNTHAL: If you would go back to the previous slide, I gather what looks like an unusually long run of piping system there is because all of the pumps are inside.

DR. WILKINS: You are speaking of the yellow or

orange pipes there?

COMMISSIONER BERNTHAL: Yes, exactly. Since all of your pumps and whatnot are inside, then you essentially go directly from the vessel through containment into the steam generators.

DR. WILKINS: That is correct. But that is not different than current plants. That piping would be essentially the same.

COMMISSIONER BERNTHAL: Except the pumps are outside. It just has a different appearance here because of the absence of very much hardware, pumping hardware outside.

DR. WILKINS: Yes. There is much less piping within the containment in this design than in the current ones.

COMMISSIONER BERNTHAL: Right. Okay.

DR. WOLFE: Those go straight to the turbine.

COMMISSIONER BERNTHAL: Yes, I see that. It is very simple in that respect.

Go ahead. That was just an observation.

DR. WILKINS: Okay.

[Slide.]

As Dr. Wolfe has mentioned, the lead plants are proceeding in Japan, and I am going to talk a little more about the specifics in that area.

And in parallel, we are proceeding with the design certification effort here in the U.S.

This is a program that is jointly supported by the Department of Energy and General Electric, and again to provide the U.S. with a viable nuclear option in the 90's.

CHAIRMAN ZECH: Are there any significant design changes between the plant being built in Japan and the design you are submitting for certification?

DR. WILKINS: They are essentially the same. There are some differences in practices in Japan versus what we do here in the U.S., and we are struggling mightily to keep them as identical as possible. But I am sure, when we are done, there will be a few differences.

CHAIRMAN ZECH: Well, you are discussing those with our staff, too, I presume.

DR. WILKINS: Absolutely, yes.

CHAIRMAN ZECH: All right.

DR. WOLFE: These are just because some of the Japanese standards, seismic standards are just implemented slightly different than ours. And so, we have to make sure that they meet our standards here and the Japanese standards.

CHAIRMAN ZECH: Yes.

DR. WOLFE: So, those are the kind of things we have to be aware of.

CHAIRMAN ZECH: I would just ask that you be sure and point out specifically all those differences to our staff, with the rationale. That will be helpful.

Thank you.

DR. WILKINS: We are very pleased that the Japanese are as eager as we are to keep the two designs as close together as possible.

CHAIRMAN ZECH: Excellent. Yes, we are going to really get standardization, maybe.

DR. WOLFE: That is the aim.

CHAIRMAN ZECH: Okay. Good.

DR. WILKINS: And I might say along that line, we understand that the staff is in contact with the regulatory body in Japan.

CHAIRMAN ZECH: Yes, I am aware of that. And I think we have a very close and profitable professional relationship. But I just would ask that in order to close the loop all the way around, that you make sure that any differences in design, specifically, or practices be pointed out to our people, too.

Thank you. You may proceed.

DR. WILKINS: The certification effort, of course, is underway.

The major event since we were here last was the staff issuing the licensing review basis, which I will talk a little bit about.

We have made our initial submitting on our safety analysis report and the review by the staff has begun. And our target is to complete this program in 1991.

And as Dr. Wolfe mentioned, this is the third meeting we have had here with the Commission.

[Slide.]

Tokyo Electric Power in 1987 announced its plans to proceed with the two lead advanced BWR units in Japan. Those will be built at the Kashiwazaki site, as Units 6 and 7 on that site. That site will be an 8,300 megawatt boiling water reactor site. And these will be the last two units on that site.

The licensing application is just about to go forward in Japan. The first unit is scheduled for commercial operation in 1996, with the second one two years later.

Also in 1987 TEPCO announced that the plants would be built by a joint venture of General Electric, Hitachi and Toshiba. And within that joint venture, GE was selected to supply the nuclear steam supply systems, the fuel and the turbine generators for those lead units.

So, GE has the major first-of-a-kind scope responsibility on those lead plants.

CHAIRMAN ZECH: Who is going to perform the architect/engineering for the balance of plant?

DR. WILKINS: Hitachi and Toshiba will carry out that work.

CHAIRMAN ZECH: Have you discussed with them the possibility of some kind of a standardized balance of plant

also?

DR. WILKINS: Let me hold that question until I come to the scope question. But the answer is, yes, we have a standard nuclear island design where all of the nuclear parts of the plant, not just the nuclear steam supply, but the entire reactor and control buildings and everything in it are going to be standard.

CHAIRMAN ZECH: Okay.

DR. WILKINS: I think we intend to do them the same here in the U.S. as in Japan.

CHAIRMAN ZECH: Good. That is what I was going to ask you next. Is there any reason we should not develop a proposed certified design for the balance of plant? You are doing that?

DR. WILKINS: We are doing the entire nuclear island.

CHAIRMAN ZECH: No, I don't mean the nuclear island. I mean the whole balance of plant, including the nuclear island as well. Are you doing both? That is my question.

DR. WILKINS: In the scope of the certification program at the present time is the nuclear island. But let me clarify what I mean by the nuclear island.

It includes everything of safety significance. It has --

CHAIRMAN ZECH: The condensers, the turbines?

DR. WILKINS: No.

DR. WOLFE: We discussed this the last time. The part that is missing in the detail -- all the interface information is there. The turbine island and the rad waste systems are presently not part of this design. And that has to do with relations in Japan and also with DOE funding concerns, as well.

CHAIRMAN ZECH: But is there any reason it couldn't be certified as a balance of plant design?

DR. WOLFE: Well, I don't think there is any reason it couldn't, and our intent is to try and make it such. And this is the same discussion we had before, and really we are funding -- we have two problems.

One is, those particular items involve different scopes in Japan than we have been working with, than GE, Hitachi and Toshiba cooperate on. That is, the turbine island is something separate from the normal plant that we work with them, as is the rad waste system.

CHAIRMAN ZECH: Yes, I know. And we did indeed have the same discussion the last time.

DR. WOLFE: Yes. And then secondly, we are, just in terms of funding, looking to see in the future with DOE whether we could not take a design here in the United States and make that part of this overall design.

CHAIRMAN ZECH: You know, there are many of us that have a strong interest in making the balance of plant as

standardized as we possibly can. Some feel we should make mandatorily standardized.

DR. WOLFE: Yes. You won't get an argument on this side of the table. It is really a matter of practicality, of figuring out how we can do it.

CHAIRMAN ZECH: Okay. Well, I am glad you are still keeping it in mind.

DR. WOLFE: As my DOE friends will tell you, we keep it in mind and we are having discussions with the Japanese.

CHAIRMAN ZECH: Good.

DR. WOLFE: Dr. Wilkins is going over there next week to talk about the rad waste system and the turbine system, hopefully, afterwards.

CHAIRMAN ZECH: Fine.

COMMISSIONER BERNTHAL: I think that the rad waste system is one thing, but I think the Chairman's point is that certainly the turbine system and the turbine hall, unless it is designed in such a way that it cannot lead to a trip of the nuclear steam supply system, a trip of the reactor, and therefore, in principal, indirectly affect the safety of operations, that then one would prefer that be included in the standard design.

Now, maybe you are rigging up a way that that is absolutely isolated from interaction with the steam supply.

DR. WOLFE: Well, we are putting interface

requirements on it which, in effect, in principle, do that.

COMMISSIONER BERNTHAL: Yes.

DR. WOLFE: But I won't argue with Chairman Zech, that it would be more desirable if we could come out with a final design of the complete plant. And that is something that we are working towards, but it has some practical financial difficulties right now.

CHAIRMAN ZECH: Okay. I would say, please keep working towards that.

DR. WOLFE: Absolutely.

CHAIRMAN ZECH: I think it really is important. The balance of plant and the steam supply system, as far as I am concerned, should be considered as one unit. For too long they have been considered separately.

In my view, the balance of plant can contribute to safety and can contribute to better reliability of operations, and we should stop thinking of them separately, in my judgment, and think of the whole plant as the nuclear power plant.

DR. WOLFE: Yes.

CHAIRMAN ZECH: And I appreciate your working in that direction.

DR. WOLFE: I don't disagree with you.

CHAIRMAN ZECH: And I hope you will continue.

DR. WOLFE: I will point out that except for the turbine building and the rad waste, which is a separate system,

we do have a complete balance of plant. We are not talking about just the NSSS supply, but the complete --

CHAIRMAN ZECH: I understand.

DR. WOLFE: But this is not intended to argue with you.

CHAIRMAN ZECH: As Commissioner Bernthal has pointed out, maybe if you can get the turbine inside the thing, it would make us feel better. And we would be able to go for the rad waste system later.

DR. WOLFE: Okay.

CHAIRMAN ZECH: All right. Let's go.

DR. WILKINS: Let me maybe add that we have to do what we are doing right now, even if we take the second step later. So, we are clearly, clearly going down the road that will get us there.

CHAIRMAN ZECH: I appreciate the fact and I honestly believe you are moving in that direction, and I respect that and I appreciate it.

I really very strongly feel we should continue that movement, and I think GE has made a commitment to do that, Dr. Wolfe, if I understand you correctly.

DR. WOLFE: Right.

CHAIRMAN ZECH: All right. Thank you very much. You may proceed.

DR. WILKINS: Let me say that we are particularly

excited about this project moving forward in Japan, and particularly with the selection of General Electric to provide these first-of-a-kind systems and equipment.

Tokyo Electric Power Company, for those of you who may not know, is the world's largest private utility. They have a very large nuclear program with 17 boiling water reactors in various stages of operation, construction or planning, and are very experienced, sophisticated buyers of quality and technology.

So, we were very pleased to be selected for this role in that program in Japan, and we think it will very much support what we are doing here in the U.S.

[Slide.]

On the next chart I have summarized the licensing schedule for the ABWR in Japan and compared it with our schedule here in the U.S.

The main point is that the schedules are practically identical.

We began here late last year with the initial submittal on our safety analysis report. The submittal in Japan will take place early this year.

The establishment permit is scheduled to be received in Japan in 1990, and our schedule here calls for a final design approval in 1990, with then the legal steps of certification taking place and being completed in '91.

So, it is a very parallel schedule with good opportunities for communication back and forth between the U.S. and Japan, and hopefully the opportunity to keep these two designs as standard as we can possibly make them.

DR. WOLFE: I might just throw out a challenge for all of us. There is absolutely no doubt in my mind that the Japanese plant is going to be licensed in 1991 and go into operation in 1996. Our experience over there is when we hit a schedule, we make it. And I think that has not been our history in this country.

So, it gives us all a challenge, you, we and your staff out there, to see if we can match the Japanese on this kind of a schedule.

CHAIRMAN ZECH: Well, let me just point out, there is a very significant difference in their procedures, as you well know.

In Japan, they get all their planning and all their -- what you might call preliminary discussions, and community involvement and all that done ahead of time, before they start building. And then once they start building, they build, and they build it fast, as you well know.

The problem we have, of course, in our country is we don't do it that way. We don't finish up front enough.

Now, that is my interest and others' interest in going to standardized designs, to get the design finished up

front so everybody knows what it is going to be, get the site selected up front. And as our legislative proposal suggests, go to single stage licensing rather than two stage like we have now.

And Japan essentially does those things. They have your design completed essentially up front. They have the site selected up front. That is all resolved. And they have their hearing process, as they do it, all completed essentially up front.

Now, if we did that same thing, in my judgment, we could build in our country just as fast as they do.

Don't you agree, Dr. Wolfe?

DR. WOLFE: I agree with you. And I am just saying, if I look at that schedule, where we are trying to do just what you said, I think the challenge for us is to hit the licensing schedule, not the construction schedule.

CHAIRMAN ZECH: It is a challenge for us, too. But I am saying, we operate under different rules which, as you well know, we have tried to change on this Commission for some time, and unsuccessfully I might add.

But it is very important that we do make those changes and get a standardized design, so we are not talking about an uncompleted design up front, get a pre-selected site and get single stage licensing. In other words, make all the decisions up front that we possibly can.

Then, in my view, we can move ahead, and there will be some predictability and stability to the whole process. That is important for us, and we have not achieved that yet. We are still striving to do that.

But it is important that we get there, in my view, if there is going to be a future in our country of nuclear power.

DR. WOLFE: I was merely trying, while you were here and your staff is there and my staff is here, to make the point that in this licensing effort, it is really our staffs that are going to be doing the major work.

CHAIRMAN ZECH: You are absolutely right, and I am agreeing with you. I am just saying that there are differences in our systems.

DR. WOLFE: Absolutely.

CHAIRMAN ZECH: That doesn't mean we are not going to work together and do what we can, because we are. But the Japanese do have a different system.

And I think, frankly, we would be better off if we made more decisions up front in the whole process. Then I think we could work closely and have a more predictable licensing process.

DR. WOLFE: I agree.

CHAIRMAN ZECH: But certainly we are going to work very closely, and I agree with you, to challenge our staffs. I would do the same thing.

COMMISSIONER BERNTHAL: I am going to take advantage of this subject having been opened here, and I am sure by now you wish you had never brought it up.

[Laughter.]

But I agree with what the Chairman is saying, and I agree with you, too, that in this instance where you are trying to develop the regulatory process for a new generation plant, there we have to look for analogies some years back in this agency. We haven't done this in a long time.

And while I would maintain, and I think the Chairman would maintain, that this system is substantially matured and more prepared to deal with that situation, I have got to tell you, as long as the industry in this country continues to focus on this mythology that it is the NRC that caused so many of these plants to take so long, they will continue to look for the enemy where it ain't, in my judgment.

St. Lucie 2, River Bend, although it wasn't inexpensive, nevertheless was built in five or so years, have demonstrated that there is an NRC under which a plant can be built in four or five years in this country.

Now, why the others aren't remains to be determined, I would say. But I think I know why they aren't, and I am not sure all the answers are to be found in this agency.

DR. WOLFE: Well, I thought I was very, very careful to mention both of our staffs.

COMMISSIONER BERNTHAL: I realize you didn't intend to imply that, and I would agree with you, that this is a rather different matter.

But after we have established the licensing procedure here and after you and our staff have done this difficult front end work, then the question of whether a plant can be built based on that licensing procedure in four or five years, I would suggest, lies more with the industry and how well they can organize themselves than it does with this agency. And I think we have had demonstrations of that in this country in the last few years.

DR. WOLFE: I think we are all looking forward to that challenge. That is, the building of one of these on a standardized basis. I am just trying to get to the point where we try to go through the certification licensing basis, so that we could consider building one of them.

So, I think we are all saying the same thing, frankly.

COMMISSIONER BERNTHAL: Yes, I agree.

CHAIRMAN ZECH: We are saying the same thing. We are just trying to -- we are just expressing a little frustration with our process, and I think that is probably very understandable.

But your point is well taken. Both of our staffs must continue to work together.

DR. WOLFE: Right.

CHAIRMAN ZECH: And I assure you ours will, and I know yours will, too.

You may continue.

DR. WILKINS: Okay. Let me assure you the staffs have been properly challenged.

CHAIRMAN ZECH: I am sure they have. And I am sure here they have been challenged, and I know they take up the challenge, too.

[Slide.]

DR. WILKINS: This chart shows the schedule for our certification program.

The vertical red line is January 26, and everything to the left of the line is done.

We are on schedule with the licensing basis having been issued by the NRC staff last year.

Our submittal of our first module on the safety analysis report went in last fall, and is now under review. The next module is scheduled for, I believe, March and is on track and we intend to meet that schedule.

You can see looking out into the future that by the end of this year, we will have submitted the entire safety analysis report. And then, on through 1989 the review process continues with, hopefully, the ACRS review completed and the staff review completed and a final design approval in 1990.

[Slide.]

Let me talk a little about the licensing review basis which was issued by the NRC staff in August of 1987.

This was a document that we requested from the staff for the purpose of defining the review process and the acceptance criteria in some key technical areas where we wanted to have a good understanding of the ground rules going in, so that we would be able to efficiently apply our resources and the staff's resources.

I think this document really has helped the program a great deal. It does define the process and the acceptance criteria in areas where we felt they were not sufficiently clear from our perspective, and at the same time it does recognize that new requirements may be established by the NRC in the course of the review, and we will respond to those as that may happen.

So, it is not an attempt to close off all flexibility for future issues that may come up. But on the other hand, for the issues that are on the table and known today, it establishes an approach that, at least going in, we, both the staff and GE, feel comfortable with, that we understand what we have to do and can get on with it.

COMMISSIONER BERNTHAL: I notice that you presume rulemaking in the design certification process. And there has been some debate and discussion about whether that would best

be done by rulemaking or by a different process.

Do you have an opinion on that? Would you care to comment?

DR. WOLFE: I think the rulemaking was intended to be generic.

COMMISSIONER BERNTHAL: I see.

DR. WOLFE: Rather than to specifically indicate the legal rulemaking. And I think that is something we have to -- it is really your responsibility. We would like to work it out with you.

COMMISSIONER BERNTHAL: You haven't taken a position on that?

DR. WOLFE: No, we haven't. I would hope that we could avoid some of what I think are wasteful practices in the present licensing hearings and do something on a more rational basis. But we have not made a specific suggestion right now.

COMMISSIONER BERNTHAL: I certainly agree that we should seek something rational.

DR. WOLFE: Right.

COMMISSIONER BERNTHAL: But that is a matter, a decision, I should say, that is hard upon us here in the near future. And whatever path is chosen, it seems to me terribly important that that path provide, for your security and the security of the potential licensees, a design that has had all of the arguments fully dealt with. Because if you don't deal

with it in this litigative form, then you are going to deal with it in the courts, and that is exactly what you don't want to end up having to do.

DR. WOLFE: Well, I agree with that and I think clearly we have to make it possible for anyone who has public input to put it in, in a sensible way. I think clearly what we want to avoid is the kind of wasteful procedures where there is so much paper and so much said that isn't relevant, that when you look at a record at the end of a hearing you can't even understand what went on. I think all of us can point out to specific cases like that.

COMMISSIONER BERNTHAL: Okay. Go ahead.

DR. WILKINS: The licensing review bases has established the procedural approach in areas such as schedule, the modular submittal approach. We have defined the modules and the schedule for them.

We have addressed and come to grips with the level of design detail that we will be submitting. And this is an area we have had to approach carefully because on the one hand this is a standard design that we want to be able to have certified, on the other hand we don't want to preempt the ability to buy a pump from one or another vendor in the future.

And so, we have had to structure the level of detail so that we can satisfy all the proper regulatory needs for information but at the same time not get ourselves into

antitrust problems or problems with procurement in the future. And I think we have found an approach to that area that will be successful.

We have laid out the process and plans for the ACRS participation and that, as I will come to in a minute, is well underway.

And we have begun to think about the certification process, although, as I will say later, that is an area that lies in front of us, to really understand what the steps and process is in that area.

We tried in the licensing review bases not to ask for up front decisions on a lot of technical issues, because that is fundamentally what the review process itself will take care of.

On the other hand, there were a few areas that we did want to establish some acceptance criteria going in, and they are listed here.

We have settled a PRA methodology and we will, through our PRA effort, bring in a design that shows a core damage probability of less than 10 to the minus 5th per year, and less than 10 to the minus 6th per year for a major off-site release, which we defined as 25 rem.

So, these are criteria which we will use as a yardstick in evaluating the design within GE before we bring it in, and then which the staff will get out its yardstick and

measure the design against. And these are ambitious objectives but I think this design can meet them. I think they are achievable.

CHAIRMAN ZECH: It is my understanding that the design will incorporate some advanced systems, such as fiber optics and multiplexing with solid state electronics.

DR. WILKINS: Yes.

CHAIRMAN ZECH: What kind of a testing program do you have for these advanced systems?

DR. WILKINS: Many of these systems are already in operation in plants in Japan, some here in the U.S., but never on a comprehensive and integrated scale that we are talking about here.

But I don't think there is anything here in these designs that hasn't already been done certainly in other industries, and in many cases within the nuclear industry.

CHAIRMAN ZECH: Okay. Well, I know you will want to look at this carefully, as will our staff as part of the review process.

DR. WILKINS: This was another area I think the licensing review bases has been particularly helpful, because we have all tended to work in the past with analog type systems.

CHAIRMAN ZECH: Right.

DR. WILKINS: And the question of what should we be

submitting and what does the staff need to review was an area with a lot of uncertainty. And we have sat down with the staff and have laid out -- and it is defined in this review bases document -- a plan.

We know what the staff expects us to bring to the table and now we can go off and do that.

CHAIRMAN ZECH: Well, it is a new area, essentially, and that is why I bring it up. We want to look at it carefully.

DR. WILKINS: Yes.

CHAIRMAN ZECH: The testing in these advanced systems is particularly important to give us all the assurance that the systems will work properly and certainly will perhaps contribute to improved safety.

But in any case, we have got to be assured with some degree of confidence that they are going to adequately perform the tasks that we expect them to perform.

COMMISSIONER BERNTHAL: I suspect that the underlying technology in most cases has been by now, and certainly will be in a few years, pretty thoroughly tested in the communications industry and elsewhere, and in the communications industry particularly, where an extremely high degree of reliability is demanded.

Now, whether they are all tested at the same power levels that we might be talking about here -- I am talking

about electronic power levels now -- is perhaps another question.

DR. WOLFE: A lot of the features of this instrumentation is that it is self testing, in a sense.

COMMISSIONER BERNTHAL: That is right.

DR. WOLFE: It has got duplicative parts to it which continually self test.

COMMISSIONER BERNTHAL: If it goes wrong, it is really wrong. It is not a question of incrementally wrong.

DR. WOLFE: That is right.

COMMISSIONER BERNTHAL: At least the odds are it is really wrong.

DR. WOLFE: But it will take -- as part of work certainly in Japan on these first two, it will be an overall system test. And as Dr. Wilkins pointed out, most of the technology has been tested on an individual basis.

CHAIRMAN ZECH: All right. Thank you. You may proceed.

COMMISSIONER BERNTHAL: I just wanted to also applaud your objectives here. I will applaud more when you demonstrate that you have achieved them, for core damage frequency and frequency of what I gather is a large release, which appears to be keyed to the rather stringent criterion.

We don't know exactly yet what the Commission will decide on this, but 25 R looks to be in the neighborhood of

what we may choose around here for an extraordinary nuclear occurrence criterion.

And I applaud the fact that your objective is to be able to meet that fairly -- well, more stringent criterion, really, than the Commission has discussed up to this point.

I want to ask one question, however, which you are probably all prepared for, because I ask it every time.

At what confidence level, then, do you expect the core damage frequency to exceed, or I should say to be below 10 to the minus 4 per year?

You have said that your expected value is 10 to the minus 5. At what confidence level do you come in at 10 to the minus 4?

DR. WILKINS: I don't have that information.

DR. WOLFE: That is the next meeting.

COMMISSIONER BERNTHAL: Well, I would hope it is at least 95 percent. That, I think, is worthwhile. Because if you say 10 to the minus 5 and you have two orders of magnitude uncertainty within a 10 percent confidence level, that isn't quite as --

DR. WOLFE: Let us try to respond to that after this meeting.

COMMISSIONER BERNTHAL: Okay.

CHAIRMAN ZECH: All right. You may proceed.

[Slide.]

DR. WILKINS: The safety analysis report, the first module which was submitted in September, included the reactor and fuel, the safety systems, and the transient and accident analysis.

So, the major portions associated with the nuclear steam supply system have been submitted, and in the future we will be bringing in the additional modules associated with the rest of the nuclear island.

We have had one major round of presentations and meetings with the staff in October.

The questions from the staff on this first module are scheduled to come to us by the end of the month, and in fact we already have a major portion of those questions. So, we are already at work preparing answers. And the next module will go in in March.

[Slide.]

We have, since the beginning on this program, had an active dialogue with the ACRS underway. We began early in 1987.

We have had now one subcommittee and three full committee meetings with the ACRS, including one earlier this month. And the schedule is set for a continuing dialogue with the ACRS as we go down this road.

We are listening carefully to what the ACRS has to say and responding to it in the design.

[Slide.]

On the next few charts -- I won't try to go through these in detail, but I wanted to give you a picture of how we stack up against the ACRS recommendations.

You may recall that the ACRS has written a letter which lays out their thinking on the requirements for future light water reactors. Their letter was not intended to be prescriptive. In their preamble, they very clearly said that here is a list of potential items we would like to see in the next generation of plants, and they recognized that it may not be appropriate to do all of them because there is some overlap between them.

But nevertheless, I thought it was a very good effort, that the ACRS did lay out its thinking, and it was independent thinking. It was really produced before any of the dialogue took place with GE on the ABWR.

And as we go down that list, there were 12 specific recommendations in their letter.

The advanced BWR incorporates, I would say, on the order of 90 to 95 percent of the items that the ACRS put on that list.

I know that letter has been referred to as a camel letter, where it has many requests coming from many different quarters. But on the other hand, as we look at it, the ABWR really stacks up very well next to it and we don't consider the

ABWR to be a camel.

So, we think it looks like a very good meeting of the minds there.

They put in their first recommendation a very strong request for dedicated, protected decay heat removal systems with independent power, fuel, water supplies, physical separation, and with good seismic capability.

And in the ABWR we have separated the plant into quadrants, and in three of those quadrants we have redundant decay heat removal systems, each with their own electricity and water supply and essentially completely redundant independent systems. And they are physically in different parts of the building, physically separated by walls.

So that we have really been able to comply very well with that request.

The only thing we did not do is our systems are operable from the control room, whereas the ACRS had called for a system that could not be turned off from the control room, presumably for sabotage considerations. And so, we did almost everything.

[Slide.]

They called for the N minus 2 or N plus 2 safety train redundancy, and the ABWR has that capability except for one fairly remote event. So, we have essentially met what they were after in that area.

COMMISSIONER BERNTHAL: What is the low probability event?

DR. WILKINS: If I recall, it is a break in one particular ECCS line followed by the failure of two diesel generators. And for that one particular break, we don't have the N plus 2 redundancy. But that is only one out of literally, what, 400 different events.

CHAIRMAN ZECH: How many diesel generators do you need to assure you can remove decay heat?

DR. WILKINS: We have three, and one would --

CHAIRMAN ZECH: One will do it?

DR. WILKINS: Yes.

MR. QUIRK: For removal of decay heat, we have three. To meet the license design basis, we need two of three. To evaluate that realistically in taking credit, we can use one in three.

CHAIRMAN ZECH: Can you tell me briefly what you mean by evaluating realistically and taking credit?

MR. QUIRK: Using realistic assumptions and capabilities we know the equipment has and applying realistic acceptance criteria, as opposed to the conservative regulatory limits.

CHAIRMAN ZECH: Under the realistic conditions, you say you should be able to get by with one?

MR. QUIRK: Yes.

CHAIRMAN ZECH: Two are needed in order to meet perhaps what you might term extraordinary circumstances that we require for the design basis?

MR. QUIRK: That is right. An example would be to get down to, say, 125 degrees within a certain period of time, you would need two out of three. To get to 212, you would need one.

CHAIRMAN ZECH: To keep it in a safe condition, you could do it with one?

MR. QUIRK: Yes.

CHAIRMAN ZECH: How about water supply?

MR. QUIRK: With water supply, we can take in minus 2 and meet conservative --

CHAIRMAN ZECH: No. I mean how about the available water supply?

MR. QUIRK: Well, we have an internal source inside the containment, which is our suppression pool. We have a condensate storage tank which can also be aligned to provide a source of make-up water. And, of course, we have the normal make-up.

CHAIRMAN ZECH: But in this design, this advanced design, is there any additional or new type of water supply that you don't have in the current plants?

MR. QUIRK: No. We really did overwhelm that in our earlier designs and we are retaining that feature in this

design.

CHAIRMAN ZECH: Okay. Fine. Thank you. Please proceed.

DR. WILKINS: On the containment systems, the ACRS letter called for severe accident mitigation capability. And we have provided that through the inerted containment to handle the hydrogen issue.

We are designing for overpressure protection such that it could take 100 percent metal-water reaction. And the other threat to containment that you worry about is core debris in the event of a severe accident, and we have drywell and wetwell sprays in the containment which would ensure that if you had that kind of event, at least you would have water on the core.

So, we think that the evaluation of the containment will meet this 10 to the minus 6th criterion for a significant release.

[Slide.]

In the area of sabotage, I mentioned the three or the quadrant layout of the plant and the physical separation of the safety trains.

In addition, the control room itself is centrally located in a reinforced concrete structure, which gives it a lot of protection.

The ACRS wanted to see the capability of cold

shutdown within 24 hours in the case of a three hour fire, and our evaluation is the ABWR will be able to get there in less than six hours following a three hour fire.

And, of course, we meet all the codes and standards and regulatory requirements relative to fire protection.

All of the systems required for safe shutdown of the plant are protected with fire protection systems, and that was another thing that the ACRS called out in the letter.

In the area of anticipated transient without scram, the ACRS called for even further features to reduce the severity of that event. And in the ABWR, as I mentioned, we have gone to this electro-hydraulic control rod drive, which gives us another means of inserting the rods.

We have retained the boron system. So, that is still there.

And one of the nice features of this new drive is we have eliminated the scram discharge volume, which has been raised in the past as a potential common mode failure concern in our plant, and that will not be in the new design.

CHAIRMAN ZECH: What level of testing have you done for your new electric-hydraulic control rod drive system?

DR. WILKINS: Well, first we adopted a design that has been used extensively in Europe, particularly in Germany, and is currently used in all of the German BWRs.

In addition, we have now built them in Japan and

tested them in Japan. We have tested them in San Jose, and we have one running right now in the LaSalle station with Commonwealth Edison on an in-plant test for -- I think it started late last year and will go for about a year.

CHAIRMAN ZECH: How has it been performing? Do you know?

DR. WILKINS: It has passed all its tests.

CHAIRMAN ZECH: All right. Fine. Thank you.

DR. WILKINS: The ACRS quite properly called for a reduction in spurious scrams. We think our advanced electronics, with the triplicated electronics, with self testing and the combination of self testing and enough redundancy that when something fails, it announces it and you can replace it, is going to help us a great deal in that area.

[Slide.]

Systems interaction. We have taken a major step in the direction the ACRS wanted with the separate mechanical and electrical divisions that I have already mentioned.

In addition, as we go through our probabilistic risk assessment and our failure mode and effect analyses on this plan, we are of course looking very carefully at common mode failures which could represent system interaction problems. And that work remains to be completed.

The ACRS called for station blackout capability, and this design has the capability of withstanding a station

blackout for eight hours.

There was a thought in the ACRS letter of having the ability to maintain house electrical loads through steam bypass, but as an alternate to the decay heat removal system that they mentioned first, and we opted for the decay heat removal system that I mentioned on the first page.

They called for probabilistic seismic design with capability on a realistic basis to withstand particularly severe seismic events.

Our assessment is that on a realistic basis the ABWR would survive a seismic event of approximately twice the ground acceleration of the design basis. So, we think there is about a 100 percent margin in there in terms of realistic capability versus what we would claim as design basis.

[Slide.]

They called for minimizing pressure boundary welds. We, of course, eliminated the external recirculation system, which is the biggest external piping system on the vessel, and we got rid of the welds and the pipe and the whole system.

In addition, we are using forgings for major portions of the vessel which will eliminate a lot of the welding within the vessel. We are using a lot of bent pipe to eliminate welds in piping.

And then, for the welds that remain after we have eliminated all the ones we can, we are going to automated in-

service inspection equipment. And that equipment has, in fact, been built and tested.

So, we expect to greatly reduce the amount of in-service inspection and associated occupational exposure.

COMMISSIONER ROBERTS: What is the diameter of the pressure vessel?

DR. WILKINS: Two hundred and seventy-eight inches

COMMISSIONER ROBERTS: That is going to be a forging? Where is that going to be made?

DR. WILKINS: In Japan.

COMMISSIONER ROBERTS: Okay. Thank you.

COMMISSIONER BERNTHAL: I had a question back on the containment systems portion. You speak, of course, of suppression pool scrubbing.

One of the concerns that is before the Commission, has been for about ten years in fact with respect to some of the early generation BWRs, is the possibility of bypassing the suppression pool in the case of a severe accident.

How do you ensure that doesn't happen?

DR. WILKINS: Well, we have a much simpler geometry in this plant in terms of the location of the suppression pool relative to the drywell and wetwell.

And the paths to the suppression pool in this case are in fact -- the vent system is embedded in the reactor pedestal. As you can see on that picture we had earlier, it is

a very clean, well defined path to the suppression pool.

In addition, we plan in the case of vacuum breakers to have dual vacuum breakers in series, so that we will meet a single failure criterion there.

COMMISSIONER BERNTHAL: So, essentially, you can't see a credible sequence, a credible accident sequence that could bypass the suppression pool?

DR. WILKINS: Let me say that in our probabilistic risk assessment, that issue is one, of course, we will evaluate carefully. But there are always sequences you can postulate that would bypass the pool. But we will keep them sufficiently remote to be able to meet the criteria we have laid out here.

COMMISSIONER BERNTHAL: What about the question of overpressure and venting from the suppression pool? Is that at this point still a thing that is up in the air? Are you going to provide that capability?

DR. WILKINS: We at the present time do not see the need. We expect to be able to meet these criteria without having to vent the containment.

DR. WOLFE: As we have all learned, as you try to see about venting, it adds problems of its own, Commissioner. And on this one we have concluded we would not vent.

DR. WILKINS: We still have to make that case and convince you, but that is our plan.

COMMISSIONER BERNTHAL: Of course, this is a

considerably larger volume than the Mark 1's, to begin with.

One other question --

DR. WILKINS: Well, it really isn't.

COMMISSIONER BERNTHAL: It is not?

DR. WILKINS: No. This plant has a very mild loss of coolant accident because of the elimination of the recirculation pipe, which has always been the design basis accident.

The next pipe that can break produces a much milder loss of coolant accident, and so we have been able, because of that, to -- I forget the exact number, but it is comparable to the Mark 1's and 2's.

COMMISSIONER BERNTHAL: I see. So, it is not comparable in volume to the Mark 3's?

DR. WILKINS: No. It is a higher pressure --

COMMISSIONER BERNTHAL: I guess I didn't appreciate that.

Finish that sentence. It is a higher pressure containment?

DR. WILKINS: Higher pressure than the Mark 3. It is a 45 psi instead of the 15 with the Mark 3.

COMMISSIONER BERNTHAL: I see. The fuel pool I notice is, apparently from the schematic, located on the top area of the containment.

DR. WILKINS: Right.

COMMISSIONER BERNTHAL: And from a first look, it would also appear that that water is available as well, if necessary, for emergency circumstances. I am not quite sure when you might choose to use it.

I assume that was intentional. Or is that just an accident of the design?

DR. WOLFE: It is not an accident.

DR. WILKINS: Well, it is not usable for emergency cooling, because if there was spent fuel in that pool we would not want to deprive it of water.

DR. WOLFE: That storage pool is standard in our plants.

DR. WILKINS: Yes. That is in current Mark 1's and 2's. In the Mark 3, it is down low.

COMMISSIONER BERNTHAL: But in principle, that water volume is there, right?

DR. WILKINS: It is there.

DR. WOLFE: And we use it in the SPWR.

COMMISSIONER BERNTHAL: You don't take any credit for it.

DR. WOLFE: That is right.

CHAIRMAN ZECH: All right. You may proceed.

DR. WILKINS: Okay. Item 11 on the ACRS list was to minimize the sharing of equipment. And again, we have gone to the three separate divisions of safety equipment.

In addition, an other improvement we have made in this plant is the -- in our current plants there is shared duty among some of the pumps between emergency core cooling and containment cooling, and required operator action to shift back and forth, depending on the needs of the situation.

In this plant, we have hooked it up so that the heat exchanger is always in the loop. And so, there is no need for the operator -- he doesn't lose containment cooling if he had to inject water into the reactor for core cooling. He still has the containment cooling function there. And it greatly simplifies the emergency procedures that the operator would have to follow.

And finally, the ACRS called for control room protection in the case of a severe accident.

Our control room has two physically separated sources of air, with filtration on each. And in addition, either or both can be isolated and go to a recirculation mode. And all of that is powered from the emergency AC power. So, we have, we think, covered that quite well.

So, that is a quick summary of how we stacked up against the ACRS letter.

Now, let me hasten to add that the ACRS, of course, is going to review each of these areas in some detail, and I would expect they will want to look in depth at exactly how we have done each of those things.

But our first reaction is that we are quite pleased -- with the ACRS having come up with their list of they thought should be in a future plant, and our having independently designed a future plant -- at the degree of overlap between the design and the ACRS letter.

I am sure as we go down the road there will be some features here that the ACRS will want to see us do differently, but at least starting out it looks like we have got a pretty good meeting of the minds.

CHAIRMAN ZECH: The ACRS has certainly given you some good recommendations, and obviously you have -- I would agree with you, that it looks like your design has somewhat incorporated many of their thoughts, and that is reassuring.

What have you done, if anything, to make the plant perhaps easier to operate for the operators? What have you done for the human factors part? Have you made it more simple as far as the operators are concerned, to operate?

DR. WILKINS: We think a great deal simpler.

One of the things we have done in this plant, really for the first time, is we started out with the definition of the operating procedure, the emergency procedure for the plant, and then from that we backed up to what information does the operator need in order to carry out that procedure, and then what is the best way to provide and display that information to the operator, which is kind of the reverse process from what

you normally do.

You designed a system and then you would figure out what instruments are needed. Then you would put them in there, and then you would tell the operator with that how to run the plant.

So, we have kind of come at it from the operator's perspective in terms of what he has to do and then what does he need to do it. And that has produced a -- had a great deal of influence on how we have designed and laid out the control room in this plant.

CHAIRMAN ZECH: Have you had any operators take a look at the design? Or have you had discussions with operators to get their views on what might go in this new design?

DR. WILKINS: Absolutely. One of the nice features of working with the Tokyo Electric Power Company, as I mentioned, is they have 17 boiling water reactors in their plan and they have lots of operators. And we have been, I would say, worked over by operators and maintenance people to a degree that has never been done before.

CHAIRMAN ZECH: That is good.

DR. WILKINS: This plant has very, very heavy utility involvement in its design.

CHAIRMAN ZECH: Well, that is excellent.

DR. WOLFE: In fact, if you look at that brochure, you are going to find it very hard to find General Electric or

Toshiba or Hitachi mentioned in it.

CHAIRMAN ZECH: I noticed that.

DR. WOLFE: The Tokyo Electric Power Company really now looks at this as their machine.

COMMISSIONER ROBERTS: You mentioned the brochure. I just saw this when I walked into the room, but perhaps you can explain some inconsistencies to me. I don't understand.

I am referring to page 19 where they say the current construction time is 60 months. But if you look at page 23, the last plant they completed, it took 82 months.

How do those square?

DR. WILKINS: Well, I think the last plant that was completed by TEPCO was, in fact, one where they had a lack of need for power and they had --

COMMISSIONER ROBERTS: Well, I don't want to be argumentative. They asterisked those where they say the construction period was delayed due to the low electricity rate.

And if I can read this, the last plant was completed in September of 1985 and took 82 months. And yet we see here that purported a current BWR takes 60 months.

I appreciate you didn't prepare this brochure. I understand that.

DR. WILKINS: Let me get you the answer to that question.

COMMISSIONER ROBERTS: Well, let me ask another question. I guess you could spend a lot of time defining what constructions costs are, but look on page 18, construction cost per kilowatt, current BWR and then the advanced BWR.

What is the comparison of the installed cost per kilowatt with the ABWR compared to the current BWR?

DR. WILKINS: We expect it to be approximately 15 to 20 percent lower per kilowatt.

COMMISSIONER ROBERTS: That is the procurement, that is the equipment and that is the construction?

DR. WOLFE: The ground rule was that the 1,340 megawatt ABWR should have the same cost or less than the 1,100 current standard design in Japan.

COMMISSIONER ROBERTS: And you think that is realistic?

DR. WOLFE: That is our estimate now, done by Tokyo Electric Power and us, and the AE's in Japan.

COMMISSIONER ROBERTS: And the Japanese agree with you?

DR. WOLFE: Yes.

COMMISSIONER ROBERTS: Go ahead.

CHAIRMAN ZECH: Let me just emphasize the importance of -- you talked about discussions with operators and so forth. In the design, you know, we have found over the years that many of the problems are people problems, personnel errors, things

like that.

And I think that if we can do something in the design stage to make the plant easier to operate, more operator friendly, if you will, we will be making a real contribution.

I am pleased to hear what you have done in that regard. I am pleased to hear you have been worked over by the operators and the maintenance people, because you are right, we don't always do it that way.

We design it, as you point out, Dr. Wilkins, and then give it to them and they try to learn how to operate it. It is backwards.

We should do the design, in my judgment, thinking all the way through to the operator. At 3:00 in the morning, that operator has got the plant in his own two hands, does the design make it easier for him to operate it safely. That is a fundamental part of design thinking, in my judgment.

So, I am pleased to hear you have brought in operator thinking and operator recommendations to it, and I hope you will continue to do that as you continue along with this design.

It is awfully important to get that done at this stage, and not find out later we could have done it better.

You may proceed. Thank you.

[Slide.]

DR. WILKINS: I had included a chart on scope in the

presentation because I knew you would want to talk about that. But since we have already talked about it, I am going to skip over that one.

DR. WOLFE: Let me just come back to that, because I don't want to leave you with the wrong impression.

We would like to put the turbine building on there. We are working with DOE to do it. But we have no commitment, no legal commitment to do that. So, we have the intent. It is a resource problem right now.

CHAIRMAN ZECH: I appreciate that. The history of nuclear power has clearly let this be a separate part of the design thinking and construction. But I do think that, as we discussed earlier, we should move towards thinking of the whole plant as a single plant and of safety as involved in the secondary side as well as the primary side.

DR. WOLFE: Absolutely.

CHAIRMAN ZECH: All right.

[Slide.]

DR. WILKINS: In the certification area, this is out in front of us and is not something that we have to resolve right now. But on the other hand, when we get there in 1990, if we keep this program on schedule, we need to know what the steps are that go from a final design approval to a certified design.

DR. WOLFE: This is what we discussed before.

CHAIRMAN ZECH: Right.

DR. WILKINS: And you have issued your standardization policy and guidance, and we found that very helpful.

In the area of certification procedures, we understand that you are working in that area, and we will be very interested in following that effort.

Somehow we need to get resolved the issue of how do we, in effect, achieve a combined construction permit/operating license, or something that is essentially equivalent to that, what is the role and scope of the pre-operational hearing, if there is one for someone who would reference one of these standard designs, and then what is the certification process, is it rulemaking, is it licensing, is there a hearing, what is the role of the hearing, and in the course of all that, how do we handle proprietary information.

Those are the kind of issues that are going to come at us and we would like to see some definition in these areas come out of the NRC well before we get to the point where we have to face these issues.

COMMISSIONER BERNTHAL: Let me just pick up on this for a moment here, just because I think we all need to be very clear on what needs to be done, whichever path might be chosen, whether it is rulemaking, where there would be formal litigation, in principle at least, or whether it is just

licensing, where if I am remembering correctly and understanding correctly, probably the single element in the so-called licensing reform packages, the legislative packages that this Commission from time to time has presented to the Hill and which yet have to receive any action, the single element there that I believe we cannot do administratively is the combining of the construction and the operating license into a single stage.

Now, maybe the general counsel --

CHAIRMAN ZECH: That is correct. I think the general counsel can affirm that.

MR. MALSCH: That is one of the items. It is probably the most important one.

COMMISSIONER BERNTHAL: Indeed.

MR. MALSCH: But I mean a complete combination. But, you know, we are working on a rulemaking right now with the staff that is virtually in the final drafting stages, which is an endeavor to carry out as much of the legislation as we can under current authority, and it will include something resembling as close as we could reach it to a combined license.

COMMISSIONER BERNTHAL: I guess that was my next question. Although the legislation speaks clearly of a construction permit or license and an operating license, I don't think it says anything about how much time has to elapse between the two.

And therefore, can that be bridged somehow administratively?

MR. MALSCH: Well, I think the concept has always been a single document at one point in time being issued that would have certainly all of the aspects of the construction permit and as much as possible of an operating license as we can manage to do.

COMMISSIONER BERNTHAL: I see.

MR. MALSCH: That is the concept.

CHAIRMAN ZECH: But in order to go to a single stage licensing completely, it is my understanding we have to have congressional authority to do so.

MR. MALSCH: To really go all the way, we need to collapse the two step licensing process.

CHAIRMAN ZECH: Right. And our effort, as general counsel is pointing out, is to go as far as we can on our own authority.

MR. MALSCH: That is right.

CHAIRMAN ZECH: That is what we are attempting to do.

MR. MALSCH: Right.

CHAIRMAN ZECH: All right.

MR. MALSCH: I might say, we are also going to address the other issues that you listed there, including, you know, hearing opportunities, scope of pre-operational hearing, the certification process and proprietary information. We are

aware of all these issues.

CHAIRMAN ZECH: Thank you.

COMMISSIONER BERNTHAL: Although the idea of hearing is -- well, the idea -- the word, hearing, is sort of a four letter word in this industry and has been for a long time.

Nevertheless, it is the way the system runs and has run now for some time, and until and unless -- I think, again, it would take legislation by the Congress that is unlikely ever to change this formal adjudicatory procedure around here.

And therefore, whether it is through a new process or whether it is through a rulemaking, whatever the process might be, you certainly want to try and see things through in a way that I often refer to as the Clinch River mode, where to the extent possible the technical issues were argued before the NRC's licensing boards and it all was out on the table and there finally came the day when the technical experts stepped up and presented their arguments, and they stood or they fell on the merits.

That is the way it has got to work, and I would sure highly recommend that be done, distasteful though it may be, be done before the NRC in its, what I call, scientific courts, really, rather than attempting to fight that out later on in whatever form it might take in the civil courts where they are not really prepared to address issues like that.

DR. WOLFE: I think however you label it, it seems to

me the advantage of the way we are going is that the issues would all be argued out at the time of certification.

COMMISSIONER BERNTHAL: Exactly.

DR. WOLFE: And it seems to me the construction permit, in general, would be, are you going to build this standardized plant. Then if the fellow gets up, the owner gets up and says, yes, that, it would seem to me, is the major issue.

And at the operating license period, the issue is, did you build it the way you promised to.

COMMISSIONER BERNTHAL: That is right.

DR. WOLFE: It seems to me, that is the advantage of the way we are going, and I hope we can reduce the legal issues and maybe get it down to one hearing. But fundamentally, this will be the first time, if we are successful, where we do just what you say, have the details all worked out before we go into the project itself.

COMMISSIONER BERNTHAL: But I guess the point that I am stressing -- and Marty, correct me if I am misstating it -- but you almost certainly by no device will be able to avoid a formalized hearing at some point on this standardized design. There is just no way to avoid that.

In fact, it is to the advantage ultimately of the buyer that that stuff all be fought out on the record in a formal proceeding.

It may sound strange to hear a physicist by training saying something like that, but I have learned enough in four and a half years here to know that in the long run that is going to be in the interest of any utility that wants to build such a plant. And there is no way you will avoid it.

So, the best thing to do is to plan for that day and expedite the day when you have that day in court.

DR. WOLFE: Let me just see if we are saying the same thing. I think our concept is that all of the arguing on the technical merits and the design --

COMMISSIONER BERNTHAL: Is all done ahead of time.

DR. WOLFE: -- Would be done on the basis of this certification we are doing now.

COMMISSIONER BERNTHAL: Precisely. That is exactly the point.

DR. WOLFE: Okay. Absolutely. And we are saying the same thing.

COMMISSIONER BERNTHAL: But there seems to be -- I am not quite sure on what basis, but there seemed to have been from time to time some idea that there may be an easy way out of this adversarial, formalized hearing process. But I don't think that there will be on the technical merits of your design and the design certification.

I am not suggesting that you ever thought there would be. In fact, to the contrary, I don't think that you have.

DR. WOLFE: No.

COMMISSIONER BERNTHAL: Some have, perhaps. I don't think there is.

MR. MALSCH: Actually, we do have some options, I think more options in structuring the design certification process than we may have in the current construction permit/operating license proceedings under the current act. So that there is some flexibility here that we might not otherwise have.

COMMISSIONER BERNTHAL: But is there a realistic prospect -- and I guess that is the issue -- of departing significantly from what we have always referred to as the "formal adjudicatory process?" That is, realistic and practical in the sense that the courts would uphold our doing it.

MR. MALSCH: I think that there is. I think what we are looking at is to do something that makes sense, that produces a decent record and considers the opposing points of view. But I don't think we regard ourselves as necessarily bound by the exact type of procedures that we followed in the past.

I think we are looking at the rulemaking as an opportunity to sort of approach the issue again and do what seems to make sense.

I mean, the minimum for rulemaking certification

approval is notice and comment.

COMMISSIONER BERNTHAL: Right.

MR. MALSCH: And so, that may not be sufficient as a practical matter. But there is a whole range of options, ranging upward from that all the way up to and including a full adjudicatory hearing. And the question is where would we want to do something that makes sense in between, perhaps. And we are addressing that in the rulemaking that is currently being drafted.

COMMISSIONER BERNTHAL: Okay.

CHAIRMAN ZECH: What I think is important on this issue -- and I think we can move along and conclude here shortly -- but I think it is important, at least it is my view, that when we go to standardization, it means you have got a design that everybody understands what it is, and you have essentially completed the design.

That is why I like to think it includes as much of the balance of plant as the steam supply system.

So, that is formally accepted by the public, they know exactly what kind of a plant it is going to be, and the site is selected. All the things are done up ahead of time, so it is all laid out on the table. Everybody knows, it is in the public domain.

It is important to me and I think the public, frankly, will be better served when they know way, way up front

exactly what the plant is going to look like, where it is going to be, who is going to operate it, and all those decisions, emergency planning, as much as possible, everything possible agreed to up front.

When those things are all laid out on the table, it is my personal view that the public is better served, rather than the process we have now to do things in steps and not really know some of the decisions until the last minute.

I agree with you, Dr. Wolfe, that once you have done it all up front in the public, then of course you must have processes along the way to evaluate, inspect, assure that the plant is built according to what you said it was going to be built, and those kind of formalized inspection techniques and programs of monitoring. And that can be done and should be done.

But it seems to me that when you do as much up front as you can, as the Japanese do and as the French do, and as most other nuclear countries do, do it up front, you are just better off.

And frankly, it is my personal view again that the public is better served when you do that.

DR. WOLFE: We agree with you 100 percent. Absolutely no argument.

CHAIRMAN ZECH: Good. Now can we move along? Are you going to give us a conclusion?

DR. WILKINS: We are down to the summary.

CHAIRMAN ZECH: Okay.

[Slide.]

DR. WILKINS: As we said up front, the program is on track. I think we are making good progress to carry out the plan we laid out before you approximately a year ago.

In particular, we have now got the licensing review bases issued. The review process has begun. The ACRS dialogue is well underway.

And we will hope to come back in another six months or so and tell you we are still on track.

CHAIRMAN ZECH: Excellent. We hope so, too.

Does that conclude your presentation?

DR. WILKINS: Yes.

CHAIRMAN ZECH: Questions, my fellow commissioners? Commissioner Roberts.

COMMISSIONER ROBERTS: The reactor pressure vessel for this project, will that meet the requirements of Section 3 of the ASME Code?

DR. WILKINS: Yes.

CHAIRMAN ZECH: Commissioner Bernthal.

COMMISSIONER BERNTHAL: I want to go back for just a moment to the questions of this containment volume, to first principles.

You have indicated that the volume is small, where

you have increased the pressure capability by about a factor of three, I guess, over the Mark 3.

Well, naively then, the question is, how much did you decrease the volume? How does the volume compare to the Mark 3 volume? Did you give us that?

DR. WILKINS: Compared to the Mark 3, it is about a third. It is a little bigger than the Mark 1's and 2's.

COMMISSIONER BERNTHAL: All right. So, it is a wash, pressure, volume, factor of three both ways.

DR. WILKINS: Right.

COMMISSIONER BERNTHAL: So, what then leads you to the statement, which I believe you made, that any credible, I guess, loss of coolant accident or other accident -- I am not sure you said more benign, but is at least a very benign event? Why is it that overpressurization should not concern us, then, in this case?

Because from the standpoint of the simplest picture, it is equivalent to a Mark 3 containment system pressure/volume.

DR. WILKINS: Well, the issue in the design of a pressure suppression containment for a loss of coolant accident is you go through the dynamic calculation of how fast water or steam or the mixture comes out of the break, how fast it pressurizes the drywell, and then how fast that is relieved through the vent system into the suppression pool.

COMMISSIONER BERNTHAL: I am really talking about the non-condensables here, not the pressure -- not the suppressible type of accident.

DR. WILKINS: You are talking about the metal-water?

COMMISSIONER BERNTHAL: Yes, where you may be generating non-condensables, hydrogens obviously one. But generally, why should we not worry about overpressurization? Maybe we don't worry about it so much with the Mark 3's right now.

But what should give us the confidence that in severe accident management, that is not a concern here and therefore that we need not under any reasonable circumstance ever worry about a venting capability or system?

DR. WILKINS: Well, we have designed to accommodate the pressure from the hydrogen due to a 100 percent metal-water reaction --

COMMISSIONER BERNTHAL: Okay.

DR. WILKINS: -- Within the factored load capability of the containment.

Now, that is not normal service loading, but emergency type loading. And that has been one of the design criteria.

DR. WOLFE: In addition to having it inerted, so that it is hard to --

COMMISSIONER BERNTHAL: So, it is inerted and 100

percent metal-water.

DR. WILKINS: Right.

DR. WOLFE: I don't think any of our containments -- the Mark 1, Mark 2 or Mark 3 -- have had a pressure problem. Correct me if I am wrong, but my recollection is -- the Mark 1 that you alluded to is a problem of a core on the floor. But it wasn't a pressure problem.

I don't think we have -- to my recollection, that has not been an issue, because it has always been designed for the maximum pressure that could be released.

The Mark 1 is, as I say, a hypothetical accident.

COMMISSIONER BERNTHAL: Yes.

DR. WOLFE: And while I have the opportunity, I might just point out that it meets all the criteria, and that it has a very low probability of a core melting, and then a problem if it does melt, as it compared to other reactors which have a higher probability of a serious accident but maybe a lower probability of what happens.

So, as you well know, the question of the Mark 1 is still an open issue, and I don't want to leave the implication that it is deficient. We don't think it necessarily is.

COMMISSIONER BERNTHAL: But I take it, then, that there is no accident sequence that I would or should be surprised by that would lead to an overpressurization event from non-condensables.

You can handle 100 percent hydrogen-water interaction. I guess you have taken into account all of the non-condensable gases, the inert gases from the fuel, and you still make it.

That is what you are telling us?

DR. WILKINS: Yes.

COMMISSIONER BERNTHAL: Okay. Well, I guess that is all can ask right now. Thank you.

CHAIRMAN ZECH: All right. Thank you very much.

Commissioner Rogers.

COMMISSIONER ROGERS: Nothing.

CHAIRMAN ZECH: Well, let me thank you, Dr. Wolfe and gentlemen, for a very fine presentation. I think your work is extremely important, of great interest to us.

I would ask you to keep working closely with the ACRS. I know you are going to keep working closely with your Japanese people. And I think that, again, we should all be encouraged by your progress.

I am pleased to see you are on schedule, as you point out.

And we will look forward to hearing from you in the future.

In the meantime, I wish you the best as you continue in this very important effort toward standardization, which I believe is a giant step forward for the American people as well

as the Japanese people and others. And I hope we will look forward to your next briefing.

Thank you very much.

We stand adjourned.

[Whereupon, at 3:35 p.m., the open meeting was concluded.]

REPORTER'S CERTIFICATE

This is to certify that the attached events of a meeting of the U.S. Nuclear Regulatory Commission entitled:

TITLE OF MEETING: Briefing by GE on New Standarized Plants

PLACE OF MEETING: Washington, D.C.

DATE OF MEETING: Tuesday, January 26, 1988

were held as herein appears, and that this is the original transcript thereof for the file of the Commission taken stenographically by me, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing events.

Marilynn M. Nations

Marilynn M. Nations

Ann Riley & Associates, Ltd.

1/26/88

# SCHEDULING NOTES

TITLE: BRIEFING BY GE ON NEW STANDARDIZED PLANTS

SCHEDULED: 2:00 P.M., TUESDAY, JANUARY 26, 1988 (OPEN)

DURATION: APPROX 1-1/2 HRS

PARTICIPANTS: GENERAL ELECTRIC (APPLICANT)

- BERTRAM WOLFE — 15 MINS
  VICE PRESIDENT AND GENERAL MANAGER
- DANIEL R. WILKINS — 45 MINS
  GENERAL MANAGER ABWR PROGRAM

# ABWR Design Certification Status

Presented to

## Nuclear Regulatory Commission

January 26, 1988

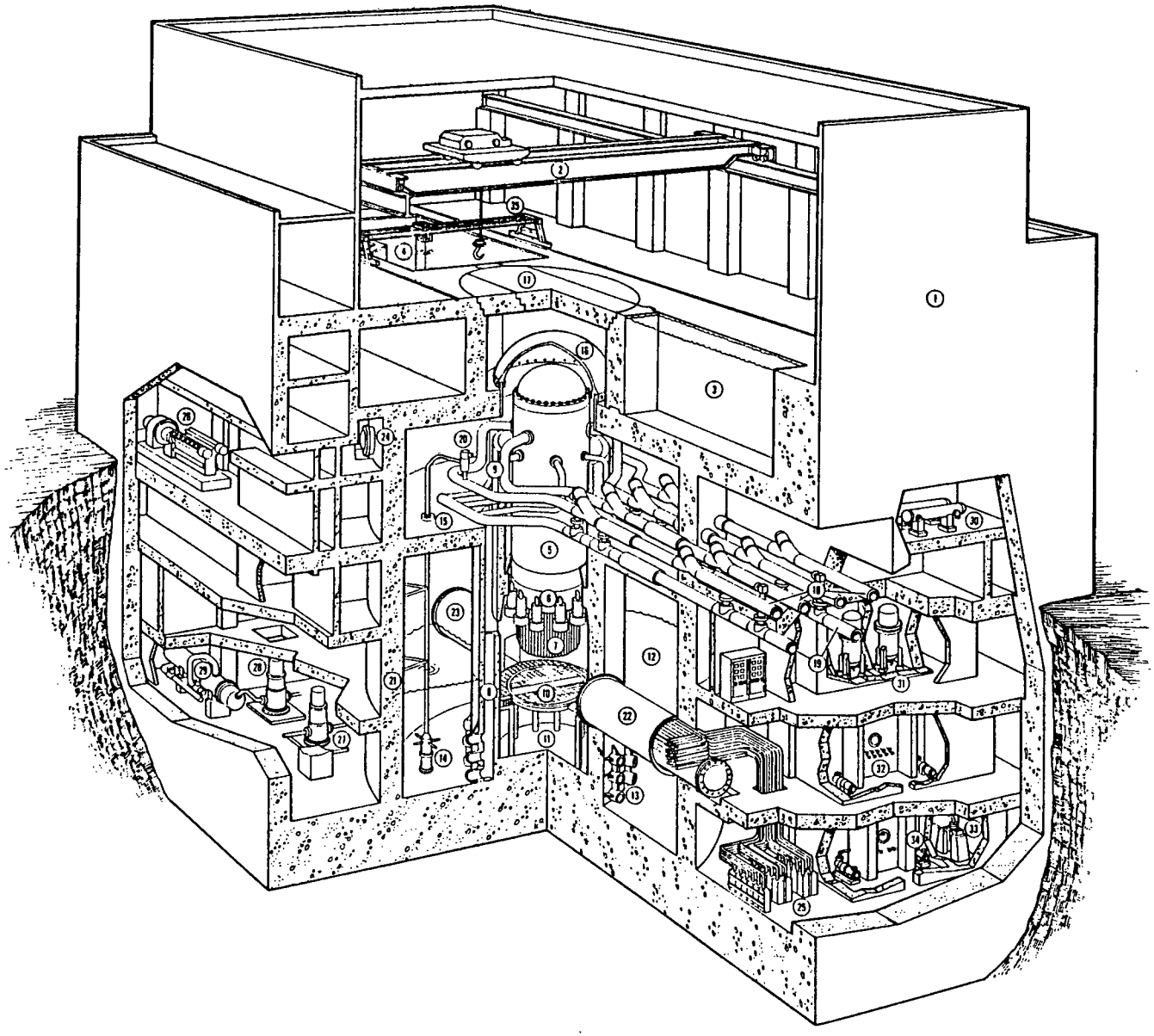
GE Nuclear Energy

# Agenda

- Background
- ABWR project in Japan
- ABWR design certification status
- ACRS reviews
- Scope of ABWR
- Design certification process
- Summary

# ABWR Background

- **ABWR Development**
  - **1350 MWe plant**
  - **International design team**
  - **Proven technology**
  - **8 years - $250 million invested**
- **BWR design objectives**
  - **Improved operability**
  - **Improved capacity factor**
  - **Improved safety & reliability**
  - **Reduced occupational exposure**
  - **Reduced costs**



# ABWR

**(Advanced Boiling Water Reactor)**

## REACTOR BUILDING

1 REACTOR BUILDING
2 BRIDGE CRANE
3 STEAM DRYER AND SEPARATOR STORAGE POOL
4 SPENT FUEL STORAGE POOL
5 REACTOR PRESSURE VESSEL
6 REACTOR INTERNAL PUMPS
7 FINE MOTION CONTROL ROD DRIVES
8 REACTOR PEDESTAL
9 REACTOR SHIELD WALL
10 LOWER DRYWELL EQUIPMENT PLATFORM
11 LOWER DRYWELL
12 SUPPRESSION POOL
13 HORIZONTAL VENTS
14 SRV QUENCHERS
15 UPPER DRYWELL
16 DRYWELL HEAD
17 SHIELD BLOCKS
18 MAIN STEAM LINES
19 FEEDWATER LINES
20 SAFETY/RELIEF VALVES
21 PRIMARY CONTAINMENT VESSEL
22 LOWER DRYWELL PERSONNEL LOCK
23 LOWER DRYWELL EQUIPMENT HATCH
24 UPPER DRYWELL EQUIPMENT HATCH
25 HYDRAULIC CONTROL UNITS
26 DIESEL GENERATOR
27 HPCS- PUMP
28 RHR- PUMP
29 RHR- HEAT EXCHANGER
30 FPC- HEAT EXCHANGER
31 RWCU- FILTER DEMINERALIZER
32 RWCU- HOLDING PUMP AND OPERATION ROOM
33 RWCU- PUMPS
34 RWCU/SPCU- BACKWASH PUMP AND OPERATION ROOM
35 REFUELING PLATFORM

# ABWR Background

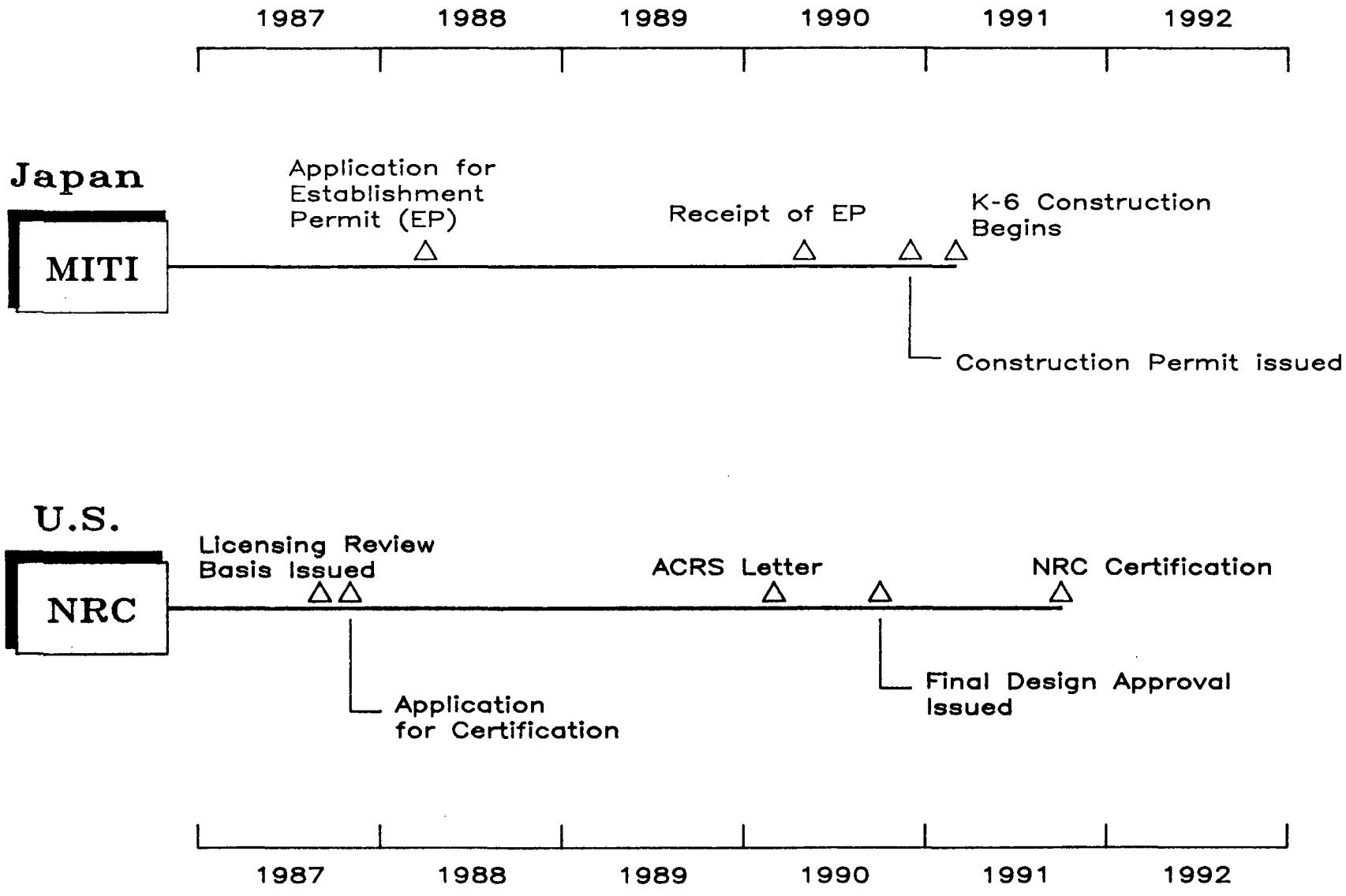
## (continued)

- Lead plants proceeding in Japan (TEPCO)
- Design Certification
  - Licensing Review Bases issued
  - Submittals/review have begun
  - 1991 certification target
- Commission meetings:
  - September 1986
  - April 1987
  - January 1988

# TEPCO Proceeding With First ABWRs

- **Kashiwazaki 6 & 7 Schedule**
  - **Licensing application 1988**
  - **K-6 commercial operation 1996**
  - **K-7 commercial operation 1998**
- **GE/Hitachi/Toshiba joint venture**
  - **GE to supply nuclear steam supply, fuel, turbine generators**
- **U. S./Japanese Regulatory interaction**

# ABWR Licensing Schedules

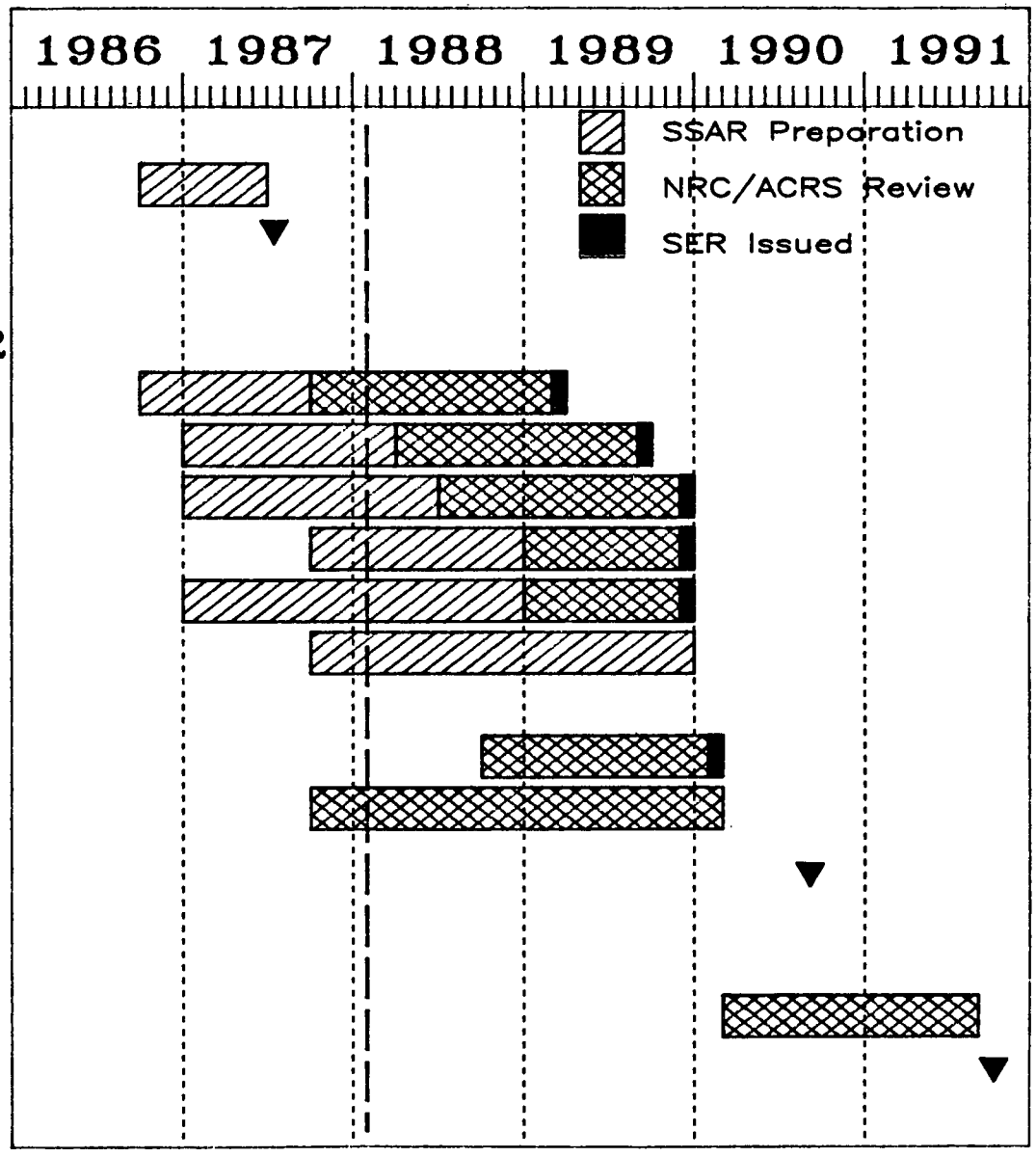


# ABWR Certification Program Schedule

**Licensing Basis**
- Lic. Basis Agreement Dev.
- LBA Document Issued

**Prep. & Submittal of SSAR**
- Reactor & Safety Systems
- Plant Arrangement & Q/A
- I&C and Auxiliary Systems
- Tech Specs & Emer. Proc.
- PRAs, FMEAs
- Requests for Additional Information and Responses
- Final SER
- ACRS Review
- FDA Issued

**Design Certification**
- Rulemaking
- Certification Issued



# Licensing Review Bases (LRB) Issued

- Issued by the NRC Staff 8/87
  - Acceptance criteria defined
  - Allows for new requirements that have been promulgated by the NRC
- Key procedural issues
  - Schedule
  - Review allows for modular submittals
  - Level of design detail
  - ACRS reviews
  - Design certification process
- Key acceptance criteria
  - PRA methodology
  - Core damage $< 10^{-5}$/year
  - Frequency of exceeding 25 Rem $< 10^{-6}$/yr
  - Advanced electronics design guidelines

# SSAR Status

- **Major SSAR chapters submitted 9/87**
  - **Reactor and fuel**
  - **Safety systems and analysis**
  - **Transient and accident analysis**
- **Kickoff presentation to NRC staff 10/87**
- **Questions on SSAR chapters scheduled for 1/88**
- **Next submittal of SSAR chapters 3/88 - on schedule**

# ACRS Review

- **ABWR under ACRS review**
  - **Begun in 1987: 1 Subcommittee, 3 full Committee meetings**
  - **1/88 full Committee meeting - future LWR recommendations discussed**
  - **Subcommittee review cycle set**
- **ABWR design reflects ACRS guidance**

# Comparison of ABWR Design With ACRS Recommendations

| ACRS Recommendation | ABWR Implementation |
|---|---|
| 1. Dedicated and protected decay heat removal | |
| • Dedicated, protected and redundant heat removal system | • Heat removal function automatically available without operator action |
| | • 3 separate, hardened and compartmentalized rooms |
| | • 3 completely separate mechanical and electrical divisions |
| • Independent power, fuel and water supply | • 3 separate divisions with diesel generator and battery power supply |
| | • Separate diesel generators and fuel supplies |
| | • Reactor water sources: |
| | - High pressure - condensate storage tank and suppression pool |
| | - Low pressure - suppression pool |
| • Makeup and recirculation capability | • All ECCS pumps (high and low pressure) can add makeup to RPV |
| | • Recirculation from suppression pool |
| • Seismic capability | • Plant design basis seismic capability is 0.3g (all soils) |
| • Actuation with no termination from control room | • Activation and termination is possible from the control room |

# Comparison of ABWR Design With ACRS Recommendations (continued)

| ACRS Recommendation | ABWR Implementation |
|---|---|
| 2. Safety train redundancy | |
| • "N+2" trains | • The ABWR has N+2 capability for the total accident spectrum with the exception of one low probability event |
| | • 3 completely separate mechanical and electrical divisions |
| | • Diverse motive power and cooling sources |
| 3. Design of containment systems | |
| • Severe accident mitigation capability | • Containment inerted |
| | • 3 completely separate divisions of containment heat removal |
| | • Drywell and wetwell sprays |
| | • Suppression pool scrubbing |
| • Low probability of a large release | • The probability of a large release is $<10^{-6}$ per year |
| 4. Protection against sabotage | |
| • Control room | • Centrally located control room in a large reinforced concrete structure |
| • Physical separation of redundant safety trains | • Building arrangement provides physical separation for essential mechanical, electrical and C&I equipment through arrangement in separate quadrants of the building |
| | • Equipment is protected by physical barriers |

# Comparison of ABWR Design With ACRS Recommendations (continued)

| ACRS Recommendation | ABWR Implementation |
|---|---|
| 5. Fire protection | |
| • Capability of cold shutdown within 24 hours with 3 hour fire | • The capability exists to shutdown the ABWR in less than 6 hours given a 3 hour fire |
| | • Reactor control building is designed to meet all existing fire codes including fire suppression systems, sprinkler systems, and ventilation systems |
| • Proper operation of fire mitigation features after a seismic event | • Portions of the fire protection system are designed to assure safe shutdown of the plant following a seismic event. The fire protection system is also designed against spurious actuation given a seismic event |
| 6. Anticipated transient without scram (ATWS) | |
| • Design features to reduce severity of ATWS | • 100% relief capacity |
| | • New electric-hydraulic control rod drive system: scrams hydraulically followed by electrical motor control rod insertion |
| | • Eliminated scram discharge volume |
| • Reduction in spurious scrams | • The frequency of transients and spurious scrams has been minimized by using:<br>- Triplicated fault tolerant control systems for feedwater, recirc, and turbine control<br>- Fault tolerant automated plant startup and shutdown control system<br>- Improved reactor trip system with two of four logic and self testing capabilities<br>- Loss of one recirc pump does not result in scram<br>- Startup range neutron monitoring system with period based trip instead of IRM range switching |

# Comparison of ABWR Design With ACRS Recommendations (continued)

| ACRS Recommendation | ABWR Implementation |
|---|---|
| 7. Systems interaction | |
| • Elimination of adverse system interactions | • 3 completely separate mechanical and electrical divisions having no common power supplies, piping systems, etc.<br>• PRA and FMEAs will validate the elimination of potentially adverse common mode failures |
| 8. Electrical power systems | |
| • Station blackout capability | • Design has capabilities for a station blackout event of 8 hours |
| • Sufficient steam bypass to maintain "house" electrical load (reduced if DHRS is provided as discussed in Item 1) | • ABWR has systems meeting the requirements of the DHRS as discussed in Item 1 |
| 9. Probabilistic seismic design | |
| • Survival and functioning of safety systems during and after severe seismic events | • The reactor and control buildings are designed as seismic Category I structures<br>• The PRA will demonstrate an ECCS equipment survivability capability with ground acceleration of approximately two times design<br>• The design includes all the equipment required to achieve and maintain a cold shutdown after an SSE including the DHRS as discussed in Item 1 |

# Comparison of ABWR Design With ACRS Recommendations (continued)

| ACRS Recommendation | ABWR Implementation |
|---|---|
| **10. Primary pressure boundary** | |
| • Minimize the number of welds and optimize the ease of inspecting them | • The ABWR design:<br>- Deletion of the large diameter external recirculation loop piping<br>- Forgings will be used for the bottom head, the transition section, and the cylindrical shell<br>- Automated inservice inspection machine and techniques are employed which results in more reproducible welding inspections as well as reduced plant occupational exposures |
| **11. Dedicated systems sharing** | |
| • Minimize sharing of equipment | • Mechanical and electrical divisions are completely separated with no sharing<br>• Post LOCA heat removal function always ready - no manual actuation required |
| **12. Control room protection for severe accident** | |
| • Safe habitation of control room following large release of radioactive materials outside containment | • Control room HVAC has 2 physically separated sources of outside air following a LOCA and incorporates charcoal filtration to remove airborne particulates and halogens<br>• Filtration is installed in a ventilation recirculation system which can also be used to treat makeup air as needed<br>• Control room HVAC is powered from the emergency AC power supplies |

# Scope of ABWR

- Nuclear island scope
  - Includes all safety related equipment
  - Logical selection
    - All safety related portions of plant included in nuclear island
    - Clean interfaces exist
- Remainder of plant design
  - Could be accomodated if appropriate

# Design Certification Process

- Standardization Policy and guidance issued
- ABWR design certification in 1991
- Certification procedures needed
  - Need for combined CP/OL (utility)
    - Scope of preoperational hearing (utility)
  - Opportunity for hearing (certification)
  - Protection of proprietary information

# Summary

- Good progress being made
- LRB issued 8/87
- SSAR submitted
  - Under review by Staff/ACRS
  - Next SSAR submittal in 3/88
- ACRS recommendations being incorporated in the design