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COMBINED ADVISORY COMMITTEE ON REACTOR SAFEGUARDS SUBCOMMITTEE ON GESSAR II AND RELIABILITY AND PROBABILISTIC ASSESSMENT

GESSAR II FDA REVIEW

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NATIONWIDE COVERAGE

COMBINED ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE ON GESSAR II

AND

RELIABILITY AND PROBABILISTIC ASSESSMENT

GESSAR II FDA REVIEW

LOS ANGELES, CALIFORNIA

DECEMBER 5, 1984

REPORTER'S TRANSCRIPT OF PROCEEDINGS

DAVID OKRENT, Chairman of the Subcommittees

JACK EBERSOLE, ACRS Member

CARLYLE MICHELSON, ACRS Member

DAVID A. WARD, ACRS Member

CHARLES J. WYLIE, ACRS Member

LOS ANGELES, CALIFORNIA; DECEMBER 5, 1984; 8:32 A.M.

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MR. OKRENT: This meeting of the GESSAR II and reliability and probabilistic assessment subcommittees will come to order.

We will continue from where we left off yesterday. I believe the next item is related to a discussion of the so-called UPPS system.

MR. QUIRK: UPPS system, Dr. Okrent?

MR. OKRENT: According to my agenda, that's next. Am I missing something?

MR. QUIRK: No.

MR. OKRENT: Let's go.

(Slide 1 shown.)

MR. QUIRK: For those ACRS subcommittee members and ACRS consultants that weren't at our last meeting on it, I would like to begin my presentation with just a brief description of the UPPS system. We talked a little bit about it yesterday. Basically it has three functions.

One is to depressurize the reactor, second is to provide makeup to the reactor, and the third function is to remove decay heat. The UPPS system does each of these three things without any electrical, AC or DC power.

First of all, we accomplish depressurization by using an air-operated bottle supply system that would function to open by air pressure, safety relief valves that would enable discharge and blowdown to the suppression pool. And thus we have accomplished the depressurization function without any electrical power.

The second function, as I said, is to provide coolant makeup. We can do this using two water sources. One source would be utilizing the diesel-driven fire protection system pumps to provide water into the reactor. The second source of water could be accomplished utilizing a fire truck, hooking it up to this connection to provide water in to the reactor vessel. Both of these water delivery systems can perform their function without any AC or DC power.

And the third function to remove the decay heat can be accomplished by opening up the containment and venting the steam from the containment, thus allowing a passive way of removing heat.

These are how we would accomplish the three essential functions of the UPPS system.

Now, at the last ACRS subcommittee meeting I believe it was generally concluded that the UPPS system is a simple reliable means to prevent the most likely accident sequences. I think it was further observed that prudent steps could be taken to enhance this system's preventive capability for other postulated events such as sabotage or fire protection or whatever.

Now, since the identification of UPPS and its capability were part of our design modification effort, it follows that our design modification studies' conclusion regarding hydrogen control are reasonably valid, that hydrogen control is simply not cost-effective. It's two orders of magnitude less cost-effective than UPPS.

So I believe that further enhancement of the UPPS system should be accommodated by an incentive, and in my opinion a worthwhile incentive would be for the subcommittee to seriously reconsider the need and the worth of hydrogen control.

In short, I will describe an upgraded UPPS system in what I believe provides a basis for the Committee to conclude that hydrogen control for the Mark III is unwarranted.

(Slide 2 shown.)

MR. OKRENT: Excuse me. Before we go into that, could we go back to the UPPS system and look a little more deeply into possible safety problems, if any, it might cause, and how they are dealt with.

MR. QUIRK: What did you have in mind?

MR. OKRENT: Well, we talked a little bit yesterday about the fact how it could lead to a loss of coolant accident by opening up your relief valves.

MR. QUIRK: Yes. Inadvertent operation of the safety relief valve would cause an inadvertent blowdown to the suppression pool, which would be no worse than an inadvertant ADS, which is evaluated and a design of the containment structure can accommodate.

MR. OKRENT: But what is the probability of this occurring? How do we judge that?

MR. QUIRK: One of the -- maybe we are getting a little ahead of ourselves. But one of the enhancements of this system could be to separate it from the nuclear island's structures, systems and components and control access to it, such that that probability would be significantly reduced. That is an enhancement that I will refer to as bunkering.

Bunkering I will define as separating portions of the system that is reasonably practical from the nuclear island structure, systems and components, and containing them in a hardened structure.

MR. OKRENT: Well, in fact, I think if you separated it in some way and put it in a hardened building, that might have some effect on access. It doesn't automatically tell me that someone might not nevertheless use this way for incorrect reasons to initiate an automatic depressurization, or, i the heat of some event, to depressurize when you don't want to. You know, when, for example, filtered vented containments are proposed, the industry is among the first to jump in and say, "Let's look at how this may do some bad things." Right?

MR. QUIRK: Right.

MR. OKRENT: All right. I would like to see the industry jump in and look at this proposal and tell us in what way it might do some bad things, if any, and how you evaluate them. And I would like to know all of the possible bad things that it might do.

MR. EBERSOLE: May I ask a question?

Joe, one thing you might comment on, there is already a potential for inadvertent blowdown, and so the real question is what is the relative increase in that potential. Is it significant the current system is automatic? Tripped by triple O level or something like that. So its inadvertant possibilities are already with us.

This is perhaps a significant or insignificant increment on an already-existing hazard which in itself I think is not too -- the consequences are not all that significant.

MR. QUIRK: That's the same type of feeling I have. But in a little further discussion of Dr. Okrent's concern, any time that you propose a reliable simple system to do something, there is some vulnerability to that system to inadvertently operate and cause adverse consequences. So I would hope that we could utilize administrative controls and access to these types of systems as opposed to complicating them so that they, you know, they wouldn't gc off unintentionally.

MR. OKRENT: Right now I'm not proposing you complicate them or simplify them or use them or anything --

MR. QUIRK: I understand.

MR. OKRENT: -- but what I am saying is, I haven't seen a complete evaluation of the pros and cons of the things it can do, things that you would want it to do, and so forth. And I am not sure we have really identified all of the possible difficulties it might cause. I don't know if you initiate a blowdown from here whether you expect it to last the same length of time as an automatic initiated one where you control it from the control room, or whatever. There are a variety of things I don't know. There may well be nice answers. But they weren't in anything that I read.

MR. QUIRK: Right. We have not done this evaluation, Dr. Okrent.

MR. WARD: Are either of the events, inadvertant depressurization or inadvertant opening of the containment, initiating events in the PRA?

MR. QUIRK: Inadvertant opening of the

containment is -- has no adverse consequences without a severe accident. But we --

MR. WARD: These are the two things that have been happening with this system. I am saying, are either of those initiated events in the PRA? You are telling me open containment is not what about depressurization?

MR. QUIRK: Well, I'm not sure.

Kevin, would you?

MR. HOLTZCLAW: Yes. We did evaluate an inadvertant depressurization as one of the initiating events in the PRA.

MR. WARD: What sort of attribution to risk does it give?

MR. HOLTZCLAW: We have got the numbers here. We can pull them out and give them to you in just a few moments.

MR. EBERSOLE: Joe, there is another track to trouble, which is just an increment on an existing track, which is that one that you are just drawing, inadvertant opening of that track.

MR. QUIRK: Yes, sir.

MR. EBERSOLE: Is that a complete schematic or aren't there some more valves? I have some apprehension about those testable checks if you inadvertently open one of those air-operated valves. Those things have been found to be in the test position and stuck there.

MR. QUIRK: Are you talking about this one (Indicating)?

MR. EBERSOLE: And this produces some surprising results if you open the valve.

MR. QUIRK: I think that the testable check valve feature is a very desirable one.

MR. EBERSOLE: Yes.

MR. QUIRK: In that because it permits to you check the free operation of the check valve during operation. And from the control room. And the way that's done is that you equalize the pressure between this valve and this valve (Indicating) because the actuator isn't sized to lift this check valve to its operating pressure. And when you do that, then you can actuate from the control room this valve, and then you open up and drain the space between those valves, and depending upon the upsilon that you get when you perform that function, you can determine that this valve in fact is seated and it correlates with the position in the control room.

MR. EBERSOLE: All of which is in the administrative controls which have not always been followed. That's the problem. I don't know what kind of indication, I don't recall what you have on that flapper, whether it's a physical position or what it is. I don't remember.

I don't think that there is a standing indication that that disk is down. There may be a secondary indication that it's down from some source. I don't know.

But anyway all this does is it presents another track to the outer world.

MR. QUIRK: I agree. But I think that this provision, this testable provision provides some assurance. It's better than not having it.

MR. EBERSOLE: I was interested in your proposition that this be used to make the argument that you didn't need hydrogen igniters. I think that must mean that you are trying to say that this so diminishes the potential for core melt that it's not worthy of consideration any more. I guess. Is that what you mean?

MR. QUIRK: That's one of the points I was trying to make.

MR. EBERSOLE: Instead of looking forward in that direction I think this might be a good idea. The long table we had of the relative choices of systems, the latter, I noticed it worked forward from the systems that we don't have, on up to a great many that we don't have, but it didn't look backward.

MR. QUIRK: I'm not sure what you are talking about.

MR. EBERSOLE: The choices that you had of mitigative systems and their relative worth on a cost/benefit consideration.

MR. QUIRK: Oh, yes.

MR. EBERSOLE: That long table. Perhaps you could look downward in that and look at now standard features.

I'll give you one as a case in point which I'm not going to sacrifice, but it certainly can be a target. There has been a lot of blood on the floor about the remote shutdown system. Surely this system would provide the critical aspects of remote shutdown. The protective aspects of it, it will cool the core, which is all it's supposed to do.

On the other hand, you pay some price for invoking this system. You don't like to do it if you don't have to. But back down in the reverse direction into the systems there must be numerous systems wherein it would be possible to make arguements that you can relinquish a lot of expensive QA and refinements which buy you little in ultimate reactor safety. I think it would be appropriate to look backwards down those systems, not forward up into the new systems that we don't have, and see what practical and realistic economies that you say, "I now have or are able to consider, or are no longer as necessary as they once were, because I have a parachute, a back door, a lifeboat."

MR. QUIRK: If you gave me one choice, if you get one system that you get to delete, if it were to come to that, I would use that on the hydrogen control. Because to me, the PRA tells us that there is very little cost -- there is very little safety benefit for having that on the Mark III. And so I would first say I would like to look at that system. And that's kind of in the spirit of this presentation.

MR. EBERSOLE: I would like to know a little more about the objectionable systems of using this system.

MR. QUIRK: Of using this?

MR. EBERSOLE: Yes.

MR. QUIRK: I just want to point out one. When you are talking about improving the system and upgrade it to safety grade, one consideration is that you only have one valve here (Indicating), and that you may want to put a second valve to make it redundant so that when you wanted it to open, it would open. But that may increase the failure reliability that one of those two could open inadvertently. You see? So how do you do that? Is it single failure proof to open or not to?

MR. EBERSOLE: There is a standard way to do that, and it costs a lot of money, is to matrix the core.

MR. QUIRK: It's crazy, isn't it?

MR. WARD: Joe, what does that "locked closed" mean on that valve?

MR. QUIRK: It is locked closed administratively controlled. That valve is key lock access. In order to open that, you have to, you know, use a key.

MR. WARD: Would that be in the field or at the station?

MR. QUIRK: Normally it's in the control room, I believe.

Ed, is that right?

MR. MAXWELL: No. That would be a valve.

MR. WARD: You are talking about one example where you have the control station possibly separated from the nuclear island and bunkered or something like that. Would this latch control be at the station?

MR. QUIRK: Yes, sir.

MR. WARD: Oh, I thought you said it would be at the valve.

MR. QUIRK: Well --

MR. WARD: Would it be in the field or at this control station?

MR. MAXWELL: I would envision the control station to be at the valve. Because it's a strictly manual --

MR. QUIRK: This valve is in the auxiliary building. And it wouldn't be practical to really bunker that valve unless you were taking a long run of pipe out into the field. So we would propose, I think, to put this as close as practicable to the containment. And lock it closed.

MR. WARD: Well, you might want to lock the valve in the air supply closed.

MR. MAXWELL: Yes.

MR. EBERSOLE: As a case in point, the seismic analysis always leaves some doubts as to whether you have gone far enough. If one could argue that the primary vessel and the other valving that emanates from it can be shown to be closed, like mainsteam, then the ultimate protective function of simply keeping the core covered is performed by this. So the collective doubts you have about weaknesses and other things in the system on a seismic basis, if you could sum them all up, could be accommodated by this, provided you had made these competent in seismic. And since there are so few things here to do, the argument could be made that that's no big expensive deal.

Anyway, I would just invite you, and I will myself go back and say, what have we done in the past to compensate for the absence of this system that you put here, which in the long run cools the core? Because it keeps it covered. We have done a host of things. We have separation, we have multiple systems, we have innumerable what I commonly call patches all over the place, trying to integrate the terminal function, which is the one you do here, cover the core.

This is an integral function in a small package, as I see it.

MR. QUIRK: Yes. I refer to it as kind of a last-ditch back-up.

MR. EBERSOLE: Why do you say that? That implies that it has some nasty aspects about it which I would rather not invoke. What are they?

MR. QUIRK: I don't mean it in that context. As you just pointed out, we have three divisional systems, each with its own independent AC power, that will come on and mitigate the consequences of a whole host of postulated events. In addition to that we have an RCIC division which is steam-driven and DC-operated which provides protection for events where you lose power and pressure.

We have, in my opinion, a complement of safety systems that show the frequency of core melt to be very, very low. And consequently, I concluded that this design does not need the UPPS system, that the core damage frequency is such that you cannot justify adding the system on a cost/benefit basis.

However, it is a prudent thing to do because it offers so much more protection for a number of far-out postulated events, such as sabotage. And as you pointed out in the last meeting, the whole plant could burn down around it, and if this was separated from it, it could provide coolant. So it provides a degree of protection for fairly reasonable investment, and I think it's worthy of consideration, and that's why we offered it.

So when I said last-ditch, I mean that you fail a whole complement of systems that are independent and separated to get to this point.

MR. EBERSOLE: Well, this is the first what I call strategic move in this war for safety that I've seen. We have been fiddling with leaves on the tree and we have made lots of patches on them. And this gets to the root, which is keeping the core cool irrespective of what else is going on. I certainly invite a backward look at the numerous things we have done which have only a fraction of the merits of this system.

MR. OKRENT: Before you take it away, please. You were murmuring about hardening and things like this. What would you harden in that system, if you were going to, and what would not be hardened?

MR. QUIRK: What I mean -- what I would do by hardening is that I would like to have a central control station separate from the nuclear island structures, set aside. And in this control building, you know, it could be bunkered, or hardened, however you want to define it. I would want the air supply source (Indicating) for depressurization in it. I would want as much as it is reasonably practical to put in that.

MR. OKRENT: A fire truck going inside this?

MR. QUIRK: Or adjacent to it or in a tin warehouse next to it.

MR. OKRENT: That's different. Beirq inside and then a tin warehouse next to it is not the same thing, as you and I well know. I'm trying to understand what it is you are saying.

MR. QUIRK: Well, right now all I'm saying with regard to the fire truck is this system has a provision that would enable a fire truck to connect up to it and provide coolant to the core. The details of is it going to drive into the building or how ever, we haven't worked out.

MR. OKRENT: Well, how about the diesel fire pump? Is this in some kind of building originally which includes the bottled air supply and so forth, or is it something else?

MR. QUIRK: The bottled air supply currently is in the fuel building. And the fire protection system is not in the fuel building.

Ed, do you know what building the fire protection system is in in the nuclear island design?

MR. MAXWELL: Out at the cribhouse or wherever the fire suppression water supply is. But it's normally in a building.

MR. OKRENT: All right. What I am getting at is, you have a somewhat dispersed system, and while I don't want to get into a detailed discussion today, we will have a subcommittee meeting where we talk in closed session about protection against sabotage. It's not obvious to me that this is ideal for some postulated forms of sabotage.

MR. WARD: But on the other hand it is, I think what you just said, both the fire truck connection and the diesel fire pump are physically separated from the nuclear island. So it's reasonable to expect that an event which would affect the nuclear island wouldn't necessarily affect either of these systems.

MR. OKRENT: Well, it depends how you define an event. In some cases an event is defined as some external force has taken over everything that isn't bunkered. And if I take that point of view, this one doesn't quite come through.

Let me ask you a different question: If you have the bottled air supply in the fuel building, are there any medium or high-pressure lines running through that building?

MR. QUIRK: Not in this area, I don't believe. I would propose to take the necessary bottles out of here into that central control station that I was proposing.

MR. EBERSOLE: To me this system could take a form similar to what the Germans used, which is a small bunker equipment area in which the -- normally the diesel fire pumps stuck out exposed on a deck someplace where you can go blow it up if you want to sabotage the plant.

MR. QUIRK: I don't see the fire truck sitting around.

MR. EBERSOLE: It comes up, but the permanent little diesel pump, I can see that as part of a package. But as I look at the system I try to look at what bad things you can do if you try to damage it. And you can't really do much.

MR. QUIRK: There are three things to depressurize. We provide makeup, and an answer to that is an inadvertent safety system open. And we vent for heat removal. So that's not a problem.

I need for the regulators and yourselves to tell me what's more important, redundancy to work or redundancy not to work, or both. And then here we have analyzed it for blowdown, and this is bounded by existing analysis and structure design. So the consequences of two out of the three are no-never-minds in my mind, and I need guidance on that.

MR. EBERSOLE: I can see in this, and I think we can talk about it without getting into any security problem, that this probably has a maximum potential for security for sabotage protection that I can think of. Because most of the aspects of its function is positive except that blowdown. That's a damaging potential. So even if you were to get in this bunker, there is not much you can do there. You could execute inadvertant blowdown, but that's about it.

MR. OKRENT: No, Jesse, the issue is whether --

MR. EBERSOLE: It could accommodate other sabotage.

MR. OKRENT: -- this is well protected in case somebody else has access to all the other parts of the plant. It is a strung-out system.

MR. EBERSOLE: As it is now, yes, it is strung out.

MR. WARD: You suggested that this might be a good trade-off for a hydrogen control system. Perhaps on a probabilistic argument that's valid. But it's not clear to me, the threat of a hydrogen detonation or deflagration I guess, does this system provide any protection or mitigation of that threat?

MR. QUIRK: No, sir. My point here is that you do what a PRA responsibly tells you is needed, and this system, as I said, is not needed in a PRA sense. But if we make these -- I'm going to call them moderate changes -- it gets at the dominant accident sequence that leads to core melt, plus a whole host of others that are not dominant but close, near at hand.

And so to me it's a responsible thing to offer to really get at reducing the risk associated with this plant. And if you are going to use a PRA in that way, I would also like to use it and not emphasize areas that have a very low probability of causing core damage, such as hydrogen.

MR. WARD: I understand that.

MR. QUIRK: Okay.

MR. WARD: What does a hydrogen deflagration or detonation do to the plant that this system doesn't help with?

MR. QUIRK: Well, the hydrogen events are that you have core damage, you have a melt water reaction that generates hydrogen, and the hydrogen will go through the pool and accumulate in the containment. And then if there is ignition, that the -- that that's the event that would overpressurize containment but not fail the drywell. And we have evaluated those sequences in our PRA. So this system does not offer any mitigation or prevention -- well, prevention, I guess it would. Because if you keep the core covered with this system, you don't have that problem. But it doesn't mitigate the hydrogen.

MR. EBERSOLE: Joe, there is a problem if you are trying to use that hydrogen system, the removal vent is a beneficial target. I can't help but notice this system in the background of the RDA presentations.

Yesterday I believe I was asked a question, why do you cool the water in the towers without first pouring it on the core?

In essence this system does just that. Puts the cooling where you need the cooling. Behind that thesis is, does it get in in any way which is compensatory for typical pipe failures that we consider as modes of failure?

And I see instantly if I take a pipe failure there between the vessel and the check valve, I've locked this system out.

Do you follow me? Right there -- no, no, no, back inward to the vessel. Right. In there. I have lost my cause.

So it says if you are going to go that far in claiming the merits of the system, multiple points of entry into the vessel must be mandatory or you have to find an argument that pipes are not going to fail and you begin to now I think come into view of making this few-element system hardened, in a really hard context.

MR. QUIRK: May I put up a slide to address that?

MR. EBERSOLE: Sure.

(Slide 3 shown.)

MR. QUIRK: At the last subcommittee meeting we talked about what does safety grade mean? And I took a cut at trying to find what it might mean. So I listed the various components, piping, instrumentation, valves, valve motive source, water supply, and on another chart the water supply motive source.

For each of those I tried to define a typically understood safety requirement such as seismic redundancy, and I added bunkering because we talked about it so much. And on piping, to your example, is the piping redundant? In other words, are there two penetrations?

And I've said here, in the commercial system it is not. And in the safety grade UPPS I have proposed that it not be, because preceding that at the entry above it, seismic category one to my way of thinking provides passive protection, such that I wouldn't fail that boundary because we have seismically qualified it so that we have confidence it would remain in place given say a large earthquake. And the LOCA has been shown by our PRA to be a very small contributor to begin that. So that's the rationale that I used for saying that the piping doesn't need to be redundant.

MR. EBERSOLE: Or you could call it super pipe or whatever you wanted to do.

MR. QUIRK: Yes.

Now, I've put on bunkering you can see that the 2 there means -- on the next chart I defined the footnotes. The 1 up here you can't quite see, says, "Includes meeting Appendix B to 10 CFR 50," footnote two defines bunkering as separating it from the nuclear island and in a hardened structure. And I put for that for the piping of three, saying partial bunkering those parts that we can take out into a simple station, and the parts that are pertinent to the vessel of course you can't. So to the extent we can bunker it, we propose to do it.

MR. EBERSOLE: The fire water you use is not exactly ideal boiler water.

MR. QUIRK: No, sir.

MR. EBERSOLE: Would you have as a first alternate using condensate?

MR. QUIRK: Yes, we would use a whole complement of systems.

MR. EBERSOLE: Yes, I know, you just showed the fire water.

MR. QUIRK: The RCIC pulls off the condensation storage tank. And we would only use this for those not available.

MR. EBERSOLE: I am only trying to find the ill effects of using this system. One of them is you are going to have some steam coming out of the containment, which would excite the general population, or something. I don't know what physical significance that has. I haven't been told that yet. Whether there is any activation products in it, whatever.

I think we need to know what are the reasons you don't use this and use other systems?

MR. QUIRK: So this chart I tried to find what it would mean to upgrade. So with this chart I have tried to put on the table what in my opinion enhancing the system safety grade would mean. And I don't think we need to go through each of these points. And you will notice down here that I have made a correction to the water supply. That's pretty difficult to bunker the fire protection system source of supply, or for that matter the fire truck, and I have changed that to reflect that.

(Slide 4 shown.)

MR. QUIRK: And this is the second chart that I have alluded to that covers the water supply source and the definitions I have already talked about.

So the whole purpose of my presentation would be that General Electric Company would consider enhancements to the old plant protection system, but I would hope that the subcommittee could give consideration to providing an incentive and, if it's reasonable to provide this, then it should be reasonable to take away hydrogen control systems that have a very low probability for causing core damage to begin with and for which I think not be mitigated.

MR. EBERSOLE: When you look at this system against the RDA, the rather massive changes proposed by them, what can you say about the relative merits of this versus those changes? This does put water on the core.

MR. QUIRK: I guess this is our RDA study. We have performed the cost/benefit for both prevention and mitigation systems, and I think that's important because I believe we have balanced, then, the safety improvement and the reliability of the total plan. And when we get done with that, if there is anything that needs to be done, and we don't think there is anything that warrants additional systems, but we are offering this system because it has so much more capability. And this would be our answer. So I might offer that this is the equivalent, the General Electric equivalent of the RDA study.

MR. OKRENT: If I could make a couple of comments.

If I understand the RDA report correctly they could, if they had so wished, put water onto the core. It was no real problem for them. They chose to not get into what they thought might be a set of phemomenological complexities. Suppose you are getting water into a partly molten core, et cetera, et cetera. And they decided to stay with the more straightforward situation of, "This is a system that is dedicated to cooling the suppression pool. It's not part of our task to protect the core." And it's exactly what the situation was.

So there is nothing that prevents one from, if one thinks that's the right thing to do, from modifying and add-on system, just as in this same way, if you have some kind of shutdown -- additional shutdown heat-removal system, you could add to it a capability to take care of small LOCA. You know, this is an arbitrary decision. Some of them cost money, some of them just cost a change in design.

MR. EBERSOLE: Yes.

MR. OKRENT: I guess at the moment, since we really don't know what you said -- well, what the evaluation of the seismic picture is and so forth. There are some aspects that we need to look at, and then, if you will, come back and see what you then say about the UPPS system.

I will give an individual comment, personal comment with regard to the question of hydrogen control and the more broad question of mitigation. The ACRS has said on more than one occasion that it thinks that both prevention and mitigation, and now we are talking about accidents beyond the design basis, should be present to provide defense in depth. Now you may feel you in fact have very good mitigation via the pool, and that the additional risk you run of a hydrogen deflagration or detonation if you had no igniters, this is an acceptably low risk.

But my observation of experience over quite a period of time now leads me to believe that those who argue very strongly that here is, quote, "the nearly perfect system," whether it's for mitigation or whether it's for prevention, it seems to me inevitably have either omitted something or assumed something that later turned out to be a -- let's say a weak spot that wasn't in the original evaluation. It's hard to think where that was not the case.

So you know, even yesterday in our conversation on bypasss for the drywell I found that a little bit curious that one hadn't assembled the past experience where bypasses had existed and tried to see how it compared with what you were predicting on paper, as it were; to see what were the difficulties. You may or may not know, but one of the fathers of this PRA game, Reg Farmer, says, in effect, "Don't give me a very small number. I don't know what to do with it and I don't believe it."

MR. EBERSOLE: Joe, in talking about the hydrogen mitigation system I guess you are talking about igniters, primarily. Right?

MR. QUIRK: Yes.

MR. EBERSOLE: I would like to have Charlie Wylie --

Charlie, are you there?

-- maybe defuse the notion that this is an expensive difficult system.

Charlie, if you can say a few words about what you and TVA and Duke did about this it might be worthwhile.

MR. WYLIE: Well, I think what Jesse is referring to is the igniters that we put in plants -- of course it depends, you know, you can make anything as expensive as you want to, and the systems that we put in were basically commercial-grade systems that had a limited fault application such as seismic. And the numbers that we kicked around yesterday, the numbers that the RDA report had were very realistic as far as the actual cost of those systems were concerned.

I think that you could almost figure something like the material cost -- the complete material cost installed to be in about a thousand dollars an igniter. And then your labor added onto that. Those are realistic numbers, and we worked with the TVA originally jointly in the system we put in for reactor plants ourselves, and TVA put them in.

MR. QUIRK: Mr. Ebersole, the resistance that I have to igniters is not one of cost. And I think I've said that before. Our results and our studies show that there is no safety benefit in putting them in, and any cost therefore tends to run up the cost of power production.

If I could comment to Dr. Okrent that I understand exactly what he is saying. And I have colleagues at General Electric Company that were pointing that out to me at the time that we were considering whether or not we should propose the UPPS system, that there was a great debate, I'll say, within GE as to whether in fact we should propose it, because we believe that the risk of core damage frequency is superior for the BWR/6 because of the carefully evolved approach taken to reactor design. And we have attained our goals and don't need to further reduce that.

And it was pointed out to me that in offering up the system I run a risk of increasing the cost of power generation and also keeping the hydrogen mitigation commitment to provide igniters in place. And so I will end up losing and adding further to the cost of the plant.

And I, you know, that's the risk we ran, and the decision was made, it was a cost-effective thing to do, it offers further plant protection, investment protection, and we will do it and take our lumps. And I am a little disappointed that I think that the safety segment of our industry should provide incentive to designers to do what they think is reasonably responsible to do to reduce risk. But the other should apply, too, that you should take off things that you don't think reduce risk.

MR. PAYNE: I would like to make a comment if I may. I'm Arthur Payne from Sandia Labs.

Considering that in the PRA station blackout isn't one of the dominant sequences, and these igniters are supposed to be AC-powered, given that you have an extended loss of off-site power, you gain AC power back, the igniters therefore, I presume, would automatically come on. If the containment spray system is also automatically actuated, that could reduce the containment atmosphere to within flammability, and you could get a very large detonation.

I wonder if this is being considered as a possible negative side effect for having AC power.

MR. OKRENT: Well, I can't speak for GE. The ACRS has raised this question with some prior applicants for operating licenses that were putting igniters in with the regular AC power sources, asking why is this the right way to go?

The staff seems to have been content in the past with such an approach where igniters have been put in.

So I myself consider it an open issue.

MR. PAYNE: Well, I think in this particular case, considering that these sequences seem to be the dominant sequences of this plant -- you know, some other plant where some other sequences are more dominant, you may be buying more than you lose, but in this particular case it seems to me you may be losing more than you are getting back.

MR. OKRENT: Let's say I am skeptical about the robust nature of a choice of sequences for any plant and labeling them "dominant." I am willing to bet that five years from now the so-called dominant sequences for almost every plant will be different, just because we've learned more. So, you know, I think that part of it, in focusing on a few of these and centering all your decision-making on a few, I think will lead people down an unfortunate path.

There is a separate issue, I would say, in should igniters, if that's the path you choose, be solely on the conventional AC power system?

See, you don't have to take it --

MR. PAYNE: Sure.

MR. OKRENT: -- from the point of view that you have. In fact, if you didn't have igniters, when the power came back on, something would be there to ignite it, and you would still have the problem. Better if you are concerned about it, have some assurance that you haven't lost the ability to ignite very dangerous concentrations of hydrogen, even though you have what we now have defined as station blackout.

MR. EBERSOLE: You made a point that it really probably doesn't matter if the igniters are there or not. there are going to be spurious sources of ignition as there was in TMI II so that you will ignite on an unprogrammed basis anyway unless you devise a system to kill all electric power to the containment.

MR. PAYNE: In a station blackout situation, in that particular situation by definition you have no AC power sources. Only DC. But in any case if the igniters were DC or independent, as proposed by the RDA yesterday, that would allow for the possibility of continuous burn before the containment atmosphere increased to the point where you could not get it.

MR. EBERSOLE: Well, the igniters, if you want to do it, could be put on a very small MD set. Chicken feed.

MR. CAMP: I would like to offer the comment that it's not clear at all that current systems have been designed particularly well or all these problems have been well thought out. But I'm not sure how relevant that is to the overall question of whether or not you need hydrogen control for the Mark III. I think if you decide you do, then you should deal with the question appropriately and come up with a proper design.

I guess the key issue is whether or not, in fact, the probability of drywell failure is sufficiently low. Your cost/benefit analysis indicates that it is. My concern is that it's not clear that we are going to get to see all the details that went into that cost/benefit analysis, and therefore it is difficult to reach any strong conclusions or come up with a consensus on what those probabilities should be. I'm sure if you got a room full of hydrogen-control-types, you would come up with a wide range of numbers for those probabilities. And I am not sure how robust your conclusions are.

MR. EBERSOLE: Let me point out a case which I was just back from the other day, Hope Creek. There is going to be a difficult argument about whether a certain retaining wall can take a seismic shock and not allow sedimentation to come down and fill the suction uptake and service water system, which is death to the plant. That's going to be hard to converge on a real hard answer, as are many of our safety problems. They always turn out to be a little mushy in the final analysis. So there was a case in even this old donut-type plant where one can dream about having a way to get out the back door. And eventual arguments about that turned out to be less than what was the real case.

MR. WARD: One more question. I guess I missed the point of whether the UPPS group opposing this is a commercial grade or safety grade version.

MR. QUIRK: We at General Electric Company have committed to provide the commercial grade UPPS system. At the last meeting we had a similar discussion, and I offered to consider upgrading it to seismic grade, for example, and consideration of bunkering, along with hydrogen mitigation. I would like the incentive for us upgrading the system to be that we are needlessly putting mitigation systems on for hydrogen. And I would like to swap, if you will, or trade.

And so the commitment by General Electric is to provide a commercial grade UPPS system, and that we would consider upgrading it were the Committee to decide that we could do away with hydrogen control systems.

MR. WARD: Have you done a cost/benefit analysis for each version, commercial grade and safety grade?

MR. QUIRK: No. We have done for a commercial grade UPPS system. And the cost/benefit ratio was above one, which in our vernacular means that it is not cost-beneficial. But we nevertheless offered it.

Now, the commercial grade would roughly -- I've roughly estimated what I think to be conservative. It may increase by a factor of ten. And that's an estimate on my part and not an analysis.

MR. WARD: What would increase by factor of ten?

MR. QUIRK: Cost of the UPPS system would increase by a factor of ten in my estimation if we were to upgrade it as I have identified here.

MR. CAMP: I would like to ask a question more philosophical in nature. You have indicated that UPPS is not cost-beneficial based on your analysis, but yet you can sort of philosophically justify it in that it seems like a neat thing to do.

If you go back to hydrogen for a minute and consider that that may be the only way of failing the drywell and thus threatening your basic line of defense against fission products, aren't there sort of philosophical arguments for having hydrogen control of the same sort that you are using to justify the UPPS system?

MR. QUIRK: We have evaluated the hydrogen sequences rigorously, and we have not found a mechanistic way to fail the drywell due to hydrogen.

MR. HOLTZCLAW: That's due to hydrogen events inside the drywell. We do fail the drywell by hydrogen events in the containment. In fact, that represents the risk, if you will, that comes out of our PRA.

MR. QUIRK: You did understand that I was talking about failing the drywell due to hydrogen detonation inside the drywell. We have found no mechanistic way to have that happen.

MR. CAMP: But there are ways, as Kevin pointed out, for failing it from outside.

MR. QUIRK: From the containment side, as I pointed out earlier.

MR. OKRENT: What frequency per year is your best estimate of this.

MR. QUIRK: Of what, sir?

MR. OKRENT: Failing the drywell due to a severe hydrogen deflagration or detonation outside.

MR. HOLTZCLAW: One times ten to the minus six. 20 percent of the cases evaluated in the PRA.

MR. QUIRK: So this is failure of the drywell due to hydrogen deflagration.

MR. HOLTZCLAW: That's correct.

MR. OKRENT: But in this case the pool is still effective; is that right?

MR. HOLTZCLAW: These are the cases really that represent the risk sequences in GESSAR where you ultimately fail the drywell, and then you have that release unscrubbed.

MR. OKRENT: So you say some of it has been scrubbed but there will be -- you can't get hydrogen into the containment without also some fission products having gone through the pool, which I assume you have scrubbed out. But you are saying further fission products would get out, and are they a large fraction of the total or where do you place them?

MS. HANKINS: They are not a large fraction of the total.

MR. OKRENT: So much of the fission product, the ones you are most interested in, have already been scrubbed in this accident.

MS. HANKINS: That's correct in the GE assessment.

Hankins, General Electric.

In the SSER assessment by the staff they did include cases where most of the fission products bypassed the pool. And even in that case, the risk was very low. So I think it --

MR. OKRENT: Why was of the risk very low?

MS. HANKINS: Because there are other mechanisms other than pool scrubbing that result in retention of the fission products.

MR. OKRENT: Like what?

MS. HANKINS: Plateout, agglomeration.

MR. OKRENT: Let me bring up a question. Have you looked at primary system reliability from the point of view of failures so massive that in fact you lose not only the primary system, but your containment?

MS. HANKINS: You mean similar to the alpha failure mode, the in-vessel steam explosion that ruptures the vessel and containment and everything?

MR. OKRENT: No. Let's say the vessel -- a nozzle blows out of the vessel. Okay? Which is a large rupture in the vessel. And I think not one for which your drywell is designed. And that would give you in this postulated event early loss of drywell, presumably early loss of containment, melting half an hour or whatever later. And substantial releases compared to anything I think you are talking about now, because there isn't time for agglomeration and so forth, or not much.

If this event would release -- let me speculate -- a hundred times as much fission product, not of all kinds but effectively -- I'm just pulling a number out of the air -- then in order for it not to be an important contributor, it has to be more than a hundred times less probable.

Now, you have just given a number like ten to the minus six for this event that you said leads to problems. By problems I mean largish, but not very large releases. Improbable, but, you know.

You would have to -- if my arithmetic is right, and I don't know if that figure of a hundred is right, but let me suggest a ball park number. You would have to get to a rather low probability of this event that I have just mentioned, not occurring.

Have you analyzed? Have you data? How robust is your position in that regard?

MS. HANKINS: We truncated the frequency of initiating events at ten to the minus eight. We included RPV rupture as one of those events with a frequency equal or less than ten to the minus eight. We did not explicitly model that event.

MR. OKRENT: Now, how good is -- You know, you truncated it. But what is the basis for so good a reliability of pressure vessels?

MS. HANKINS: There is a discussion in appendix A of the PRA.

MR. OKRENT: Oh.

MR. QUIRK: With those assumptions, though, there is not a hydrogen control system that's going to help that at all.

MR. OKRENT: We were just talking about, a moment ago, about the drywell, and could it fail, and I was just trying to look at other possible -- Maybe Mr. Etherington would like to ask --

MR. QUIRK: We were talking about drywell failure, but the mechanism for that failure --

MR. OKRENT: I realize that.

MR. QUIRK: -- and with those set of assumptions hydrogen is not going to help anyway, hydrogen control systems.

MR. OKRENT: I'm exploring a little bit into some of what you would call the serious accident range to see how -- because of the low probabilities, the low frequencies, that you are claiming, whether in fact you have included enough other paths. And I'm raising this one.

MR. QUIRK: I understand. And the answer that was given at our last ACRS subcommittee by NRC staff, Jack Rosenthal, as I recall reading the transcript, went like this, that roughly he has assumed uncertainty on the order of a hundred on the back end of the PRA which are the risk consequence sensitivities, I guess, and a factor of ten on the front end, which he pointed out was a factor of a thousand, the bottom line conclusions aren't changed. That was in the transcript of our first meeting. And I think it provides some insight into sensitivities and results.

MR. OKRENT: I'm sorry, it's hard to translate factors of ten here and factors of a hundred there. You wouldn't let Professor Catton do anything linearly yesterday. You recall? Because things entered with different decontamination factors for different sequences and so forth and so on. So I can't really think and believe what I am thinking, you know, without having something to read along the lines you are saying. But why don't we for a moment or two look at the question of how well you know your vessel reliability.

MR. ETHERINGTON: Yesterday we were told that the failure of the class one components, that's not only the vessel, that's the vessel and valve bodies and pump casings and piping, was so low that it was not a significant contributor to risk.

But then it developed that this was based on perfect structure, no cracks anywhere in the system.

Appendix G of the ASME code, section three, requires a fracture of mechanics analysis on the basis that there is a crack in the system, the crack should be at least a quarter of the thickness, and at least one-inch depth and the length six times that. And although that's a non-mandatory appendix under the code, the code is part of 10 CFR 50 by incorporation. And appendix G of 10 CFR 50 specifically requires that the ASME appendix G code requirements be met.

Now, that appendix is based on linear elastic fracture mechanics. It's primarily directed to PWR problems, but it's worded generally so that it covers also BWR systems. It's obviously not a good yardstick for ferritic steels in the upper shelf, and still less for austenitic steels. I think that we can accept that any failure for austenitic piping would almost surely be by plastic instability rather than by fracture.

But appendix G of course is old. There was no J and K integral at the time that it was written. I believe it was written just about that time. What bothers me is the assumption we have no faults or defects anywhere in the system in making the conclusion that failure is essentially incredible.

The vessel itself does have bimetallic welds, it does have bolts, and it does have a very complicated lower head system.

The piping, can we absolutely guarantee that there will be no mistakes in the material? Or in the welds? Or even in the thickness of the plate? We have seen cases for an instance where the plate was under-thickness and there was a failure.

So how we can justify assuming an absolutely perfect system really puzzles me a little bit, and I think the staff might perhaps take a position on this and set some kind of ground rules. But I think appendix G is not the right ground rule. But as long as it's part of the regulation, I don't know on what basis, without discussion, it can be ignored completely, as it seems to have been done by GE from what we were told yesterday.

I think that's -- this is a matter of some concern to me, and I think I would like to see some resolution, perhaps a substitution of some other criteria in appendix A which does recognize the possibility of less than perfection in the entire primary system.

MR. PAYNE: I would like to make a comment on that if I may.

From a PRA point of view there are really two reasons why LOCA's are not dominant. One is the fact that initiating the frequency is of the order of ten to the minus three or ten to the minus four. But the other is all the systems that have been designed to take care of that. That continues to reduce this probability. So even if you increase the initiating event frequency say up to the order of around middle ten to the minus threes, these sequences would still be not the dominant sequences of the plant. The sequences that are dominant are the transient events that have high frequencies and the possibility of small LOCA's such as reactor coolant pump seal LOCA's or things like that which have probabilities in the range of ten to the minus two or higher.

So I don't think that they are assuming perfect piping or anything like that.

MR. ETHERINGTON: I was told yesterday that they were assuming perfect components. No cracks.

MR. PAYNE: Yes, but I think if you look at it statistically from the point of view of how many pipe ruptures we have in the number of operating hours that we have available, that the estimate of the frequency of pipe ruptures is not unreasonable. Irregardless of whether they are assuming perfect piping or not. I am just looking at the statistics of the amount of piping we have and the amount of ruptures we have had.

MR. ETHERINGTON: I am inclined to believe that this true. But I think there should be some formalization of the ground rules. Do you completely ignore what is in essence part of the regulation without discussion?

MR. PAYNE: I have no objection to doing that.

MR. ETHERINGTON: I would like to see some kind of a discussion on ground rules. That's all I am saying.

MR. OKRENT: If I can interject a comment. I think what you have said is insufficiently qualified in the following sense. You are assuming that the equipment that was put in there to deal with the LOCA is capable of dealing with the LOCA's that might be caused by the failures we are talking about. And they are not designed, nor is much of the structure itself designed, for certain kinds of vessel failure, perhaps for certain kinds of valve body failure, et cetera. And we heard numbers -- I think ten to the minus eight? Is that the number I heard?

MS. HANKINS: For an RPB rupture greater than the DB in LOCA.

MR. OKRENT: That may be the right number, but I myself know of no robust justification for that number. So far as I'm concerned, it's a subjective probability. And I'm sure I can find people in England who will give a subjective probability for the same number which is between ten to the minus five and ten to the minus six per vessel-year. So there just isn't data and there is not going to be data.

And this is part of the picture now.

We do have flaws in existing vessels. There is a lot of question, time being spent at Indian Point now because they see a flaw. But even though we don't see them, there are flaws around, and Mr. Etherington was in part saying however things are analyzed, they should not ignore the existence on the average of some spectrum of flaws.

MR. PAYNE: I would agree with you. These very large events that there is a substantial and a certain need there in the calculations. However, I thought the stuff that was discussed yesterday, and initially it was brought up in terms of their LOCA frequency, were referring to LOCA's that they had analyzed at the plant as being within the capacity of the safety systems to respond.

MR. ETHERINGTON: That wasn't the intention of the question. I think when we spoke about the danger of a crack causing failure, we mean during a faulted or emergency condition. That's your leak-before-break criteria. What you are afraid of is a leak that you don't detect and which sits there quite comfortably in normal operations, but would lead to a rupture in an abnormal event.

MR. PAYNE: I can agree that more work needs to be done in that area.

MR. ETHERINGTON: Pardon?

MR. PAYNE: I can agree that more work needs to be done in that area.

MR. HOLTZCLAW: Can I add a couple of comments?

I think in agreement with some of the things that Mr. Payne has said. Because I think we tried to put it into some perspective as to what we did for the PRA and where we are in the deterministic world. For a situation like things like a pipe break industry, we made use of industry data which governs, which provides information that is available on systems that are operating in the field today.

But I think we also looked at the BWR/6 GESSAR system and looked at some of the changes that have been made from more or less the lessons learned on the operations in the field. Now, regrettably there have been problems on BWR piping systems. It's very well known. In the GESSAR design I think there was a presentation on our last subcommittee meeting just focusing on changes made in the piping systems and materials in order to preclude this. This was a change made in the deterministic world that is not reflected and cannot be reflected until you develop a new and additional data base in that one area.

Mr. Etherington brings up another point on bolting -- on other areas in the plant design where there could be flaws. In many of these areas there are not adequate PRA means in reflecting these things in analyses. So there is some fallback on other areas in the nuclear business in the deterministic world to try to prevent some of these items. Things like the unresolved safety issues and generic safety issues where you address things like bolting requirements and things of that nature. So I think there has to be some kind of a juxtaposition of both the PRA world and what you can evaluate, and then the lessons learned in the deterministic world based on plant experience, and to try to bring those to the fore with the new plant designs. And we feel we have done that on this design.

MR. OKRENT: To give an example on the BWR vessel, it's my impression you still have a problem investigating in-service many of the welds around the safety control rod penetrations. Am I wrong?

MR. HOLTZCLAW: We think that's correct, Dr. Okrent.

MR. OKRENT: Well, so, you know, you are saying ten to the minus eight with an inability to really go back over the life of the plant and confirm on a really frequent basis that something untoward isn't developing. And I am only giving that as an example. Okay?

It's a low-number problem. When you are getting down to low numbers and you are creating problems.

MR. SHERWOOD: And I think we agree with you. We essentially derive those numbers from industry experience. And even though we have many many injection points as you point out at the base of the reactor, there only have been in something like five hundred years of reactor history one or two leakers.

But I also wanted to state to Mr. Etherington's point, before PRA were invented a few years ago, by the English and a few members of the ACRS, the plants were designed to good engineering judgment, and I think GE has always been proud of this. For example, we have a core spray system, six thousand GPM system, as you well know, which in the event of a large catastrophic break in the base of the vessel would provide a fairly substantial core flows throughout all the bundles. And we have, I might say, considered during many design evolutions, including the current one with the Japanese, of removing that. As you know, there is no requirement for high pressure core spray system in the regulations, and we have always added that as an extra safety feature. And we are continuing with that extra safety feature in our current new design with the Japanese.

And I think also the philosophy that we use in terms of redundancy with both steam power systems and coolant systems as well as diesel-powered, I think is part of this non-PRA good engineering judgment approach.

MR. OKRENT: I don't want to prolong this discussion. But I for one haven't seen the analysis that says your core spray would really cool all channels, given a substantial break at the bottom of the vessel, because you now have a different core cooling mode than you are using when you have the bottom of the vessel.

MR. SHERWOOD: That's correct.

MR. OKRENT: And whereas now you are not sensitive to distribution, you suddenly become very sensitive, among other things.

MR. SHERWOOD: That's correct. But in earlier tests we did prove fairly good distribution. And remember, we have a system which is not required and many plants don't have.

MR. OKRENT: I am just saying we have to be a little bit careful about things when we say, here's something that will cover anything.

MR. SHERWOOD: That's true, but I did say that on the basis of the fact that we did have full-scale tests at Valesatos for our BWR/6 core spray system and it showed fairly good distribution. Again, not the type that you are talking about, Professor Okrent, where we essentially defended it with the staff, but essentially very good distribution.

MR. OKRENT: Let's get back to the hydrogen ignition system to see if there are any further comments to be made at this time.

I'm sure this is not the last time this subject will be discussed. Any further comments made now?

MR. CAMP: If you fail the containment due to a hydrogen event, do you have any feel for how much suppression pool water you will lose, and particularly if the containment fails explosively? Will you lose enough water to uncover the vents, for example?

MR. HOLTZCLAW: We are going to be discussing this in a lot more detail when we talk about containment structural analyses. But based on our evaluations we wouldn't lose any pool water because the failure location is in such a location that it doesn't impact the pool. It's a hundred feet above the pool surface.

And in the explosive events that we evaluated and included in the PRA, in fact we evaluated large-scale detonations in the containment that would ultimately fail the drywell. Again in those sequences it becomes a moot issue because for the portion of the event following that failure you wouldn't be counting on the pool for any mitigation aspects.

MR. CAMP: Okay. I guess my concern is that the containment, being a steel containment, may tend to rupture more like a balloon than a particular hole. So the fact that the initial loss of integrity is a hundred feet up may not buy you that much if in fact the whole structure goes.

MR. HOLTZCLAW: That's a good point. I think possibly what you should do is review again a portion of our appendix G in the PRA which looked at the transient hydrogen events, if you will, the events where you get more than just a hydrogen burn; some kind of a hydrogen detonation. Because we did do some sensitivity on that in looking at failure modes. And we moved the potential locations around somewhat to try and assess what that impact would be.

MR. OKRENT: Maybe we better go on to the next agenda item. Let me see. It is scheduled for 45 minutes, it says, which my experience is means at least an hour.

Why don't we take a ten-minute break.

(Recess from 9:55 a.m. to 10:09 a.m.)

MR. OKRENT: The meeting will reconvene. The subject is interface requirements. I assume General Electric will make the presentation.

MR. FOX: My name is Jack Fox, GE. I would like to say, the subject here is interfaces.

(Slide 5 shown.)

MR. FOX: Primarily severe accident interfaces. But the design of every interface is deemed to be a severe accident interface because it is an assumption of the PRA that certain interface requirements between the BOP and the unstable nuclear island in fact get done as required by the applicant. So what I would like to do is describe what I call three types of interfaces. I will get into specific, examples of them, and detailed examples of the PRA interfaces themselves, and then spend some time on what we use to control these interfaces.

(Slide 6 shown.)

MR. FOX: There are three types of interfaces. The first type is what we call the GESSAR II/FSAR interfaces. These are the interfaces that basically result in a standard design, the requirements required by Reg. Guide 170, but because of various reasons cannot be provided at this time. And there are four primary that fall in this category, add to them the BOP scope itself, like the turbine driven generator. The equipment which is vendor-dependent, like the specific kind of pump we use. Applicant dependent may be procedural in nature, that which is required for the applicant performing his function for his plant. And of course site-dependent interfaces which vary specific to the site.

And we have a fifth in GESSAR which is called type five, which is deferred. In the technical sense we chose to not pursue all the details at the time just prior to the FDA. This was as we were getting reviewed last year and certain items came up in which there was no difference of opinion technically between the staff and GE, and they felt as long as the details were arrived at before the first applicant of GESSAR, that would be satisfactory to do at that time.

The category one through four items are all provided by the applicant in his FSAR. And the first applicant, as I mentioned, we will provide him, you might say, with the details to fill out the mechanics of Reg. Guide 1.70 information.

(Slide 7 shown.)

MR. FOX: I give you a couple of examples. Now, I just pulled these out of the table, out of chapter -- section 1.9.2, and there is a total of 19 tables in there chapter by chapter which specifically delineate a requirement that the applicant must perform in completing his FSAR. And the -- I say I just pulled these out of the 19, for each chapter.

And the interface category as I call it is BOP scope, this is turbine generator information (Indicating).

This is equipment-dependent type information such as qualification results.

The industrial security like a certain applicant.

Seismic analysis, the specific parameter of the site is something that's required. By the way, this matrix puts down the page, subsection, so on and so forth. This is a typical -- and when I say typical, it was approximately 20 items in which we deferred in details.

And this, for example, was the purge system, we had made a design change near the end and went from an 18-inch purge to a 9-inch purge system.

So that's the type of information in those categories.

MR. EBERSOLE: Before you pull that down, let me ask Joe a question.

Joe, something occurs to me with respect to that last topic. When you go back in and examine the UPPS system, take a list like this, and ask what can the UPPS can do in each of these areas. I think if you look at them, you see it just about copes with any problem in each of those. So what is suggested there in my earlier suggestion of a backward look is looking a little bit differently at what you have to do in these areas, in a cost and safety sense. Do you follow me?

MR. QUIRK: I do, sir.

MR. MICHELSON: I have a question on interfaces. Is the insulation of the recirculation loop, for instance, an interface item or a supplied item in the GESSAR?

MR. FOX: That's within our design scope.

MR. MICHELSON: You supply the insulation. What type of insulation do you supply?

MR. FOX: I couldn't give you the details.

MR. MICHELSON: Has some various points in the kinds of sump arrangements, et cetera.

MR. FOX: Yes.

MR. MICHELSON: At what point will you work out these kinds of details?

MR. FOX: No, sir we have them, I just don't have the details.

MR. MICHELSON: I see. You have them.

MR. FOX: Oh, yes, I just don't have them. I remember two years ago going over these with the staff.

MR. MICHELSON: Perhaps at the next meeting you could discuss insulation in drywell and wetwell areas.

Another thing I would like to hear discussed with the catastrophic accident which I thought was taken care of a long time ago I am not so sure now. I would like to know how you took care of the catastrophic situation.

MR. QUIRK: In our GESSAR II design we transferred the fuel elements down an incline tube into a fuel pool.

MR. MICHELSON: One at a time. And the fuel pool is outside the reactor building?

MR. QUIRK: That's right --

MR. MICHELSON: You don't handle a cast inside the reactor building is what you are saying.

MR. QUIRK: That's right.

MR. MICHELSON: That problem then goes away.

That's all I need on that one. But I would like to hear about the insulation.

MR. FOX: Would you write that down.

(Slide 8 shown.)

MR. FOX: The second type of design interfacing between nuclear island and BOP. I have an example of this in my next chart. But its character is a little bit different. Appendix A of 10 CFR 170 is related to that interface information which normally occurs between a full plant, whatever that is, and the BOP. It is all safety-related. And this information, of course, was used in the staff's review of the standard design.

Chapter 1 provides a road map of this, of where you find this information throughout the 18 or so volumes or chapters.

And I say the specific interfaces again are provided at the end of each chapter and are in accordance with appendix A of 10 CFR 170. And these are design interfaces as opposed to the first, what I call more paper interfaces, to fill out the information requirements.

Now, at the time of application by an applicant, or an applicant referencing GESSAR, there would be no initial information in this area. This is the information we have defined as design, let's say moment or torque or whatever it happens to be. And it's used, this information of course is used by the applicant or the BOP designer, and is correct with the nuclear island.

(Slide 9 shown.)

MR. FOX: Now, this is the type of information, I won't get into details, but we are talking about specific assumptions, or if you want what was used in the detail, in the design on the standard end of the design. And this is, for example, as it says allowable anchor loads. And this is the type of information we call -- which again this information or these design values must be adhered to for the -- it's implicit in the assumption of the severe accident analysis.

(Slide 10 shown.)

MR. FOX: Now the ones you've been waiting for.

And what I have done, of course, this is a general description of what we call PRA interfaces. Now, these interfaces were generated by looking at literally all of the -- excuse me -- all of the assumptions, if you will, that we made about the plant, about performance, about a specific piece of equipment that may or may not have been purchased.

And we ran it through a sieve, if you will, if it didn't -- if the data that we used, assumptions that were made, whatever, was backed up by -- was well documented in

GESSAR or our design specifications for that, that was sufficient. That is we had a base by which these specific numbers were generated. Or in some instances we had to use industry data. Because for example we can't specify a specific cost/benefit. We do in our designs specify reliability information.

But if the specific assumption that was used was, for example, let's just say something outside of the normal nuclear island scope, but it was substantiated by recognized industry data base, well, that was sufficient, or it had a very little, by definition, small effect to the PRA. Okay? And I'll give you the results that came out on the next chart.

And the interface areas you will see, the applicant must do one of the two, either shows that his design, his purchased parts, his whatever, is within the assumption, or go back and do a reanalysis to justify if it has a measurable impact.

MR. EBERSOLE: May I ask a question?

MR. FOX: Sure.

MR. EBERSOLE: Earlier on I think we asked, somebody did, are you going to impose reliability requirements on equipment and components? The answer was no.

But how in the world do you avoid doing it if you are going to do this? Suppose I tell the applicant that you have to give me service water pumps. I don't want them to fail. What are you going to tell him? You certainly must have to have reliability limits.

MR. FOX: There are some. Not on every piece of equipment.

Anybody want to address that?

MR. KNECHT: Don Knecht of GE.

I think you will see it on the next chart, but for those areas where we have a requirement on the balance of plant, such as you are mentioning the service water system, which could be significant, we did put a reliability goal to be consistent with the assumptions used in the PRA. On other areas where there was a less significant effect, we haven't put any kind of requirement.

(Slide 11 shown.)

MR. FOX: There is one of three, one table with three pages. And this is an integral part of the GESSAR document. The first two types of interfaces were also in table form or in the interface requirement area, and this is a third table which is deemed to be -- which is dedicated strictly to what has been identified as, quote, "Interface requirements relating to the PRA."

Now, I think if you have any specific questions on any one of these, we can address them. I can go over all three pages. Or parts to this. But this is the -- I don't know of the exact total number of assumptions that were made which we applied the three, it's got to pass one of the three requirements before the -- and then say, this is what in our estimation fell out as either significant, not backed up data, not backed up by industry standards, or it was not well documented in GESSAR.

Do you have any specific questions?

MR. OKRENT: Well, under three, you talk about a site hazard curve. And I think you don't imply a distribution as well around the site hazard curve. If they are going to do some kind of seismic PRA, they have to have some kind of uncertainty distribution around the -- whatever you call the median or mean site, site hazard curve. I don't understand, is there an interface requirement in this regard or what?

MR. FOX: Let's put it this way: This review, as you know, isn't one hundred percent complete. I might be stepping off.

The -- we are going to get some basis level of agreement between the staff and ourselves and, you know, from the standpoint of the FDA, we expect to get.

Now, this may (Indicating) before the final analysis is done, have other restrictions. I agree with what you are saying. But there is going to be some --

what I don't want to do is say we start from scratch each time we get to a new site and new applicant and can't utilize any portion of that which is done.

Do you want to make a comment on that, Kevin?

MR. HOLTZCLAW: I think what Jack has said is correct. We put this up as our interpretation of what that interface requirement might be pending the outcome of the seismic review. And it's my understanding that that's still ongoing, and in fact we are going to be reporting on it in a future meeting with the subcommittee.

Our approach, if I can give you a brief summary, was to develop what we termed a generic seismic hazard curve for purposes in the evaluation with the intent that on a site-specific basis the applicant would go back and develop a specific hazard curve for his site and compare it to the curve used in the GE analysis. That could take a broader perspective, as you have indicated, Dr. Okrent, which would be not just limit yourself to the one curve but also include uncertainty bounds on that hazard curve.

And that could very well be the interface requirements that evolves. We have been looking at this relatively simplistic from the approach that we took, and this is the interface requirement that we defined.

MR. OKRENT: Well, I would suggest that this will give you a limited capability to evaluate the seismic risk if you don't have an uncertainty spread around them.

MR. FOX: I agree.

MR. HOLTZCLAW: Just a further point. That we did do an uncertainty analysis on the seismic review and did address an uncertainty in the hazard curve itself, the one that we utilized.

MR. OKRENT: Could you go to the next one?

MR. FOX: Sure.

(Slide 12 shown.)

MR. OKRENT: Could you tell me what is required to be consistent with reference one, for item 13.

MR. FOX: Well, I have to go back to that section.

Right now, I draw a blank. Looking at this, looking at this section, Reg. Guide 1.70, this non-category one structure does not impact or adversely affect the category one component. I'm a blank.

I'll have to get that. Complete blank.

MR. HOLTZCLAW: We are scratching our heads here trying to figure out which reference one was. I believe that the seismic report, and what we would have to do is confirm that the seismic category one fragilities are consistent with those included in the seismic one report. But if that's not the case, it ought to cover this item where we talked about the seismic analysis.

MR. OKRENT: I'm sorry, but this is talking about the non-seismic category one. At least it seems to me you ought to have a qualitative picture of what is in that particular interface. Tell us now what is is.

MR. HOLTZCLAW: There were values utilized in the GE seismic analysis report for fragilities associated with seismic as well as non-seismic components. And this refers to a table in that report. And the values that were utilized in our analysis. And we are saying that the applicant would have to ensure that his components meet the same fragility values utilized in our evaluation.

MR. OKRENT: Did you give fragility values for all non-seismic equipment?

MR. HOLTZCLAW: No.

MR. OKRENT: What about the things you didn't list, what is he supposed to do?

MR. HOLTZCLAW: I think in that area we would have to refer back to the seismic analysis itself and point out to you the bases on which we decided the equipment was important, and then evaluate it in our report. So we would be limiting the applicant to consider just that equipment that is included in our evaluation.

MR. OKRENT: Well, again I find it hard to tell whether your proposed requirement is adequate for the purpose or in fact could lead the designer of the balance of the plant in just the wrong direction, to thinking that he can pretty much ignore a variety of other things whose failure in an earthquake might indeed embarrass some important equipment.

MR. KNECHT: Let me just make one other comment on that. The criteria for picking these interface items was that we excluded items that had a very low contribution to the risk, and we are jumping a little bit ahead to the seismic PRA review, parts of that --

MR. OKRENT: Sorry. You have a list of PRA interfaces. I'm trying to understand what they are, that's all.

MR. KNECHT: And these include interfaces that result from both the internal and seismic PRA.

MR. OKRENT: Yes?

MR. KNECHT: On the non-seismic category one components here, simply an interface requirement to determine that those non-seismic components that did have an important contribution in the analysis are consistent with the PRA.

MR. OKRENT: Well, I must say, if that's the extent of the requirement, it seems to me it's incomplete because you don't know what else is going into the plant and are just saying it doesn't matter. Something's wrong somewhere.

Let's leave it for now. You are unable to explain what you put up.

MR. FOX: I apologize, and I was just trying to get more examples, and I did forget what reference one, two, three and four were. I apologize.

And I think we should pick that up. It will be part of the seismic discussion and we will try to put that in perspective and at that time I hope we can.

MR. OKRENT: Let me ask about item ten.

MR. FOX: Sure.

MR. OKRENT: It talks about flooding.

MR. FOX: Yes.

MR. OKRENT: And it says, "Same as GESSAR II/FSAR interface." I don't know what that means.

MR. FOX: Okay.

MR. OKRENT: I would like to know how General Electric quantifies the risk from external flooding for a plant that uses GESSAR II. Do they think it's quantifiable, in the first place? If so, how they do it.

MR. FOX: Well, first of all, the flood level of water level assumptions -- quote, "assumptions" -- the envelope for the GESSAR II design is very specific. I can't remember the exact -- I think the groundwater is one foot below grade, and something like that. I mean they are very specific elevations we do, the dry site approach, or whatever it is.

The point is the PRA in that sense does the analysis consistent with that external configuration. Okay?

Now, if the plant does not have those specific groundwater and flood level characteristics, then the applicant must do a PRA on that portion of the plant and so save from flooding.

MR. OKRENT: Let me elaborate on the question.

MR. FOX: Okay.

MR. OKRENT: I assume, correct me if I am wrong, that you are proposing that the applicant use what I think the staff calls the probable maximum flood calculation approach to set some level and then doors, or whatever, are put above. Right?

MR. FOX: Right. Exactly.

MR. OKRENT: The staff, when pressed, says "We really can't specify what the frequency of excedence of that flood is. It's a hard thing to do. Someday we might do research on it." But you won't find very much on it in this year's research budget or last year's research budget.

And for example, one time when asked what the likelihood of excedence of a maximum probable flood was, the particular man from the staff said somewhere between ten to the minus three and ten to the minus 11 per year.

I suspect the range was large enough to catch almost every site.

But I am not sure how that helps us in knowing what the risk would be more precisely due to flooding from a plant that might use GESSAR II. And General Electric is giving us risk estimates for their plant.

MR. FOX: No, I agree exactly with what you are saying.

MR. OKRENT: Which talk about numbers much smaller than ten to the minus three per year or something untoward. So I am trying to see, has General Electric got its own research program to pin down this matter and to reduce the uncertainty range? And place the median and the band at a very small value? Or just what?

MR. FOX: I am not a real PRA type, so I'll look at the deterministic world a little bit. We do have a maximum probable flood. It does have a frequency assigned to it, occurrence, an annualized frequency.

Now, I have divorced myself from these PRA guys a couple of years ago. And we sat down and said we are going to design a plant to take the maximum probable flood, whatever we designed it at. We designed it from a deterministic basis. Okay?

Now, this limit right here (Indicating) is the deterministic limit in terms of it has a frequency assignment to it, but the plant is designed for that set of conditions.

Now, the PRA world came in, and I don't know exactly what they did, but if in fact I say the plant -- I can't give you the probability that it's designed properly for that -- but they designed for that maximum probable flood level, or they analyzed for it. Now, I don't know what frequency they assigned that and above that. But I want to look at it from a deterministic end.

I have provided a design, and designed against a flood of a certain magnitude with a given frequency. Okay? I just wanted to put that in perspective.

MR. OKRENT: I'm not sure that it's completely logical to choose when you use deterministic approaches to say "We'll go some way," and when you will use probabilistic. You are quite willing to use probabilistic to throw out a whole bunch of possible improvements.

Now I am raising a question that maybe you and the staff -- and I don't know what the excedence frequency is for a maximum probable flood for a particular site. In fact, it may well vary from site to site --

MR. FOX: Definitely.

MR. OKRENT: -- by a large amount, despite the fact that you are using a similar methodology to try to do the calculation. Okay? And suppose we are so unfortunate as to have someone choose a site for which the methodology is at nine times ten to the minus four per year instead of nine times ten to the minus 11th. That would change the total risk to the plant. And nobody seems to be doing anything about it.

We are doing all this PRA, you know, making big decisions on things, or trying to, anyway, and here is what seems to be an area of very considerable uncertainty which is left that way, left in a state where we don't know whether in fact we have here perhaps what some people call an outlier, a risk outlier which by a factor of a hundred is making nonsense of the numbers you are putting on the board for risk.

MR. FOX: Sure. I think it's time for the, quote, "PRA types.":

MR. HOLTZCLAW: Dr. Okrent, I just want to make a few comments with regard to what we did and did not do with regard to external events. In reality there were many things that we were very limited on what we could do for a standard plant. We really encountered this, as you will see as we get into more detailed discussions of seismic analysis.

One of the biggest problems in these kinds of analyses is trying to define siting parameters and include them appropriately into a generic evaluation. We had that difficulty with a number of the external events. External flooding was one of those. In our evaluation you will find that it was an internal flood probabilistic analysis, if you will, and neglected the external flood initiator, for some of the reasons you just cited. What we tried to do in this area was point out site specific parameters that are going to have to be evaluated at the time of application of this generic design to a specific site.

And one of those would be the potential probabilities for floods beyond those that have been considered in the deterministic analysis of the plant.

And there are also external fire initiators that weren't included in GE's probabilistic assesment of risk on the plant, for the same reason, that -- that that could be a very site-specific initiator and would have to be evaluated as such. There are guidelines, however, in the GESSAR envelope design as to what the plant can deterministically respond to, and those are the things that Jack was pointing out as the levels that the designers utilized in just doing the plant design for those types of threats.

MR. OKRENT: If I were to find table 1.9-9, or item number 9.10 or subsection 9.2.5, or look somewhere in GESSAR II anywhere, would I find something that told the purchaser of a GESSAR II that he cannot just calculate the probable maximum flood; that he has to in fact take serious steps to evaluate what the frequency of the maximum probable flood is?

MR. HOLTZCLAW: Yes, you would. In fact those sections of GESSAR give instructions to the applicant directly, gives him an envelope of where GE stands behind the design where we believe it is robust with those types of initiators. But if it exceeds that he has to do a specific evaluation to show that the plant actually has capabilities to go beyond that envelope.

MR. OKRENT: I didn't understand your answer.

MR. HOLTZCLAW: Let me try it again. You asked if you were to go to those sections would there be cautions or directions to a potential applicant on having to do additional analyses?

MR. OKRENT: Beyond computing the probable maximum flood with wind, runup and so forth and so on.

MR. HOLTZCLAW: Yes. If you go to those sections of GESSAR, it tells the applicant the parameters such as those that were utilized in setting the design, for which the design is capable of withstanding. But it also points a note that if any of those parameters are exceeded --

MR. OKRENT: Oh, but you are answering a different question, if I understand you correctly.

Nowhere in what I heard is there some need to see whether the chance of exceeding those parameters is unacceptably large. That's what I am getting at.

MR. HOLTZCLAW: Maybe you can correct me if I am wrong, Jack, but I think that there is a frequency that's given for some of those specific events, external initiators --

MR. FOX: Called a Reg. Guide.

MR. OKRENT: But the Reg. Guide has a recipe.

MR. FOX: But it only specifies a value for a region or whatever way of doing it.

MR. OKRENT: Let me leave this as something to think about, but for us to come back to before we are done talking in subcommittee meeting, and the staff should think about it also.

MR. FOX: Do you care to see any other part of the table? Do you have a question on it? Let me just put it up there. There is only two more left.

(Slide 13 shown.)

MR. FOX: You might like to talk about aircraft or missiles.

MR. OKRENT: No. By the way, you might just recognize that our meeting site is not that far off the flight path, and the frequency with which such a meeting location might be hit per year is larger than what you calculate for core melt.

(Laughter.)

MR. SCALETTI: Dr. Okrent?

MR. OKRENT: Case of that passing interest.

MR. SCALETTI: Make a comment here, as far as staff's evaluation, we have addressed internal and external plotting. And the interface requirements are that you tell the applicant that reference to this design, and also PRA will have to demonstrate to the staff that the risk from external flooding, internal flooding, is low. Now certainly it's not quantified, but there is a qualification there.

MR. OKRENT: And it seems to me you have ignored in your response the position that the staff has taken in prior discussions that they have a difficult problem quantifying the likelihood of excedence in your statement. And so if you go up to the Commission and say, "The risk is low from all these plants, we don't need to do anything," and don't step back and say, "But we really don't know what it is for flooding except ten to the minus three and ten to the minus eleven minus" -- whatever, I haven't seen that in this statement -- it seems to me you are being incomplete and withholding important information. I can make a strong statement.

MR. SCALETTI: I guess I just don't understand what you are saying, then.

MR. OKRENT: If you really can't quantify external flood any better than what I have just said, for existing sites, then it seems to me you have to go back and ask yourself, "Is what I said in the policy statement robust?" "Why is it robust in the face of this inability to quantify?" And at least, "Have I acknowledged somewhere that people can see that this is one of the things not included in my conclusions?"

I haven't seen anything about this in reading the safety policy statement. Maybe I am mistaken.

MR. SCALETTI: It may not be in the policy statement, but certainly the staff has addressed it in the SER, and it is an interface item that will be required at the utility applicant stage in its application.

MR. OKRENT: But what will be required? is my question.

MR. SCALETTI: Again, I said that --

MR. OKRENT: Calculating the PMF has been required in the past. Independent of what it might mean from a frequency of excedence point of view.

By the way, while I am talking about information that really maybe ought to be spelled out, I hope there is nothing in this report on the Mark I, whenever I get to see it, that throws any serious question on the general conclusions that the staff has been advertising in all of its copies of Secky (Phonetic spelling) 82-1 leading up to the safety policy about the possible merit or not of improvements. Because it will be very awkward if that had been around and wasn't released until after the Commission had voted.

MR. SCALETTI: I'm sure you --

MR. FOX: Okay?

MR. OKRENT: Yes.

(Slide 14 shown.)

MR. FOX: I would like to close with a little treatment on control of these interfaces. The next two charts, I think the last two charts are out of order in the packet. But I would just like to make an observation on this more than anything.

There is a fair interface control item in the FSAR and SER system themselves. We require the applicant in Chapter 17 in his -- let's say in the GESSAR FSAR, as you will, that the applicant will reflect the interface requirements on all of the tables in 1.9.2. This is married with the SER -- the SER itself, not the supplement. But when it was written for GESSAR -- makes a direct reference to the need to refer to GESSAR section 1.9.2 for a complete list of interface requirements. So we have it kind of covered in the regulatory and at least the GE end of the standard plant owner.

The interface procedures and implementation, we have a -- we have developed and have in hand a BOP interface control specification that is like a master -- part of the master parts list, using the GE system of documentation, to designate all the interface requirements and all of the reporting specifications. And primarily this is the piping, electrical, access control, structural and shielding. And all these interfaces are specified specifically as to what they are, where they are located, and who is responsible for them.

And this is a brief listing of the compliance activities.

(Slide 15 shown.)

MR. FOX: To show you during an applicant's design process or detailing-out process, would be demonstrated. We have done this in the past, we will do this in the future. This GE team actually visits the applicant, and normally his AE. This common -- well, not common. In fact, the practice is that the applicant audits his own AE interfaces. AE is subject to an independent QA verification within his own procedures.

And as a signoff point of view or guarantee, you might say, GE has approval conformance or non-conformance approval of as-built documents.

And then certainly, but not lastly, the NRC performs a site-specific review to demonstrate compliance, for example, with the siting envelope.

So this isn't all, but just an indication of the types of controls we have to ensure the interfaces do in fact get complied with.

(Slide 16 shown.)

MR. FOX: And the final note, this schematic illustrates the applicant holding up the bottom. But the process by which we generate the interface requirements, nuclear island interfaces, and then the spinoff from that is the BOP interface control spec. As a matter of fact I have a copy with me. It's only about 20 pages.

These (Indicating) are about 150 to 200 pages each. As an example, all of the design interfaces that I listed on the previous chart are geared -- are included, and the applicant, of course, gets those, along with his contract, and says, "Let's go to it."

So the process, I think we have not only the -- I say again, all interfaces in my estimation are PRA interfaces potentially, if they are not done, it's going to have some effect on the PRA results certainly. And I think that even though we have what I call the FSAR-GESSAR II interfaces, the design interfaces and the PRA interfaces, to me they are all of equal importance to ensuring that they do in fact meet that interface requirement.

MR. EBERSOLE: I have a little problem with that last set of three blocks down there. Says, "BOP interface control spec," and then, piping and electrical and the other three.

I guess my problem is the notion up there that you have not covered all BOP interface theories. I don't think you have.

MR. FOX: I have all the design interfaces in this matrix.

MR. EBERSOLE: I will take one that doesn't appear in any of those. H and V.

MR. FOX: I didn't hear you.

MR. EBERSOLE: H and V. Environmental controls. My problem is I can't find equanimity of range, if you wish, an integral range of interface considerations. You have three areas down there which are not the integral picture. There are more things than that.

MR. FOX: Okay. I guess I was working from a truncated list.

MR. EBERSOLE: I just picked one.

MR. QUIRK: H and V is in the scope of the nuclear island.

MR. FOX: Thanks, Joe.

Yes, this is BOP interfacing. There is nothing safety-related outside the nuclear island.

MR. EBERSOLE: Okay. What about soil stability, or any other of a number of things -- civil structures. Well, you have structural interface. Maybe it's in there.

MR. QUIRK: Yes.

MR. FOX: From the standpoint of BOP interfaces --

MR. EBERSOLE: I just can't see them under those three nominal boxes there. All of the ones we must potentially look at. Maybe they're there. I just can't see them.

MR. MICHELSON: As I recall from sometime back, GE will not be doing the essential water systems for the plant. Is that still the case?

MR. FOX: Partly.

MR. QUIRK: The essential water system is both within the nuclear island scope and outside the nuclear island scope.

MR. MICHELSON: Significant safety-related interface there. Where is it?

MR. FOX: Going to be in at least two places.

MR. QUIRK: Probably three. The intake structure be would be covered over there under structural interfaces.

MR. FOX: What happened is, the interface document was not supposed to be system by system, component by component, as opposed to the way, at least, our AE lays out their work.

MR. MICHELSON: I don't think you call it nuclear island, though, is my problem. And there is an inference here that you are dealing with nuclear island and its interfaces, and there is more to it.

MR. FOX: In a way. Nuclear island design, our AE or we put together drawings and construction in a certain way. Okay? Piping, electrical, you know, whatever.

Now, from that list we generate the interface requirements from those documents. Okay? And we put them in a category as they go out in the field and put them together.

And electricians and plumbers don't work together. You know what I mean. So this is a job kind of related get-the-work-done interface.

MR. MICHELSON: Well, I got my question answered. Thank you.

MR. EBERSOLE: Let me take a case in point, which would be Hope Creek. And I will take the case of the intake building. Where is it in these blocks?

MR. FOX: It's not there.

MR. EBERSOLE: Why is that?

MR. FOX: Because there is not a -- well, the interface is going to be -- Okay. It will be part of piping, electrical and structures. Okay? If I had a system --

MR. EBERSOLE: What about mechanical pump design?

MR. FOX: Well, I don't think there is an interface there. I might give -- there may not be a reliability number coming out here. But I might tell them that I need -- By the way, there is also a system type of specification.

But we specify head flow requirements.

MR. EBERSOLE: And you wouldn't reliability.

MR. FOX: I don't want to get into that.

MR. EBERSOLE: Without it, you don't have any basis for PRA.

MR. FOX: I just didn't want to answer your question.

MR. MICHELSON: In my opinion it's the same kind of fuzzy answer we got last time we raised the question of an important element like the service water system. Not being under adequate control of the design organization, but rather being left to the purchaser to worry about. And it still looks like an inherent weakness in your proposal which is in most other respects a package proposal. Here is an essential piece of the package which for one reason or another you have elected not to include, and so therefore I think we would want to look very critically at how you take care of the interface of that piece of the package.

MR. FOX: I will take that system specifically and dig out the documentation exactly how we, quote, "Control those interfaces." This is more general.

MR. MICHELSON: I think it's the only essential system that you do not have in your package, was my understanding.

Therefore maybe it's a system which the subcommittee Chairman may elect to hear more about as a part of our continuing review.

MR. FOX: Yes.

MR. OKRENT: Well, I will ask Mr. Major to identify as an agenda item at some future subcommittee meeting.

Okay?

MR. FOX: I'm done.

MR. OKRENT: Nominally, we would go to number eight. But I have a feeling that a discussion in that general area, and in particular how to treat uncertainties prudently, might come better when we have more information in front of us about a total PRA as well as the different kinds of possible features for improving safety, and their costs and so forth. So unless someone has a comment that he thinks would be quite helpful in this area now, I would propose to bypass it for now and probably for today.

Any comments from the staff or GE?

MR. SCALETTI: No.

MR. QUIRK: I have none.

MR. OKRENT: Okay. That moves us on to agenda item number nine. So we are at 5:15 p.m.

Let's see if we can really hold this one to 30 minutes.

MR. QUIRK: I hope to hold it to 15.

MR. OKRENT: You have counted with the subcommittee members.

MR. QUIRK: You are right.

MR. OKRENT: My comment was to both parts.

MR. QUIRK: At the last meeting we talked at considerable length about new design features in the GESSAR design. But we didn't get to the three topics that I will present today. But we really did. In other words, we talked quite a bit about a couple of the items. So it is my intent to just be brief on those items because we have had considerable discussion on them already.

(Slide 17 shown.)

MR. QUIRK: The first item is the control room human factors design. And in the GESSAR BWR/6 we have a solid state control room with important controls and instrumentation that are easily accessible. This design complies with the emergency-response capability requirements and addresses control room design guidelines.

The design has an upgraded control room that includes emergency response information system. And this system provides safety parameter display capability for use both during maintenance and operation. It couples with emergency response capability requirements and has undergone a review by the staff, and they are if the midst of documenting their conclusions in an SER.

MR. OKRENT: What are the Achilles heels, if any, of a solid state control room?

MR. QUIRK: Although the solid state control room has many features that we believe superior, I think one concern or one sensitivity might be sensitivity to temperature changes.

MR. OKRENT: And at what temperature are you really at the threshold of important concern?

MR. QUIRK: Ed, can you help me out?

MR. MAXWELL: Designed for 140 degrees maximum temperature. Beyond that, I don't know what the individual capabilities are.

MR. EBERSOLE: However, if you get into trouble in that area, isn't it true that via the remote shutdown panel or even UPPS or whatever, you have a back door to safety?

MR. MAXWELL: Yes, sir, that is correct. There are many paths to safety from the control room in abnormal conditions.

MR. MICHELSON: Are you using solid state controls at your backup control point?

MR. MAXWELL: No, sir, they are manual.

MR. MICHELSON: Yes, they are manual, I understand. But are they solid state design or conventional hard-wired relay?

MR. MAXWELL: No, sir, hard-wired relays.

MR. FIRST: What is the progress on this so far? Is this a paper study or have you built a simulator to try it out? Where are you on this?

MR. QUIRK: Ed?

MR. MAXWELL: The control room has not been built for GESSAR II. Portions of it have been built. The solid state circuitry is quite similar to the nuclear steam supply portion of the controls, which have been built for Clinton station.

As far as the emergency response system, that is part of the error system which is being installed on quite a few plants.

MR. FIRST: Are you referring specifically to the instruments or are you also including the human factors aspects of the displays and the presumably improved access and logic to the operator?

MR. MAXWELL: Well, the human factors aspects have been studied for the control room. Not specifically for GESSAR II.

MR. KNECHT: Yes, they have.

MR. FIRST: Well, again, that same question, is this a paper study so far or has it been worked out on a simulator and parts on a real reactor?

MR. KNECHT: The control room human factors review conducted a large parts of its work down at the simulator for Black Fox which, although it was canceled, is extremely similar to the GESSAR control room. So we did use that simulator for a large part of the control room review, including the task analysis. So I think we have a reasonably good cut at those human factors aspects.

MR. FIRST: Has this been compiled into some kind of a report that's accessible to us?

MR. KNECHT: That's part of the GESSAR documentation. I think it's Chapter 18.

MR. FIRST: Thank you.

MR. EBERSOLE: Let me ask you, before TMI II, the operator was hardly even regarded as part of the safety picture. Thus the annunciator systems, the window drops, the visual displays, everything that puts things into his brain, the audible alarms, were all non-safety grade. And a great dependence was placed on automated response of such systems that had to meet emergencies. The lighter systems were 1-E in design and qualified for 279 and so forth.

After TMI II it was recognized the operator was in fact an element of the safety system. Some attention has been paid to upgrading the quality of information that feeds his brain. It's a very muddy picture as to what has been done to improve that. For instance, I already know o. course the SPDC is not seismic it's not much of anything except single track information system.

What has been done to the annunciator drops, the audible alarms, and can you give me a kind of integral picture of the improvement that you have made to the information flow to the operator to enable him to have accurate information without mistakes? Ways in which to confirm what he is seeing is in fact true.

MR. KNECHT: There have been several things that have been done. Probably the larger contribution, as far as the information to the operator, has been the development of the emergency procedure guidelines, where a very systematic review of the degraded events has been looked at and what are the options, and a lot of the problems that can develop have been pre-thought. Those have been used as a basis, then going back and looking at the displays that are in the control room that the operators use. This is all part of our Reg. Guide 1977 core status monitoring.

So all of the parameters that are important for the operators to use during the -- in following the EPG's have been reviewed as far as their adequacy in terms of range, accuracy and location, and these kind of effects, so that in the events that are both most probable from the risk standpoint and also in a deterministic sense, that the instrumentation available is in fact accurate and gives a non-ambiguous indication. There have been several improvements made in the control room that respond to that type of concern.

MR. EBERSOLE: Could you name them?

MR. KNECHT: Probably the largest is our enhanced water level instrumentation where we have provided compensation of the water level signal for changes in vessel pressure and also drywell temperature.

MR. EBERSOLE: That's just accuracy. Not really a refinement in reliability, but rather a refinement in the adequacy of the --

MR. KNECHT: We did have accurate redundancy in that channel two, we gave them three channels instead of two.

MR. EBERSOLE: I guess what I am looking for is has there been a design augmentation or new features in the actual presentation of information to the operator which give him the privilege of looking at 1-E type indications with diversity with ways to cope with contradictions in redundant channels? I have had real difficulty in integrating what has been done to upgrade the hardware senses. For instance, is all this indicator type information seismic?

MR. KNECHT: Well seismic is part -- they fall into a group of instrumentations. Certainly those that rely on operator action are required to meet the seismic quality.

MR. EBERSOLE: What about the annunciator system?

MR. KENCHT: No, not the annunciator system has not been upgraded.

MR. EBERSOLE: What about the indicators?

MR. KNECHT: The indicators are part of the instrumentation channel, so those have been included.

MR. EBERSOLE: The indicators and recorders, are you telling me they are now seismic grade?

MR. KNECHT: That's correct. That is a difference from the older design.

MR. EBERSOLE: Are those fallbacks from the annunciator trips.

MR. KNECHT: We rely on the operator using his instrumentation to control the plant.

MR. EBERSOLE: Does he in reading commercial grade instrumentation, is he obligated to go back and confirm what he sees on qualified instruments before he takes some action which might be the wrong one if his initial display was wrong?

Do you follow me?

MR. KNECHT: I think I'm following you in terms of does he believe a non-qualified instrument before he would believe a qualified instrument.

MR. EBERSOLE: No. Does he first -- does he look at an unqualified indication and then confirm it by going to a qualified indicator?

MR. KNECHT: Well, the EPG's do have some cautions that relate to use of multiple instrumentation to confirm his readings. It's difficult to tell you precisely in some events whether an operator would run around to confirm that. But he is in fact given basic training to keep that in mind and think in terms of whether to believe that instrumentation or not.

MR. EBERSOLE: Would he, to prevent blowdown -- which is a critical problem, as you know, if he intervenes too long in blowdown, he's had it. Would he use an annunciator or unqualified instrumentation to intervene or not to intervene? Or would it be mandatory that he use instruments with confirmatory information that he should or should not intervene in blowdown? Do you know what I mean by that?

MR. KNECHT: I'm not sure I follow --

MR. EBERSOLE: If you delay blowdown too long, then when you do blow down it's too late.

MR. KNECHT: I follow what you are saying there. And the instrumentation that he is using to track an event, certainly down in the range you are talking, the wide range of the level of instrumentation, that would be safety grade instrumentation that he is using. I can't think of an instance where there is non-safety grade instrumentation that he would be using and he would be relying on that to take an EPG-related action.

MR. EBERSOLE: All right.

MR. MICHELSON: Let me ask you a couple of interface questions.

The control inevitability system, is that a part of the nuclear island BOP scope?

MR. KNECHT: Yes.

MR. MICHELSON: Chillers and so forth, are part of your scope?

MR. KNECHT: That's correct.

MR. MICHELSON: Fire protection, whose scope is that?

MR. MAXWELL: The design of the system within the nuclear island is GE. The supply to the nuclear island is the customer. And it's controlled by interface documents which define the flow, quantity and pressure.

MR. MICHELSON: Would CO2 be a supply situation, for instance?

MR. MAXWELL: Yes, sir, that's correct.

MR. MICHELSON: And you prescribe where the tanks can be and so forth or where at least they can't be?

MR. MAXWELL: They are external to the nuclear island.

MR. MICHELSON: That takes care of me. Thank you.

MR. CAMP: I would be interested in hearing what sort of procedures you have developed for what the operator does after he's lost the core. Are those documented, or in something we have?

MR. HOLTZCLAW: There are the emergency procedure guidelines that have been developed by the BWR owners group in conjunction with GE primarily aimed at the sequence of events up to core degradation. And that is the extent of their development as of today. However, there is an ongoing activity with the BWR owners group and GE to reexamine that information in light of information coming out of severe accident reviews, both information that GE has developed in the course of doing this work on

GESSAR, as well as the course of work going on as part of the industry degraded core program.

In fact, just recently the ex-chairman of the BWR owners group wrote a letter to the Emergency Procedure Guidelines Subcommittee and scheduled detailed review in this area that will be on going in a matter of weeks. So the expectation is that there will be additional guidelines put in place to deal with the events post-degraded core. But as of today those guidelines do not exist.

MR. CAMP: Do you have hydrogen monitoring in the control room on real time? And for example, could you tell the operator to turn the igniter system off if he has indications of high hydrogen levels?

MR. KNECHT: The actual instrumentation to monitor hydrogen, I believe, is left to the applicant to supply that. There are requirements on the range which really goes up to something like 30 percent. And that of course would be sufficient to be given instruction on that.

I can't really answer how real time that instrumentation is, what the response time of that instrument is to changes in hydrogen concentration. That would have to be left for a later review.

MR. WARD: I think what you said was that the control room is similar to the Clinton design, but it has had some improvements or upgrades since the development of the EPG's. The Clinton design was before the EPG concept was developed; is that right?

MR. HOLTZCLAW: That's correct. Yes.

MR. KNECHT: Yes.

MR. WARD: So there have been some improvements.

You have done a PRA for the GESSAR. And are these improvements reflected in the PRA in some way, or are they at the level of things the PRA deals with? If so, can you give me an example.

MR. KNECHT: The human error probability in the PRA does not so much relate to the human factors review. I don't think there is really a close tie between those two. We didn't take credit for the human factors aspects and the failure probabilities, except to the extent that if there were EPG actions that were clearly specified, that there was probably a higher chance that the operator would actually take that action. So we did take some procedural credit for having EPG's there in the PRA. But as far as the type of displays, the arrangement, the mimicking and all those types of human factors aspects, no, those don't really factor into the probabilities. Except in a qualitative sense.

MR. WARD: They don't because they shouldn't or you didn't do it?

MR. KNECHT: No, I think mostl·· because it's very difficult to assign a quantitative value to th,se.

MR. WARD: But you said you did assign a quantitative value to some. You took credit for the EPG's; is that right?

MR. KNECHT: In a sense that it would be more than likely that the operators would in fact take those actions, pretty thought-out procedures.

MR. WARD: Can you give me an example of the numbers? Of a case and of the change in numbers that there were?

MR. KNECHT: Just wait one second.

MR. HOLTZCLAW: As an example, there are some operator procedures in the course of an accident sequence such as a branch on an event tree that would credit the operator with manual depressurization, say. We used Swayne and Guttman as a basis for determination of the human error frequencies. As you are probably familiar with, Swayne and Guttman in many of those instances gives you a range of values to assume given certain conditions and timings. And going to those ranges we credited the operator with, I guess, increased capability if he has got a written procedure in front of him that gives him explicit directions.

So from that standpoint, when we went to Swayne and Guttman for those operator actions that cover a range, we then would give him more credit if there were procedures in place. And that's the extent that we actually implemented the emergency procedure guidelines in the PRA.

(Slide 18 shown.)

MR. QUIRK: Another item that we pretty much touched on in earlier meetings, but I would like to summarize here because of its interest to the ACRS members, is the scram discharge volume. And the BWR/6 is of a different design configuration than that on the Browns Ferry 3, such as the problem associated with the Browns Ferry 3 event had been precluded by this design. If you recall, the Browns Ferry 3 design had a separate instrument volume which was connected to the discharge volume. The problem appeared to be a blockage in the pipe that connected the discharge volume with the instrument volume.

The instruments are mounted directly on the discharge volume with this design, so we precluded that with this design.

This design also precluded undetected water in the scram discharge volume resulting from valve leakage due to slow air pressure loss. And it precludes not detecting any other source of water that could leak into the discharge volume. It does this because of the diverse and redundant instrumentation mounted directly on the discharge volume.

MR. OKRENT: I must say, "preclude" is a very strong word to associate with diverse and redundant instrumentation.

But go ahead.

MR. QUIRK: Well, let me talk about that, then. I use the word "preclude" in reference to the Browns Ferry 3 event. And as you can see in this chart, the level of instruments are mounted directly on the discharge volume. The configuration at Browns Ferry 3 is different, and so it precludes that concern.

Because of the redundancy and diversity in instrumentation on both the volumes, we have enhanced the protection, if you will, and improved the reliability.

We have in a previous chart redundant drain valves and redundant scram valves. These are redundant to provide isolation so there could be no leakage that could go out in the BOP and cause interaction problems.

MR. EBERSOLE: Nevertheless, the whole rationale is one of patchwork against a fundamentally unsound rationale. You still have -- are facing a common dump volume, and then you put patches on it to say "I know it's always empty," and put valves on it which are in redundant configuration in series so that you can close rather than open.

I presume you have some way, of course, of knowing -- well, of course the level switches monitor the function of the vent and drain valves they don't work. So everything hinges on the patches that are the level systems.

I heard yesterday you had done, however, a good thing, which was to revert to the ancient Humboldt Bay rationale, which is to give each rod the privilege of an independent discharge point. Will you confirm that for me?

MR. QUIRK: We have done that, you said?

MR. EBERSOLE: That's what was said yesterday.

MR. QUIRK: Not while I was here, it wasn't.

MR. KNECHT: Let me clarify that. I was referring to the ABWR design, not the GESSAR design.

MR. EBERSOLE: Oh, that's the next stage, I see. I didn't understand it was not here but there.

I have difficulty finding why you do things at the ABWR and don't do them here, especially when they don't seem to be so costly.

MR. QUIRK: The ABWR control rod drive design is significantly different than the BWR/6. It has fine-motion control rod drives as well as pressure scram drives. And it is a significant redesign that allowed us to discharge into the vessel so we don't need the volume.

MR. EBERSOLE: Have you ever found, Joe, the roots of that rationale that it makes a lot more sense to close this volume before you ascertain you are home with the rods, rather than wait and confirm it?

MR. QUIRK: Jesse, I have the same rationale that I have provided at earlier meetings for you that doesn't set well with you, and I guess we kind of agree to disagree on it.

But for the sake of others that maybe haven't heard that discussion, Mr. Ebersole's concern is that when we scram the control rod drives into the reactor, the water is discharged into this scram discharge volume. At the same time the signal is given to scram the rods, a signal is given to close these drain valves and these vent valves (Indicating) and thus bottle up the discharge volume.

Mr. Ebersole's concerned is that you are trying to discharge into a closed vessel now, and doesn't that theoretically work against what you are trying to accomplish?

Is that a fair --

MR. EBERSOLE: That's a fair statement.

MR. QUIRK: Okay.

Our answer to that is that we have level instruments that assure that we know the level in these tanks (Indicating) and alarms are given when the level reaches a certain point. From that point on we have ample volume, a conservative ample volume, such that ample margin is available to accept this discharge.

So I think Mr. Ebersole would like a delay or something on these valves so that after the rods are in you could close them. And we have looked at that and find that this design adequately, in our opinion, accomplishs its function reliably.

MR. EBERSOLE: Explain my argument. Very simple. Why do you use them when you don't have to use them? Namely the level switches.

MR. QUIRK: Oh, the level switches.

MR. EBERSOLE: Yes. Why do you have to depend upon them when you don't have to?

MR. QUIRK: I don't propose that this volume should be filled with water and that these valves are open that the scram would be accomplished in the same way.

MR. EBERSOLE: It would be slower.

MR. QUIRK: And there are requirements that they go in at a certain rate. So we would still need the level switches.

But you had another concern. And you mentioned it just a minute ago. An earlier design where you recall having relief valves on the discharge piping such that should this volume be filled with water, that the relief valves would relieve and still enable the rods, the water to be discharged, enabling the rods to go in.

I have been in contact with our control rod drive system engineer in San Jose who has been working on this for me for a while trying to dig back through the documentation. He does confirm that the early Humboldt Bay design had relief valves on the discharge piping. Those valves are located upstream of the withdraw valve, upstream of the withdraw valve, and wasn't put in there to allow continuation of the scram given a filled volume.

In fact, wouldn't serve that function. The relief valve was put in there to offset a concern we had that the insert valve may open and withdraw valve would not open, and we would have kind of a hydraulic water hammer effect that would start to scram the rods and then be water-locked, if you will, and then wouldn't move, and resulting pressures then would be relieved through that relief valve.

If both insert and withdraw valve opened and you are scramming into a discharge volume, the resulting pressure wouldn't raise that relief valve unless the rods wouldn't continue to go in. So it appeared from your point of view to be a feature that was superior and failsafe, and it's not that way.

MR. EBERSOLE: I see.

But you are on the ABWR looking at a modified version?

MR. QUIRK: Let me restate. On the ABWR we have no discharge volume.

MR. EBERSOLE: Oh, great. That's the best solution of all.

MR. QUIRK: What it does do, then, it drives the water into the vessel, which requires in a higher-pressure accumulator to begin with. We have been able to accommodate Jesse's concern in that design.

And the last item I would like to talk about is ATWS.

(Slide 19 shown.)

MR. QUIRK: And this is really I hope a non-controversial item, because our approach has been to accept the outcome of the rulemaking. And we stand by that commitment and will incorporate the ATWS rule, which is to have an alternate rod insertion, recirc pump trip, and an automatic initiated 86 GPM or equivalent standby liquid control.

MR. EBERSOLE: Joe, what did you do with the horrors of inadvertent insertion of boron? Did you put in any features to preclude that?

MR. QUIRK: Well, this chart says automatic initiation of a standby liquid control system. I wouldn't say that precludes inadvertent initiation.

MR. EBERSOLE: But you must certainly begin with at least coincidence requirements, if not go more than that, to prevent it.

MR. QUIRK: I'm not sure I understand you.

MR. EBERSOLE: I mean you must require coincidence calls for this system to be energized and, you know, thus require two shots to energize it. And I was really asking have you put in three or four or five? Or what have you done, if anything, to get rid of that specter of inadvertant initiation which I believe you-all once claimed because of the capacity of the demineralization system would take weeks and weeks to clean that up and cost millions of dollars of loss on system outage.

MR. QUIRK: I think we feel comfortable that the signals we used to automatically initiate this are the signals you would expect to have on an ATWS event and wouldn't exhibit itself for other plant transients.

And that concludes, Dr. Okrent, my presentation.

MR. OKRENT: On ATWS are you able to postulate a chain of events where the boron or poison gets into the vessel and then is washed out?

MR. QUIRK: Well, Don, can you help me?

MR. KNECHT: Let me see if I can answer part of that, at any rate. The ATWS event has been looked at by the GE committee pretty extensively, and a large part of that operation is to avoid getting water, high water level situations that would wash boron out. In fact, it goes through the opposite direction to try to maintain lower water levels to control power level. So as far as washing the water out, I think that's a very low, not very likely situation. It would require going opposite to the procedures that are spelled out.

MR. EBERSOLE: One of the things that made the ATWS event such a vicious thing was the absence of a high capacity of the safety relief valve complex, which led to high pressures.

Have you done anything to change the relief capacity to enable a higher degree of blowdown and thus reestablishment of voltage? And do the operators attempt to depressurize with perhaps a new depressurization capability and both void the core as well as reduce the level to cope with ATWS?

MR. KNECHT: Well, we haven't made any changes to the SRV design.

MR. EBERSOLE: Are they 60 percent SRV's?

What is the blowdown capacity of the safety relief valve complex?

MR. KNECHT: All of the SRV's together?

MR. EBERSOLE: Suppose you had 150 percent instead of 60. If you opened them all you would immediately stop an ATWS because you would void the core. But you don't have that. So what you have instead is the opposite of that, you have a diminished flow capacity, which raises pressure, which compresses the voids, which makes ATWS what it is. I am asking what have you done if anything to alter the relief valve capacity to help in the ATWS case?

MR. KNECHT: None, really. Encountering that is the problem of suppression pool heat up in an ATWS. And if we were to go to such a change, it would go opposite in that area. So it would have a much faster heatup --

MR. EBERSOLE: Would it in view of the fact that it would reduce the power down to what I think you calculated to about 8 percent if you really voided it down to 100 psi --

MR. KNECHT: You wouldn't be able to continuously depressurize. It would be a short-term solution.

MR. EBERSOLE: Have you not shown that if you get down to low pressure and low level you can go to 8 percent, which is not far away from shutdown heat? I mean decay heat.

MR. KNECHT: Water level is sufficient to get the

8 percent type level. Low pressure is not sufficient -- or not necessary.

MR. EBERSOLE: Low pressure is not --

MR. KNECHT: You do not need to get low pressure to get to that type level of power.

MR. EBERSOLE: You don't try to use low pressure as a voiding mechanism

MR. KNECHT: No. Lowering the level achieves that.

MR. PAYNE: If I can make a comment on that, the Hope Creek study shows by lowering the pressure you can get down to about 3 percent. Within the capability of the RHR heat system. The problem with that is that they indicate some instability in that situation.

MR. EBERSOLE: Instabilities.

MR. PAYNE: Yes. Power spikes, difficulty controlling the level under those low-pressure conditions in low-pressure situations.

MR. EBERSOLE: I see.

MR. OKRENT: How many errors would the operator have to make to overfill the vessel and wash boron out?

MR. KNECHT: At high-pressure conditions, all of the systems that inject into the vessel have high-level trips on them, with automatic restart to back that up. So it would be -- does not blow down the plant during an ATWS, and he does have his injection capability available. No operator actions would be needed to exceed the high level -- or rather no operator actions would be -- It would not be operator actions that would allow him to go above those high-level trips except for bypassing of the interlocks and whatnot.

Under low-pressure conditions which, if he did not have high pressure available and he did blow down and used his low pressure pumps, there it would be possible to exceed the high-level trip points if he did not keep his injection rate under control.

MR. OKRENT: Let's see. Remind me, these are safety grade trips, high level?

MR. KNECHT: That's correct.

MR. OKRENT: At high pressure?

MR. KNECHT: Yes.

MR. OKRENT: Any other questions on this? I guess not.

MR. QUIRK: Dr. Okrent, can I raise a question with regard to schedule?

MR. OKRENT: Yes.

MR. QUIRK: We have a couple of people that I would like to utilize and then release and enable them to go back. And as such, I would ask that at an appropriate time, maybe the first thing after lunch, that we deal with sabotage, which is proprietary, and we would need to close the session, and then follow that up, then, because of that reason, with item 13, which is the assessment of PRA, limitations and uncertainties.

I propose that for your consideration.

MR. OKRENT: Well, let me accept your first proposal and then we will see. I want to chat with the subcommittee members over lunch, consultants, and see which way we go then. Clearly we are not going to be able to finish the entire agenda by five, so there will have to be a choice. But we will take up the sabotage item right after lunch.

Why don't we break for lunch and reconvene at a quarter of one.

(Lunch recess from 11:48 a.m. to 12:50 p.m.)

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LOS ANGELES, CALIFORNIA; DECEMBER 5, 1984; 2:05 P.M.

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MR. THOMAS: Dr. Okrent, I would just make the observation that we have been discussing some things today that certainly could be considered safeguards information. We notice a transcript is being kept, and we would urge the committee to make every effort to ensure it's marked "Safeguards" and afforded every protection that should be given to safeguard material.

MR. OKRENT: I'm sure Mr. Major has had this in mind from the beginning. But thank you anyway for making a note of it.

The subcommittee has a couple or more choices. We have about three hours left. There were a series of questions of various sorts raised at our October meeting. And these were shown as the way we were going to begin this morning's agenda. There also was a topic called, "Assessment PRA Limitations and Uncertainties," in which I must confess I am not clear quite what we would hear or who was going to present what. But I think if we took that on, it would also probably eat into much of the available time.

General Electric has suggested that they could provide responses to the ACRS questions in writing. I think they mentioned a time like a week or so. And thereby we could go on to the PRA aspects. Of course, I guess they could also supply answers to the PRA things in writing, in which case we could recess or adjourn the meeting right now.

(Laughter.)

MR. OKRENT: I should note that we have received a first set of comments from our consultants who are looking at the PRA, looking at the water information and so forth, which we either will or have forwarded to the staff, and I assume there will be more questions as time goes by in this area.

What are the preferences of the subcommittee members?

MR. EBERSOLE: It seems that you would break these into two groups, one of which says this group has more potential for improvement with conversational inquiry than the other. Which one would that be; the PRA? I don't know. The others can be rather explicit.

MR. MICHELSON: The problem with explicit answers is that they aren't always clear. And sometimes the question was misunderstood and discussion is a great help. I would personally very much like to hear the responses to item number 11 and save General Electric the job of having to write them all out, which would be unnecessary if we could discuss them.

MR. OKRENT: All right. I am going to propose, unless I hear differently, that we in fact at least start the so-called response to questions. And let me say I will welcome from General Electric a good written treatment of the topics that were supposedly to be covered beginning at one p.m. this afternoon, because I think some of these in fact we asked for, and I thought we might see them in writing before this meeting. I myself find it hard to digest, evaluate and react to a list of ten things on the board before the next viewgraph is there already. So if I could get an erudite, complete discussion on these, maybe a discussion at a subcommittee meeting could be more pointed and shorter.

In any event, let's start by trying with agenda item number 11, and see how it goes for a while.

MR. QUIRK: Dave, the meeting is open now, right?

MR. OKRENT: The meeting is open.

MR. QUIRK: I couldn't remember if we declared that in the transcript.

MR. OKRENT: Thank you. I sort of used in my own mind Mr. Thomas' comment about the previous portion. But you are quite right. And a formal declaration is relevant.

Mr. Major, item A, would you mind saying --

MR. MAJOR: I believe that was your question on issues that weren't contained in the SER controversy prior to any kind of a final SER.

MR. OKRENT: Well, I guess this is related to, is there more than one side to the monolithic staff position that we get in the SER? And what should we hear that isn't in the SER that might be helpful to us?

Is that a fair way of restating it?

MR. MAJOR: I would think so.

MR. OKRENT: And what can the staff add? I guess I may have asked whether all the discussion took place in the men's room or something, since there seemed to be so little difference of opinion on paper.

MR. EBERSOLE: In this connection, Dave, let me bring up an old question. We see the SER in a level context, you describe issues and their solutions as though it was all a placid sort of thing, no blood on the floor about decisions about anything, yet we know that's not the case. And I remember we used to ask for you to pick out those in which there was blood on the floor and tell us how you reached a decision which appears so innocuous in the SER. There is no differentiation in the SER about these things. They all assume a common level of insignificance. So if you have some bloody issues in there that weren't settled too peacefully, we need to know that.

MR. SCALETTI: Everybody seems to have all of their blood remaining.

As far as GESSAR goes, we had discussed this previously, at the last ACRS subcommittee meeting, based on a request from Dr. Okrent to Mr. Dircks, we turned over all of our files, all of the internal memoranda that was generated throughout the course of the GESSAR review, very early draft SER's that come from the technical review groups to the division of licensing prior to being issued. So you have all of that information, you know wherever the opinions in the draft SER and the final SER's were changed or if there were any changes there. I don't believe there were any changes. There may have been revisions, editorial changes, et cetera, et cetera.

We do have a differing professional opinion policy that if anybody has this, they have a right to make their peace with themselves and bare their soul. There is, so far as I know, this has not occurred on GESSAR. You have all the Brookhaven documents which -- unedited by the staff, in draft form. They may change some in final form. They have not been issued in final form yet.

So you have everything that I have. As far as this review goes.

MR. EBERSOLE: All right.

MR. SCALETTI: Granted, there have been meetings and discussions at meetings. There have been opinions expressed by people that were different from those of other members of the staff.

MR. EBERSOLE: But nothing that stands up as a spike.

MR. SCALETTI: Nothing that as far as I'm concerned is substantial, and it's all available to you.

MR. OKRENT: What were the three most difficult decisions for staff when they -- in what they have written so far in GESSAR SER?

(Pause in proceedings.)

MR. OKRENT: You can give more, if you want.

MR. THOMAS: There is a difference of opinion here.

MR. SCALETTI: The point that was brought up as a difficult decision was lack of guidance with regard to a final policy statement. GESSAR review has been ongoing, as far as severe accident goes, back in I guess March of '82. And at that time there was the proposed policy statement when it came out in April of '83, I believe, has changed somewhat. The staff has tried to accommodate all of the revisions of the evolving policy statement, and GE has been subject to evolving policy.

As far as identifying three most difficult decisions, I certainly would need more time than a couple of minutes to make that choice.

I don't know if any of the staff has a pet peeve that they would like to bring up. Or a pet decision.

MR. EBERSOLE: Everybody's perfectly happy with the scram system design, I take it.

MR. SCALETTI: I'll let Mr. Hardin speak for himself as far as ASPO work goes.

MR. HARDIN: Jack Reed and I have been conferring here, and we think in terms of something that may not have caused a disagreement among the staff but was very difficult for us. Was initially when we started reviewing GESSAR we hoped we would have new source term codes available to use to analyze the consequences. And because of the lengthy delays in those, we have been continually having to look again at how we were going to calculate the consequences for GESSAR.

As a result of that, we haven't felt comfortable in providing any best-estimate results, and that's why a range of results, and really very little has been reported. There are only the three results that we felt we wanted to report at this time. And that's something that we certainly had many discussions, both among GE and among the staff. I think that's continuing to be a problem. As you can tell, it's something that we hope we will be able to do a little better job on eventually. But it's taking much longer than we had expected.

MR. SCALETTI: There is one other point that probably should be made. And with regard to the seismic review. The staff had opinions in directions that they felt GE wanted to take that is documented, and I think you probably have the internal memos that discuss what the staff wanted GE to do. GE decided that for their own reasons they felt this work would be probably too expensive and too detailed, consume too much time, and wanted to take another approach. And we have been trying to resolve the differences. And as you have already the draft SER or the SER that has been translated to DL, you have another division engineering report that went to the division of safety technology which put forth their concerns. So the seismic aspects, which I will endeavor next week to send you people an advance copy of the near-final SER on seismic. Which will constitute an NR position on this issue.

MR. EBERSOLE: Ask you this question about the SER. In the paper I have seen so far there is almost nothing about the topic which is pretty popular now, diminishing the challenge frequency on safety systems. It's just as though that was unimportant, yet that's in an area where there is a double return on whatever you do. Your operation is more efficient and the plant is safer. There are fewer times you challenge the system.

But as a cas in point in the discussions I have here there is virtually no discussion of what if any steps GE has taken to improve main feedwater reliability, which is one of the focal points of challenge frequency to shutdown and even emergency heat removal.

I wonder if you can explain why there is no consideration given to this general topic of diminishing challenge frequency.

I'm sure GE has worked on it to some degree. The question is how much. You've got new systems for reliability of feedwater. I don't know whether GESSAR II incorporates them or not. I presume it does.

I have of course just come back from where if you get more than one scram in three years, you commit hara kiri, or whatever the equivalent of that is. Dr. Chiu, from Brookhaven National Lab will address it.

MR. CHIU: I'm not sure what I will say. I will try to explain for you what we have done when we reviewed the GESSAR PRA. GE did come up with a list of initiating frequency which was different than other BWR/4 plants. So in their PRA they list a BWR/4 initiating frequency and they also listed BWR/6 initiating frequencies.

Some of the frequencies as we looked into them were derived partially by analyses and some of them based on limited experiments.

We feel in our review that those numbers cannot be well supported at this time because the data base is very small, and then also the analysis has been done was towards -- trying to minimize certain of these challenges, and yet because new equipment has been introduceed, such as solid state control boards and other things, we don't know what the downside risk or downsides are.

So when we quantified, we quantified the GESSAR core damage frequencies, we used the data base that has been available to the general public, including BWR/4 and other types of BWR's. I do believe that as time goes on and data becomes available that the BWR/6 demonstrates itself to be a more superior plant, credit ought to be given in these areas, and that's what we have done in the analysis. That's the base for the numbers.

MR. EBERSOLE: What did you use for the annual scram rate?

MR. SHIU: Manual shutdown or scram?

MR. EBERSOLE: No, no, no, no, automatic scram. How many times a year.

MR. CHIU: The frequency is I think on the order of ten.

MR. EBERSOLE: Ten per year.

MR. CHIU: Ten per year.

MR. EBERSOLE: Yet we all openly know for the

Japanese it's one every three years. Is the staff doing anything to close in on why we have this astonishing difference?

MR. CHIU: Let me qualify that ten per year number. There has also been discussions in quantifying the initiating frequency, because we have a lot of plants coming on line in the last ten years, and during the initial years there tend to be more challenges. When we look at the data, we include these challenges in the data base. Other approaches had been to eliminate the first year or two years and saying these are part of the learning curve, and my plant, the actual data that reflects the plant transient would be more like five per year or six per year or thereabouts.

There have also been attempts to try to amortize this initial two years transient over a 40-year period and average it out.

We feel that at this time there is not enough evidence to justify eliminating the first two years or trying to divide it up into 40 years.

MR. EBERSOLE: Tell me, how does that stands against the maintenance practice of the Japanese? They take their plants completely apart every 18 months and have no front end to the bathtub at all.

MR. CHIU: I think it varies tremendously on the maintenance technique and the practice. And you could have a bad crew that comes in and you will actually destroy the plant every 18 months. You might have heard that the people who have been operating the plant know that once you scram the plant, the next time you bring it up, there are more problems. If you let the plant run, the plant just hums along.

And you asked the question why, you know, from a reliability standpoint. And there are other intricate things that we might not understand from a theoretical standpoint. And how best can we model it I'm not sure.

MR. THOMAS: Partial response to your question, Jesse. I think in the last week or two there was a task force that went to Japan to discuss this very subject --

MR. EBERSOLE: I know. I was with them. I was with them.

MR. THOMAS: Perhaps you could share with us some --

MR. EBERSOLE: If you get up to more than three a year, you have to get out the dagger and towel, almost.

MR. OKRENT: Well, let's not forget for all time this interest in knowing what were the difficult decisions that the staff has made on GESSAR. That, of course, includes at some point your decisions on what measures you feel are warranted to make the plant safer as the draft commission safety policy statement or severe accident policy statement, the last time I saw it, said new plants should be.

But we will, if you wish, go on to the next question for now.

Let's see. This says further staff and/or GE consideration of unprioritized generic issues.

MR. MICHELSON: Let me help you out on that before you give the answer. As I recollect, I was concerned that those items which have not yet been prioritized were not being considered by GE in evaluation of how to handle generic safety issues. My concern is, of course, that most of these issues have now been or will within the next three months, be prioritized.

And yet how are they going to be handled by GE, or is there some commitment to pick them up as they become prioritized, or what?

MR. THOMAS: Would you like to direct your question to GE first?

MR. MICHELSON: Well, I would like to hear the staff's position and I would like to hear GE's intention. Maybe GE will promise to take care of all of them, in which case you don't have a problem at all.

MR. THOMAS: Okay. The staff's position on this at present at least is we have no requirements in general to consider issues before they are prioritized. As a practical matter, at any point in time new issues are identified and go through the prioritization process. So I think waiting three months or five months or six months from now may pick up some additional issues, but certainly they will be replaced by others.

MR. MICHELSON: But as an issue becomes prioritized, if it's made medium or high, will you then have GE include that as an amendment to GESSAR?

MR. THOMAS: Right now we would, yes.

MR. MICHELSON: Okay.

MR. THOMAS: The whole issue of how to deal with this is under consideration in a revision to the '78 policy statement on standardization. There is a practical consideration here of when it's appropriate to cut off new requirements. We have yet to come to grips with that. One could make an argument, for example, that we close the door when six months prior to docketing, or some any other date that you can define, as a practical matter.

I think since the staff really has not articulated a position, and certainly the Commission has not since it hasn't been presented with a draft revision in its policy statement yet, if a new issue were to be prioritized as medium or high priority we would focus on it for GESSAR, yes.

MR. MICHELSON: These are not necessarily new issues. These just happen to be a large inventory of issues that for one reason or another the staff hadn't got around to prioritizing. But they are old issues. Some two, three years old.

MR. THOMAS: That's correct.

MR. MICHELSON: But from what I understand looking at the list, virtually all of them will be prioritized by March of 1985. And I would expect to see in the final GESSAR submittal a consideration of each and every one of those doesn't seem unreasonable. I don't think it gives General Electric any particular difficulty, and they are not necessarily tough.

MR. HOLTZCLAW: Kevin Holtzclaw from GE.

In response to the questions in section 11 I will be acting as something of a spokesperson and then refer to some of my people to give me support as we go along with each question.

With regards to this question, in our last subcommittee meeting we tried to give the subcommittee some kind of understanding of the procedure that we went through in the actual -- actually the definition phases of the issues that the staff wanted us to consider and the approach that we went and then the ultimate report that we issued to provide the technical basis for issue closure.

It turns out in fact that after the meeting that we had earlier in the year with the staff, the note -- the issues that we ended up reporting on in the GE report did include a couple of issues that had not yet been prioritized but were thought, or I guess deemed to be important enough by the staff in our discussions that we went ahead and tried to put together an appropriate technical position to respond to those issues.

We also encountered a little bit of difficulty in addressing one or two of the prioritized issues from the standpoint that a definite lack of substantial body to the issue itself -- to the issue definition itself, existed. And I am referring primarily to the issue on beyond-design-basis accidents in a spent fuel pool, where on that issue GE more or less had to identify potential threats and then try and show where the design of the GESSAR plant would preclude events beyond a current design basis for fuel pool accident.

But be that as it may, we did try to address the issues that were identified by the staff.

At this time we have no real position on the remaining issues. I think we are waiting for some staff direction, and if there is some redirection in that effort, then we would definitely have to comply or be found to be wanting in the area of addressing these issues.

But I think Mr. Michelson has pointed out very validly that many of these issues have been issues around the industry for a number of years, and it probably would not be a real problem for GE to address those issues.

MR. MICHELSON: Would it be reasonable to assume that the staff will require that these be included in GESSAR up to some reasonable cutoff date, and if that isn't the case, let the subcommittee know?

MR. THOMAS: Yes.

MR. MICHELSON: Okay. Thank you.

MR. OKRENT: The next item is consequences of inadvertent trip of the fire protection system on plant equipment.

MR. MICHELSON: I believe that was my question also. And let me give you a word or two first so we can be sure to get the right answer the first time.

The concern here, of course, is GE is supplying the equipment, but the utility is supplying the fire protection features. And really my question was simply this: Is the equipment to be supplied going to be resistant to inadvertent actuation of fire protection? Were it not, then how do you accommodate inadvertent actuation by interface documents or whatever?

MR. HOLTZCLAW: Let me address the issue of how we accommodate it. And then I might refer to Mr. Maxwell to help me on the equipment itself. Appendix 9A of the

GESSAR II document provides a fire hazard analysis for the GESSAR plant. And in that analysis the consequences of operation of the suppression system was considered, and it was considered on a fire area by fire area basis for all the GESSAR II buildings. And in that evaluation we substantiated that there would be no unacceptable consequences from the operation of the suppression systems, and especially due to inadvertent operation, because there were sections in each fire area where we did assess the problems of potential inadvertent operation for each area.

MR. MICHELSON: Before we go on further, relative to that portion of the answer, you do appreciate, of course, that the problem here might be simultaneous actuation in a number of different areas of the building at the same time, such as perhaps during a seismic event. So does your answer indicate that you can take one inadvertent actuation at a time or could you take simultaneous inadvertent actuation?

MR. HOLTZCLAW: No, it was really relative to simultaneous because what we did do, in fact, the way the buildings are compartmentalized, if the actuation took place in each individual compartment, each compartment has been sized to handle the inadvertent actuation within that compartment.

MR. MICHELSON: Has the equipment though been qualified to continue to perform whatever needed functions there are in the face of an inadvertent actuation?

MR. MAXWELL: Ed Maxwell.

Backing up just a little bit. We don't assume gross inadvertent operation of the fire protection systems. In the arrangements on the sprinkler system they are seismic design, closed-head system with individual thermal leaks on the head. So with a seismic event you don't have inadvertent operation.

MR. MICHELSON: Charge the system by a separate actuation valve as well?

MR. MAXWELL: I don't recall whether it is or not.

MR. MICHELSON: That also is a process that some utilities use.

I think that's a good answer. I don't have any problem with the answer. If you don't use deluge systems, for instance.

MR. MAXWELL: We do not use deluge systems.

MR. MICHELSON: You have an interface document that says the utilities shall not use deluge systems. Because each utility has his own idea of what is right and wrong on fire protection. I just wondered to what extent you control it.

MR. MAXWELL: We provide all the fire protection within the nuclear island.

MR. MICHELSON: Do you supply the equipment?

MR. MAXWELL: The equipment and everything, it is part of the nuclear island design.

MR. MICHELSON: Okay. Do you consider the equipment itself to be qualified for inadvertent actuation, then?

MR. MAXWELL: No, sir. And that's part of what the hazard analysis did. It went through and looked at each area on the basis of each fire area. What happened if the fire protection system activated? And if that was acceptable --

MR. MICHELSON: What did you assume was the incident that you were facing when it became actuated? Did you assume a LOCA or loss of off-site power, or what is the situation in which it became activated? Keeping in mind a seismic event is one way this could happen.

MR. MAXWELL: We assumed there was a fire in the area. Regardless of cause, it was there. And that that fire destroyed everything in the area.

MR. MICHELSON: But decay heat removal was your only objective; is that correct?

MR. MAXWELL: That's correct.

MR. MICHELSON: I have no other question on that one.

MR. OKRENT: When you say that the fire destroyed everything in the area. Does that include a listing of each of the ways in which a circuit might be altered or shorted, opened, so forth? Or do you assume just that it's wiped out?

MR. MAXWELL: No, sir. We assume if the failure is any mode of failure that may occur: open, short or intermittent. And I will qualify there is one area in the plant where we didn't take a fire through the whole area, and that's the containment, of course. And you have all divisions in that containment. That's the one area.

MR. EBERSOLE: Does GE build oil collectors for the main coolant pumps and other ways to confine oil spills?

MR. MAXWELL: Yes, the oil is collected for the recirc pumps.

MR. MICHELSON: I guess one more question I did have. I jumped to conclusions too quickly. You discussed water systems. Do you use any CO2?

MR. MAXWELL: Yes, sir, we do, we use the CO2 systems in the diesel generator buildings. It's a common supply. The actuation devices are on an individual building basis. So again an inadvertent operation of one CO2 system does not affect the others.

MR. MICHELSON: Are they seismically qualified so that they do not actuate during a seismic event?

MR. MAXWELL: Yes, sir. They are class 1-E actuation systems.

MR. EBERSOLE: Does that mean that if you serve these individual cubicles from a common cylinder or storage source, that you program some fraction of the total into a given volumetric space? In other words, you have a large storage facility for CO2 and you take part of it and set it into a given space?

MR. MAXWELL: I can't remember the exact numbers. Yes, we did. In the sizing of that, I don't remember the exact numbers. But it's more than one, sufficient for one space or one discharge.

MR. EBERSOLE: So you have a storage space which is a large storage facility for a variety of various places to be protected.

MR. MAXWELL: Yes, sir.

MR. EBERSOLE: The next question is a very natural one. How do you guarantee that the allocated version -- the allocated proportion of the total goes to a room and no more than that?

And even before you answer, I can tell you why I ask this. It's because I have found on at least two and probably several other occasions this has been done with a timed valve which is stuck or something like that. And literally blown the doors off the protected room.

MR. MAXWELL: I am going to have to say this is a detail I don't have an answer for you. I know we looked at the effect on the structure of the discharge of the $CO_2$. And I can't remember whether the timing device terminated it, or if it will take a continual blowdown until you blow down the whole system, drain the system.

MR. EBERSOLE: You are accommodating the thesis that maybe you won't stop pumping $CO_2$ into a closed volume.

MR. MAXWELL: That may be a solution, I don't remember the --

MR. EBERSOLE: As long as you address it in some organized way rather than find out it happens and you didn't know it would.

MR. MAXWELL: We thought about that.

MR. MICHELSON: In your seismically qualified detection and actuation for $CO_2$, on what principle does the detector work? Does it pick up smoke particles or infrared heat waves or just what?

MR. MAXWELL: Sir, I gave that answer to this committee once previously, and I can't remember now what it was. It was not the ionization.

MR. MICHELSON: It wasn't dust-sensitive, but I wanted to make sure that that was still the case. Sometimes asking the same question twice gets two different answers, and hopefully the last answer is the more correct.

MR. MAXWELL: I do recall it was not dust.

MR. MICHELSON: Because there you have a common mode actuator.

MR. MAXWELL: I can't remember if it's infrared or rate of temperature.

MR. MICHELSON: Thank you.

MR. OKRENT: With regard to Mr. Ebersole's question, I guess, when you do have in mind just how the flow is terminated, could you somehow write that down and send it along, maybe, or whatever, so that it's not a residual question?

What is the fragility of the different components of the fire protection system? Has that all been assessed?

(Pause in proceedings.)

MR. HOLTZCLAW: Dr. Okrent, I think we are going to have to bring that answer in when we cover the seismic analysis next time.

MR. OKRENT: Or at some future meeting. Okay. One would be interested in knowing, for example, could you have CO2 getting into all the diesel buildings when you didn't want it, because an earthquake developed some flaws in the lines or whatever? Okay?

MR. HOLTZCLAW: Yes.

MR. OKRENT: Those lines may be small enough that

Mr. Kennedy didn't look at them. Assuming Mr. Kennedy worked for you.

MR. EBERSOLE: While he is on the subject of the diesel engines and with reference to Hope Creek, which has a curious design, in accounting for the survivability of the AC fire systm which is critical to safety, do you regard the diesel engine both individually and as a complex as potentially capable of being a scene of great violence due to engine runaway and disintegration of the flywheel and crankshaft and crankcase and presumably explosions and fires? And in doing that do you carefully separate the point of convergence of off-site and on-site power from such physical effects?

Is my question clear?

MR. HOLTZCLAW: Yes.

MR. EBERSOLE: By the way, Hope Creek didn't --

MR. MAXWELL: If Kevin could answer the first part of your question, I can take the second part.

MR. HOLTZCLAW: Why don't you start with the second part.

MR. MAXWELL: The diesel generators themselves for the division one and two are separated from the alternate AC off-site source by a goodly distance and buildings within the --

MR. EBERSOLE: That's a deliberate feature, right?

MR. MAXWELL: Yes.

MR. EBERSOLE: That's all I need to know.

MR. MICHELSON: I want to make sure I understand the answer. The electrical board to which the off-site power comes and also the on-site diesel power comes, that board is far away from the diesel engine?

MR. MAXWELL: Yes, the electrical boards are up in the auxiliary building. Diesel engines are --

MR. MICHELSON: Thank you.

MR. HOLTZCLAW: Mr. Ebersole, could you repeat the first part of the question.

MR. EBERSOLE: Well, I said do you regard the diesel engines as being potentially capable of considerable violence such as runaway, explosion and so forth? I'm not looking for side to side damage to the diesels, interfacing with each other. I'm trying to protect the off-site power component.

My rationale is that if such an accident should occur, it would be during the testing rather than in a time of real need, and you will always have off-site power available. That is, I am arbitrarily invoking the thesis that they will not run away and do it when you really need them. They will only do it on those days when you are testing them.

MR. KNECHT: Well, there is of course the overspeed protection on them.

MR. EBERSOLE: I'm aware of that.

MR. KNECHT: And electrically the diesels are not tied in with the off-site grid, except during that brief testing period.

MR. EBERSOLE: I was just looking for the fact that your point of convergence was distant from the diesel.

MR. KNECHT: There is that separation.

MR. MICHELSON: Have you considered the diesel engine as a potential missile generator? There are several reasons why they would generate a missile, and historically they have been known to generate missiles from crankcase explosions and things like that. Have you considered that?

MR. MAXWELL: As far as the electrical side of the house and design I can tell you yes, we did consider that. And that's the basis of one of the reasons we put the electrical boards where we did with respect to where the diesel are located.

MR. MICHELSON: The diesels are side by side.

MR. MAXWELL: Division one is on one side of the reactor island and division two is clear on the other side and division three is beside the division two.

MR. MICHELSON: Okay. Relative to those two, what kind of consideration did you give to putting a barrier wall in and how did it turn out to be?

MR. MAXWELL: Although they are in the same building, it is in fact separate buildings. It has a three-hour fire-rated wall between them.

MR. MICHELSON: That doesn't help me much about missiles, though.

MR. MAXWELL: And I guess I can't give you an answer on the missile except that wall is essentially the same thickness as the exterior wall. So now you are getting into the missile from a telephone pole --

MR. MICHELSON: Above the diesel engine is just a compartment where the silencer is located, that sort of thing.

MR. MAXWELL: That's correct.

MR. MICHELSON: And underneath the diesel engine what is there?

MR. MAXWELL: Nothing.

MR. MICHELSON: And the oil tanks are buried in the ground.

MR. MAXWELL: The day tanks are in a separate vault in the room and the storage tanks are outside the building in the ground.

MR. MICHELSON: In the ground.

MR. EBERSOLE: Do you maintain control over the AE or utility's design of those tanks? Do you specify tankage, methods of keeping them clean and purging them for contaminants, et cetera?

MR. MAXWELL: We specify the quantity of fuel required and the amount and flow rate and such as that. Beyond that, I don't know.

MR. EBERSOLE: Do you require protection against flotation in floods?

MR. MAXWELL: No, we don't tell him how to design the tanks, the location of the tank or the facility that supports them.

MR. EBERSOLE: Do you review what he does?

MR. MAXWELL: Yes, sir.

MR. EBERSOLE: Before he does it?

MR. FOX: Yes.

MR. MAXWELL: Before he physically builds it, yes, sir.

MR. OKRENT: What does that mean? Can you tell him this approach is not acceptable?

MR. MAXWELL: Yes, we can. We have in some of our past existing plants told them what we thought was acceptable and given our comments. And the one experience I've had with it, the utility has been responsive to our comments.

MR. OKRENT: I see. He doesn't have to be, but --

MR. MAXWELL: He doesn't have to be. But we are headed in the same direction.

MR. OKRENT: Anything else on this portion?

Let's see. Maybe if we take a break right now it will split the afternoon into two equal parts. We will be back in ten minutes.

(Recess from 2:49 P.M. to 3:01 P.M.)

MR. OKRENT: By special request, we are going to take question H next.

Is it so that there is a lack of a three-hour fire-rated damper in the ventilation system?

MR. MAXWELL: Yes, sir. There are points in the ventilation system where there are not three-hour dampers. That is the design philosophy, to uses fire dampers where ventilation ducts penetrate fire barriers. And as a matter of fact, there is over three hundred fire dampers in the nuclear island design.

There are some specific instances where other considerations led us to not put a fire damper in and to use alternate means to get the desired results, which is to prevent the unacceptable transmission of fire from one fire area to another.

The case in point when we do this is on a smoke-venting system or a portion of a dual purpose H stack and heat venting system where it serves a dual role, we do not put a fire damper in because at the very time that you would utilize the smoke-venting system, you would stand the danger of closing the fire damper and rendering your smoke-venting system inoperable.

The equivalency of a three-hour fire barrier or the control of unacceptable spread of fire is obtained by several methods. In one case, one instance, a duct providing smoke venting from a fire area which contains ESF equipment is routed through another area containing no ESF equipment and to an external vent. Another method is used, some smoke vents, for instance, are completely contained within a divisional area or zone of the building. In the GESSAR II design, basically every room in the plant is considered a fire area, so that we have subcompartmentalization within a division. The point being as trying to confine fire not only to one division but to minimize the area of influence of fire in the plant.

The ducts in some instances are designed to have the equivalent of a three-hour fire rating, so that you go out of one room and go through another one with a duct that is rated for equivalent of three hours.

Other instances there are manually operated non-fire rated system isolation valves that are exterior to a given fire area that can isolate the duct and serve the purpose of isolation. Some cases normally closed remote manual intake dampers are provided. In at least one instance we are provided a terminally actuated spray nozzle to cool the gases that go into the smoke vent.

And some instances, the smoke venting duct is completely contained within one fire area. It's just where the duct goes out of the building which we would normally put a three-hour -- or a fire damper in the exit. And another feature is taken care of, local conditions may limit maximum exhaust gas temperatures which would occur due to a fire. That's in general a listing of the things that we use to obtain equivalency.

I am prepared to give you with flimsies to show you each individual instance of where we have omitted a fire damper and the reason why we think that's acceptable, if you desire.

MR. MICHELSON: Has the staff reviewed each of these instances and satisfied itself that it's an acceptable equivalent?

MR. SCALETTI: The staff had originally called this item out as an outstanding issue item in the SER that was issued in April of 1983. And we wrote off on that outstanding issue in supplement 1 on page 91.

MR. MICHELSON: And as far as you know it was written off on the basis that they had provided these equivalent kinds of protection in these special cases.

MR. SCALETTI: That's correct.

MR. MICHELSON: Thank you. I have no further questions.

MR. EBERSOLE: I have one.

In the execution of fire protection with dampers, is cooling flow still maintained in rooms that have need for artificial cooling? I mean in the closing of dampers to provide fire protection is there a closing of any room circulation patterns which is critical to the removal of waste heat in that room?

MR. MAXWELL: No, sir. If a fire damper closes, and shuts off a ventilation flow in that room, it's assumed that the fire has made that room -- the equipment in that room inoperative. And there are redundant means of performing the required function elsewhere.

MR. EBERSOLE: So it's a selective closing function.

MR. MICHELSON: Are you using generally thermal links for closure?

MR. MAXWELL: That's correct. We used a separate ventilation system for redundant divisions.

MR. EBERSOLE: So what happened in one of them is not supposed to happen in the other.

MR. MAXWELL: That's correct. Requires two fires.

MR. EBERSOLE: So when you close off, you do it with fusible links and at that time you already assume that the ambience is so high the equipment is inoperative anyway.

MR. MAXWELL: That's correct.

MR. EBERSOLE: Thank you.

MR. MICHELSON: In general for room cooling like ECCS pump rooms, are you using service water or chilled water?

MR. MAXWELL: The ECCS rooms are generally service water. The switch gear rooms, for instance, though, are chilled water.

MR. MICHELSON: Is that the same chilled water for control room habitability?

MR. MAXWELL: The ECCS switch gear rooms use the control building chillers for their supply. They also have self-contained coolers, room coolers that use service water as their heat rejection medium.

MR. MICHELSON: Thank you.

MR. OKRENT: Anything else? Any questions here?

Could I ask, have you or has anyone else to your knowledge examined the likelihood of fires produced by an earthquake? And if so, what was found out?

MR. MAXWELL: In our fire hazard analysis and all of the analysis I am familiar with as far as fire is concerned, we have not considered multiple fires. We have considered a single fire and the consequences of that fire.

MR. OKRENT: Well, that's a part of the answer of the question to which I was leading.

MR. MAXWELL: I realize that, sir.

MR. OKRENT: I was wondering whether anyone -- Brookhaven? -- has looked at whether earthquakes -- count earthquakes somewhat more severe than the SSC have small or an appreciable likelihood of producing one or more fires. Has anyone looked at this?

MR. CHIU: In our review of the GESSAR seismic PRA we did not come across any evaluation. And we ourselves did not reevaluate that frequency.

On a related project this question has been brought up. And we are trying to resolve that, or come to some better understanding. So at this point I don't have anything to say on the matter.

MR. OKRENT: Would you mind telling me what you mean by the term "on a related project"?

MR. CHIU: BNL has been directed by the staff to prepare a procedure guide for external events. And seismic is one of them. And in the numerous discussions we have with Chuck Benjamin and Associates, who are the consultants, we have raised this question about seismic-induced fire. So we are in the process of developing a better understanding in that area. I don't know whether there will be any results that come from it.

That's the extent of attention that we have paid to the subject so far.

MR. OKRENT: Now, suppose we had multiple fires, and they happen to occur in rooms belonging to different divisions, or whatever you call them. Would that cause a problem?

MR. MAXWELL: There has to be a limit, yes. There is some point where multiple fires can cause you a problem.

Now, in the GESSAR design, with the subcompartmentalization that we have, the effects of multiple fires are probably minimized. But, you know, if you take a fire in the division one switch gear room and a fire in the division two switch gear room, now you are down to HPCS and possibly something out in the turbine building to provide cooling. Take a fire in the HPCS. If you keep considering additional fires, there is some point where you get in trouble. But it's -- the plant is tolerant. If you are going to go beyond the design limits, it's still tolerant to situations like this, I think.

MR. OKRENT: Can you lose your heating and ventilating by pure fires or -- it wasn't quite clear to me.

MR. MAXWELL: A pair of fires in division one and division two could wipe out the ventilation systems for division one and division two. The HPCS would still be available with its required cooling, ventilation for the rooms that are required to have it. So we have that.

MR. OKRENT: That won't work indefinitely.

MR. MAXWELL: That's correct. If you are going to fall back on the equipment in the turbine building to provide cooling, why, that ventilation out there is separate from the nuclear islands.

There is a number of fires that you run out of alternate ways of providing cooling to the core. And it's not two -- it's definitely not one. You might find someplace a combination of two, but it's more likely to be more than that. And beyond that, I don't know.

MR. OKRENT: Did the group that are looking at seismic effects on non-nuclear plants find out whether there were fires or not fires, and in any event, whether whatever happened there was applicable? I would assume it could be partly applicable. Do you recall?

MR. EBERSOLE: Squaw.

MR. OKRENT: Squaw, yes, or some such acronym.

Nobody recalls?

Anyway, it might be something to think on. We will talk about seismic again, I guess.

Okay. Let's see. Before we took up H we had done A, B, C, which then takes us to D, which in fact was mentioned before by Mr. Ebersole, but I'll read it again. Development of instrumentation and controls to reduce the number of spurious trips.

Whose nickel is that?

MR. EBERSOLE: Let me pick it up.

It is my understanding that the staff was beginning to look into the interface area to use as a model for this. I'll just take turbine instrumentation and control, including main feedwater.

With a view toward doing this very thing we talked about earlier, reducing challenge frequency by invoking such simple considerations as requiring coincidence of trip circuits. In short, if you are going to get a vibration trip, don't do it on one instrument, but get a confirming signal from another one.

Is the staff in fact now beginning to look upon these non-safety grade but interfacing grades and systems, which in the long run produce the -- that is they produce through contact multiplication, that is the scram system which is in the stop valve, wherein a given relay, a single relay, an induction relay, a vibration trip or whatever, because it trips the turbine, produces a scram through the actuation of stop valve scrams? Is the staff moving into the commercial regime of instrumentation to improve the scram frequency?

At all? I thought they were.

MR. SCALETTI: I will check.

MR. EBERSOLE: It's part of this theme to reduce challenge frequency wherever it may occur. And the first place to look at it is the main feedwater system.

What about GE? Are they invoking coincidence where they used not to?

MR. KNECHT: Well, not on the turbine control, since that's outside of the scope of the GESSAR. We can't necessarily speak for the LSTG wing of GE, because it is a utility decision which turbine they design.

There are several things we have done to the GESSAR design, though, to reduce the initiation frequencies, and they were spelled out I think in the documentation. Things like going to the analog trip system and reducing the frequency of inadvertant relief valve openings and closures, those are things that are built into the BWR/6 design. So we think we have gone a long ways improving over the BWR/4, for example.

MR. EBERSOLE: Well, when you furnish the other part of the package the turbine generator?

MR. KNECHT: We don't do that.

MR. EBERSOLE: You don't?

MR. KNECHT: That would be the utility's scope.

MR. EBERSOLE: You don't ever furnish the whole package?

MR. KNECHT: No, I don't think so.

MR. EBERSOLE: Not as part of GESSAR.

MR. MICHELSON: Your answer gives me a little difficulty. Even though admittedly one doesn't want to specify the trip arrangement coming from the turbine, since it's presumably a non-safety island, certainly GE ought to make some strong recommendations to the potential customer as to how it ought to be handled. And you do this through an interface document. Does your interface document say anything about the desirability of redundancy and so forth in such cases?

MR. KNECHT: I don't believe we have an interface on that item.

MR. MICHELSON: Wouldn't it seem kind of prudent, though, that -- I mean, if you feel that there is an important area, you certainly have the capability of suggesting it, even though maybe not requiring it. I would think you would want to carefully consider a strong suggestion concerning the need for redundancy in this area, since it's obviously a significant economic advantage to the potential customer as well.

MR. MAXWELL: Mr. Michelson, on the GESSAR II design we had some rather strong recommendations to the utility in the area of those particular trips, and how they should be routed in the way of their cabling. It was a turbine by another manufacturer. The utility listened to what we had to say and made their decision accordingly. But we did give them our thoughts on the subject. We did not have a formal document, however.

MR. MICHELSON: In case of GESSAR II, are you putting it into the interface, not as a requirement, but as a strong suggestion?

MR. MAXWELL: No, sir. It is not in the requirements. This is something that has been handled more in the form of letters.

MR. MICHELSON: Is that the desirable way to handle such an important matter?

MR. MAXWELL: Well, I don't know, sir.

MR. MICHELSON: Just, you know, it just surprised me a little bit. Unless you don't feel strongly about the issue. If you felt strongly you have means of getting those feelings well felt, I'm sure.

MR. EBERSOLE: In your interface documents, there is almost an invitation on the part of you to tell the customer, "Oh, go ahead, have ten trips a year. I shouldn't worry, my PRA is designed for that."

So he will in a relaxed sense do that. Because after all he passes the bill on to the customer when he gets all those trips.

So where is his incentive? I think it has to come from you. And it seems that it could come in the form of a document like Carl was suggesting, making strong recommendations and even hard words that you don't expect for him to in fact go ahead and have ten trips a year; you expect him to reduce it to one every three years if he can, and thus be like the Japanese.

And in doing that taking certain critical steps like requiring coincidence or critical trip functions, putting cages on float switches on heaters -- there are lots of things you can do to keep these spurious trips from creeping in and deteriorating your safety logic.

I think you ought to express your PRA to him as being a minimal sort of thing. If he has more than that, he is outside the bounds of your PRA, but he should certainly work toward the other end. Do you write him or admonish him or talk to him about this?

MR. SHERWOOD: My name is Sherwood from GE. I might make a couple of points.

One point is with regard to the scram schedule of all of our plants around the world. I think, as you know, Mr. Ebersole, with plants in Switzerland and the United States and even among the many utilities in the United States and many of the Japanese plants which I am sure you have seen are virtually identical plants.

MR. EBERSOLE: Yes.

MR. SHERWOOD: And the scram rate varies from ten per year to less than one per year. And we have a program, maintenance management program which we are encouraging many of our domestic plants to work with us on to reduce the trips of some of the domestic plants to the kinds of experience which you have seen overseas.

And with regard to the currents BWR/6, the BWR/6 experience, although that's been very moderate, has shown -- unfortunately I don't have the numbers with me today, but the scram experience with the BWR/6 has been really excellent. It has shown, as we all know, a number of scrams early in lifetime, of say the first six to nine months, and then it rapidly settles out at very few scrams per year. I think we can get those numbers for you.

But I think two things we are working with all of our customers on a reduced scram program, and also the BWR/6 has shown very excellent results and the kind of direction you are thinking of.

MR. EBERSOLE: Glen, you implied that maintenance would do the trick. But you notice this curious hard break that occurs at the point where you identify a scram circuit such as on stop valve?

MR. SHERWOOD: Yes.

MR. EBERSOLE: At that point you automatically put in coincidence. You are required two to execute a trip, but upstream of that into the turbine it only takes one to make the turbine trip.

MR. SHERWOOD: That's right.

MR. EBERSOLE: So there is this curious step change in rationale. Apart from looking at just maintenance are you looking at the inclusion of coincidence upstream from such things as stop valve?

MR. SHERWOOD: We have in those cases where we have found there is a large incidence of those cases. And we are taking a cue from the questions here with regard to the interface requirements for the turbine building. For GESSAR II.

MR. MICHELSON: There is a chance that I might have misunderstood. But I thought the Japanese told me that they had put in redundant trip circuits on their turbines and this is one of the many reasons they had --

MR. SHERWOOD: This is true, and I wasn't arguing it.

MR. MICHELSON: Their record was due to several things, not the least of which is a design modification, and another is their attention to care and maintenance, which is important.

MR. SHERWOOD: That's right.

MR. MICHELSON: Perhaps maintenance alone will do the job. That will I guess remain to be seen over several years. It would appear, though, that redundancy would do the job. And I would think you could save the cost of the modification with one trip or so.

MR. SHERWOOD: I would suspect that's true. I think it is a a combination of those modifications as well as maintenance training. The experience from Switzerland, for example, and Japan was almost identical. Again these plants are virtually identical to many of the domestic plants. But certainly the experience is totally different. And as you well know, the maintenance and operation philosophy in Switzerland and those Japan plants is almost, let's say, very close to those operators and maintenance people belonging to a, what you might say a sect.

MR. MICHELSON: They are dedicated.

MR. EBERSOLE: Yes.

MR. SHERWOOD: They are dedicated.

MR. MICHELSON: I was just a little disappointed, I guess, that General Electric didn't take a stronger position in GESSAR by coming out with a good pitch on the need for new redundancy and even perhaps suggesting how it be achieved pointing out, of course, that it is in the balance of plants. But I would have thought you would give whatever encouragement you could to the idea. If indeed you think it is a good idea and sufficiently worthwhile. I don't want to judge. Because I'm not sure whether it's needed or not.

MR. FOX: Excuse me. I'd like to make one comment. I said there was not a formal interface document. The one document we have is the GESSAR document itself, I think it's table 349-1 is the big table, gives all the event frequency assumptions in the design for the vessel on out.

So the applicant, when he utilizes the GESSAR document, basically insures, whatever exactly that means, that yes, in fact his plant does meet those requirements, which includes the number of scrams, the total number of scrams in 40 years or the life of the plant. So anyplace that he takes exception to that, any data that we have, quote, "assumed" in the GESSAR design, he has to bring that up in the exceptions section.

So yes, we do have a control on that in not as a, you know, a hard interface document, but if he can't meet those requirements he has to tell us or tell the staff.

MR. EBERSOLE: From someplace there has to come the motivation to do these good things. I think we found out in Japan the motivation is loss of reputation. Just that. Not the fact that it's going to cost money or whatever. And here we find our problem is largely institutional, which means you can effect it or try to, generate some institutional pride in the GE reactor and your customer. I don't know what else you can do.

MR. FOX: I didn't want to leave you with the idea that there was, quote "no controls" over the number of scrams in a plant's lifetime.

MR. EBERSOLE: I think sometimes the PUC's don't even know what number of scrams a year is out of order or in order. So the bill goes on to the customer and the motivation is not there.

MR. SHERWOOD: I can assure you that we have a strong interest in reducing that scram schedule. We have been working on that with our customers.

MR. EBERSOLE: Yes.

MR. OKRENT: Okay. Let's on go on to item E, seismic design basis for the reactor water cleanup system, effect of a single pipe break? Can valve isolate the system under LOCA conditions?

Somewhere do we have questions? Yes, later on we have multiple breaks.

Is that yours, Carl?

MR. MICHELSON: Yes.

Let me tell you what I think I've heard the answer is. Because we got these answers I think in bits and pieces the last day or so. As I understand it, the reactor water cleanup is non-seismic outside the outboard isolation valve; is that correct?

Third part of the question was can the valves isolate under LOCA conditions? The answer I think I heard was it is your intention that you think do so and you will have actual tests to verify that they can do so. Is that the case?

MR. FOX: Yes so far to your questions.

MR. MICHELSON: Okay. The other question was the effect of a single line break. If you can indeed isolate, then the only consideration is that you can handle the 30 seconds of flow or whatever it takes before the valve closed. And I assume you have done an analysis of some sort.

MR. FOX: We have included analysis of reactor water cleanup system piping in our flooding analysis. And we are, you know, this is just --

MR. MICHELSON: And you have shown what happened in 30 seconds of flow or whatever.

MR. FOX: Yes. We have showed that the reactor water cleanup system is important to look at, but there is other flooding events associated with other pipes that are more severe.

MR. MICHELSON: I think the key is to be sure that it isolated in 30 seconds. Because otherwise it could be a potentially difficult problem.

MR. FOX: Yes. Yes.

MR. MICHELSON: That takes care of my problem.

MR. OKRENT: Okay. F. Have RHR pumps been designed to cope with large quantities of entrained air? Is pump suction optimally located?

MR. MICHELSON: Let me tell you what my problem is there so that you can narrow your answer. If my voice holds up, at least.

We have heard in the last day or so about the bubbling that occurs in the suppression chamber and the amount of non-condensible gases that have to bubble up through the chamber. These are the same gases that in part arrive at the suction of the RHR pump because it's pumping that same fluid. And I am wondering in your -- have you done or how have you considered the possibility of that kind of air entrainment and shown it to be a non-problem? I'm not concerned now with the vortex effects of the suction, but rather the entrained air itself in the bulk fluid.

MR. HOLTZCLAW: In order of your questions, first of all the pumps themselves have not been designed to cope with large quantities of entrained air. However, this has been care taken in the locations. For the GESSAR design, the suctions are located more than ten feet from the drywall vents and more than twice the quencher arm length from the quenchers themselves. And the elevation of the suction is about one foot below the quencher to minimize the entrapment of air at the pump suction location.

MR. MICHELSON: How far above the bottom are they, then?

MS. HANKINS: Four feet.

MR. HOLTZCLAW: Approximately four feet or so.

MR. MICHELSON: And the quenchers you are saying are about five feet or so.

So you are arguing that they aren't really able to suck in very much of this air that's suspended in bulk.

MR. OKRENT: No, I'm skeptical about this because we were hearing how things are pretty well mixed in that pool. And I have to assume that includes air bubbles.

MR. MICHELSON: But not near the bottom, I think must be the argument.

MR. OKRENT: Well, in fact there may well be convection paths starting at the bottom if some of the fission products go downward and set up a heat source. So right now, I have no basis for assuming other than what I was told in an earlier discussion, that there is a considerable degree of mixing.

MR. HOLTZCLAW: At that point in an accident sequence I doubt if we would have RHR pumps because we would have already degraded the core and released the fission products into the pool.

MR. MICHELSON: The air is there to begin with. You are driving it down with the steam from the break in the drywell, it's suspending in the water. Just plain old air now, not fisson products or gases, just plain air. And it will be there for several minutes as you keep sweeping out of the drywell.

MR. EBERSOLE: I think what Carl is talking about is a lockup of the pumps in the first phase of the blowdown.

Is that right, Carl?

MR. MICHELSON: That's part of it. The other part is in the longer term do you have a problem with entrained gas? And I think that part of your argument was in relative positioning, and I think that's a reasonable argument.

The first part, of course, is the question of the early-on blowdown, the first few minutes when you entrain a lot of air blown in with the steam.

MR. HOLTZCLAW: Of course at that part in the event it is still going through the blowdown phase of the event, and so you haven't depressurized to the point where you would be initiating the low-pressure systems.

MR. MICHELSON: I think the RHR is already in operation, isn't it?

MR. HOLTZCLAW: No.

MR. MICHELSON: Didn't you get an ECCS signal at that point? I thought it did because you got a big break going and doesn't take long. A matter of seconds and your vessel level is giving you an ECCS sequence.

MR. EBERSOLE: Yes.

MR. PAYNE: The pumps should have started and the recirc lines should have opened, but when you have an injection you will find --

MR. MICHELSON: They will within about 20 seconds or so for a big break. Doesn't take long for it to get down to 500 pounds. The valves open at 500, injection starts at about 325. So yes, they are injecting very early on. In fact that's the big flooder you have going on in the big break, the RHR from the suppression pool.

So you got the big one going. And I was wondering during your eight segment tests on blowdown whether you had ever set up a loop and tried pumping the fluid and looked at and watched all that frothing going on. Did you ever try pumping that fluid? That would be one way of showing it was a non-problem.

Of course this is not a GESSAR question, this is a question that pertains to all boiling water reactors.

MR. OKRENT: By the way, is it one of the unprioritized generic issues?

MR. MICHELSON: Not really, I don't recall that it is, because it was very difficult to get anybody too excited about it. I'm not sure whether I should be excited about it either. Rather hear a rational answer.

MR. KNECHT: Let me just try one more on this, this early part of the blowdown. We are really looking at the drywell LOCA type events where we are going through the vents. That initial blowdown of air out of the vents would occur very early on, probably at the time that the plant is starting to depressurize. And I think by the time you got the RHR pumps up and running to speed and the valves open and whatnot, that air has long risen to the upper part of the pool, so that wouldn't be a problem.

Now, when we have a specification on the width of the pool, part of that consideration was how big is that bubble following a large break or DBA, and what is the size of it, and can we make sure the pool is wide enough so that it doesn't go into the suctions?

I don't think it's really a problem with that type.

MR. MICHELSON: I think that kind of rationalization helps. It doesn't help me much, however, in thinking about Mark I, for instance, because there the suction of the RHR pump is only a few feet from the downcomer which is where this air and steam mixture is coming in. So physical separation doesn't work very well in that case. But we are talking about GESSAR II right now.

And so your argument would be it's the physical separation from the suction, and the suction is some 20 feet away, I guess, the width of the pool.

MR. OKRENT: I am still interested in knowing how many small bubbles per cc of water going into the suction of the RHR pumps could cause trouble, and then how you know that you don't have a concentration like this of bubbles of that size due to various convection paths. You know, bubbles don't all disappear immediately. Air doesn't all disappear immediately from the water. The big ones, I'll grant you, won't stay in their non-equilibrium form very long. But when we are talking about smaller bubbles, it's not so obvious to me that they just go all zip up out.

MR. HOLTZCLAW: Dr. Okrent, we will expand our answer on this one so we will include a little bit more than we provided here.

MR. MICHELSON: Yes. I would appreciate a little bit from the viewpoint of how you feel about the Mark I arrangements, too.

I have seen some numbers on it from a pump manufacturer that indicated that approximately 2 percent by volume of air is what it took to very quickly -- and by very quickly, in a matter of minutes -- inactivate a core spray in an RHR pump. 2 percent by volume is a fair amount air, of course. But you get a lot of air blowing around inside the suppression chamber in the initial stages of blowdown.

And I have a vague recollection of asking this question at some distant past. And I thought GE had said that they had done some work during the eighth segment test to verify this was a non-problem, but I never could get my hands on any documentation that I could read to learn about it. And I was hoping that would be the answer, "Here's the document to go read."

MR. HOLTZCALW: We will check on that, too.

MR. ETHERINGTON: That's 2 percent by weight?

MR. MICHELSON: No, my recollection was 2 percent by volume. It isn't a whole lot, but it's a fair amount. The problem is that it very quickly chokes off the pump because it gets in the very top part of the volute casing and that's when it diminishes the pumping capability. And then you have to go vent the pump to get it started again.

MR. OKRENT: If you had a break that wasn't the largest break, something between a small and medium, where you are blowing down for a considerable time, would that be more likely to lead to a condition where you --

MR. HOLTZCLAW: In those sequences, though, with the hierarchy of demands that you are placing on the ECCS you would be more likely to start with the high pressure system until you got blowdown, until you had to immediately automatically or manually depressurize.

MR. MICHELSON: Of course the high pressure system once you are on the torus, you have the same question associated with it.

MR. QUIRK: No, the high pressure spray pump off the condensate storage tank.

MR. MICHELSON: Oh, then you are all right. You never do take it from the pool in that case. Is that right?

MR. QUIRK: That's right. Initially the HPCS is aligned to the condensate storage tank and upon low level in the tank it will automatically switch over to the pool.

MR. MICHELSON: Or when you get too much water in the pool you have to switch over.

MR. QUIRK: Yes, high level in the pool will also cause it to switch over.

MR. OKRENT: Well, I think the staff may be better able to tell us on Hope Creek, because I don't see that that's fair to ask GESSAR II to tell us a problem about Hope Creek.

MR. MICHELSON: Of course these aren't Hope Creek people here.

MR. OKRENT: I know. But the staff can pass the message. Okay?

And GESSAR II can tell us about GESSAR II.

MR. MICHELSON: I think for GESSAR II it's probably a non-problem because of the physical separation of your venting, your ports in the wall versus the suction point. And I think those bubbles tend to rise, is my understanding. I'm not a bubble expert and don't pretend to be.

MR. HOLTZCLAW: That's a good point. One thing comes to mind and I think we will, with the permission of the subcommittee, it will probably be helpful, we didn't bring it to this meeting, but we do have a very short film, about five minutes on the test program that we did for pool scrubbing, and I think it gives you a feeling for the bubbles and the bubble dynamics that are involved for just the scrubbing aspect of the pool and under typical blowdown conditions. And if it's acceptable we could bring that movie for the next subcommittee meeting just to give you a feel for what is physically involved.

MR. MICHELSON: One other question. You do have vacuum breaking or pressure equalization between a drywell and wetwell, don't you? See, that's the mechanism by which this condensible and non-condensible air keeps recirculating back down with the steam again. And this goes on for a long period of time. It just isn't an initial burst. It gets recycled a number of times.

MR. OKRENT: Okay. I guess we will hear a little more or a lot, as is appropriate, to dismiss this, hopefully, for GESSAR II.

G, consequences of the failure of the first RHR valve outboard of the suppression pool.

MR. MICHELSON: Clarification is needed on that before we get an answer.

I recollect reading somewhere in the SER you considered a possibility, the staff considered the possibility of a valve break, a valve rupture as an initiating event. I just wondered how you handled the valve rupture. Isn't it incredible to the valve or the pipe between the valve and the compression chamber to rupture? I shouldn't say that. In the suppression pool.

Is that considered incredible?

(Pause in proceedings.)

MR. OKRENT: Which way does that line run in GESSAR II, by the way? I don't remember seeing it on the drawings you flashed, or if it was there, I didn't notice it. Which way did the pipe run, or the RHR line, with regard to the is actual location of the pool itself?

Horizontal or what?

MR. FOX: Horizontal.

MR. MICHELSON: About three feet off the floor, as I understand it, so if you broke there you would essentially drain the pool down, and if you pressurized it all inside the containment you would push the rest of the water out. It wouldn't just go into a hydraulic equilibrium.

MR. FOX: The valve is in a watertight room.

Oh, oh, I'm sorry. I was answering the wrong question.

MR. MICHELSON: Your RHR is a watertight room.

MR. FOX: Yes. That's where the valve is.

MR. MICHELSON: You will essentially fill that room and then some, and it's tight. So you proceed then after you fill it to pressurize it with whatever containment pressure you have at the time. And one of the questions is, have you actually uncovered the rear wall first line of ports yet?

MR. FOX: No.

MR. MICHELSON: So you think you will still get vapor suppression enough to keep from pressurizing the containment.

MR. FOX: Yes.

MR. MICHELSON: And the room itself can take the hydrostatic pressure.

MR. FOX: The walls will take the hydrostatic pressure.

MR. MICHELSON: Isn't the same basic answer true for your core spray -- well, you don't have a core -- your high-pressure core spray?

MR. FOX: All the ECCS rooms are watertight compartments, and each have them looked at from a volume standpoint, filling, like a leaky seal, and it has been demonstrated --

MR. MICHELSON: Confined to the one room.

MR. FOX: Yes.

MR. MICHELSON: And all your seals are designed for whatever pressure you get from filling the entire room?

MR. FOX: Yes.

MR. MICHELSON: I think that would take care of it then, provided you didn't get too much containment pressure. Do you know how much containment pressure you could stand before you would start to reach the possible rupture point of the room?

MS. HANKINS: Open during operation.

MR. FOX: What is the mechanism of containment pressurization?

MR. MICHELSON: The same incident that kind of filled this whole corner room probably disrupts things electrically, and I wouldn't be surprised that you get a scram in the process somewhere along the way. And when you did, then you would get an isolation or bypass -- I don't know what. As long as you are on the condenser you should have no pressurization. If you isolate for any reason.

MS. HANKINS: You have to describe your scenario.

MR. MICHELSON: You don't know what your margin is.

MR. FOX: Certainly there is a pressure at which we would have a problem.

MR. MICHELSON: That takes care of my question.

MR. OKRENT: Could I understand the geometry. You mentioned that the valve was in a room. Does that room connect physically with a wall which constitutes the outer barrier for the suppression pool? Or is there some space between the outer wall of the suppression pool and the outer wall of this room?

Is my question clear?

MR. FOX: Yes. I was looking at -- I was only looking at the location of the valve relative to the shield building wall. And the -- it's --

MR. KNECHT: It's just a straight shot. It's just opposite the outer wall of the suppression pool.

MR. OKRENT: I don't know what that means. Again I'm trying to understand is there a pipe which, if it broke, would not be in a sealed room?

MR. KNECHT: It goes, the suction line, the suction inside the suppression pool itself, goes through the concrete wall and directly into the RHR pipe chase, which is part of the RHR room.

MR. OKRENT: Okay. You have now answered the question, I think. And this pipe chase is designed as if it's part of the room, you are talking about.

MR. KNECHT: That's correct.

MR. OKRENT: It doesn't somehow vent into the containment building.

MR. KNECHT: No, it communicates with the rest of the RHR room. There are some different walls that are in part of the structure, but it is all, the RHR room itself is the watertight barrier that we were talking about.

MR. OKRENT: Okay.

Any other questions on G?

Then we are on I, A-43, containment emergency sump reliability -- can cyclone separators concentrate contaminates and threaten pump seals.

That sounds like an Ebersole question.

MR. EBERSOLE: That goes back to the ancient days when they put common plaster on the thermal insulation complex, and we took some issue with that and eventually wound up with laminated stainless.

We learned at Hope Creek they were putting in fiberglass which was clad with one single layer of stainless on the outside. And the argument was put forth that the destruction of that due to LOCA and other physical effects would never produce contaminates in the coolant that would challenge this little tiny hydroclone filter.

Here I think the question is in a more general sense. You still have hydroclone filters on your pumps, I believe.

MR. HOLTZCLAW: That's correct.

MR. EBERSOLE: What I have never seen is the identification of the contaminants in the input stream to the hydroclone, and a set of arguments that says in fact the hydroclone takes these out and spews them to the discharge rather than feeds them to the barrier.

And this involves a discussion of what are those contaminants? What is the specific gravity? What is the concentration thereof? The whole contaminant source term for the hydroclones, and how you manage to use hydroclones without identifying a source term for input contaminates I still have to find out.

MR. HOLTZCLAW: Let me preface my remarks by telling you that I am not the cyclone separators expert at GE, but I can read his answer and we can try and enlarge on it. It sounds like a lot of the things that you are concerned about, Mr. Ebersole.

The separators remove the majority of the particles with specific gravities greater than one. The lighter particles are likely to rise to the upper portion of the pool and thus not be drawn into the pump seals. Any light particles which are drawn into the pump seals when they separate are are not expected to be abrasive, not result in seal damage, or seal damage would not be expected. The seal flow from the cyclones is expected to be of better water quality than is found in most industrial applications.

And that was the extent of our response. Anything that we want to add to it?

MR. EBERSOLE: Let me tell you what stories I am getting from the field about where these things are. One, I think most operators in utilities have removed them. And a matter I think you should look into. That's what I understand from the last task action discussion we had on this TAP. So I suspect there are in being at this time a number of your pumps that don't have any kind of contaminant protective feature.

It's very, very ambiguous right now what exists in the field. And why you stick to this particular kind of removal device, which I think is controversial. I certainly would have thought a comparatively large deep-bed filter would have been better. But I'm not about to get into that argument.

But I am saying this hydroclone separator is an object of controversy which I think should be settled, both by looking at the field practice that is present at this time as well as its future use.

Incidentally, I understand that the journals on these big pumps I think were said to have a bronze bearing with a three-mil clearance or something like this which is water-lubricated, and thus had a fairly high -- I guess I'll call it a digestive capacity to deal with contaminants, which I will believe if you tell me that's true. And it may be it doesn't need polished water. I'm not sure. But that's not my earlier impression of these journals.

And oh, the other thing is the seals, we don't want to cut the seals with this stuff. You remember that in TMI II everybody shook his hands in horror in using these pumps because of the potential for losing seals and thus coupling the containment atmosphere to the outer worlds. So they didn't use a system which was designed to provide the cooling. Instead they went to the condenser.

That's kind of an open ambiguous issue which I think needs a little solidification.

I can comment, in case you are looking far down the road, that your competitors don't use this type of pump journal at all. They use journals which don't use this kind of cooling or lubrication. They use cooling which is a pipe-wound jacket for cooling, rather than straight-through flow. And I think the journal design is much more robust to take contaminants than this particular one.

MR. OKRENT: Any more comments?

MR. MICHELSON: Yes, I have a couple of comments.

One is you should look carefully at the ability to accept fibrous insulation in the pump bearings and seals because there is a tendency of fibrous insulation not to circulate so well, and then it begins to clog them up and then it shuts off the coolant water. And also fibrous insulation is not well separated by cyclone separators because there isn't a large density difference which they depend on.

The industrial practice when they are pumping sand and that sort of thing, cyclones work real well, and again you have to look carefully at the micron size particles that you are handling. These days there is a range of particle sizes that separates very well and there is another range that separates very poorly. So you have to look at the size. But always it has been spherical particles that it was dealing with and not fibrous insulation. I haven't seen any data on cyclone separators where you are dealing with fiberous materials as opposed to sand or other reasonably spherical particles.

MR. EBERSOLE: That will be the Hope Creek case.

MR. MICHELSON: And I think the key question, though, to answer for us right now, if you know, is exactly what is the source term that we would be dealing with from a LOCA inside of the drywell? What kind of insulations are in there? And so we could see better what the problem might be.

MR. OKRENT: Paint chips too.

MR. MICHELSON: Yes, you have to deal with anything stripped off the wall. And there you have to deal with the quality of the paint job.

MR. HOLTZCLAW: I think we already have an action to look for some insulation materials for you from a previous question.

MR. MICHELSON: Okay. So we will just delay this one until next time.

MR. EBERSOLE: Do you specify the insulation? The thermal insulation?

MR. FOX: Yes.

MR. OKRENT: We will go to J, which is A-43, paint qualifications for containment surfaces, design life of paint and qualification of multiple layers.

MR. EBERSOLE: In the long run that's no more than the same question. Historically there was much attention paid to paint but none to insulation. As a matter of fact, there was an ANS standard on paint but none on insulation. So this is no more than a part of the prior question. The reason this question is asked is what is paint going to do to the ECCS system?

MR. OKRENT: And how will your interface requirements achieve whatever is needed, if anything is needed?

MR. MICHELSON: And I think you would want to tell us about the kind of strainer that you are using as suction from the suppression pool. Probably an eighth-inch mesh, but may be something else. But when you are dealing with paint particles you are dealing now with slivers versus nice round spherical shapes, and slivers tend to lodge in the cyclone separators and the pump. Unless you are using much larger cyclone separators, then you can tell us.

MR. OKRENT: Anything more?

MR. HOLTZCLAW: With regard to the coatings, the protective coatings that are applied inside the containment are specified to meet Reg. Guide requirements indicated in Reg. Guide 154 and have qualified -- as Mr.

Michelson started to answer the question of Mr. Ebersole -- are qualified with the ANSI test included in the ANSI standard N-101.4, 1972.

Exemptions are restricted to small-size equipment where in the case of a LOCA the paint debris is not deemed to be a safety hazard. Compliance with these requirements provides the assurance that the protective coatings will not fail under the design basis accident conditions and generate significant quantities of the solid debris that could adversely affect the ESF's.

The Reg. Guides and the standards themselves do not specify that design lifetime of paints. Which I think is one of the questions that came up in the last meeting. In fact, quoting directly from the ANSI standard, it was indicated there that it was not intended that a coating system initially applied to a reactor containment facility last for 40 years without appropriate maintenance and overcoating.

So the standard itself precludes, I guess, consideration of that design lifetime.

MR. OKRENT: I must say it remains obscure to me how one knows whether or not paint will be a problem. Given what you have read, I certainly have a mixed experience at home --

(Laughter.)

MR. OKRENT: And I paint to careful standards.

So it seems to me we need to hear somehow more about why it's okay, whatever is going to be done, and in that context just what is going to be done, how it's going to be controlled. We have heard stories about how people just paint over paint. In reactors as well as in houses.

MR. MICHELSON: Yes, I guess we would ask are there any tests of the overcoat process before it's used inside. Because I'm not aware -- I'm aware of the original tests, but I'm not aware of repeat tests for the overcoat procedure.

MR. EBERSOLE: On the same topic, I think it would be worthwhile to look at competitive pump seal and journal designs. I mentioned the other ones.

As I recall, I should have stated though you may use a water-lubricated journal, you may use it with zero flow, provided you execute the cooling function by coil. And thus you have a static water submerged condition for the journal, but you don't have a cooling function. There is no transport through it which stops the ingest of particles and makes them a lot better for pumping garbage than one that uses a high flow rate with a high clearance.

So it seems to me while you are working on this beautiful new design you would have a hard look at your journal and seal design.

MR. MICHELSON: I guess another way of asking is do you buy pumps from anybody but Bingham?

MR. FOX: The answer to that question has got to be yes.

MR. MICHELSON: I should have said RHR pumps. Do you buy your RHR pumps --

MR. FOX: I am just saying that we cannot --

MR. MICHELSON: But that is where you are getting into it. Certain manufacturers have their own pet ideas of the best way. It's a simpler way to design the pump.

MR. FOX: As you know, we can't do that.

MR. MICHELSON: That's the problem is, I think all the BWR's got their pumps from the same source, and it's a common question.

MR. FOX: I think there has been several.

MR. EBERSOLE: You can't specify journal and seal design?

MR. FOX: Well, you can specify performance. But there is a point at which you lock into a design.

MR. MICHELSON: Quite a bit different pump journals when you go the other way.

MR. OKRENT: Anything more on this matter at this time?

MR. EBERSOLE: No.

MR. MICHELSON: No.

MR. OKRENT: K. A-47, safety implications of control systems, impact of control system reliability on safety for BWR's - implications of current work?

I guess I may have raised that question and asked the staff what was being learned in the safety research program or tech assistance program, as the case may be, on control system reliability. I did receive a report that related to BWR's, but I'm interested in knowing where the staff thinks this issue stands, and is it resolved for GESSAR II? If not, what would it take to resolve it? If it is, why is it?

MR. SCALETTI: The issue as it stands right now is not resolved for GESSAR II. And it was identified as one of the ten open issues in supplement two.

MR. MICHELSON: Is the vessel overfill aspects of this issue a part of your answer also?

MR. SCALETTI: Excuse me. I didn't hear your question.

MR. MICHELSON: Is the vessel overfill due to the control system failure part of your answer?

MR. SCALETTI: I'll let Mr. Rubin respond.

MR. RUBIN: Yes, it is.

Dr. Okrent, are you referring to report -- to the EG&G report on A-47, Control System Failures and Transients in the General Electric Boiling Water Reactor, July '84?

MR. OKRENT: That sounds like the one I recently received after requesting it at the last subcommittee.

MR. RUBIN: Fine. Then you have all the information I do.

I did talk briefly to the task manager. This concludes phase one of the program for A-47, which is identification of the possible control system failures that would cause events worse than considered in the FSAR analyses.

At the next stage will be risk evaluation of seriousness and impact and risk resolution assessment for the issue. That's ongoing now. I have no further information, except that the information from the task manager is the events quite possibly will not be risk-significant, but the work is just not progressing far enough at this stage to make those conclusions.

MR. OKRENT: Let me understand something in a procedural sense. It is my recollection of the severe accident policy as drafted by the staff that if someone comes in, applies for an FDA, they must have a way of resolving the unresolved safety issues, and they are not to be left to future research to be resolved. Am I misquoting something?

MR. RUBIN: I don't believe you are misquoting it.

This was one of the few unresolved safety issues where the technical issue we did not feel was defined in a complete enough sense for us to give total technical resolution at this time. We did deal with one of the elements, which was identification of vessel overfill. We believe that's pretty well taken care of on GESSAR II.

The overcooling event and other ramifications were ill-defined when we conducted our review. We are looking towards an applicant treatment of the issue as an interface item to be a demonstration of resolution. We just don't have enough technical grasp to complete it.

MR. OKRENT: I must confess, when you say resolution as an interface item, that's saying that you are not going to ask that it be resolved at the time you issue an FDA. And correct me if I am wrong, if that's what you mean, it means you are in effect bypassing what I understand was a requirement of the policy. So I would like to -- really understand, you know, I would like to really understand where this matter stands, whether it's complex or simple.

MR. THOMAS: Your interpretation is absolutely correct. The severe accident policy statement uses the term "technical resolution," and says that for each standard design application the technical resolution will be achieved.

The staff is having a little built of a problem trying to determine exactly what that means. Let me share some discussions the staff has been having with you.

Historically, on USI's especially, the staff has approached USI's much as prescribed in ALAB-444, that is we would do the usual standard review plan, type review of a particular subject, and in the categorization process the regulatory impact analysis process of a USI. Justification has to be given why it's okay to proceed with licensing pending the generic resolution.

Historically, we would write in our safety evaluation reports an appendix that listed the applicable USI's and provided essentially the same generic justification of why it was okay to proceed with licensing pending the generic resolution. Now we are faced with the severe accident policy statement that says it will have to be resolved on each individual application for a standard plant. And while that's easy to do on paper, it's a little bit more difficult to try to do in practice.

We are finding there are some USI's that have to be resolved by both the standard plant applicant and the utility applicant. A-17 is a prime example of that. I don't mean to get ahead. But systems interaction involves both doing things on paper and doing things in the as-built plant.

Since usually in standard plants we are talking about plants that are on paper, you just simply cannot do the latter part of it. That's clearly I don't think anyone would argue with the fact that there is more work that has to be done than can be done by the standard plant applicant at the time that design approval is granted.

So the best thinking and latest thinking on the part of the staff is, the technical resolution or the USI, would involve the term "state of the art" information. State of the art methodology.

We are not hanging our hat, as in the ALAB-444 approach, on a generic resolution. We have to understand the problem as best we can, and, in some cases, like Mark pointed out, the problem may not be clearly defined at this time, and as you look into a problem and learn more about it, you can better define it. But the idea of the severe accident policy statement is to look at the problem as best as you can right now, as it's defined right now, and do the best you can to come to grips with it. Usually that means more than just the standard review plan approach. It involves digging into it a little bit more.

MR. OKRENT: Gee, excuse me, but it sounds to me like you are putting on a convenient interpretation of what is in the severe accident policy plan. When I read it, it said the unresolved safety issues will be technically resolved prior to the CP, and it wasn't that we would do some kind of a best effort or use our state of knowledge, however incomplete, you know -- you would find a way around it if that's what you had to do, make it go away, that was, I thought, the idea, so it wasn't something ten years down the road like ATWS to address or so forth and so on. And so --

MR. THOMAS: Maybe I misled you. I agree with what you are saying. They do have to be resolved. Maybe part of the problem is what the staff considers to be resolved.

Historically, we have allowed the plant applicant to confine the scope the scope of the supply of the equipment, the scope of the analysis or whatever. For example, on a particular USI, we go back to the applicant and ask for more information, information it would take for us to achieve a technical resolution for that particular application, and the standard plant applicant says, "No, I don't want to do that, I want to put that off on a utility."

Then we have to accept that the resolution then is an interface requirement to do it. In any event they have to be all resolved before a CP or an OL could be granted. We want to resolve as many as we possibly can.

Ideally we resolve them all on a standard plant.

But given the somewhat competing philosophies of allowing a standard plant applicant to define his own scope of supply, and some things like systems interaction, you just can't wrap it up right now. At least part of that has to be put off on a utility applicant.

MR. OKRENT: With regards to a systems interaction, it seems to me the staff could in fact have a requirement. It might be that the study was done in part after the plant had been constructed. It should in part be done on a model, I would hope, or everybody would be doing things sort of in a less than optimum way.

But nevertheless, there could be a requirement that certain things would be done, and it seems to me in that sense you would have technical resolution in the same sense that you now have technical resolution of the applicant's building a containment to meet 55 psi. I mean -- okay?

MR. THOMAS: That's pretty much the way we are approaching systems interaction.

MR. OKRENT: Except you haven't written out yet just what it is that GESSAR plus the utility would have to do. But I think you could in fact have a proposed resolution and not say, "Well, we have to wait. It's impossible for us to do this until we have an application for a CP."

MR. THOMAS: We are taking essentially the approach you are describing. But even with models that go down to the scale of including one-inch pipes and so on, there is still a number of things that our experience has been that you learn from a walk-through of the plant that doesn't show in models.

MR. OKRENT: You notice I had a two-pronged approach.

MR. THOMAS: Yes. So a technical resolution could involve a very specific interface requirement. If the standard plant applicant chooses to put this outside his scope, if it's well enough defined to give whatever guidance is needed by a utility applicant. It could involve a number of things. Ideally, though, it's resolution of everything before the standard design approval is granted, but in practice that's really not hard to do. I suggest it's more than a convenience, it's almost a practicality that we have to approach them that way.

MR. OKRENT: Well, I guess at the moment that item is not only an open issue with you, it's an open issue with us, as to just whether what we seem to be heading for is an acceptable approach, which sounds to me like a deferral. I'm talking about A-47.

It is not unrelated to part of what Mr. Ebersole was talking about earlier on scrams, but that's not the whole, that's one part of control systems. There are other things.

MR. THOMAS: Yes, we agree with you on A-47. It's still open.

MR. OKRENT: And it will be closed --

MR. THOMAS: One way or another it will be closed before we issue a -- the ultimate design approval.

MR. OKRENT: Does General Electric have any comments in this area?

MR. HOLTZCLAW: Our only comment, Dr. Okrent, is that we have provided the staff with our assessments of the impact of A-47 on GESSAR. And I guess we are waiting, with others, to ascertain how that's going to be received in light of the ongoing program relative to A-47 itself.

MR. OKRENT: Okay. We may have discussed A-17 as part of this prior discussion.

Is there anything the staff wanted to add on A-17?

Is there anything you wanted to add as to A-17? Or do you think that's it?

It's still open as of now.

MR. SCALETTI: A-43. I mean A-17.

MR. OKRENT: If it's stated --

MR. [illegible]: Systems interaction is an interface item right now.

MR. OKRENT: Period? Or does the staff have some requirements?

MR. SCALETTI: Requirements I'm sure will come as far as laying out what we expect to be done. But it is an interface item, and at this point the staff believes that is as far as it can go with A-17.

A-47 is unresolved.

MR. OKRENT: Excuse me. On A-17 that's as far as you expect to go before issuance of the FDA?

MR. SCALETTI: That's correct.

MR. OKRENT: I think that you may be problematical.

I fail to see how that can be considered technical resolution. In my opinion it's deferral.

MR. SCALETTI: There are certain portions of A-17 that need to be carried out by the applicant when the plant is constructed.

MR. OKRENT: There are many things that have to be carried out. Startup tests have to be carried out. But nevertheless, that doesn't mean you are unable to have a rather good specification of what should be in the startup test program. So just saying that it's something that can't be done until a later date doesn't impress me very much.

Well, think on it.

Let's see. M was B-6, loads, load combinations and stress limits - consideration of multiple breaks of non-seismically qualified pipes.

Who wants to start on that, GE or the staff?

MR. FOX: Does anyone want to make a clarification on the question?

MR. ETHERINGTON: That's my question.

MR. OKRENT: Carl?

MR. MICHELSON: Part of the question was mine. I'm not sure all of the question was mine. But I think the only clarification of the latter part which I am interested in is how do you deal with non-seismically qualified piping and its integrity during a seismic event, keeping in mind that large piping can probably withstand the seismic event even though it is not seismically qualified, but in view of the fact that it may not be seismically hung it may move around a fair amount and rip off smaller attached piping, and to what extent and how do you handle that problem?

MR. FOX: Okay. I would like to address it in this way. Essential safety functions aren't dependent on non-seismic equipment piping or otherwise. So from that standpoint I will say that there is another aspect of flooding which is more encompassing and we start talking about multiple breaks and start talking accumulation.

MR. OKRENT: Flooding and environmental.

MR. FOX: Both, right.

MR. MICHELSON: You don't want to forget about steam as a possible source --

MR. FOX: Entirely right.

Now, what we do, we have addressed this early on in our consideration of flooding and environmental effects. And what we have found is that when you say multiple, you know, that can mean, you know, more than two and as many -- as far as you want to go.

So to accomplish that, to take care of it or to address the potential for multiple breaks, each non-seismic category one pipe capable of producing flooding, if you will, in itself, is analyzed or designed in a manner equivalent to a seismic category one pipe. In other words, we do show that it can take the seismic load and thermal stresses and maintain its supports and so on and so forth. We do this analysis for every non-seismic category of pipe in the area to produce flooding.

MR. MICHELSON: By areas, you mean you have gone over the entire nuclear island and identified those areas.

MR. FOX: Yes. The only building or piping that is excluded from this was in the rad-waste building which contains no essential equipment.

MR. MICHELSON: You did this one break at a time.

MR. FOX: Well, we looked at the seismic event. Okay? And demonstrated to our satisfaction that no pipe that we didn't want to break, if you will, would not fail.

This doesn't mean that we didn't take each pipe individually, whether it be seismic or non-seismic, and go through the flooding and adverse effects. But that's applied to both the seismic and non-seismic.

MR. MICHELSON: Looking at a large pipe in a given area with a number of branch connections, such as a water pipe, for instance, did you go in and assure yourself that you didn't get multiple failures of branch connections, even though you did not get a failure of the main line?

MR. FOX: Yes.

MR. MICHELSON: And if you did get even one failure of a branch connection, you --

MR. FOX: We went back and supported the program. The point is we provide that as we look at from the seismic capability whether it is seismic or non-seismic.

MR. MICHELSON: Seismic, we don't have the same problem. The non-seismic lines we are worried about.

MR. FOX: When I am talking about non-seismic category one pipe doesn't mean that we don't design it to the same kind of limits. What I am really saying is we don't pedigree the pipe.

MR. MICHELSON: Yes. That would be the principal difference, you don't maintain a QA record of it.

MR. FOX: Right.

MR. MICHELSON: I'm not sure I've got the answer. But let me play back what I thought you said. Maybe I'm stretching it just a wee bit. So let me ask you a question instead.

MR. FOX: Okay.

MR. MICHELSON: If you find that a branch connection gives a problem, you fix it.

MR. FOX: Yes.

MR. MICHELSON: Even though it's a non-seismic or unqualified pipe.

MR. FOX: Yes.

MR. MICHELSON: In the process of looking to see maybe one branch doesn't give you a problem, but three of them rip off in that same area you do have a problem, do you look to see if more branches might break as soon as you find one could break?

MR. FOX: Well, any pipe big enough to cause a flooding problem environmental effect, we fix it, whether it be one or three.

MR. MICHELSON: Well, the environmental problem may be a non-problem if only one two-inch line breaks, but if 16 of them break it could exceed the capacity of the drain system to handle it, for instance.

MR. FOX: Well, the seismic analysis is the piping, is a total system analysis. Not taking a little pipe and --

MR. MICHELSON: Yes, but I understood you said that you determine whether or not the break was acceptable.

MR. FOX: Oh, I see what you mean.

MR. MICHELSON: One break may be acceptable but multiple breaks may not be acceptable in that area. And that's the original question and still the question.

MR. FOX: I was looking at something above, you know, two inches in diameter.

I believe -- I want to make a statement and then I'll back up for next time. On the connotation of flooding potential. You can address that with respect to a particular-size pipe or 25 two-inch pipes. I'm going to have to go back and check the design spec. But I believe flooding potential in the way it was used was to look at multiple pipes in the same flooding area, if you will. Okay?

MR. MICHELSON: Flooding volume.

MR. FOX: I'll have to verify that.

MR. MICHELSON: That's a problem, of course, if there are targets from selective flooding coming from smaller lines breaking, then your flooding volume concept is not the correct one to use.

MR. FOX: You are right. I'll address that further next time. I understand your point.

MR. MICHELSON: Thank you.

MR. OKRENT: I would like to understand what it was you really said about the pipe that is not seismic class one.

MR. FOX: We do the same analysis to demonstrate its seismic capability at least as far as the limits, loads and so on.

MR. OKRENT: For the SSC.

MR. FOX: Yes.

MR. OKRENT: So it would meet code stresses for the SSC, you are saying.

MR. FOX: Yes.

MR. OKRENT: And that's true down to what size, all sizes? One-inch? Two-inch?

MR. FOX: I was using a very loose phrase, any pipe with potential flooding capability. I would say it was all sizes, but I'm not in a position to say, you know, who did a one and a quarter inch line, you know, five hundred of those.

MR. OKRENT: So you are not sure down to what size the analysis is performed. Is that what you are saying?

MR. FOX: Yes. And I will verify that for next time.

MR. MICHELSON: The problem being, of course, it isn't a volumetric question altogether, and whether that can enter into it.

MR. FOX: No, I agree. But I'd like to be a little more sure.

MR. MICHELSON: All right.

MR. OKRENT: And these analyses are part of the record of design?

MR. FOX: It's a requirement, it's a requirement we place on the BOP design -- excuse me, the plant designer. You can appreciate all the piping analysis has not been totally done because valves and valve operators come into play. But it is a requirement, this is a requirement, in fact it's stated almost precisely that in GESSAR itself, not that it's an interface document totally. But it is provided as part of the piping requirement for the plant design.

MR. OKRENT: So for the finished design, the thing that has been built, there will exist analyses --

MR. FOX: Yes.

MR. OKRENT: -- seismic analyses --

MR. FOX: Yes.

MR. OKRENT: -- for all piping which is seismic class one. And for non-seismic down to some size which you will have to tell us about.

MR. FOX: That I could tell you about and it won't have --

MR. OKRENT: You will tell us why it's okay to go down to that size, in terms of questions of this sort?

MR. FOX: Yes.

MR. EBERSOLE: Let me ask a question in this same line.

A matter of requiring services of water to critical systems, I take it it's a mandate you will at least provide two piping systems, two pipes, redundant piping, to any set of service systems to ensure you have two water supplies in passive systems. At no point do you go down to a singular source of water in pipe, do you?

MR. FOX: Certainly not in GESSAR.

MR. EBERSOLE: I found out long ago that on the back end of this system, suppose you are in an open cycle system going to drain. While heavy attention was paid to the supply side. As soon as you got through the heat exchanger or whatever, everybody forgot all the rules, and converged to common dump lines? Do you have rules in your requirements that preclude now descending to common dump lines?

MR. FOX: Yes.

MR. EBERSOLE: You provide duality right out to the ultimate discharge; is that right?

MR. FOX: Yes.

MR. EBERSOLE: Are there some words that you put into your instructions to the AE's and utilities to always do that?

MR. FOX: This question was asked -- in fact, it was one of the -- excuse me -- it was one of the safety issues that were addressed specifically in -- Has anyone got a list of the issues. GSI's?

MR. EBERSOLE: Anyway, you have it nailed down.

MR. FOX: Oh, yes, definitely.

MR. EBERSOLE: All right.

MR. OKRENT: Is there any reason why I should be worried about relative motion of components to which small lines are connected as a source of multiple breaks in an earthquake?

MR. FOX: No. Since we considered both the thermal and seismic loads simultaneously. The thermal loads of course were there. And the analysis is I would say equivalent to the seismic category one.

MR. OKRENT: Okay. I want to --

MR. FOX: No, no. Appreciate it.

MR. OKRENT: Anything else on M?

N, a discussion of events beyond a DBA involving the spent fuel pool - Is fuel pool cooling equipment seismically qualified? How is the chilled water system reviewed?

Whose was this?

Carl, did you --

MR. MICHELSON: I will only recognize and take credit for part of the question.

MR. OKRENT: Go ahead.

MR. MICHELSON: The latter part, the chilled water system.

MR. OKRENT: Go ahead.

MR. MICHELSON: Since there is no standard review plan for chilled water system, how did General Electric go about deciding what their requirements were supposed to be and so forth?

MR. HOLTZCLAW: Let me answer the first part of the question, and also answer the second part. The first part was is the fuel pool cooling equipment seismically qualified? The fuel pool cooling system is designed to seismic category one requirements.

The chilled water system, non-safety related, and the drywell chilled water system is non-safety related, and the control building chilled water system which is safety related were reviewed in accordance with SRP section 922 which is the SRP governing reactor auxiliary cooling water systems of NUREG-0800. And then the results of the staff's review is contained in that section, section 922 of the GESSAR II SER. NUREG-0979.

MR. MICHELSON: Did you have a personal acquaintance with this review?

The reason I ask is it's a kind of leading question. If you read 922 it has little or nothing to do with chillers, and I just wondered how you read that. This is the same position the staff takes and I keep asking them, how do you read that and figure out to review chiller systems? I just wondered what you people did.

MR. FOX: I did take a look at that specifically, particularly after your question. The answer to your question was easy enough, as you noted. It was reviewed, but I did not see -- let's put it this way: Didn't direct itself directly to chilled water.

And I guess I asked you the question, maybe other than maybe material properties is there something you have specific --

MR. MICHELSON: Are there problems? You are asking? Yes, there are problems.

MR. FOX: Yes.

MR. MICHELSON: Yes, if you are equated with chilling packages. You might want to go back and look at your manual. For instance it comes in a chiller package and find out how it is controlled. It has some very interesting manufacturer's control systems on it which you probably leave as a black box. Most utilities leave it as a black box.

Within that black box, for instance, is an automatic cutoff that if you shut off the chiller it won't start again for 20 to 30 minutes. I am wondering if you are aware of that sort of thing. And there is a number of other protective features that are built in there to protect the chillers which are not necessarily in the best interest of safety if you are into a safety situation. Whether or not you can tolerate long time delays, for instance, which are built in, depends in part upon the urgency of the need to get the chiller going and so forth, and you do a study.

I've seen chillers being added to emergency power supplies in the first ten to 15 seconds, for instance, and I wonder why, and I am wondering if they are aware that even if you add the chiller to the system it won't start anyway unless you have gone back and tampered with the black box. Because it has got an automatic cutout that will wait for 30 minutes.

I just wondered, have you really reviewed chiller packages? These are rather sophisticated control systems built from years and years of good experience with the need for good air conditioning systems, but not built with nuclear power protection in mind at all.

MR. EBERSOLE: Before you answer that, let me add just a little bit more to it to make your answer more fertile.

I gather you are using this to chill the drywell probably to economize on the size of the air coolers inside. So you bring about, then, the potential, if you get chiller failure, of a rise in temperature and thus a rise in pressure in the drywell. And that can synthesize a loss-of-coolant accident as you know because it only takes a few pounds to trip that high pressure signal.

So are you prepared to take along with the advantage of the chiller the disadvantages that Carl talks about in respect to keeping the plant on line and avoiding spurious signals that tell you wrongly that you might have a high pressure in the containment?

MR. MAXWELL: Ed Maxwell.

My first statement is I haven't heard any issue raised here this afternoon that has not been raised in discussions on the design of the chiller systems. And there have been many hours spent in discussions back and forth on these questions. Cutoffs within the black boxes of the chiller packages, we have gone through those. I can't give you the details of the resolution on all cases.

And I don't know that you are interested in a specific set of details.

MR. MICHELSON: No, no. Just want to know that you have been through it.

MR. MAXWELL: We have been through it. We have been through the one on the reactor island chiller and its effect on the drywell and the cooling and the pressure rise and deemed that our design is adequate in this area.

MR. MICHELSON: My main interest was, did you have something that I haven't seen on how to properly review a chiller package from the viewpoint of nuclear safety? And I'd like to see that.

I think what we need is that section of the standard review plan that would deal with how to review chiller packages. It isn't the water system that works. Several things to look for which I am sure you are aware of from having gone through and done such a review. And there are some tricks to the trade that ought to be documented.

MR. MAXWELL: We used the yardsticks that we had used in the normal nuclear systems. And you are right, there is not a SRP or anything to tell us how to do it to my knowledge.

MR. MICHELSON: For instance, I don't know what is an acceptable restart time, for instance. Just a lot of features.

Relative to this same question, have you looked up the requirements for the material properties of the chilled water piping? Since you are dealing with temperatures about 40 degrees more or less, and you are probably dealing with A-106 piping which can have a transition temperature of anywhere from minus 20 to plus 80 or 100, and how do you decide -- have you specified particular piping requirements to ensure that you have ducting materials for circulating the cold water?

MR. FOX: I assume so. But I can't answer.

MR. MICHELSON: That's one thing that I would like to know about for our next meeting, just to find out have you got some particular specification.

MR. FOX: Ed assures me we do have the specification.

MR. MICHELSON: I would like to see how you dealt with that.

MR. EBERSOLE: When you test a chiller do you test it when it is chilling in a seismic test? When it's cold?

MR. FOX: I don't know, Jesse.

MR. EBERSOLE: Okay.

MR. MICHELSON: I also wondered a little bit, you know, since the chiller manufacturer has probably so-called seismically qualified his package as a whole, have you gone and looked into the materials that the manufacturer has used in their relationship to potential ductility at these temperatures? I've looked at the piping a little bit, and you are going to tell me how you have done it.

MR. FOX: I'll look at the whole subject. I know, that was my basic thought.

MR. MICHELSON: Also be sure to look at flanges and valve bodies as well as pipe. Because pipe is fairly thin wall and may get by flanges, and valve bodies are thicker cross section and may have a little more problem.

MR. FOX: I'll do that.

MR. MICHELSON: When you gave the answer on the fuel pool cooling you said it was designed to seismic one requirements. Does the system actually consider a safety related system as 1-E and so forth or is it just designed to seismic one requirements?

MR. QUIRK: I just came up to interject along those lines. I didn't look up the answer to this question and wasn't involved in discussion on it. And recalling from memory, I recall that just the portion that would provide makeup to the pool, the pump and the piping, are seismic. And that there are trains in there that has demineralizers and heat exchangers, and I don't recall whether they are seismic. So I would like to confirm that at the next meeting.

MR. MICHELSON: Okay.

Could we go back for just a moment? I'm sure you have the answer. On the reactor water cleanup, since it's only seismic out through the second isolation valve, was the rest of the system built over any kind of QA requirement, since it is a non-seismic one?

MR. FOX: It fell within those, quote "categories of piping that would produce flooding," it was analyzed in exactly that manner.

MR. MICHELSON: I was thinking of fabrication QA. Any special record-keeping and so forth?

MR. FOX: Not to my knowledge.

MR. MICHELSON: Reactor water cleanup is kind of a unique system since it's primary pressure boundary at virtually all times, I assume. And only becomes non-pressure boundary after it is isolated.

MR. FOX: I'm sorry, the seismic category one portion, that portion which is part of the containment penetration up to the second isolation valve meets all --

MR. MICHELSON: It's all good stuff. I'm wondering about downstream of the second isolation valve.

MR. QUIRK: Downstream of that the equipment is classified as safety class other, which means it does not perform a safety function. But GE has designed it to ASME class three, so it's quality group C. And there are QA requirements associated with quality group C, but it's not appendix B to part 50.

MR. MICHELSON: That class C only pertains to piping. Vessels, so forth, what did you do with those cases?

MR. QUIRK: Class C.

MR. MICHELSON: Still class C.

MR. QUIRK: Yes, sir.

MR. MICHELSON: And the pumps I assume are also class C.

MR. QUIRK: Yes..

MR. MICHELSON: Thank you.

MR. OKRENT: Okay on those?

Well, we have a few minutes. Let's see how item O goes. Have probabilistic risk assessment methods been used to identify and categorize on a risk basis the chain of events that could lead to a large water hammer?

Let me try the staff.

MR. RUBIN: The only risk assessment that has been applied to water hammer has been the work done just for resolution of A-1, which I believe has been presented to you. And that was primarily an experience-based assessment, operating experience, projection to the risk impact to operating plants. There has not been any further risk assessments to look at potential scenarios from operating experience.

MR. OKRENT: In effect what I am asking is, has anyone done a SASA-like study -- severe accident sequence analysis -- where he is looking to see if he can find situations, should they occur, that would lead to a potentially severe water hammer?

Certainly one has a beginning idea of circumstances which, if you can create them, will have a good chance of leading to a severe water hammer. Given that knowledge -- we are not starting with a complete lack of knowledge -- given that knowledge one could then try to do an event tree analysis to see what events could lead to the circumstance that is conducive to a severe water hammer.

Having found such events, you could try to estimate their likelihood, and maybe you can't find any that have a sufficient likelihood to be of concern. Or, on the other hand, there may be one or two or more that have not occurred yet, but are, you know, could occur under the right circumstances. And is the point clear?

This is the sense in which this question is being posed.

MR. RUBIN: The point is clear, and I believe it was raised earlier.

MR. OKRENT: Yes. It has been raised several times to the staff.

MR. RUBIN: I have to say that to the best of my knowledge that approach has not been applied. During the resolution of A-1, I think the conclusion was, the water hammer severity would not be exceeded by what they had considered in the program. And I don't know of any program to look at it, the approach you suggested.

MR. OKRENT: Has General Electric done a kind of systematic examination of what I will call anomalous transients, for lack of a better word, that might lead to situations conducive to severe water hammer for the GESSAR II?

MR. HOLTZCLAW: Actually we have not, Dr. Okrent, primarily because we went back to the information that has been put together on A-1 which does provide a compendium of the history of water hammer events on BWR's and found that it doesn't appear to be an overriding problem with BRW's. That I believe is what Mark Rubin is referring to.

Any analysis that has been done using the PRA logic and methodology, if what he is referring to there is what appears in NUREG-0993 division one, which is part of a sequence of documents covering A-1, there was an attempt at some assessment made there to do a comparative risk delta, if you will, of water hammer events versus other plant risk. And the conclusion was it was a relatively small delta.

MR. OKRENT: That was using experience, I think.

MR. RUBIN: It was based primarily on experience. There was some projection that the severity may be somewhat worse, but surely not the development of completely new scenarios as you are suggesting.

MR. OKRENT: Well, I guess I just thought of a good topic for a Ph.D. thesis. That seems to be the only way we will get the answer.

MR. MICHELSON: I think one of the water hammer questions that have been raised from time to time is the case of the hose spray sparger that's used inside the vessel to allow the coarse spray to spray the core. That sparger is normally filled with water and is rather confined and has a number of nozzles on it so the interior is confined. And it sits there at approximately exit temperature of the core.

When you experience a large break LOCA or whatever that causes a rapid depressurization of the reactor, you also get a rapid depressurization of that confined volume of hot water within the sparger, and it will proceed then to flash and steam and spark, and by the time this has gone on for a little bit you end up with a pipe partly filled with steam, partly filled with hot water and further down the line partly cold water.

At that point the high pressure cold spray comes on and sends a cold water injection into this heated region. And have you looked at whether or not there is a potential for water hammer in a case like that?

MR. QUIRK: Yes, we have. And what we found is, as you were describing, you can postulate the break, the breach in the reactor coolant pressure boundary, which depressurizes the reactor, the level drops as well, uncovers the spargers, and at the same time you give the signals to the high-pressure pumps to come on. And it pumps cold fluid in and as you approach the vessel hot piping the leading edge of this cold fluid is churning and develops kind of a foam, and as it's accelerated into the sparger has a cushion effect, and the loads associated with this phenomena are very low. And we have looked at those.

MR. MICHELSON: Is there condensation possibility there in inducing rapid deceleration of the cold water? If you suddenly condense the steam you are going to condense that water and that gives the effect of water hammer.

MR. QUIRK: The effects of the shocks and the flashing and the froth all mix, and the resultant loads from that we found are very low.

MR. MICHELSON: By "found" you mean calculated.

MR. QUIRK: Calculated.

MR. MICHELSON: Or you plan to do some kind of test?

MR. QUIRK: We calculated it.

MR. MICHELSON: I guess it depends on how you did the calculation, but your expert opinion is it's a non-problem.

MR. OKRENT: Is there a report available that gives some details on the calculation?

MR. QUIRK: There is not a report, no.

MR. OKRENT: Memorandum?

MR. QUIRK: There is in General Electric Company a design record file and basis for the calculation.

MR. MICHELSON: The reason I worry a little bit with this is about two years ago on one of the BMW plants that has a sparger on top of the steam generator it created some very severe water hammer that broke the sparger, tore it loose and whatever. And I don't know just how that water hammer developed, but that one led to my wondering about whether a similar situation could develop in the GE plants.

MR. QUIRK: We have looked at that in the GE plants and have reported in another subcommittee that the resultant loads were low.

MR. OKRENT: Is it possible to get a copy of the analysis?

MR. QUIRK: We will look into that for you.

MR. OKRENT: Thank you.

Well, let's see. We seem to be approaching the originally defined adjournment time. Should we take up item P?

MR. MICHELSON: We might as well since it's related to item O.

MR. OKRENT: Okay.

MR. MICHELSON: I will tell you what the concern is, and that is that some of these pumps in your system are pumping with the valves and discharges open and dumping water into suppression pools and whatever, and if at a point in time you lose power to the pumps, they close down, but the valves don't close.

And then there is a little electrical ritual you go through and the pumps restart. But now they are restarting against valve wide open and the discharge of the pumps and that can create some very interesting water hammers in the process of refilling the pipe.

And have you somehow taken that into account and accommodated it?

MR. HOLTZCLAW: Mr. Michelson, I have to apologize. We have looked into this partially, and we don't have a complete answer available. I have -- I'm on record of disagreeing with some of my support people here today, so I would rather hold this one off until next meeting, if I could.

MR. MICHELSON: TVA, a long time back a person wrote a report in some detail on this problem in the case of Browns Ferry, which was a far more severe case than you have because of the particular piping configuration. But not being real familiar with the details of your piping configuration, I don't want to pass judgment. But you might want to go back and ask TVA. If you want to call Henry Jones, as I recollect, he was the co-author, and he could probably send you a copy of it. Just kind of points up what the problem is.

MR. OKRENT: Have him send me a copy too.

MR. MICHELSON: I think -- I don't think it's a problem in your case, but I'd like to see it, just to know what it is.

MR. OKRENT: Okay. Well, I think we will come to a close in a few minutes. My expectation is that we will try to schedule a one-day meeting, closed meeting, devoted to the sabotage question, industrial security question, and that we will also try to schedule a two-day meeting dealing with seismic-related matters, and then we will have to see what other kinds of PRA-related or other-related issues also. We need to talk about button.

My guess is that those would likely be -- by seismic, I mean probabilistic. The things that we will try to address, if I understand correctly, the staff will have its SER that relates to seismic matters out this year. Is that fair?

MR. SCALETTI: Hopefully next week.

MR. OKRENT: I was giving you what sounded like a grandiose amount of time.

We will have to see what the exact timing of these meetings will be. Those are what I will try to work out. And perhaps by the end of next week we will have some idea of the schedule for those two meetings?

Okay?

MR. SHERWOOD: Okay. If possible, Professor Okrent, we would like to have those subcommittee meetings in January if they can be worked in, say the second couple of weeks you are back, that would help, you know, keep the schedule moving.

MR. OKRENT: I certainly will try to not be a significant impediment to progress by delaying subcommittee meetings. So I will try as best I can to accomplish things expeditiously. That's all I can say now.

If there are no other important comments, I will thank everybody for an interesting two days and adjourn the meeting.

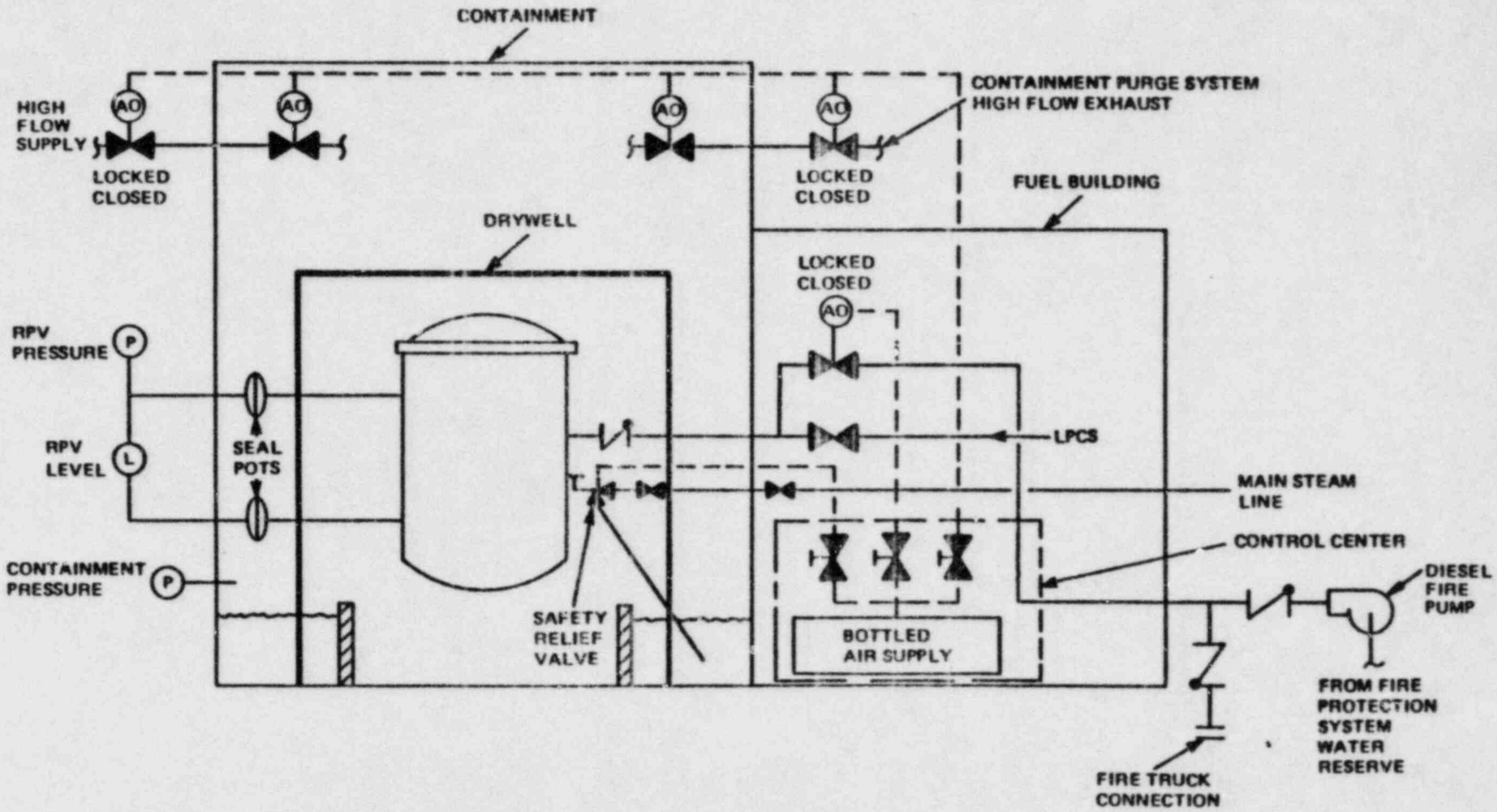
(The hearing was adjourned at 5:04 P.M.)

# ULTIMATE SAFETY SHUTDOWN SYSTEM

A PRESENTATION TO ACRS SUBCOMMITTEES
ON GESSAR II/RELIABILITY & PROBABILISTIC ASSESSMENT

LOS ANGELES, CALIFORNIA

GENERAL ELECTRIC COMPANY
DECEMBER 4-5, 1984




GESSAR II Ultimate Plant Protection System Schematic Diagram

## COMMERCIAL VERSUS SAFETY GRADE UPPS DESIGN

| | SAFETY GRADE REQUIREMENTS [1] | COMMERCIAL GRADE UPPS | SAFETY GRADE UPPS [1] |
|---|---|---|---|
| PIPING | o SEISMIC CATEGORY I | NO | YES |
| | o REDUNDANT | NO | NO |
| | o BUNKERED [2] | NO | PARTIAL [3] |
| INSTRUMENTATION | o CLASS IE (AS APPLICABLE) | NO | YES |
| | o REDUNDANT | NO | YES |
| | o DIVERSE | NO | NO |
| | o BUNKERED | NO | PARTIAL [3] |
| VALVES | o CLASS IE (AS APPLICABLE) | NO | YES |
| | o REDUNDANT | NO | YES |
| | o BUNKERED | NO | PARTIAL [3] |
| VALVE MOTIVE SOURCE | o CLASS IE (AS APPLICABLE) | NO | YES |
| | o REDUNDANT | YES | YES |
| | o DIVERSE | NO | YES |
| | o BUNKERED | NO | YES |
| WATER SUPPLY | o TWO SUPPLIES | YES | YES |
| | o INDEPENDENT | NO | YES |
| | o BUNKERED | NO | YES |

## COMMERCIAL VERSUS SAFETY GRADE UPPS DESIGN
(CONTINUED)

| | SAFETY GRADE REQUIREMENTS (1) | COMMERCIAL GRADE UPPS | SAFETY GRADE UPPS (1) |
|---|---|---|---|
| WATER SUPPLY MOTIVE SOURCE | o CLASS IE (AS APPLICABLE) | NO | YES |
| | o REDUNDANT | YES | YES |
| | o DIVERSE | YES | YES |
| | o BUNKERED | NO | YES |

---

(1) INCLUDES MEETING APPENDIX B TO 10CFR50
(2) BUNKERED IS DEFINED AS SEPARATED FROM NUCLEAR ISLAND AND WITHIN HARDENED STRUCTURE
(3) EXCLUDES COMPONENTS INSIDE REACTOR BUILDING

12-5 A.m. FeX

(2)

# SEVERE ACCIDENT NI/BOP INTERFACES

A PRESENTATION TO ACRS SUBCOMMITTEES
ON GESSAR II/RELIABILITY & PROBABILISTIC ASSESSMENT

LOS ANGELES, CALIFORNIA

GENERAL ELECTRIC COMPANY
DECEMBER 4-5, 1984

TREATMENT OF INTERFACES IN GESSAR II

- O DESCRIPTION OF INTERFACES

- O INTERFACE EXAMPLES

- O CONTROL OF INTERFACES

ALL INTERFACES TREATED AS
SEVERE ACCIDENT INTERFACES

# GESSAR II/FSAR INTERFACES

- REGULATORY GUIDE 1.70 INFORMATION UNAVAILABLE UNTIL CONSTRUCTION PERMIT STAGE

  1* - BOP Scope
  2 - Equipment-Vendor Dependent
  3 - Applicant Dependent
  4 - Site Dependent

  OR

  For Commercial Reasons, Selected by GE for Deferral

  5 - Deferred

- EACH APPLICANT PROVIDES CATEGORY 1 THROUGH 4 INTERFACE INFORMATION IN THEIR FSAR

- CATEGORY 5 INTERFACE INFORMATION IS SUPPLIED IN CONJUNCTION WITH FIRST APPLICANT

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* Denotes GESSAR II/FSAR Interface Category

## EXAMPLES OF GESSAR II/BOP INTERFACES

| ITEM NO. | SUBJECT | DESCRIPTION | PAGE | SUBSECTION | RELATED QUESTION | INTERFACE CATEGORY |
|---|---|---|---|---|---|---|
| 3.7 | Turbine Missile Identification and Characteristics | Describe Postulated Turbine Missile Properties Per R.G. 1.70 Subsection 3.5.1.3, Item 2 | 3.5-16 | 3.5.1.3.2 | | 1 |
| 3.28 | Qualification Results | Provide the Results of Environmental Qualification Tests for Each Type of Equipment Per R.G. 1.70 Subsection 3.11.3 | 3.11-82 | 3.11.3 | | 2 |
| 13.2 | Industrial Security | Provide a Comprehensive Description of the Physical Security Program for the Plant Site | 13.6-1 | 13.6.2 | | 3 |
| 3.39 | Seismic Analysis | Investigate the Liquefaction Potential of the Foundation and Site Soils for a Long Duration, New Madrid Type Earthquake | 3A.1-2 | 3A.1.2 | | 4 |
| 19.7.7 | Containment Purge | Provide Details of the Purge System | 19.3.6 .28-4 | 19.3.6.28 | 6.28 (480.23) | 5 |

# NUCLEAR ISLAND/BOP DESIGN INTERFACES

- INTERFACE INFORMATION REQUIRED BY REGULATORY GUIDE 1.70 APPENDIX A (INTERFACES FOR STANDARD DESIGNS)
  - SAFETY-RELATED
  - INFORMATION USEFUL IN STAFF'S REVIEW OF APPLICANTS FSAR
  - CHAPTER 1 ROADMAP
  - SPECIFIC INTERFACES PRESENTED IN APPROPRIATE GESSAR II SUBSECTIONS

- NUCLEAR ISLAND/BOP DESIGN INTERFACE INFORMATION CONTAINED IN GESSAR II
  - NO SUPPLEMENTAL INFORMATION REQUIRED BY APPLICANT OR GE
  - UTILIZED BY APPLICANT IN DESIGN OF BOP

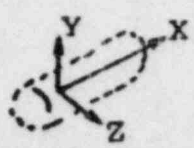
## Table 1.9-23

### NUCLEAR ISLAND-BOP PIPING INTERFACE ALLOWABLE ANCHOR LOADS

| Nominal Pipe Size Sch 40 Minimum | $F_x$ kip | $F_y = F_z$ kip | Primary Moments (includes OBE loads) $M_{xp}=M_{yp}=M_{zp}$ ft-kip | Primary Moments (includes SSE load) $M_{xp}=M_{yp}=M_{zp}$ ft-kip | Primary and Secondary Moments (includes OBE loads) $M_{xt}=M_{yt}=M_{zt}$ ft-kip |
|---|---|---|---|---|---|
| 3 in. & under | 1.13 | 0.56 | 0.5 | 1.0 | 1.13 |
| 4 in. & 6 in. | 2.8 | 1.40 | 2.2 | 4.33 | 4.93 |
| 8 in. & 10 in. | 4.77 | 2.36 | 5.3 | 10.6 | 12.23 |
| 12 in. & 14 in. | 6.6 | 3.23 | 8.23 | 16.5 | 19.0 |
| 16 in. & 18 in. | 6.73 | 3.36 | 9.46 | 18.93 | 22.13 |
| 20 in., 24 in., & 26 in. | 6.93 | 3.46 | 10.7 | 21.4 | 25.33 |

NOTES

1. All forces and moments act simultaneously.
2. Coordinates as shown:




3. See NF-3200 of ASME Code for definitions of primary and secondary loads.
4. Those anchors having loads greater than specified loads shall have special anchors designed for loads given on individual piping interface data sheets in Interface Control Specification.

- O PRA INTERFACES
  - o PRA ASSUMPTIONS <u>NOT</u> MEETING ONE OR MORE OF THE FOLLOWING
    - CHARACTERISTICS WELL DEFINED BY GESSAR II DESIGN DOCUMENTATION
    - RECOGNIZED INDUSTRY DATA BASE
    - LITTLE IMPORTANCE TO PRA CONCLUSIONS (E.G. 100% CHANGE IN ASSUMPTION CHANGES OVERALL PRA RESULT 1%)

- O APPLICANT MUST DEMONSTRATE IN HIS FSAR THAT
  - o BOP DESIGN IS CONSISTENT WITH PRA INTERFACES BEFORE APPLYING PRA RESULTS

    OR,

  - o INCONSISTENCIES HAVE A NEGLIGIBLE IMPACT ON OVERALL PUBLIC RISK

Table 1.9-24

PRA INTERFACES

| Item No. | Subject | GESSAR II/FSAR Interface Table No. | GESSAR II/FSAR Interface Item No. | GESSAR II/FSAR Interface Subsection | PRA Interface Requirement |
|---|---|---|---|---|---|
| 1. | Grid Reliability Analysis | 1.9-8 | 8.6 | 8.2.2 | Initiation Frequency $<0.05$ events/year and loss of feeder probability $<10^{-2}$ (Table D2-14 of Appendix D to Section 15D.3) |
| 2. | ESW Reliability Analysis | 1.9-9 | 9.6 | 9.2.1 | Sufficient as to not degrade the conclusions in Appendix D of Section 15D.3 tables:<br>D2-2 RCIC<br>D2-11 ESW to RHR/LPCS<br>D2-14 EDG Service Water |
| 3. | Seismic Hazard Curve, Geology and Seismology | 1.9-2 | 2.28 | 2.5.1 | Site hazard curve response within Figure 2-1 of Reference 1. Geology and seismology same as GESSAR II/FSAR interface. |
| 4. | Meteorology | 1.9-2 | 2.10 and 2.11 | 2.3.4 and 2.3.5 | Total risk within Figure 7.1-2 of Section 15D.3 bounds. Site unique data to be applied to confirm applicability of risk conclusions. (applies to items 4, 5 and 6) |
| 5. | Population Distribution | 1.9-2 | 2.3 | 2.1.3 | |
| 6. | Emergency Planning | 1.9-1 | 1.39 | 1.8.101 | |

Table 1.9-24

PRA INTERFACES (Continued)

| Item No. | Subject | GESSAR II/FSAR Interface Table No. | Item No. | Subsection | PRA Interface Requirement |
|---|---|---|---|---|---|
| 7. | Containment Design | 1.9-3 | 3.24 | Table 3.8-3 | Failure location and capability consistent with Appendix G of Section 15D.3. |
| 8. | Emergency Procedures | 1.9-1 | 1.68 | 1A.8 | Plant emergency procedures consistent with EPGs. |
| 9. | Maintenance Procedures | 1.9-1 | 1.27 | 1.8.33 | Consistent with Reference 2:<br>a. References 3 and 4 of Tables D.2.1-1 and D.2.4-1<br>b. Footnote 1 of Table 2.2.3-1 |
| 10. | Flood and Groundwater | 1.9-2 | 2.16 and 2.26 | 2.4.3 and 2.4.13 | Same as GESSAR II/FSAR interface. |
| 11. | Ultimate Heat Sink | 1.9-9 | 9.10 | 9.2.5 | Same as GESSAR II/FSAR interface. |
| 12. | Site-Dependent Blasts | 1.9-2 | 2.6 | 2.2.3.1 | Same as GESSAR II/FSAR interface. |
| 13. | Collapse of Non-Seismic Category I Components | 1.9-3 | 3.5 | 3.3.2.3 | Consistent with Reference 1, Table 3-18. |

Table 1.9-24

PRA INTERFACES (Continued)

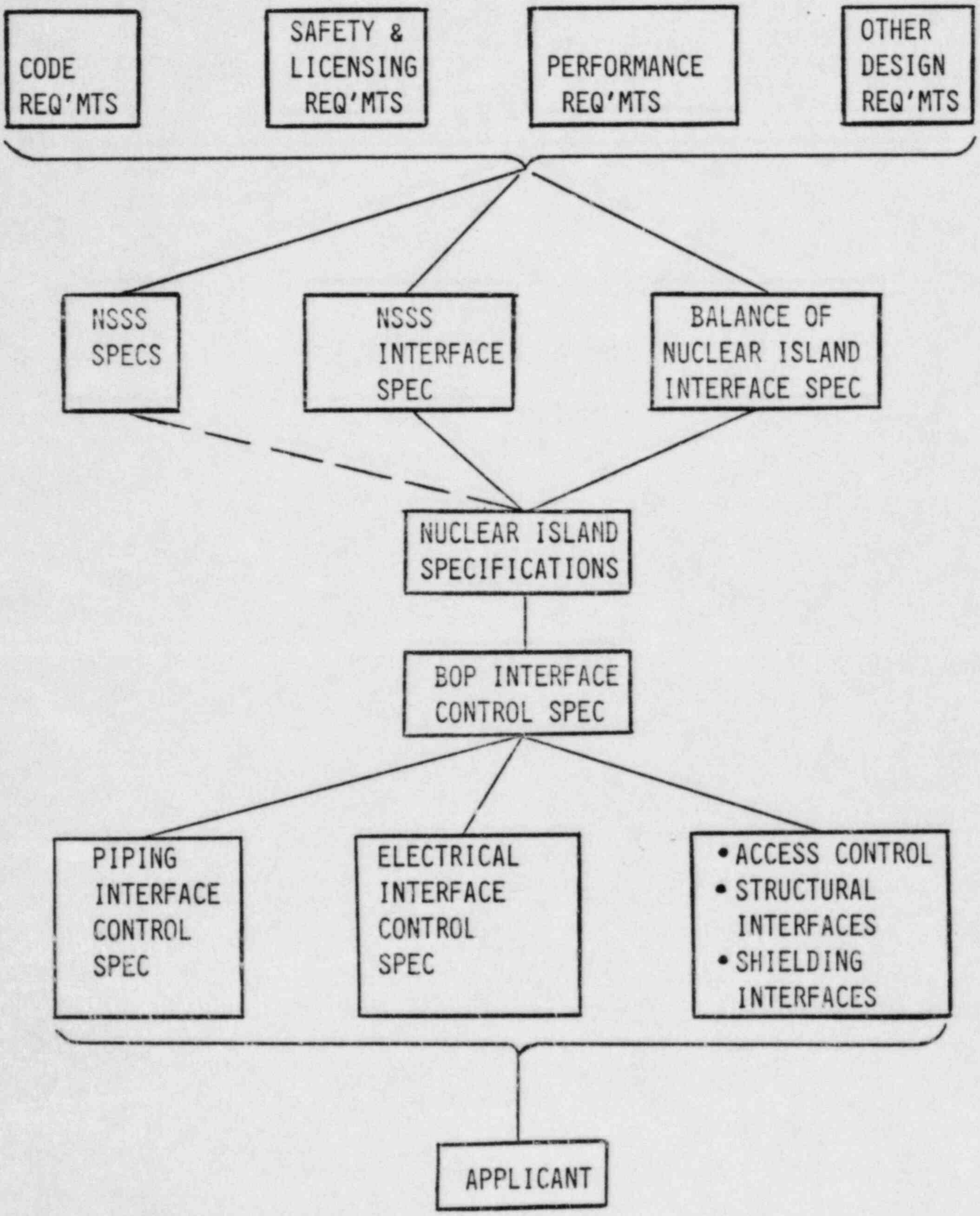
| Item No. | Subject | GESSAR II/FSAR Interface | | | PRA Interface Requirement |
|---|---|---|---|---|---|
| | | Table No. | Item No. | Subsection | |
| 14. | Missiles Generated by Natural Phenomena | --- | --- | --- | Same as Subsection 3.5.1.4 requirement. |
| 15. | Turbine Missiles | 1.9-3 | 3.9 | 3.5.1.3.4 | Same as GESSAR II/FSAR interface requirement. |
| 16. | Aircraft Hazards | --- | --- | --- | Same as Subsection 2.2.2.5 requirement. |

# CONTROL OF INTERFACES

- O IDENTIFICATION OF INTERFACES
  - o GESSAR II CHAPTER 17 REQUIRES APPLICANT'S PERFORMANCE SPECIFICATIONS AND MONITORING PROCEDURES INCLUDE ALL INTERFACE REQUIREMENTS
  - o SER SECTION 1.10 MAKES DIRECT REFERENCE TO GESSAR II SECTION 1.9.2 FOR A COMPLETE LIST OF INTERFACE REQUIREMENTS

- O INTERFACE PROCEDURES AND IMPLEMENTATION
  - o BOP INTERFACE CONTROL SPECIFICATION PRIMARY VEHICLE TO ESTABLISH AND FORMULATE REQUIREMENTS
  - o SUPPORTING SPECS
    - PIPING INTERFACE CONTROL
    - ELECTRICAL INTERFACE CONTROL
    - ACCESS CONTROL
    - STRUCTURAL INTERFACES
    - SHIELDING INTERFACES
  - o DOCUMENTS SPECIFY LEAD RESPONSIBILITY FOR THE INTERFACE AS WELL AS TECHNICAL REQUIREMENTS

INTERFACE CONTROL PROCESS



# CONTROL OF INTERFACES
(CONTINUED)

- O COMPLIANCE ACTIVITIES

  - o PERIODIC REVIEW OF ALL INTERFACES BY GE TEAMS THAT VISIT APPLICANT
  - o APPLICANT AUDITS HIS OWN ARCHITECT ENGINEER FOR INTERFACES
  - o ARCHITECT ENGINEER SUBJECT TO INDEPENDENT QA VERIFICATION WITHIN HIS OWN IN-HOUSE PROCEDURES
  - o GE APPROVAL OF NON-CONFORMANCE AND APPROVAL OF AS-BUILT DOCUMENTS
  - o NRC PERFORMS SITE-SPECIFIC REVIEW TO DEMONSTRATE COMPLIANCE WITH SITING ENVELOPE

# DESIGN CHANGES

A PRESENTATION TO ACRS SUBCOMMITTEES
ON GESSAR II/RELIABILITY & PROBABILISTIC ASSESSMENT

LOS ANGELES, CALIFORNIA

GENERAL ELECTRIC COMPANY
DECEMBER 4-5, 1984

# CONTROL ROOM HUMAN FACTORS DESIGN

- O SOLID STATE CONTROL ROOM WITH IMPORTANT CONTROLS AND INSTRUMENTATION EASILY ACCESSIBLE

- O UPGRADED CONTROL ROOM BY INCLUDING EMERGENCY RESPONSE SYSTEM WHICH PROVIDES

  - o SAFETY PARAMETER DISPLAY CAPABILITY FOR BOTH MAINTENANCE AND OPERATION

# SCRAM DISCHARGE VOLUME

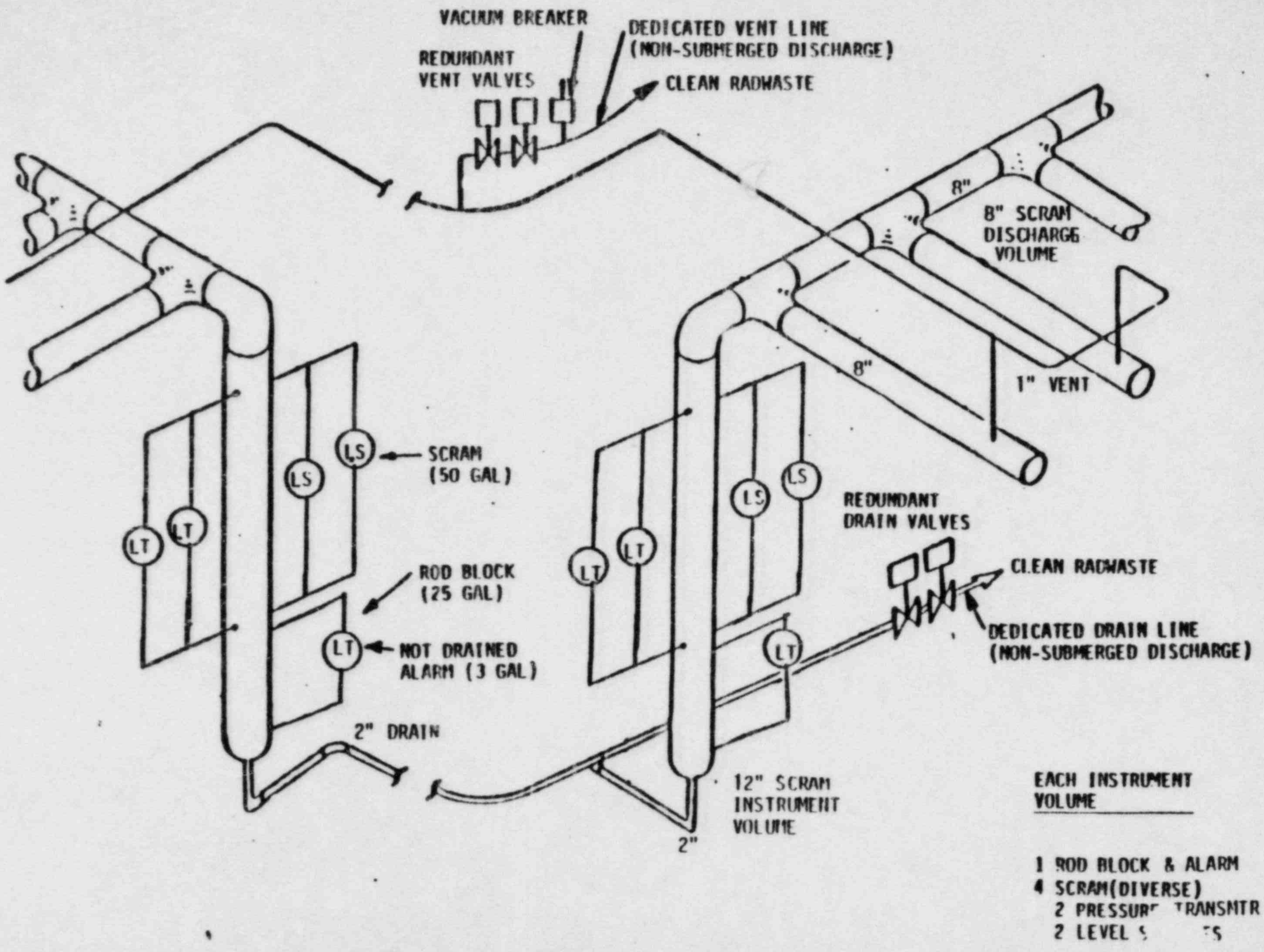
- O DIRECT WATER LEVEL MEASUREMENT ON SDV
  - o Precludes Browns Ferry 3 Event
  - o Precludes Undetected Water in SDV Resulting From Valve Leakage With Slow Air Pressure Loss
  - o Precludes Not Detecting Any Other Source of Water in SDV

- O DIVERSE LEVEL INSTRUMENTATION
  - o Precludes Sensor Common Mode Failure From Disabling Water Detection

- O REDUNDANT VENT AND DRAIN VALVES
  - o Precludes Leakage as a Result of a Single Failure

- O MARK III CONTAINMENT
  - o Any Inventory Released From a Postulated SDV Break Will Enter Suppression Pool

## SCRAM DISCHARGE VOLUME



# ATWS IMPROVEMENTS

- O ALTERNATE ROD INSERTION

- O RECIRCULATION PUMP TRIP

- O AUTO 86 GPM STANDBY LIQUID CONTROL SYSTEM