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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

242nd MEETING

Room 1046
1717 H Street, N. W.
Washington, D. C.

Thursday, June 5, 1980

The Committee met, pursuant to notice, at 8:30 a.m.,

BEFORE:

Dr. J. Carson Mark, Presiding

Myer Bender

Max W. Carbon

Jesse Ebersole

Stephen Lawroski

William M. Mathis

Dade W. Moeller

David Okrent

Jeremiah J. Ray

Paul G. Shewmon

Chester P. Siess

Harold Etherington

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James M. Jacobs
Raymond F. Fraley
Richard Savio

P R O C E E D I N G S

(8:30 a.m.)

DR. MARK: The committee will come to order. This is the 242nd meeting of the Advisory Committee on Reactor Safeguards.

The arguments to be discussed during this meeting are identified in the agenda as published in the Federal Register and including initial review of the operating license for the Sequoyah Nuclear Plant, the Proposed Emergency Planning Rule 10 CFR Part 50 and Part 70, and stability of B&W reactors; also the NRC Research Program and the Program on Development of Qualitative Risk Criteria. Copies of this notice are posted at the door.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act and the Government and the Sunshine Act. Mr. Raymond Fraley is the designated federal employee for this portion of the meeting.

I would like to remind everyone that those portions of the meeting where a transcript is being kept for those portions it is particularly important that speakers identify themselves and speak with sufficient clarity and volume that they can be readily heard.

We have not received any written statements or requests for permission to make oral statements from members of the public with regard to this meeting.

Before turning the meeting over to Mr. Mathis to give us comments on the subcommittee meeting on Sequoyah Nuclear Plant, there are a couple of items that I might mention for the members' consideration.

I believe that a month ago it had not been urged by the committee that we had items to bring before the commissioners but would be happy to meet with them if they had items they wished to bring before us. And they have proposed that there be a meeting which will take place tomorrow at 1:30.

In connection with that meeting they have suggested that we raise, or that they would like to raise, questions and receive any ACRS comments and suggestions on the matter of siting and whether unfavorable characteristics can be compensated by design features, whether that policy should be continued, or whether site approval should be independent of plant design.

They have expressed an interest in hearing any committee comments there may be on that.

Also in the same general area, comments on the question as to whether siting decisions should be based primarily on the risk to the most heavily exposed individual or on the total man rem or societal risk, how those should be taken into account would be of interest to the Commission.

I think some of us or some of you will remember that both of those have been part of the approach to siting, both on the part of the committee and I believe of the agency, from early days, including for example the fact that the nearest city was supposed to be at such a distance that the probability of at least many early fatalities, even in the most serious events, would be acceptably small.

It may be useful if I could persuade Dave Moeller and possibly Dave Okrent to think of a few comments jointly or singly on the way this has been approached and the thoughts that might come to them as worthy of consideration or suggestions they might take with respect to that problem.

I think it is particularly necessary for us to have our own thoughts and view on that and that the NRC's position be firmly developed with the Indian Point and Zion as the highest present reactors, the highest threats. The decision that something must be done about them is understandable, but then there will be other reactors which will then be the highest and one really needs a policy that can be applied. And it is somewhat up for discussion and comments on how we got to where we are or where we think we are or where we think we should go. I am sure it would be appreciated by the commissioners if they could be perhaps brought out at the time we meet with them and this will be on their mind.

That is one thing I wanted to mention in connection with tomorrow meeting with Chairman Ahearne. There is another thing that should be mentioned, also in that connection, the action of the House -- no, I guess it is of the Office of

Management and Budget, in cutting the agency's travel funds. It is thought now to have the effect of reducing the amount of travel money available for the committee's use between now and the first of October, from an amount like $89,000, which was the best estimate of what would be needed to cover operations as normal, as usual, down to a number like $41,000. If that number in fact must apply, there will be some need of curtailing activities in some way or other of the committee between now and the end of September.

There are probably items which should not be cut back, such as continuing work on project reviews, on the Safety Research Report, on things directed bearing on rulemaking, site committees. I believe that Mort Libarkin is preparing a listing of items which were expected to be covered, trying to identify some which will have to be either reduced or removed from our program between now and the end of the fiscal year. I think that will be in people's hands today, and I am again urging that it be looked at because it is a topic that ought probably to be introduced in discussion with the commissioners.

MR. FRALEY: The actual funds that we need for the last half of the year for travel are 220,000, and we had requested an additional 89,000, you know after they had gotten through cutting our budget. We needed 89,000 to perform all of our travel, and we were actually authorized 41,000. So our total travel for the last six months of the year is up in the order of 200,000. It was just the deltas that we were talking about.

DR. OKRENT: How much do we spend . month on average?

MR. FRALEY: Let's see, I guess about -- oh, I have got those figures here. The first quarter was about 60, about 66,000 for the first quarter and second quarter of the year.

DR. MARK: Each?

MR. FRALEY: For each quarter, right.

MR. OKRENT: So that is over a month's worth of travel?

MR. FRALEY: That is two months.

MR. OKRENT: No, no, but the decrement.

MR. FRALEY: Yes. So Mort is looking to see what meetings we can defer. It certainly may impact on some of the committee's activities, and I think we will need to tell the Commission what impact this will have, so that if there is any possibility at all of getting any additional funds that they can do it, if they can't stand that deferral of activity.

DR. OKRENT: Is he considering taking September off as one alternative?

MR. FRALEY: No, we were not considering that. We were really going to try to look at doing the priority work as we see it and putting off some of the work which does not have as high a priority. Basically it looks like, you know, just from a quick and dirty, that we will be able to continue work on the safety research area. We probably will be able to continue work on the development -- I mean on rulemaking that is in progress -- there are a couple of those -- and then probably do project work where it is absolutely needed, not necessarily all the project work that we would like. Other work will probably have to be deferred, like the development of quantitative risk criteria, the revisions to the clad ballooning model and regulatory guides and some other things of that nature. Not all regulatory guides but some regulatory guides. We will try to defer the stuff that does not seem to have high priority.

DR. MARK: I don't imagine that in the short time we will easily come to an agreement of the list of things exactly which should take what proportion of the cut, but in a broad sense this would make a suitable thing which really should deserve to be mentioned in the meeting with the commissioners tomorrow.

MR. FRALEY: Yes.

DR. MARK: I failed to mention the very first tab in the folder, which has to do with proposed procedures for the review of papers to be published at technical society meetings or in journals, I think particularly on the part of the ACRS Fellows or ACRS Staff.

There is in the tab a proposed set of procedures for dealing with that. The question has been raised on the part of some of the fellows, and there weren't very clear and specific things in hand for guidance on that. It would be good if people could look at the proposed rules which Marv Gasky has sat down, which are believed to be consistent with the NRC approach to the similar problem in connection with NRC Staff. And I don't know that we need to discuss this further. It has been discussed, at least as a general question, in the procedures of the committee at least once.

If anyone should see in that things which seem troublesome, it would be good to bring those to the attention of Ray or Marv Gasky. If they are serious enough, they may want to have them brought for committee discussion.

The last item, not already clear from the agenda itself, is the fact that fairly recently, I think in the appropriation bill for the NRC, as it stands, which is to say as considered presently by some of the House subcommittees, there is a proposal to establish a panel, a public panel, to deal generally with the questions coming up concerning the decontamination of Three Mile Island; this panel to consist probably, by one description at least, of 15 members, 3 representing each state, 3 representing local government, 3 representing local citizens, 3 representing science at large, and 3 representing other things at large.

That doesn't necessarily concern us directly, except that in the description of the panel it requires the ACRS to make available technical assistance to this panel, with the admonition that the panel only ask the ACRS reasonable or essential questions and only invite such assistance on a not-to-interfere-with-other-committee-work.

It is not clear that all of those things are compatible. A letter is, I believe, in the state of preparation or --

MR. FRALEY: Right, it was passed out at your places this morning.

DR. MARK: It is in front of you then -- which proposes to point out that such activity on a not-to-interfere basis is not possible.

DR. SIESS: It seemed to me the thrust of that letter was go through the NRC Staff, and that was the main thrust I got out of it. So maybe we want to be sure of what we are trying to say here.

DR. MARK: I think the letter will warrant discussion after we can get --

DR. SIESS: Was it the feeling from the congressional action that it was intended to by-pass the staff?

MR. FRALEY: That was my feeling, yes.

DR. SIESS: If that is true, then I certainly favor the letter, but I am not sure I just want to tell them we don't want to advise anybody.

MR. FRALEY: Well, if you will read the letter carefully, it does not say that either.

DR. MARK: It might be good if it isn't necessary to read it too carefully in order to get the message.

Does that cover the point?

MR. FRALEY: Yes.

DR. MARK: Do any of the members have things they would like to raise at this time before we proceed with the agenda as published?

If not, then I would like to call on Charlie Mathis, who chaired the subcommittee meeting on the Sequoyah Plant application, which I think was on Monday this week.

MR. MATHIS: That is right, Carson. We met, the subcommittee met members of the staff, TVA, and Westinghouse on Monday. I think basically the material covered in the general outline and minutes of that meeting were handed out late last night. You probably haven't had time to look at them.

We will cover today basically the highlights of that meeting, and I will quickly run through it so we won't have to spend a lot of time on repeats. But you will get a brief picture of the plant's status as of now.

One thing that we didn't get into the other day was the seismic audit which had been requested. I think we will hear that today. A review of the special low power test program, which you remember we approved sometime back. And you will get some more detail on that today, because previously it was a very sketchy kind of thing.

There will a discussion of feed and bleed. And there were a lot of questions posed as far as Sequoyah is concerned concerning upper head injection, the ice condenser loadings and things of that nature, which again will be covered.

The other thing I would like to remind you of is that Sequoyah is anxious to have an operating license, hopefully by the end of July. The time here is going to be a little tight. As you will hear this morning, the low power test program probably won't be completed until about mid-July.

Anyway these are some of the things I think we need to consider.

Jesse, do you have any other thing to add?

MR. EBERSOLE: I don't have anything to add to that.

DR. LAWROSKI: Is there an intervenor in this application?

MR. MATHIS: Not that I know of. I think there was some request, but it was tossed out or something.

SPEAKER: So the licensing -- amount of ac ess? Is that correct?

MR. MATHIS: Carl Stahle, do you have anything to say on that?

MR. STAHLE: Yes. There is no intervention on this project.

MR. EBERSOLE: I mig say to the committee I think there is a forthcoming and unusually interesting presentation on the reflux condensation process by Westinghouse. So in case any of you have a particular interest in that, I suggest you be around when it is presented.

DR. MARK: Dave?

DR. OKRENT: Do I understand correctly that this is one of two meetings by the committee, that we expect to meet soon again, in July?

MR. MATHIS: Yes. There will have to be another meeting before we really get to the point of a letter.

Now for purposes of economy, living within the budget, and a few other things, I would hope that another subcommittee meeting would not be necessary. Now maybe this can or can't be. Carson, I think it is going to be up to you. But I would be hopeful that we would get enough information today with an update hopefully of the July meeting that we can make some kind of decision without another subcommittee meeting. Maybe I am optimistic.

DR. MARK: Let's try.

MR. EBERSOLE: Along that line there is also an issue forthcoming which I think we will have to consider, and that is whether, if an operating license is granted, it is just for Unit 1 or for both units, because there is going to be some adjustments done before Unit 2 comes on line which have safety implications.

MR. MATHIS: Well, I guess with no further ado on that, unless, Carson, you have anything?

DR. MARK: No. I was going to wonder if it would be comfortable for you to call out the items that we are going to work through in the presentations from the staff and the vendor. If that is not a good suggestion --

MR. MATHIS: I think I have hit most of them.

DR. MARK: I meant calling on the people at the time you think --

MR. MATHIS: Oh, okay. I think to start off w' will call on the staff and --

DR. CARBON: Charlie, before you do could you tell us what will be held over till next time, what won't be covered now, and what comes up for review in July?

MR. MATHIS: Basically, I think the major holdover will be some of the items as far as plant status is concerned, where they may not have completed -- -- and the results of the low power cuts. Could I ask Carl Stahle of the staff to basically answer that question.

MR. STAHLE: In my introduction I will try and cover this matter in more detail or to your satisfaction. So we can get into that on schedule and so forth.

DR. MARK: Dave?

DR. MOELLER: I missed what Mr. Ebersole said. What is it about Unit 2 that will be different than 1?

MR. EBERSOLE: Among other things, as I understand it, there will be a shifting in dependency from certain cooling towers and four-bay storage systems to an interval intake building on the Tennessee River. I don't know what else beyond that, but there will be some substantial changes as you go from Unit 1 to Unit 1 and 2.

DR. LAWROSKI: The tests that TVA has proposed will be conducted only on 1, Unit 1, is that not right?

MR. EBERSOLE: Yes.

DR. LAWROSKI: That is not planned to be done on 2?

MR. EBERSOLE: Right.

MR. MATHIS: If there are no other questions, I will ask Carl Stahle of the staff to pick up and start the presentations

MR. STAHLE: My name is Carl Stahle. I am the project manager for the Nuclear Regulatory Commission. I plan this morning to summarize the report I gave to the subcommittee.

What I did do Monday was provide a chronology of events, major events, in order to inform the committee of the manner in which we actually reviewed the Sequoyah Unit 1.

In particular, I pointed out to the committee members that a culmination of our review resulted in a Supplement No. 1 that had two parts to it. Part 1 dealt with the review by the staff essentially along the lines of our Standard Review Plan. And this dealt with the items I would classify as non-TMI.

Part 2 of the SER dealt with the fuel load requirements; that is, those requirements that were identified in the action plan and also further categorized in a guidance memorandum from the commissioners as to those items that would have to be satisfactorily completed in order for us to license the plant for the program that we had proposed at that time; namely, the low power test program.

Our objective of course as things progressed was hopefully to license Sequoyah Unit 1, load fuel, run the basic zero power test and then to conduct the low power test program of which you will hear more detail this morning, and of course has been under review for several months.

DR. CARBON: Now we are talking Unit 1 this morning?

MR. STAHLE: Yes.

DR. CARBON: Are we talking Unit 2 at all?

MR. STAHLE: On this matter this becomes a bit complex. The review of course of certainly the Part 1 items have generally dealt with both Units 1 and 2, and I do intend, and the fuel load requirements generally also apply. I think it is our intent to be able to review the Sequoyah Units 1 and 2 and write an SER supplement that will apply to both.

We have not at this point looked at some of the specific details or exceptions that may occur at this point, being so mentioned.

DR. MOELLER: The license which has been issued for low power testing, again, that is a license for Unit 1?

MR. STAHLE: The license for Unit 1. The license that exists today is run Unit 1 in order to carry out the low power test program. There is nothing in the license inferred or implied, of course, on power ascension and full power operations.

That was, if you will, a ground rule and of course a point which was carefully made in all of the discussions. We were only talking about our attempt here, at that point in time, to conduct the program.

All other matters of course are subject now to further review, in particular by yourselves, and of course to the commissioners. We intend as this project progresses through the review process at some point in time, hopefully in July, we will present our findings to the commissioners in hopes of licensing Unit 1 and go to full operations.

I had planned to skip over the essence of Part 1 and Part 2, I emphasize this was done quite deliberately and somewhat uniquely to what we in the past have carried out. Part 1 again, I must emphasize, dealt with the non-TMI items. And Part 2 followed the action plan both by its numerical designation, its objective and so forth.

We will plan to continue the Sequoyah review on the same basis, this time of course picking up the full power requirements.

The SER Supplement No. 1 of course states that all of the requirements have been met to initiate this program that will be in discussion this morning.

There are items of course there that are not fully resolved for full power operations and this of course is what we are dealing with.

In any event, the basis for licensing Sequoyah was, technical basis, was the Supplement No. 1.

After providing the committee members a chronology of events in order that they have a understanding of how we approached the Sequoyah review and what transpired, we provided a brief status report by the resident manager of the activities at the plant.

The license was effective on February the 29th, and since that time the plant has of course been undergoing numerous activities which was discussed by the resident inspector.

This slide very quickly identifies these activities. My purpose in this viewgraph is to immediately draw your attention to item 6 of this, identifying now the schedule has slipped, and based on our estimate, initial criticality, appears to be on or about July 4th, about a week test, and then approximately three weeks or so for the low power test program.

So based on the plant activities and what is going on, as we see it, the low power test program will be conducted through the month of July, which on the basis of plant status it would be that the first of August it is possible to go into power ascension and ultimately full power operations.

Now of course our reviews in the past and present, we do attempt to make our reviews of technical matters consistent with the plant activities, which we have done.

The review to date has essentially been involved in the non-TMI items and those items related to fuel load; that is, those items that had to be completed in order to initiate the low power test program.

There is ongoing and intensive review of all of the full power requirements, obviously in the items as it relates to TMI. This is ongoing. The schedule that I have projected here is I believe that on the schedule basis we will be in the position to discuss the early part of July, should be able to discuss this matter with the ACRS Committee.

We will not in all probability have a formal supplement to our SER, but I feel that there will be sufficient information and understanding where we are to discuss this matter with you, in hopes that the ACRS can see this and be able to provide us a letter in order to continue the review up the line.

Now in light of this schedule for plant activities, the low power test program will just about be initiated at the time we would like to discuss the items as it relates to TMI and on TMI and so forth.

Nevertheless, I think that we can keep you informed as the program progresses, even after the issuance of a letter.

After the discussion of the schedule with the staff and subcommittee members, I proceeded to discuss with the members the following incomplete non-TMI issues.

Each item was discussed with the committee by staff members and myself, with the exception of number one. We deferred that until today, the seismic part of the program. I remind you that item one of course was a committee recommendation that we recommend or consider a program for quantification of the seismic design margin. In that manner both TVA and ourselves have been discussing this matter, and at this point I will list our items to be further discussed, other than number one.

I believe the subcommittee members were satisfied with the remainder items, and we now can proceed to item one.

If that is the case I will ask Mr. Knight to provide you a status review of this item.

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DR. MOELLER: To help me, how does the seismic audit -- I can understand, you know, doing a seismic audit, but how does that relate, could you refresh my memory, to TMI?

MR. STAHL: It's independent of TMI at this point in time. This was a non-TMI --

DR. MOELLER: Non-TMI?

MR. STAHL: Yes.

DR. MOELLER: Thank you.

MR. KNIGHT: I'm Jim Knight, NRC staff.

With regard to the program recommended by the Committee, just as a refresher, the words in the ACRS letter were all structures and equipment necessary to accomplish safe shutdown -- I started in the middle of a sentence, here.

The Committee recommended that the program be expanded to insure that all structures and equipment necessary to accomplish safe shutdown do, indeed, have some margin. We have been discussing this matter with TVA and they have now proposed a program to us which requires some interpretation. I think we're still discussing the interpretation of the word "all."

It's a concept that I think the staff has grasped, and I don't see any difficulty in our proceeding in these discussions with TVA to make the program entirely consistent with the committee's recommendation.

The format of that program is intended to be identical to that used previously, largely one of the staff going to Knoxville, sitting down with the qualification material and calculations and assessing the margin that's available.

There is a difficulty in interpretation of what margin once one passes above the normal engineering margins, how much further does one go to gain the level of confidence that is required. It is a matter that requires a good deal of judgment and I would propose that we, in a reasonable period of time, in terms of some few months could be back to the committee to inform them of our findings, including both the extent of the audit and a general characterizations of the margins that were discerned.

DR. MARK: I think, Dade, in connection with your question, this really was totally separate from any TMI implications. It came up because there was a change in the approach to the seismic consideration in Sequoyah between the time some of the early work had been done and the situation, as of a little more than a year ago, and a site-specific spectrum came into the picture for describing the situation at Sequoyah.

There had been then a check on the part of TVA and the staff of, as a list of selected items, to see if those selected items met the margin, and it was reported here that some of them showed themselves to have more margin than one would have required and some rather less margin than an earlier review might have suggested, but I believe in all cases to have some.

It was then suggested by the committee in a letter that while not necessarily every mechanical item be reviewed, that the review be approached from the point of view of insuring that all items necessary for safe shutdown were included in the statement that they all have a margin under the new pattern approach.

I believe Dade had something to say, or another point.

DR. OKRENT: Well, there was some discussion in this general area, not directly on Sequoyah, at our subcommittee meeting yesterday. Maybe I'll make a couple of comments on the general question and on the matter as raised by Knight.

What the staff has been doing in recent times at least, is developing information which gives them, among other things, some basis for estimating what the "safe shutdown earthquake" means in terms of recurrence frequency. The reason I have to put it in quotes is because it is some kind of synthetic earthquake and an actual earthquake is not going to resemble the synthetic one in detail, certainly.

The numbers, I think, that reflect their best estimate now is the return interval for the safe shutdown earthquake for the typical eastern plant getting it's CP within the last ten or twelve years, let us say -- not a very old plant -- is between -- let's say it is one in 1,000 or one in 10,000 years, somewhere in that range.

I think, understandably, it's hard to know the number precisely, and if they told me they knew exactly what it was, I wouldn't believe them. But I think, myself, the range is reasonable based on what little I know about it.

That's not an exceedingly low probability by itself, so in other words you do want things to work at a fairly high reliability given such an event, and I guess a bit of lore has developed that you are likely to scram if you get an earthquake, so there has not been too much concern about that, unless there is some particularly weak point somewhere in the design and, as far as I know about Sequoyah, I haven't heard of any suggestions of that sort.

I guess there is some lore that you are not too likely to get a large LOCA, although for bigger events, I think that needs -- by that I mean earthquakes exceeding the design basis, that still needs some looking.

Whether or not you get a small LOCA, whatever that means, either due to a valve opening or an actual crack or bearings or seals going somewhere, I would say is not necessarily a very low probability thing. So the small LOCA is probably not necessarily related to that earthquake or some larger one.

But in any event, you're pretty sure you are going to have to remove decay heat with a high reliability and for a long period of time. You may also have lost pretty high confidence, let's say, for a small LOCA. Decay heat, you really need to do and, in fact, if this is a -- let me take a median number. If this is the -- or using the square root of one in 3,000 year earthquakes or something like this, and if you think that from any single cause, and you're looking for a goal like -- I don't know. One in 10^6 or less for a serious earthquake -- in other words, an earthquake being a single cause, and I think there are a hundred rather than ten order of magnitude, ten being what the Atlas report talked about, you not only need a high reliability for the safe shutdown earthquake. You need better than 99 times out of 100 for the safe shutdown system to work, but you need a high reliability for the earthquake having a probability ten times less, because that is still a one in 30,000 year earthquake, and if you're looking for one in 1 million or less, the system has to work -- I don't know, at least 19 out of 20 times. Let me use a round number, which is still a pretty high reliability of having a severe earthquake.

And that means everything, not just the building and not just the pipes, and not even just the pumps, but all the control equipment and all the electrical equipment that is vital has to work and also, anything whose failure could impede its working must not fail in such a way as to impede it.

So Sequoyah is just one of, I guess, three at least on which the Committee has identified this kind of a problem. It is really, in my opinion -- and I think the Committee has talked about it, a fairly common, generic if you want to use that word -- I don't want to use it in terms of putting it off for eventual burial -- it's a generic question for many reactors and, in fact, I think there is a need for the applicant here to really look hard at everything that has to work, in the first place to know that it has been designed well.

One advantage to this -- I hope it's not just a paper study, because I think we should really go back and look to see that they really do know what the status is of the equipment that has to work, and then as was mentioned in connection with Diablo Canyon, but by no means do I think it is related only to Diablo Canyon, it needs to be rather confident that things won't fail in such a way, other things, as to impede what you really need to work enough that -- this doesn't mean every last thing, but enough that you can remove decay heat not only on a short-term basis, but, you know, you may not have anything else except this and I think also you really want to get down to cold shutdown. I think you will feel uncomfortable if you're sitting there with a reactor and don't see a way of getting from hot shutdown to cold shutdown for not only a week, a month -- it's not that it's a completely untenable position, but it is certainly uncomfortable not to be able to see a way of getting from hot shutdown to cold shutdown for an extended period and enough damage, you know, here and there to not be readily able to fix them.

So in my opinion, this is really worse doing. In my opinion, it may be a more probable need than Atlas, which we have spent a lot of time on. If you look at the probabilities, even the staff's probabilities in Atlas come out smaller than the staff's probabilities on the need to call on this system for an SSC and the industry's probabilities differ more on Atlas than they do on earthquakes.

I don't think the industry and the staff are radically different on the probabilities of earthquakes -- not that any of them know it, but they fall within a decade in general.

So I just wanted to note that this is, I think, somthing that is worth doing and that the intent, then, of the margin is not to cover not only the SSE but this earthquake that is a factor of 10 less probable, which is still a substantial probability.

I don't know whether that helps clarify the committee's letter.

DR. EBERSOLE: Mr. Chairman, I don't know whether Mr. Knight wants to say what I want to say or not. If we are going to now concede that an earthquake can cause a large or small LOCA, we are plowing new ground -- ground which the staff has refused to plow prior to this time. And there are some logical reasons for this.

Although the ECCS systems have been designed for seismic competence, and the presumption must be that you could have induced a LOCA by an earthquake, the posture has been that actually the earthquake didn't cause the LOCA, so that they were somehow magically coincidental, which nobody of course, believes.

The problem is this. If you argue that an earthquake can produce a failure of a seismically designed system, you have a far richer field of failure in systems other than the primary loop out in the plant, systems which sustain the safe shutdown, a condition that you know you are going to go into.

As a case in point, you have simple redundancy in many plants on such things as the service water system or batteries or component cooling or many other things.

It takes only two failues which are coincidentally introduced by earthquake influence to put the plant dead in the water.

So this emphasizes the need for strong designs against seismic influence and those systems which effectively shut down the reactor would power the LOCA. And in the past there has been a refusal to admit that anything which is seismically designed could fail at all, because this would introduce the idea that you could have coincidental failures and say a relay in one system and a valve in another, a motor in another and a pipe in another, at one point in time.

So we're entering a difficult era when we get into this and we'll have to appropriately bolster the design features to withstand earthquakes on both systems, particularly those systems which simply enable us to execute safe shutdown.

DR MARK: Well, I'm sure that the phrasing of the request on the part of the Committee as it specifically is related to Sequoyah was a rather qualitative matter to reflect the feeling that there had to be a margin where you could examine it, that it might not be possible to quantify and wouldn't have to be considered in every possible combination of things that might happen, but that there were margins that would assure you that there was a good chance that your shutdown systems would stand an earthquake.

I believe that our original wording had been that the systems selected which may indeed have been acceptable, we didn't know enough about the basis of selection to know whether they had this property and the review, the word "all" I think is where we are trying to elaborate. All does not mean every, but it means all of those things essential for what seems like the alternately urgent need.

Well, maybe you should go on.

MR. KNIGHT: I found this discussion extremely beneficial for the staff. I think we have enough guidance to move forward and I would see no difficulty in being able to come back here in, as I said, something on the order of two to three months, to be able to at least demonstrate a large amount of progress and I'll further demonstrate that the matter did not get buried.

DR. MOELLER: Mr. Chairman, in Mr. Ebersole's comment that we must now accept the fact that an earthquake could damage severely a component that had been designed to withstand the seismic event, are you saying that our design is not -- the people who design for seismic events are not doing it properly, or are you saying the earthquake is larger than they design for, or what are you saying?

MR. EBERSOLE: I think that in the few, brief studies we've done that show margins to seismic confidence on these shutdown systems, we've shown these to be low margins of confidence and little, if any, diversity.

Of course, it's a little bit like that wonderful one-horse shay. If a system is exactly identical to its counterpart, then of course they'll both fail for the same reason.

So we must insure the viability of the shutdown processes.

It might even turn out that it would be well if we did have a LOCA, because this is another method of cooling.

MR. KNIGHT: If I may, I think we have some work, a small amount of effort at the moment going on to assist in looking at this question.

Very often, the margins that have been reported to the committee are what I have referred to as standard engineering margins. And you see numbers like 1.1, or 10 percent more than the design number. They are not truly indicative of the capacity, the ultimate capacity in many cases of the equipment or the system, and we realize that.

It's difficult because engineering practice over the years has left us with no bank of information as to the true capacity of this equipment.

MR. EBERSOLE: Well, frequently the emphasis is on retaining a membrane against a fluid leak, or something like that. Here, it is compounded by you must assure we have rotating shafts, without any problem to preserve.

It's not that we just sit tight and don't leak; we've got to move water.

MR. KNIGHT: Yes, and it's even more difficult where you have electrical equipment, even if it's been tested. It's tested at some level and we can look at the required response factor and we can look at the test response factor, which is always above that, but we never have gone to the true fragility test, so common sense, I think, says there is something there, but we can't quantify it.

MR. EBERSOLE: Yesterday, we were hearing about certain seismic tests performed on components of patrol systems where they are shaken through many cycles, extreme -- 18 g's, I think it was.

MR. KNIGHT: Yes, it was.

MR. EBERSOLE: And then they are set off to the user, without being tested and they were not shaken to the point of failure, to establish any kind of margin.

One could argue that they were probably shaken to the point of near the last cycle of confidence before they were put in the box and sent to the user.

MR. KNIGHT: One could argue, yes. I think, as you discussed yesterday, there are inspections subsequent to testing, certainly an installation and check out in the plant.

MR. MATHIS: If there is no more discussion on that, I guess the next item on the agenda is the staff response to the interim measures on the interim measures on the hydrogen control in the condensers.

Carl?

MR. STAHLE: Walt Butler.

MR. BUTLER: Good morning. My name is Walt Butler, NRC staff.

The staff wishes to describe for the Committee the position it proposes to take for the Sequoyah station regarding hydrogen control, in view of th TMI-2 experience. The object here is to obtain from the ACRS a reaction to this proposed staff position.

The staff will be presenting its views to the commissioners before the full power OL is issued, and it would be helpful to have the committee's reaction for that presentation.

Let me start off here with a brief description of the current situation at Sequoyah regarding hydrogen control. The existing system satisfies the current provisions of 10 CFR 50.44 in that it includes redundant recombiners. It includes a back-up purge system and the designs are based on accommodating 1.5 percent metal water reaction.

An examination of what can be accommodated by the Sequoyah station, should more severe events occur, indicates on best estimate basis that a containment failure pressure of 36 PSIG can accommodate up to 25 percent metal water reaction.

DR. OKRENT: What assumption is made about rate of burning in that, if any? Or what percentage of hydrogen in the atmosphere, at that point -- say 41?

MR. BUTLER: We assume that the hydrogen is released from the primary system pretty much at th rate at which it is formed. We did not assume that it was bottled up in the primary system and then immediately released instantaneously.

The object of that line of computation was to estimate the rate of pressurization of containment so that an assessment can be made of the size of a vent system, should a vent system be considered for mitigations.

Now, the rate of combustion thast we assumed is a relatively slow rate in terms of dynamic response of the structure, but there should be no problem with it burning in relatively short periods -- by that, I mean 5 to 10 seconds duration.

DR. OKRENT: Could you say what the concentration of hydrogen would be?

MR. BUTLER: No. I suspect for 25 percent metal water reaction, uniformly distributed through the Sequoyah containment, we're talking about a 10 percent concentration of hydrogen.

DR. OKRENT: Is the assumption that the air and the hydrogen are uniformly mixed, they are in both compartments?

MR. BUTLER: Yes.

DR. LAURO: Did you say that you assumed the hydrogen to have been formed in how many seconds?

MR. BUTLER: To have been burned. The maximum burn was --

DR. LAURO: Oh, burned. But I think Dr. Okrent asked a question of how rapidly you assumed the hydrogen to have been formed.

MR. BUTLER: Oh, the formation rate.

DR. OKRENT: I asked about the rate of burning and how that was --

DR. LAURO: Oh, rate of burning.

MR. BUTLER: Well, we did some computations as reported in SECY 80-107 wherein we concluded that the reaction would not be expected to proceed more rapidly than around 15 minutes for a substantial amount of the zirconium to reactive water.

MR. BENDER: What other circumstances do you include when you are trying to assess the effect of a hydrogen burn as it occurs? Are you assuming some other things might have pressurized the containment as well?

MR. BUTLER: Such as steam?

MR. BENDER: LOCA followed by hydrogen?

MR. BUTLER: LOCA followed by hydrogen?

MR. BENDER: Yes.

MR. BUTLER: Yes.

Our computations considered a parametric analysis of the preconditions inside containment and it turns out that a containment with very little steam leads to higher pressure than a containment with a lot of steam.

MR. BENDER: Is that because the steam suppresses the burning, or what? All the gases are there except for the matter of what might be generated by some kind of reaction that heats up the place.

MR. BUTLER: I'm not sure specifically. There indeed is that contribution of steam to suppress the reaction, but I think there is more involved than that.

When the hydrogen concentrations are low, like around 8 percent, the burn assumption is to take it down to around 4 percent. If you start with a concentration of around 9 or 10 percent, we burn down to something close to 2 percent and if the concentration at the point where the burn starts is up high, like around 12 or 13 percent, then it assumes that it burns all the way to zero -- that is, all hydrogen burns.

DR. LAURO: Do you assume the same kind of burn no matter what the concentrations?

MR. BENDER: Evidently not.

MR. BUTLER: No, no. We assume different fractions of the hydrogen burns, depending on the starting point.

DR. LAURO: Yes, but it's a burn as opposed to a --

MR. BUTLER: A detonation?

DR. LAURO: Yes.

MR. BUTLER: That is correct. We did not consider any detonation at all.

MR. BENDER: In establishing the lower limit on burning, what is determining? Evidently, you conclude that when you start with high concentration, the likelihood of burning all the way down is more likely than if you start with the low and what is the logic?

Is it to reach a combustibility limit, no matter what?

MR. BUTLER: I believe there is some documentation from the Bureau of Mines that indicates that when, at the onset of ignition, if your hydrogen concentration were moderately low, like 6 to 8 percent, you will not go to complete combustion.

There is --me argument about the manner by which the flame front propogates, so that you do not burn all of the hydrogen that is there.

MR. BENDER: But if the concentration is high, I take it that you have some data from somewhere, possibly Bureau of Mines, that says that the burndown could go as little as 2 percent?

MR. BUTLER: Yes.

MR. EBERSOLE: At the end of the combustion interval, you have lost some fraction which you haven't stated of the oxygen component, and you actually could go if you had an advantageous effect of that after condensation.

What fraction of oxygen would you have gotten?

MR. BUTLER: That was the question that came up at the subcommittee meeting and a member of the staff has done a computation of that.

For a 10 percent hydrogen concentration at the start, which is that amount corresonding to around 25 percet metal water reaction, you will burn around 3.5 percent of the oxygen.

The loss of 3.5 percent oxygen is worth around half a PSI in containment pressure.

DR. OKRENT: There are some scenarios one can visualize where you push the air up into the upper part of the ice condenser and it's held there for some period of the accident. In other words, the air is not mixed back throughout the upper and lower containment, and the hydrogen might or might not be uniformly dispersed. It might be part in the lower, part in the upper.

In other words, not all scenarios lead to a uniformly mixed system, and that then becomes a somewhat different kind of analysis. I am just trying to understand how good your 25 percent number is, whether you think it covers all the scenarios or most of the scenarios relating to accidents leading to partial core degradation, or what.

MR. BUTLER: The analyses upon which the 25 percent metal water number was based were rather elementary analyses. They certainly were not a full scope of analysis.

The object there was to get a handle on nominally what is the capability of the containment where you use as the cut-off point the estimated failure pressure for the containment.

So the idea in those analyses was to get a handle on where we are prior to th upcoming rulemaking proceeding to see whether there was a basis for continued licensing of ice condenser plants and other plants.

Does that answer your question?

DR. OKRENT: Well, I don't know.

Suppose the number came out 15 percent or 40 percent. Would it have a difference, either way, on your conclusion with regard to what you thought was the metal water reaction percentage for failure pressure?

MR. BUTLER: I think if it were up to 40 percent, it would probably make no difference. If it were down to 15 percent, we would be rather uncomfortable with respect to proceeding without some additional capability built into it.

It's a very subjective feeling. I can't really give you a good answer on that.

MR. EBERSOLE: Do the hydrogen recombiners act as effective igniters, and is that desirable?

In other words, do you want to ignite, positively, before you have excessive release, and do the present recombiners do that for you, or should you deliberately do it by other means?

MR. BUTLER: The subject of intentional ignition of the hydrogen is something that needs substantial study, clearly, and we intend to undertake that study. Whether the electrically heated thermal recombiners have a sufficiently vigorous ignition source, I really don't know.

I suspect it does on the basis thast it doesn't take very much energy to start the reaction going. If you have the hydrogen and oxygen there in sufficient concentration, once you ignite, you should be able to propogate throughout the volume of the concentration.

MR. EBERSOLE: Can it be argued that igniters that were more competent certainly won't hurt anything, and they might help?

MR. BUTLER: If the ignition were under controlled circumstances, there is potential there for improvement, yes.

MR. MATHIS: Mr. Butler, as I remember our discussion Monday, it was mentioned that the ventilation system in the containment does sweep to the top so that there is a mixing that doesn't exist in so many other containments?

MR. BUTLER: No, but there is an area which says you don't have power, and then you don't have mixing and, in fact, the same scenario leads to overheating the core, and then the scenario is you turn on the power, you start getting water, you also have ignition sources.

DR. OKRENT: But as compared to some of the other containment where the ventilation system intake and circulation point is way down, and even for the recombiner to take their intake, you still have got a large void above, but this is different from that -- again, assuming it's working.

MR. BUTLER: That might be helpful, to say a word about what we call a skimmer system. It takes suction at several high points in several compartments throughout the containment.

The object, or the design, of that skimmer system, was to promote the mixing of any accumulation at high points.

DR. MOELLER: Excuse me.

In terms of the recombiners, I presume they are outside of containment and you hook them up?

MR. BUTLER: The recombiners in the Sequoyah station are the Westinghouse combiners located inside containment.

DR. MOELLER: Inside. All right.

Are they in the upper or the lower half of containment, or is one in each, or whast.

MR. BUTLER: Jim says it is in the upper compartment.

DR. MOELLER: So if you looked at a situation, then, where as Dr. Okrent and others were saying, perhaps you lost power and you don't have the interchange between the upper and lower compartment, could you have a significant difference of hydrogen concentration in one portion of the containment versus the other?

MR. BUTLER: It's possible that you would. It depends very much on the amount of free convection movements that one would have and the duration over which you have lost the power.

DR. MOELLER: You would expect the hydrogen to be released initially into the bottom portion of the containment, I presume?

MR. BUTLER: Yes.

I'd like to go through a brief statement of the position, therefore --

DR. OKRENT: Excuse me.

I would be a little cautious about actual numbers, like it can support 25 percent -- it may be more, or it may be less. The analysis you have described has been -- oh, let us say less than comprehensive, I guess.

MR. BUTLER: That's a fair statement, but I think it is also appropriate to characterize the 36 percent, or 36 PSIG failure pressure, as one that was more substantively based.

There was some substantial effort made to determine what the failure pressure might be.

DR. MARK: I think it is true that the analysis made is, indeed, straightforwarded, limited. It is just to consider the pressure which would accrue if you had a 25 percent thing distributed uniformly and burned.

MR. BUTLER: Yes.

DR. MARK: If you have another scenario detailed in time, it has not been analyzed, nor does the report claim that it was.

DR. OKRENT: No, but there is just on the viewgrapH, it says 25 percent --

DR. MARK: Only under the assumptions --

DR. OKRENT: Yes, fair enough.

MR. BUTLER: Yes. The qualifying assumptions are pretty well detailed in the SECY paper upon which that number was based.

DR. OKRENT: But if you don't make it clear that there could be other distributions with the same amount of hydrogen, then the other reader may not understand the qualifications.

MR. BUTLER: The staff position is because one recent changes have made the likelihood of severe accidents remove, the TMI Lessons Learned; because capability exists to accommodate hydrogen generation well above the design basis level; because substantial studies on an accelerated schedule will be undertaken by both the staff and the applicant; and, finally, because clearly beneficial mitigation systems have not yet been defined for the Sequoyah station, staff concludes that no additional provisions for hydrogen control should be required for full-power licensing of the Sequoyah plant, pending results of the staff's and applicant's study programs and/or the rule-making proceeding.

DR. OKRENT: Could you tell me what the staff's program is and what the applicant's program is for studying this matter?

MR. BUTLER: The staff, at this point, has prepared a user's request which hasn't yet been issued, to request that its Office of Research undertake a program of studies that are tailored to the needs of ice condenser plants in general as well as other hydrogen mitigation systems in support of the staff's upcoming rulemaking proceeding.

The program is to extend over a couple of years where the early milestones for the ice condenser plants are to conclude near the end of 1981. The applicant's program is one that I believe they've described it in a set of viewgraphs they are prepared to present to the committee should the committee want to hear it, but basically it's one stretched over two years to concentrate on two potential mitigation systems the distributed ignition set and the halon system.

They intend to perform feasibility studies for these two systems and complete that program in a two-year period.

DR. OKRENT: So you are saying you have not issued the user requests yet?

MR. BUTLER: It's just through the signature chain right now. It has not been shipped.

DR. OKRENT: In the first place, I haven't understood why up to now the Office of Research has not started to look at ice condensers -- at least that is my impression, that their program has been limited to the large, dry containment.

So it would be of interest to me to see your request before July to see just what its nature is. I don't understand why it takes two years -- well, roughly about a year and a half, I guess -- to say where to put similar concentration onto it as they have done in the last few months on the large dry containment to get you a fairly good head start.

So I would be interested in knowing in July, know what the reason is for the particular schedule, and could it be staged to give you some information earlier, or so forth.

Does it include anything that goes beyond hydrogen control in the staff's request?

In other words, are you asking that the Office of Research also look at other containment modifications, possibilities and the pros and cons of the containment?

MR. BUTLER: This particular request, we are asking that they take a look at the vented, filtered containment as well as to support the offshore power system of using the ocean as a forum for filtering of vented releases.

However, the scope does not go beyond additional areas at this time, such as the core retention devices.

We believe that those other matters will be subject to further requests of the Research Office, because it needs to be covered in the rulemaking proceeding.

DR. OKRENT: But if I understand you correctly, you said for your RFP that you are about to issue, that it includes not only hydrogen control but possible pressure leak, if mechanisms are very meaningful to an ice condenser containment.

MR. BUTLER: Yes.

DR. OKRENT: And not only restricted to the ocean.

MR. BUTLER: That's one series, also, is the off-shore power bit, yes.

DR. MOELLER: Mr. Chairman, could we keep that slide up for a moment?

In recent months I have been trying to look at the wording of the staff's position because I think it very important that they be worded carefully and accurately and state what you mean.

I can read this staff position quite easily and item four says to me that since we don't know how to control the problem, it's okay to go ahead and let this plant operate. Now, that's exactly what that says and it is a very poor statement.

What I think the staff meant -- and this is only my own opinion -- but what I think you meant was items one, two and three, and then your fourth position statement is that until such time as these studies by the staff and the applicant are completed that during this interim period you will reach the judgment that the operation of the Sequoyah plant would not represent an undue risk, during this short period of a year or two or three until we have answers.

And if that indeed is your position, I think you should have said it. Because to say your item four as currently stated, that would be totally unacceptable to me.

MR. BUTLER: Your comments are well taken.

We are not really relying on that -- and we've confronted that particular issue on a couple of other occasions. It is not the staff's position that because nothing can be done about it, it's okay. That's certainly not the case.

DR. OKRENT: Is there some logic you can give us for why it's okay for the ice condenser to wait until we learn more, but not with BWR's?

MR. BUTLER: We believe that in the Mark I and Mark II BWR's, you find a greater degree sensitivity of the containment, a greater vulnerability of containment to failure in the event of substantial releases of hydrogen.

We believe that an existing system demonstrated to be successful can resolve that problem and avoid the burn.

MR. BUTLER: It will lead to pressures that are well above twice designed pressure, which we consider --

DR. ETHERINGTON: Here you are up to three times design pressure, aren't you, on your ice condenser?

MR. BUTLER: That's correct The ice condenser, three times design pressure, is something that is based on actual computation. The factor of two used for all other containments is because computations were not done on those.

Now, nevertheless, I believe if you actually computed the pressures in a Mark II or Mark I BWR containment, you would have pressures that are substantially greater than three times if you burn that hydrogen produced from 25 percent metal water reaction.

It is a relatively steep curve.

DR. ETHERINGTON: That was my question. You say you believe. You don't really have a --

MR. BUTLER: I don't have a number but I can get that number for you.

MR. EBERSOLE: How can you say that along with the statement that you consider this to be a slow burn and that in the production of byproducts of hydrogen combustion it is steam, and you have the benefit of the suppression system to relieve the pressure?

Do you take the dry well as in fact a dry containment to make your calculation unrelieved?

MR. BUTLER: We took account of the energy storage capability, the heat sink of the torus, in computing the BWR response to these burns.

MR. EBERSOLE: Is the rate of combustion such that the suppression system can't respond fast enough to cause high pressures in the dry well?

MR. BUTLER: The suppression system is there and we do rely on it to some extent. What we do not rely on is the heat removal system to take energy out of the torus because the burn operates much faster than the rate of energy removal by the RHR.

But we do believe, and we do give credit for, the energy transfer to the torus.

MR. EBERSOLE: You took the hydrogen burn, then, after the torus had been heated, right?

MR. BUTLER: Heated by a postulated LOCA, yes.

DR. OKRENT: I guess given an event that -- getting into the region where I am beyond on the order of a percent of the tie reaction, in other words, a situation that is out of hand -- I myself have little basis for assuming that there is a substantially different probability between 25 percent clad water reaction, 15 percent, 35 percent, 50 percent.

In other words, I am unable myself to find a factor, V, for example, between 25 percent and 50 percent. In fact, in my mind, the factor is substantially less.

The ice condenser at 50 percent is less

satisfactory than at 25 percent. Somehow, you say well, because it will hold below 25 it's all right, but if something else is let's say not more than a factor of two or three less probable, then our certainties are factors of ten, I wonder, you know, in the end whether you haven't just drawn a new line.

The staff used to draw a line at 5 percent which was a convenient line because the BWRs fell on one side and the ice condensers fell on the other, and again you were in a situation where you could inert the BWRs and you could inert the ice condensers and it worked out.

I suspect you don't have too much choice immediately with a course of action you're prescribing. The logic that you're using is not necessarily completely satisfactory.

If you press the ice condenser people, for example, they might be able to develop this ignition system about as rapidly as the BWR people developed inerting and now that doesn't answer everything, but I doubt that you could make a convincing case to, let's say, a third party -- the Kemeny Commission, for example, that 25 percent is a good number.

Not only is it a sound number, but, you know, it isa meaningful place to draw the line.

MR. EBERSOLE: What is so complex about the ignition system in view of the fact that if it were there and it didn't have anything to do, it wouldn't hurt anything?

Is it necessarily any more difficult than ordinary commercial igniters, for instance?

MR. BUTLER: I guess one needs to be very careful in installing ignition systems to make sure that you know the concentration of hydrogen inside containment and its distribution before you set the igniters on.

You also need to have a feel for how reliable the ignition system is, so when you turn it on, will it assuredly set off a low-concentration mixture of hydrogen?

It's these sorts of things we feel we need more information on before we proceed with that or any of the other alternatives

MR. BENDER: Walt, have you looked at D.C. Cook and made a similar analysis of it?

MR. BUTLER: When we did the work for the SECY paper, it was convenient for us to have the Sequoyah and McGuire stations analyzed, because all the paperwork was there. We had the information, and we could proceed with it.

D.C. Cook was a different story. We needed to take some steps to collect the information before we could do similar analyses. We are proceeding with that. We did some rough estimates and concluded that the parameters for D. C. Cook were on the order of those for

Sequoyah.

We didn't feel any basis for taking immediate steps with respect to D. C. Cook.

However, we do have a contract with Ames Laboratory to determine the failure pressure for D.C. Cook's containment.

MR. BENDER: Well, to some degree, then, the judgment you make about Sequoyah has to take into account the plants that are already operating that might have a comparable circumstance?

MR. BUTLER: Yes.

MR. BENDER: I think that's why the committee is pursuing to some degree the status of the BWRs, just to see if there is some incremental risk associated with this that involves a grossly different basis for evaluation than we have had in the past.

I guess my own view is that the staff has not been very effective up until now in presenting the Sequoyah licensing action in terms of its incremental contribution concerning the risks to the health and safety of the public.

Does the staff make any attempt to judge the matter on an incremental risk basis?

MR. BUTLER: I don't believe that is one of our criteria that is used in a decision to go forward with licensing. With respect to the ice condenser plants, I think we share the committee's concern on hydrogen. We would like to be able to do something more on Sequoyah, but we feel that what is there is enough for now, and we will work vigorously to identify other effective mitigation systems and will require them at that point in time when we find these effective systems and are satisfied that they should be imposed.

MR. BENDER: Well, I wouldn't want you to put words in the committee's mouth as far as taking a position, and I am not sure right now what the committee's position on the hydrogen, on the risk from the hydrogen combustion question.

The committee has made such a point of trying to have some quantitative basis for risk judgment, and here is a place where, at least if you just took the number of reactors that are involved and took a percentage of them, you might come to some conclusion as to how much incremental risk exists. And personally I am not the world's greatest proponent of quantitative risk assessment, but here is a place where we might get something from such an assessment, and I don't see anything having been done yet.

Is the staff going to do anything or is it just going to continue to make judgments on the basis of, well, whatever we can do we will do. And if it is technically feasible to improve things we will improve things. Which is about the way I hear you talking right now.

MR. BUTLER: Well, you are well aware we just went through the recent reorganization, and there is now a separate branch that is chartered to perform risk assessments. Whether they get geared up in time for taking a look at Sequoyah, I can't answer that question.

MR. BENDER: Well, it is the first issue on the agenda, and the order of priorities which exists with respect to that particular organization's activities are confusing to me. If the first thing that is on the Commission's agenda is to license Sequoyah, then the risk organization, whatever it is, ought to be looking at Sequoyah. Otherwise, they are doing things in a very abstract fashion, and I don't see that they are making much contribution.

MR. EBERSOLE: Your answer to my question about the igniters requires a kind of work that would be seem to me to be almost endless, and I would like to have you clarify it.

You said if you had igniters that might be, say, an ordinary commercial design, you would be selective in choosing as to whether you would energize them or not. And that implies that you are going to go through a process of assessing what the concentration is and be rather selective in choosing whether you would ignite or not.

I would certainly think that the rationale would be you would ignite continuously on the basis of the problem, rather than try to wait until the problem built up in your face, and that if you failed to ignite anything, so what, it wouldn't matter, and if you did ignite, it would be a very good thing that you did so as early as possible.

So I don't know where you are going to go with your studies that are evidently aimed at when you would ignite.

DR. MARK: Jesse, I think there is still a deeper question, whether the igniters in fact --

MR. EBERSOLE: Can work.

DR. MARK: -- are desirable, even if they can work.

MR. EBERSOLE: Yes.

DR. MARK: They don't change the kind of arguments which have been gone through today. You can't stand more than 25 percent even if you have igniters.

DR. OKRENT: Oh, no, you can.

MR. EBERSOLE: Well, what is the difference? You can progressively ignite.

DR. MARK: Only if you are going to assume the time across which things happen.

MR. EBERSOLE: Yes.

DR. OKRENT: No, but you don't generate the hydrogen instantaneously.

DR. MARK: True.

DR. OKRENT: If you are in a situation where the hydrogen is being generated, let's say the whole core is going in a minute, you are in a different ballpark anyway.

DR. MARK: That is very complicated. You address a limited range of scenarios, and if that is important, fine, and if it isn't that needs to be found out.

Harold?

DR. ETHERINGTON: I would like to have a better understanding of the numbers in your best estimate of existing capability. You mentioned a slow burn. Supposing the burn were instantaneous, apart from any question of pressure waves, how much difference would that make in the calculated pressure? How much credit are you giving for the slowness of the burn?

MR. BUTLER: Yes. I think we are giving no credit for the slowness of burn. The only reason for that is the dynamic effects on the structures.

DR. ETHERINGTON: All right. The second question is: if you had 10 percent hydrogen, what degree of combustion are you assuming? Are you assuming all of that 10 percent burns or burning down to 2 percent or what?

MR. BUTLER: Let's see, the answer to that question should be in the SECY paper. I don't know it directly. I suspect it is either 2 percent or down to zero. Bill Milstead was the one who did those computations. And, Jim, do you have those notes by any chance?

We will have to get back to you on that.

DR. ETHERINGTON: All right. Now the third question, supposing all of this hydrogen were in a lower compartment and you had a rapid combustion there, would that alter your conclusions as to the containment pressure capability?

MR. BUTLER: It might. We did not consider localizing it.

DR. ETHERINGTON: Isn't that a likely condition though? You are really assuming the hydrogen gets uniformly distributed before it burns?

MR. BUTLER: Yes.

DR. ETHERINGTON: I would think it is quite likely that it would burn close to its source sometimes.

MR. BUTLER: Well, we assumed that there was substantial transfer of atmosphere between the upper and lower compartments.

MR. EBERSOLE: That regards fan transference, and one of the postulations is you don't have fans?

MR. BUTLER: We didn't postulate that.

MR. EBERSOLE: Well, there is no direct coupling without fans of the lower and upper compartment. You have to drive it forceably.

MR. BUTLER: That is right. If you had a small LOCA, for example, you would --

MR. EBERSOLE: That is right, you would not drive that couple. It would all accumulate in the lower compartment, the hydrogen would.

MR. BUTLER: No, if you had a small LOCA your doors would open and you would have that transfer.

MR. EBERSOLE: I think it takes a considerable LOCA to open the doors. A small LOCA wouldn't.

DR. MOELLER: It is one pound per square foot, I think.

MR. BUTLER: It is a very small pressure differential that is needed to open those doors.

MR. EBERSOLE: Well, this accident happens after the differential pressure has disappeared to a great extent, and the initial pressure differentials are now down and are literally hardly anymore than that you associate with the fan-driven pressure plus whatever long-term release there is from the primary --.

I think there is a substantial potential that you might get quite high concentrations in the lower compartment if the fans stop.

MR. BUTLER: Well, of course that warrants further examination, but we believe that the containment's spray system and the fan coolers both participate in substantial mixing.

MR. EBERSOLE: The spray system doesn't get into the lower compartment.

DR. MARK: Charlie, I think you had a comment to call for.

Does TVA wish to comment on this?

MR. MILLS: We want to make a comment regarding the fan. Those fans are on emergency power. They run off of diesels. To make sure you are aware of that.

MR. EBERSOLE: Right. I think the postulation is that you may not have that power.

MR. BUTLER: For a protracted period?

MR. EBERSOLE: Yes. I don't know that.

MR. BUTLER: That has not been to date a design basis, but it certainly is something that we are considering.

MR. EBERSOLE: Well, you are taking the ground rule in your consideration of hydrogen potentials, you will in fact always a multi-power to mix the containment atmosphere with the hydrogen. Is that a baseline that you are going to continue with?

I believe Dr. Okrent described a scenario where you didn't have that privilege.

MR. BUTLER: Well, again I would have to defer to what the study program comes up with, and among the things they have to determine is what would the design bases be, what would the design criteria be for these mitigation systems.

MR. EBERSOLE: Yes.

MR. BENDER: Do we have somewhere your current postulations that you are using? Are they written down somewhere?

MR. BUTLER: The assumptions for these analyses are written in the Commission paper, SECY 80-107, dated Feb 22, 1980.

DR. LAWROSKI: Could you refer me to a report where either analytically or experimentally is given information on hydrogen concentration in something like two million cubic feet -- this is not two million -- but in a containment the concentrations of hydrogen and the volume of such concentration, taking into account the bouyancy of the hydrogen. And let's say that you have lost the fans right from the beginning.

Do you have any such reports?

MR. BUTLER: Is the issue there the mixing of the atmosphere, free convection mixing of the atmosphere?

DR. LAWROSKI: Yes, and the volumes of hydrogen with a substantial concentration as it comes out -- you get the hydrogen coming out warm into the containment and it doesn't quickly and automatically mix --

MR. BUTLER: Yes.

DR. LAWROSKI: -- but we will have a certain buoyancy. And I would like to get some idea of how large a volume you could have of substantially high concentrations, higher than, you know, the 4 to 8 percent.

MR. BUTLER: In the recent presentations sponsored by the Office of Research in Gaithersburg, Bureau of Standards, I believe there were a couple of papers presented by people from West Germany, where they have done some experimental work involving the injection of hydrogen at the bottom of a containment and observing the transport of that hydrogen upward.

We can get you the reference to that.

DR. LAWROSKI: That is the kind of stuff that I am looking for.

MR. BUTLER: Yes.

MR. BENDER: When you make assumptions about the release of the hydrogen, which presumably is coming from the reactor core, what are you assuming about the rate of release? How is it getting out of the reactor system in your analysis?

I know how it got out -- I think I know how it got out at TMI too. I am not sure, but I think.

(Chuckles.)

But what is your current view of the ways in which the hydrogen would get out of the containment -- I mean out of the primary coolant system.

MR. BUTLER: Basically we assumed that the hydrogen left the primary system simultaneously with its generation, that there was no accumulation in storage in the primary system prior to release.

MR. BENDER: Is that a rational kind of approach? You are going through a very rational analysis to determine the burning characteristics, but I have a hard time accepting something that says the hydrogen will come out as soon as it is generated, just because I think that is an unlikely kind of scenario.

MR. BUTLER: But I don't believe that the computations are sensitive to that assumption unless you go to the extreme of saying you have got it all bottled up and then instantaneously you released it.

Then you would have all kinds of pocketing concerns.

MR. BENDER: Well, I understand what you are saying, but I am looking at it from the standpoint of what I have to protect myself and how fast I have to act and a few things like that that might influence the judgments about whether it is all right to wait until later and in fact perhaps never do anything about the hydrogen combustion question. It has to do with how quickly I can sense it, what I can do about it to mitigate the circumstance and things of that sort.

I don't accept out of hand that if there is enough time I can't do something besides inert to protect myself against hydrogen burning. Conceding that the operators wouldn't understand the circumstances prior to that, maybe I would take that viewpoint. But right now I am of a mind to say we are putting in a lot of equipment to tell us when hydrogen exists, and we are putting in a lot of equipment which perhaps could suppress burning if it existed, and right now you are saying the hydrogen suddenly appears, and then doing a very careful analysis to determine whether it would burn or not.

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I guess I don't think the front-end of the accident is being looked at very hard.

MR. BUTLER: I don't believe the results are that sensitive to that assumption. Basically you are tied to the heat removal rate through the RHR. The heat removal rate has to run through 10 or more hours before you can remove enough energy to accommodate the energy from the burn. So that if the releases are short relative to 10 or 20 hours, then the RHR system is not effective in dealing with it.

MR. BENDER: But I know among other things that steam itself suppresses burning and suppresses the combustion of hydrogen, and it may be an important suppressant.

MR. BUTLER: Yes.

MR. BENDER: And I don't know whether you are taking any credit for it or not, but I have a hard time believing that it doesn't exist concurrently with the existence of hydrogen, TMI-2 notwithstanding.

MR. BUTLER: Yes, you need to have a relatively high concentration of steam for it to be effective. And if you say that you have got inadvertent actuation of sprays or have no control over the sprays, then you can't assure that you got the necessary concentration of steam.

MR. BENDER: Well, I think if you put enough "if's" in everything, you will guarantee that the accident will get out of hand. I promise you that. What I am trying to do is look at

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things somewhat in a logical and probabilistic circumstance.

DR. MARK: Charlie, I think it is really true that the present position on hydrogen is indeed a tentative one, based on a rather straightforward, simple, not-event-determined scenario, and that we are asking questions which there is no hope of getting present answers for. And I am not sure if this hasn't brought us about as far as we can get with respect to Sequoyah on this matter, unless Charlie would suggest that we call for something specific besides. And Harold has a question.

DR. ETHERINGTON: Could I shift the question a little bit, Mr. Chairman? The question of the ultimate capability of a containment has always bothered me. It is one thing to say that the design stress is, let's say one-third of the specified ultimate, and in obsolete terminology perhaps, you have a factor of safety of 3. It is a reasonable presumption that it is apt to have gross failure until you got up to perhaps about three times the design pressure.

It is another thing to say that you could go up to high pressures, getting large plastic deformation, uneven deformation, with some components almost surely overdesigned and not stretching at all, and still not have any ruptures of seams or material leakage.

When you speak of the capability of the containment do you make some kind of analysis to show that it is not going to

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leak, or are you just basing it on the ratio of ultimate stress to design stress?

MR. BUTLER: It is basically the latter. It is the ultimate stress, the design stress --

DR. ETHERINGTON: Well, that isn't good enough if you get down to a serious consideration of it, I would say.

MR. BUTLER: We agree with that. Our only point is that we are talking about an interim period between now and when we do something about it.

DR. ETHERINGTON: My comment is made entirely in that context. I think it is something that you probably will want to look at when you get around to it.

MR. BUTLER: Yes.

MR. MATHIS: Walt, you had one other slide and kind of a summary, I believe.

MR. BUTLER: I think it is not necessary. It is in the subcommittee's minutes.

MR. EBERSOLE: One small residual matter. We have always talked in the context of pressure here. I think this hydrogen burn implies very abrupt high temperatures distributed throughout the containment which is going to have an undesirable effect on certain pieces of equipment that you might want to keep. So I think in the course of your investigation you might ascertain what the temperatures are as distributed throughout the containment, even though they only last a few seconds.

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MR. BUTLER: Yes, that matter was looked into, and it is reported in the SECY paper that I referenced earlier.

MR. EBERSOLE: Is the equipment capable of taking that spiking temperature?

MR. BUTLER: It is our judgment that the spiking temperature is high, but the duration is short and that the heat transfer is not fast enough to raise the equipment temperatures to damaging points.

MR. EBERSOLE: Thank you.

MR. MATHIS: Mr. Chairman, I think we now have got a logical break time in the agenda.

DR. MARK: Well, the next item, I believe, will be comments on the present program at Sequoyah from the TVA representatives, and in order not to interrupt that why don't we have a break and resume about twenty-four minutes till eleven.

(A brief recess was taken.)

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DR. MARK: We can resume the meeting then.

MR. MATHIS: Okay, Mr. Chairman, the next item on the agenda is the discussion of the special low power test program, and I guess the first part of that the TVA is going to present. I will ask Larry Mills of TVA to take over from here.

Larry.

MR. MILLS: This is Larry Mills, Tennessee Valley Authority. We will ask Joe Banham from our Nuclear Power Operations Division to make this presentation for us.

MR. BANHAM: I think Carl Stahle basically covered the schedule that the Sequoyah plant is currently on, and for running the special test program we are looking at initial criticality around the first week in July. After about seven days of seal power physics testing we will begin the special test program, and we expect to be able to complete the special test program in about three weeks.

So he has already discussed that schedule. I would like to talk first about the objectives, overall objectives of the special test program. Those objectives are: provide a significant demonstration of reactor operations in natural circulation modes under both normal and certain degraded conditions; through this demonstration to provide operator experience and training under the various conditions; and, thirdly, to verify simulation models of training techniques used on the Sequoyah simulator. We have coordinated these tests very closely with the staff for the Sequoyah simulator. We have run portions of those tests that can be run on the simulator there with all our operations crew.

We expect to work very closely with them on the results of the special test program.

Now I would like to look at the individual tests and how we meet those objectives in each of the individual tests. I have got the tests in the order that we are actually going to perform them during the startup test program, and a little bit later I will go through some slides that show you exactly how they are scheduled from day to day.

There was a good bit of interest in the subcommittee meeting on Monday on exactly how we are going to bring shift crews in. So I will discuss that after we talk about what each individual test does.

The first test we will run, test number one, is just the basic natural circulation test where we trip the reactor coolant pumps, and this test will demonstrate decay heat removal capability of natural circulation, demonstrate the pressure and level response to loss of forced circulation, demonstrate feedwater flow control required to maintain adequate cooling under natural circulation conditions.

Again this is just the basic natural circulation test. This test will be run first. All the operating shifts will run this test prior to running any of the followup tests, any of the tests we need to look at the degraded levels of equipment.

DR. CARBON: You are going to run tests at several different initial power levels, aren't you, tripping out?

MR. BANHAM: Well, several of the tests are run from different conditions. Now this one we don't really expect to run it now at various power levels.

DR. CARBON: What power level will it be then?

MR. BANHAM: I believe this one, we trip the reactor close to 3 percent.

DR. CARBON: Three?

MR. BANHAM: Right. Some of the tests were run at 1, some were run at 3. Some of the tests were initiated, the tests that are of long duration, are initiated at 3 percent power and then we slowly reduce power to 1 1/2 percent over roughly an hour. So the tests that are of long duration we actually reduce the power level.

DR. MOELLER: At the power level that you will be operating at, do you anticipate that natural circulation will be a continuous flow process?

Why I ask this, and I realize conditions of power and many other conditions are different, but I understand at TMI that some of the time the natural circulation was a burping process.

You would have more of a continuous flow?

MR. BANHAM: We expect a continuous flow. As you will see in some of the other tests, you know, we will run tests where we interrupt natural circulation and reestablish it. But for this particular test we just expect, you know, established runs continuous flow.

DR. MOELLER: How do you interrupt -- what do you mean by that?

MR. BANHAM: We will --

DR. MOELLER: Okay, I will wait.

MR. BANHAM: When we go through, we will identify those tests and identify how we expect to do them.

Okay, test 9A, forced circulation cooldown, this is a test with all the reactor coolant pumps running, and it is strictly a test to determine an X core detector indicated by a corrective factor for use in later tests where we are going to take the reactor coolant systems down in temperature below normal operating levels.

Here we are trying to account for the shadowing of the downcomer temperature on the X core. This test really is an information-only test and to determine this power correction factor. So it actually will only be run once. And again it is with forced circulation.

Special test 3, natural circulation for loss of pressurizer heaters, the objectives in this test are to demonstrate the ability to maintain natural circulation with loss of pressurizer heaters for determining depressurization rate after the reactor coolant pumps and pressurizer heaters have tripped, and to demonstrate the saturation margin for decontrol using charging flow and secondary steamflow.

MR. EBERSOLE: Pardon me just a minute. On that 9A what sort of accuracy do you expect on a power measurement where you are somewhere near 3 to 5 percent and you have full flow through the main coolant pumps, virtually no delta t and a fairly crude measurement of flow itself?

Again, what is the accuracy of the power level measurement?

MR. BANHAM: Okay, we expect to be able to do it within 2 percent of raise power, and that is based on, as you say, the inaccuracies in the RCS flow rates, which we will be using the best estimate Westinghouse calculations.

MR. EBERSOLE: Well, what I meant is, if you are at 5 percent power it is 5 percent plus or minus how much percent of 5 percent?

MR. BANHAM: Well, it is 2 percent of --. So if you are at 5 percent, you may be at 7, you may be at 3.

MR. EBERSOLE: So you are going to be willing to miss your power estimate by a factor of 2 or 3.

MR. BANHAM: That is correct.

MR. EBERSOLE: And it won't matter, is that what you are saying?

MR. BANHAM: That is correct.

And the search analysis that Westinghouse did, you know, is based on that fact. That is in determining the set points for reactor trip, we reduced the reactor trip set points on the intermediate range and on the power range low set points.

MR. EBERSOLE: Whatever finding you may make then on natural circulation efficacy will be based on a premise that you might have been at a factor of 2 or 3, greater or lower power?

MR. BANHAM: That is correct.

Test No. 5 is actually a followon of Test No. 3. Test No. 5 is natural circulation at reduced pressures. And again the objectives being basically the same, here we will take specific data on the use of a saturation meter to monitor -- -- saturation.

We will also use the auxiliary sprays to increase the depressurization rate, and again we will demonstrate the effectiveness of charging the secondary steam flow to control saturation.

Again, the first part of the test was just to identify the depressurization rate with the pressurizer heaters off, and this part of it, we are going to, in addition to having the heaters off, we will use the auxiliary sprays to increase the depressurization rate.

Test No. 4 is the effect of the steam generator of secondary site isolation on natural circulation. The objectives are to determine the effect of steam generator isolation on

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natural circulation, to demonstrate that natural circulation can be maintained, partial loss, deep sink. Demonstrate the reestablishment of that natural circulation in isolated steam generator.

Now this particular test is one where we are going to isolate up to two steam generators, and here we expect obviously a decrease and almost a stoppage of flow in the isolated generators.

We will show that we can maintain that condition, that we can maintain natural circulation in the active loops, and then we can reestablish natural circulation in those isolated generators.

Test No. 2 is natural circulation of simulated loss of offsite ac power. Here we are demonstrating that we can establish natural circulation and maintain it during a loss of offsite power and from restoration of that power we can transfer the emergency loads from the diesels back onto the offsite power.

This is the test we will be showing with the auxiliary feed pumps, motor-driven pumps only, running, that we can lose offsite ac power, that we can reestablish those pumps and reestablish pressurizer heaters on loss of offsite power.

No. 7 carries that scenario further in that we lose not only -- simulate the loss of not only offsite power but also onsite ac power, the objective being to demonstrate the following loss of all onsite and offsite power, including the emergency diesels, natural circulation can be maintained; verify hot standby conditions will be maintained on manual control, voluntary feedwater, steamflow; verify the critical plant operations can be performed using emergency lighting, and that the 125-volt vital battery can supply the emergency loads.

Here we are selectively taking out equipment which we have looked at and judged to be necessary to maintain natural circulations.

DR. MOELLER: The third item there is simply to be sure they can see the dials or charts?

MR. BANHAM: Right. That is just to show that the emergency lighting can be carried from the emergency lighting vessel. That is one load that is on the batteries -- and to show that that is adequate lighting; also to show -- in doing this test, go on to those locations in the plant where manual operation is required, and we have installed permanent emergency lighting in those areas too.

So this will show that that permanent emergency lighting is adequate for this type of an operation.

MR. EBERSOLE: Are you using distributed emergency lighting from battery packs throughout the plant?

MR. BANHAM: That is correct. In certain locations, again where we looked at the test and evaluated it with, you know, access to this area and operations here as it is necessary.

MR. EBERSOLE: All right.

MR. BANHAM: Particularly for the auxiliary feed pumps, the level control valves, and the main steam BRB's.

MR. EBERSOLE: I believe you told the subcommittee that this was not really a true, full loss of ac power test --

MR. BANHAM: That is correct.

MR. EBERSOLE: -- and you were going to exclude certain systems --

MR. BANHAM: That is correct.

MR. EBERSOLE: -- and you were going to make a list?

MR. BANHAM: That is correct.

MR. EBERSOLE: Are you prepared now to tell us?

MR. BANHAM: Not at this time but we can go --

MR. EBERSOLE: Okay. You will eventually tell us how many systems are still left running?

MR. BANHAM: Right. Again what we will do, for instance, as was mentioned, I guess in the subcommittee meeting, the containment. The containment coolers and the air-handling units and all those things in the containment will be left on. So systems like that that, you know, we can look at the response, for instance, of the containment, we know that containment response, we know how long those things can be out, we didn't really feel like those were as applicable to this test as far as operator demonstration as the other things.

For instance, a lot of the things, we are taking out the coolers in the rooms where the auxiliary feed pumps are, the control room ventilation, things like that we are taking out.

MR. EBERSOLE: Have you conceded in this plant, if you really lose all offsite power instead of just tests like this, that you will lose the main coolant pump seals and thereby establish a leakage path?

MR. BANHAM: I believe that is correct.

MR. EBERSOLE: So you are prepared to take that leakage path with the full loss of power case?

MR. BANHAM: I believe that is correct.

Test 8 is establishment of natural circulation from stagnant conditions. Here the objective is to verify natural circulation can be established from stagnant no-flow conditions in the primary system.

In this test we will actually have the reactor subcritical, have all of the steam generators isolated, and then slowly bring the reactor from subcritical to 1 to 3 percent power. And simultaneous with that we will be opening the steam dumps and establishing feedwater to the generators and with this simultaneous action establish natural circulation from essentially no-flow conditions.

Test 9B, boron mixing and cooldown under natural circulation conditions. The objectives here are to demonstrate that reactor coolant system can be uniformly borated following the natural circulation, and then we have the capability to cool down the primary system using the steam generator.

Test No. 6, cooldown capability of charging and letdown, here the objectives are to demonstrate the capability of charging and letdown to cool down the reactor coolant system. This test will be run with one reactor coolant pump running, and we will demonstrate maximum charging and letdown, look at the depressurization rate or temperature change rate, and then also isolate the letdown, minimize charging, and look at the heatup rate.

Okay, this test, the reason it is shown, even though it is the easiest to do, shown as being last is in the schedule we will actually do that when time permits, when the unit is in a hot standby condition, and hopefully catch that as we go during the program.

This is the special test schedule, and as you will see, we think if everything went perfectly and we could schedule Day 1 immediately following Day 2, it takes about 9 days just to run a test, obviously we in cases don't expect to be able to exactly schedule Day 1 immediately after Day 2. So there will be some variations.

But this is the basic approach that we went to to get our operators the hands-on experience and training during the special test program.

You see Day 1 is basically just Test 1, and it will be run five times with each shift running at once.

What I am referring to here, three regular shifts of 7 to 3, 3 to 11, 11 to 7, ROW is what we call Relief and Other Work, and then the off-shift of those people that are scheduled to be off that is their scheduled off day. So we are bringing the Relief and Other Work and the off-shift people back in on the 7 to 3 and 3 to 11 shifts to do Test 1.

Day 2, we will run Test 9A. And again, as I mentioned, 9A is the one where we are determining the X core detector calibration factor. That test alone would be run once.

Tests 3 and 5 will be run Test 5 immediately following Test 3, will be run the latter part of the Day 2, the first part of Day 3.

Again, I have indicated here that the off-shift on the 3 to 11 will be running Tests 3 and 5.

Here is a case where there was a slot and we scheduled Test 6 to be run on this day.

Day 4, we are running Tests 3 and 5 and Test 4. Test 4 actually, indicated up here by the asterisk, Test 4 is actually only run completely twice. But I have indicated that on each shift you isolate at least one steam generator and return at least one steam generator to service. So the test will only be run three times -- twice rather over the three shifts. But each shift will return and isolate at least one steam generator.

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Test 2 and Test 7 are the next two to be run, and again with 7, the more severe test, run after Test 2.

As I have indicated on Test 7, the first time we will do all portions of the test. A second time we will leave the power sources normal for the test. You know, the power sources being normal don't affect the manual operator action that is required during that test at all, because we are selectively de-energizing equipment, isolating control air.

So it will not affect the actual operator training or the, for that test. So the power sources are left normal.

MR. EBERSOLE: I wonder if you could elaborate on what you mean by isolate a steam generator in view of the fact you don't have any primary coolant valves?

MR. BANHAM: Well, okay, it is isolation on the secondary side.

MR. EBERSOLE: So you will get reverse flow through that steam generator, and it in fact will be absorbing a considerable amount of the -- well, you are not going to cool it though on the secondary side?

MR. BANHAM: No. See, we are isolating the feedwater and the MSIV's.

MR. EBERSOLE: Is this going to change the flow pattern?

MR. BANHAM: Right.

MR. EBERSOLE: Okay, does your flow system detect

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the fact that that by-pass is occurring around the steam generators?

MR. BANHAM: No.

MR. EBERSOLE: Oh, it doesn't?

MR. BANHAM: Day 7, Test 7, again run for the third time. Test 8 is run, Test 8 is repeated. You will notice Test 8 and Test 9B are the only tests that we are actually only running twice. And I guess we have had several discussions with Westinghouse with the last few days, and we are now saying that Test 8, after it is run the first time, Test 9B also, the boron-mixing part of Test 9B, will have to be fully evaluated, the results of those tests, by TVA and by Westinghouse prior to running it again the second time.

We are going to have to look very closely at the results of these two tests before we decide to run them again. These two involve actually more risk and have more uncertainty associated with their results than any of the other tests.

So right now we have got them scheduled to be run once, with the hopes that after satisfactory evaluation we can then run them a second time. Those are our current plans.

As I indicated at the bottom, you know, Test 6 will be performed at various times during the program when we have hot shutdown, and all five operating groups will complete that test prior to concluding the test schedule.

DR. MOELLER: Well, under 9B will there already be, or there will already be boron in the coolant --

MR. BANHAM: That is correct.

DR. MOELLER: -- and you are adding more?

MR. BANHAM: That is correct.

DR. MOELLER: And will you try removing it while it is in natural circulation?

MR. BANHAM: Well, actually what our plans are, the way we have gotten 9B arranged right now, we would actually have Bank D essentially fully inserted. We would borate it out, and then we would do the cooldown portion of the test with Bank D at 160 SEPs and the boron concentration established in the first part of the test.

That way, one reason we are doing that is because the Test 9A that we ran, you know to get the X core shadowing effect, we ran that and we are going to run this portion of the test at the same basic rod position that we ran that test, and this will put us in that configuration. So we will leave the boron concentration where it is. We are actually making about 100 ppm change over about two hours.

DR. MOELLER: What would it be from where to where? A 100 ppm change?

MR. BANHAM: I guess it will probably be in a range of a thousand to eleven hundred, something like that.

DR. MOELLER: Okay, thank you.

DR. ETHERINGTON: There will be predictions of all the

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quantities to be measured during the tests?

MR. BANHAM: We have made steady state predictions of the delta t's and the flow rates and things like that. Now we have not done group transient type to look at the timeframes, but we have done steady state predictions, and we have looked at the test results from other natural circulation tests that have been performed.

So we do have a table of predicting responses for various power levels with the expected delta t's and expected flow rates. Of course flow rate we really can't measure, but it does have the expected delta t's associated.

DR. MOELLER: Will you inject the boron at a slower than normal rate since you are on natural circulation?

MR. BANHAM: Really I am not exactly sure. I don't believe so.

Steve?

Okay, it is essentially the same rate we would -- that is right, I guess that is 500 ppm per hour -- 500 pcm per hour, which is -- I guess that is a pretty standard rate.

MR. EBERSOLE: Is one of the systems you are not going to disable in your full ac power failure test the control room air conditioning complex?

MR. BANHAM: No, the control room air conditioning will be off.

MR. EBERSOLE: It will be off?

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MR. BANHAM: Yes.

MR. EBERSOLE: Thank you.

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MR. MATHIS: If there are no other questions or comments there, our staff, I guess, present their status of their review. Bob.

(Pause)

MR. BAER: My name is Robert Baer, and I'm a member of the NRC staff. And I'll just briefly give a summary of where we stand on the staff's review of the safety evaluation, put things somewhat in perspective. I have one slide here that discusses the chronology of when various things happened on the safety analysis; and then these dates are approximate.

We received the safety analysis from TVA on about April 9th, 1980. And we did have a series of questions. We drafted these up and telecopied them to TVA and to Westinghouse on the 18th of April, which was a Friday afternoon, if I remember correctly. And we met with them on the following Wednesday, discussed the questions, and as a result of our discussion some of the questions were eliminated and a number of others were revised fairly extensively. And we sent out questions on May 5th, 1980.

And for a moment let me jump over this spot.

We received responses, they were dated May 20th but with the U.S. Postal Service and our own internal mail system we really got the responses in our hand just really about a week and a half ago, on 5/27.

In the interim -- well, part of the difficulty that we

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had with the -- part of our questions on the safety analysis stemmed from the fact that at these low flow rates the Westinghouse normal calculational model is not suitable, or completely suitable, for predicting the occurrence of DNB or precluding the occurrence of DNB. And one area that we did have a bunch of questions was that for certain transients, like rod withdrawal accidents, ones that we consider of moderate frequency and normally have a criteria that there shall be no DNBR, Westinghouse and TVA were not able, in their initial safety analysis, to preclude the occurrence of DNB for those transients.

On May 9th, they sent in a supplement to the safety analysis, that we received about May 16th, which described why they were having this calculational difficulty. And frankly, the tone was very negative and we were quite concerned. Since then we have had a number of phone conversations with TVA and Westinghouse about this, and on May 30th, last Friday, they followed up with a telecopy where they had looked at DNB for these moderate-frequency events on a more realistic basis.

Now, they still -- what they've done is, they've done several things -- extrapolated the W-3 correlation where they felt it was reasonable to extrapolate it outside the normal flow range, they looked at some pool boiling data, they looked at some data developed by Tong, they looked at some data that Roger Mattson was a co-author of; and they've come to the conclusion that they would not expect DNBR to occur for any of these transients of moderate frequency. And that is certainly quite reassuring from our point of view.

The heat fluxes are very low. And I think one's engineering judgement would be that there wouldn't be any DNBR. And now Westinghouse and TVA has done some documentation of that.

So that relieves, certainly, one of our major concerns.

We still have to fully review the responses to our questions and review, perhaps in a little more detail, this tele-copied information that we received just last Friday. But things are, I think, reasonably well resolved. We have to review them and perhaps we'll have a few residual questions.

There's one more open area of concern, that again I hope we're fairly close to resolution on. The -- a number of the automatic reactor trip functions and automatic safety injection functions are by-passed during these low-power tests, for a variety of reasons, mostly that -- in some cases you just couldn't run the test if you had those trip functions, in other cases they're concerned about spurious safety ejection -- safety injection and the resultant thermal transients.

One of the criteria used for operator action is the amount of subcooling observed during the test. The approach that TVA will use is, they will monitor all the core exit thermo-couples -- and there's about 60 of those, 60 or 61 -- plus the four hotleg RTDs and auctioneer those temperature readings and use the lowest -- I'm sorry, the highest temperature. They will

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also auctioneer several pressure inputs and use the lowest pressure.

So that, on the face of it, appears to give a very conservative value of subcooling. However, all of the core exit thermocouples in Sequoyah are in the UHI guide tubes, and the flow paths in those guide tubes are really not well -- well, they're not known at all during natural circulation. The core circulation is very complex; the flow is downward in some tubes and upward in other tubes. And it really isn't clear, when they run the first test, as to how accurate or how meaningful those temperature readings will be. The hope and the expectation is that after running the first test and evaluating the data, one can come to some positive conclusions about the validity of the temperature readings for the core exit thermocouples. But for the first test, it's the staff's opinion that only the RTDs in the hotleg are relatively certain of providing meaningful information. And we do have some questions on the possible inaccuracies of those thermocouples relative to the set points at which the operator would be taking action. And we hope to get that resolved, I am hoping, this coming week. And that should be, I think, the last major technical issue; and it would be just a matter of writing up the safety evaluation at that point, and I'm quite confident we can do it in a schedule consistent with the test schedule that Sequoyah just described.

And that concludes my formal presentation. I'm available for questions, though.

DR. SHEWMON: Well, in this set of questions, did you get back into the reactor vessel nozzle cracking problem, and what the basis is for feeling sanguine about that?

MR. BAER: No, sir. This was looking at specifically the special safety analysis provided for the low-power test program. I'm not familiar with --

DR. SHEWMON: Okay. They aren't -- this, we're going to hear all this again before they come back in for a regular operating license?

MR. BAER: I'm the wrong person to ask that.

DR. SHEWMON: Carl?

MR. BAER: That's for the project people.

MR. STAHLE: Would you ask the question again, please. We didn't quite hear it.

DR. SHEWMON: The question has to do with the reactor vessel nozzle cracking that was found in these European, or Rotterdam-made vessels.

MR. STAHLE: Yes, sir.

DR. SHEWMON: And what I have in my hand is a letter from Anderson, dated January 31, which promises a variety of things, and another one, December 13; I've never seen the follow-up. I'd like to know what basis the staff has for feeling that this problem -- that they understand this problem and that it's not of concern, or what the concern is to them.

MR. STAHLE: Mr. Knight is not here at the moment to address the question specifically. But let me respond to it in this manner.

That subject, of course, was brought up. And the decision was made at the time, in light of the vessel being from Rotterdam, that there should be a thorough ultrasonic inspection of the nozzles on the Sequoyah vessel number one.

With that decision, TVA did perform the inspection ultrasonically of the vessels, reported all of the data. The staff made its analysis, all of which is -- was reported in a, actually in a paper to the Commissioners, as part of our review of Sequoyah number one.

The bottom line, I think, of the report, as I recall it, is: we found, based on the analysis by TVA-Westinghouse, our own inspection and review of the data, that the data that we've seen, some nozzle cracking was quite acceptable. This is all formally reported. I can provide you the report and so forth, if you wish, if you do not have it.

DR. SHEWMON: Just a minute.

Dick, there's a note here that you say this is on the July meeting agenda?

(Pause)

Okay, is there any summary of this report that you're --

MR. STAHLE: Yes. It's in the Commission memorandum, which I can forward it to you. The plan I will follow, plan to

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follow, is, this would -- this would be incorporated in the next supplement as a matter of routine, incorporating our analysis that had been submitted to the Commissioners.

I believe we had a --

DR. SHEWMON: By the time your lawyers get things, putting in SEREs, I don't find much technical content that's said for performing. Could we get some summary of --

MR. STAHLE: Yes, sir.

DR. SHEWMON: -- what size the cracks the French found, what size these found, what the analysis is that says that they are quite livable with?

MR. STAHLE: There's been a very detailed report on this, certainly, from TVA and our own analysis of this data. So I think this matter, as far as Sequoyah, in the vessel, has been thoroughly examined and reported. So it would be a matter of my administratively providing this information to you.

DR. SHEWMON: Good. Thank you.

MR. STAHLE: I think, referring to additional information.

DR. SHEWMON: I'm sure that says there's nothing to worry about. I'm not sure it gives much basis for why there's not anything to worry about. But it might be there; we can look at it.

MR. STAHLE: Sir, excuse me, I want to make sure that I correct myself here. The supplement number one contains a large amount of this information.

DR. SHEWMON: Okay.

MR. STAHLE: If you have not seen our --

DR. SHEWMON: I have not read it.

MR. STAHLE: -- supplement number one, dated February 1980. But the report itself, you know, the Westinghouse-TVA report, is available, if you wish to see that.

DR. SHEWMON: Okay. A different question in that vein: Could you tell me what happens if a control rod guide tube flexure support pin fails in one of these reactors and what TVA has told their operators to look for if one does go?

MR. STAHLE: I think TVA would have to respond to that at this point.

MR. MILLS: Sir -- Larry Mills, Tennessee Valley Authority -- you are aware that we replaced all those pins in the Sequoyah unit.

DR. SHEWMON: I've never seen a basis for why you thought this solution was better than the one you had before, though I suspect Westinghouse has a basis for it. But my question still is, if one goes, what does the operator see?

(Pause)

MR. MILLS: Sir, we don't think there's any way that the operator would be able to detect this. If you'd like for us to -- you know, we have -- it has been somewhat analyzed as to any results of the pin breaking or cracking.

DR. SHEWMON: Well, the Japanese found it just with a loose parts monitor, or what?

MR. MILLS: Maybe I can ask one of the Westinghouse gentlemen here that's more familiar with the actual analysis that they did to address this, then.

MR. JOHNSON: Bill Johnson, from Westinghouse. The Japanese discovered the guide pin cracking problem during refueling. So it was a visual inspection when the upper internals were removed.

DR. SHEWMON: You mean they took the pins out and saw a crack? Or they found parts someplace?

MR. JOHNSON: They only determined that it was cracked. There were no parts.

DR. SHEWMON: And they determined it was cracked when something wouldn't move --

MR. JOHNSON: Yeah.

DR. SHEWMON: -- is that it?

MR. JOHNSON: That's correct.

DR. SHEWMON: They couldn't move the fuel?

MR. JOHNSON: The guide tube. That's correct.

DR. SHEWMON: Okay. And we're corcerned about this in plants of this vintage because why? Or the staff is concerned about it why?

MR. JOHNSON: Well, the concern for the cracked guide pins was, one, if a guide tube pin would fail in some manner in

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which, for instance, a part could become dislodged or move around the system, potentially cause either some damage or some blockage, or if the failure would result in, say, misalignment, then, of a guide tube, which would prevent or disturb the potential flow of UHI when needed during a loss-of-coolant accident.

DR. SHEWMON: Okay, thank you.

MR. MATHIS: Any other questions of Bob?

We'll move on to the next item of the agenda. And this is Research's analysis and evaluation of this.

Yes?

MR. STAHLE: Yes. Carl Stahle. Brief introductory remarks.

This next item came up at the subcomittee meeting, namely, whether or not we had, or were performing, pre-prediction type analysis. I indicated that we were, or had been, and would have someone at the meeting today.

At the time we were reviewing the low-power test program, concurrently with TVA and Westinghouse's review and making its own pre-prediction type of analysis, we decided to ask of Research to look into this matter if they will. They, in turn, assigned this task to Brookhaven. So we were fortunate, in the short time we had, to ask Mr. Perkins, from the Brookhaven National Laboratory, to give us a very brief report on this matter, based on the studies they've done.

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Mr. Perkins.

DR. PERKINS: As Mr. Stahle has indicated, this was emphasized to me, that this was to be a brief presentation. We did the analysis at Brookhaven using RETRAN, and specifically for test one and technical support of the NRC staff. And for your review, if you have already forgotten, the first test chronologically and numerically is a constant power 3 percent nominal level trip from full flow conditions. Some of the other items are outlined on that, on that slide. The objective was to provide an independent assessment of the performance of the test. And our overall results are pretty much summarized on this table that we have put together with the NRC guidance as to what the uncertainties in measurement would be.

Basically, we have done calculations -- again, using RETRAN -- transient calculations, but these are summarized for equilibrium, steady state, once the pumps have come to a stop, for a range of power. And the range of power that was chosen is from 1.5 to 4.5 percent. And the nominal value, the expected value, is 3 percent.

For that specific flow value, we expect -- for that specific power level, we expect -- the plant to come to an equilibrium flow of 4.2 percent and a core delta key of 48 degrees.

The range of behavior is, obviously, also shown there. And it is in the range of 2.2 to 5 percent flow and three-one to six degrees delta T.

In all of this, we are of the understanding that there is a large uncertainty in the actual power measurement, and we have anticipated that in the calculations. The -- so the results generally show a trend of expected natural circulation capability.

The transient results are again somewhat summarized.

MR. MOELLER: Excuse me. On the previous slide --

DR. PERKINS: Yes?

DR. MOELLER: -- I don't understand the first line there. You had that the power, if it's at one-and-a-half percent, at 45 megawatts, it could be as low as minus 60 megawatts below that. Does that mean the coolant is putting heat into the core?

DR. PERKINS: Yes, I understand that discrepancy. I believe the 60 megawatts uncertainty takes into account the noise level of the instrumentation, and that you certainly cannot be at negative -- at negative power. The objective -- or not to be at 3 percent -- and we did not consider that the test will be run at negative, at negative power. I think the realistic values, as TVA has indicated, is that they will normally run the test at 3 percent, 90 megawatts of power, and have a fairly large uncertainty as to exactly where they are.

That is somewhat misleading.

MR. EBERSOLE: In that connection, TVA stated that they

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did not use the auxiliary feed water mass flow in water and steam, because they felt that the measurement of level was inaccurate.

Is it Westinghouse's position also that that is not the most accurate measurement of power? Or is it simply that you just don't need an accurate measurement for this sort of work?

DR. PERKINS: I am not sure what the Westinghouse position is on where they can measure the power.

I think the objective of the investigation was to assess what the general behavior would be and what the natural circulation capable -- capability would be.

We have not tried to reassess whether these numbers, the uncertainty in measurement is realistic or whether they could do better by using something -- something else.

I think they have indicated in their test specifications that they would actually try to calibrate the power using in-core flux detectors and flow delta T measurements at full flow.

MR. EBERSOLE: But the flow delta T measurements are the ones which are so crude, and at this power level, such that you may be a factor of three or four higher or lower.

DR. PERKINS: Well, I -- a factor of one higher or lower, I guess; if one went to 1 percent it may be difficult to measure. But I think the assessment was made that powerimetry

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(phonetic) was the best bet as far as obtaining accurate --

MR. EBERSOLE: What are the limits of power removal on natural convection that Westinghouse would get nervous about? Is it more than 10 percent power? Or what is it?

DR. PERKINS: Again, I guess, I am not in a position to talk to what Westinghouse would get nervous about. I am from Brookhaven and --

MR. EBERSOLE: Oh.

(Laughter)

DR. PERKINS: -- we made an independent assessment, and I have tried to assess what this --

MR. EBERSOLE: I see. I misinterpreted. Right.

Well, there certainly is some power level above which the natural convec[illegible] process will begin to be a little nervous. I don't know what that is. And maybe Westinghouse could respond.

END TAPE 6

Tape 7

MR. JOHNSON: Bill Johnson. I'm not sure exactly what you mean by what point we get nervous. But let me state that at below 5 percent power the core delta T experienced during natural circulation is less than that experienced during normal operation. So that's a good milestone or benchmark to use to say that's the point at which above you get a core delta T in excess of what you would see during normal operation, and as power goes up, that core delta T then, of course, goes up.

MR. EBERSOLE: That will be your marker as to whether you're really getting in trouble with natural circulation, the core delta T? You'll be watching that?

MR. JOHNSON: That's correct. The operator safety criteria is based on core delta T.

MR. EBERSOLE: Thank you.

DR. ETHERINGTON: The pressurizer sprays are automatic. Does that mean it may or may not be on at the time of pump trip?

DR. PERKINS: The pressurizer ·ays have established equilibrium at the specified pressure, will not be on at the time of a pump trip. The calculations indicate that it will, pressurizer spray will, be initiated some 90 seconds into a transient.

DR. ETHERINGTON: But on natural circulation are you going to get any appreciable spray?

DR. PERKINS: It depends what you mean by "appreciable."

DR. ETHERINGTON: Well, any, even, let's say any spray.

DR. PERKINS: Yes. Because this is at the nominal power level, because it is a general heat-up of the average temperature of the primary coolant, and the test specifications call for controlling the mass rather than the level, as the level increases the pressure will go up.

DR. ETHERINGTON: Yes, but the spray -- the spray water comes from the dynamic -- from a dynamic head in the recircu- . ting pipe. You've got no driving force there, to speak of, in natural circulation.

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Jesse, am I off on that?

MR. EBERSOLE: Your -- the spray system derives its spray from operation of main coolant pumps. If the pumps are off you can't have that spray.

DR. PERKINS: The automatic spray derives its pumps from the head, derives its pressure from the head of the pumps. The pumps are coasting down during the initial part of the transient. Part of the objective is, from, I believe, TVA's viewpoint is, to determine when and how much auxiliary sprays will be needed. But that -- when the pumps come on, there is still appreciable head and the -- I believe the automatic system is supposed to function.

And I may be -- somebody is standing up there ready to correct me.

MR. SERO: All I was going to say -- Ray Sero, from Westinghouse -- all I was going to say was that the intention is to use the auxiliary spray to maintain the inventory. The normal spray will not work once the reactor coolant pumps are turned off. There is a coast-down effect, but that -- that will -- very short duration.

MR. EBERSOLE: Well, will you have an auxiliary spray using another pump source?

MR. SERO: The auxiliary spray comes from the chemical and volume control system.

MR. EBERSOLE: So that theory is that --

MR. SERO: Charging pumps would.

MR. EBERSOLE: -- will hold the levels. Okay.

DR. PERKINS: Well, I guess, with that kind of general information, equilibrium information, the more interesting transient information is, as far as the predictions of hotleg temperature are concerned is, that if you do approach the high limiting value in power, of four-and-a-half percent, you will also approach a high temperature of 600 degrees. And I believe the -- again, the shutoff point is 610 degrees, at which they expect to terminate the experiment.

DR. MOELLER: Excuse me. This is the temperature difference between what and what?

DR. PERKINS: This is -- no -- this is the predicted hotleg temperature. This is not a --

DR. MOELLER: All right. All right.

DR. PERKINS: We were looking at (WORD UNINTELLIGIBLE) graphs. I wasn't going to bother to present all the other ones. This is just the hotleg temperature.

DR. MOELLER: Well, on the other one, what is the, where you say core temperature difference, what is the difference with respect to?

DR. PERKINS: Well, the difference across the active part of the coolant, the inlet to the core minus the average exit temperature of the core.

DR. MOELLER: It's the difference in the temperature of the coolant across the core?

DR. PERKINS: Yes.

And I guess, in keeping with the introduction, to remain brief, I think I'll quit there and say that our calculations indicated that the tests will demonstrate substantial natural circulation capability but that the measurement uncertainty will make it difficult to relate that capability to a specific prediction.

Are there any further questions?

MR. FAVIC: Stan Favic. I'd like to point out that we started off this exercise hoping that we'll have some full-scale test data base on which to do some (WORD UNINTELLIGIBLE) assessment. And we intended ED to do pre-test calculations for every test in the series, 12 tests, whatever. And we have done pre-test calculations for the first test, as you have seen. It's not clear, however, to me, knowing that we have these large uncertainties in input -- power generation, for example, a large uncertainty there, there are also uncertainties in measurement -- it is not clear to me whether there is a value in (WORD UNINTELLIGIBLE) assessment in this exercise.

I'd like to ask the question whether you think we ought to be conducting pre-test predictions for every test in the series, or we ought to do subsequent (WORD UNINTELLIGIBLE) test calculations but knowing better what the operator does and what the power might have been in the test, in order to get (WORD

UNINTELLIGIBLE) results.

MR. MATHIS: Well, I think the subcommittee concluded Monday that the basic benefit, if you will, from these tests is basically operator training. And as far as gathering any substantial or meaningful data, it (WORDS INAUDIBLE) due to the instrumentation and the uncertainties.

MR. EBERSOLE: Are you saying if you, in fact, could precisely measure the power level, you would see some considerably increased value in these tests? What I'm --

MR. FAVIC: Yes. Yes.

MR. EBERSOLE: Well, then, is it not possible to get that if you just put enough effort toward it? What I've heard here is that although you might make an accurate measurement of auxiliary feed water flow, that there's some problem with the level system. I would think that using an integrating process of looking at this, that you could ultimately sharpen the measurement quite sharply.

I really think there's been no particular effort made to precisely identify the power level, on the grounds that it maybe didn't matter. But what you're saying is, it would matter.

MR. FAVIC: It wouldn't matter to people who are interested in checking how valid the codes are (WORDS UNINTELLIGIBLE). Whether that's a good enough reason to prolong the whole program in order to get better measurements, that's another story.

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MR. EBERSOLE: Well, maybe -- would you think some discussion might be in order as to just how difficult it might be to sharpen the measurements?

MR. FAVIC: Yeah, I don't think that we would be holding this particular discussion.

MR. EBERSOLE: Okay.

MR. FAVIC: Between TVA, Westinghouse, and (WORDS UNINTELLIGIBLE).

MR. EBERSOLE: Yeah, but you -- but you'd have an interest in getting the sharper data.

MR. MATHIS: This is something that should be considered the next time around, for sure.

MR. EBERSOLE: Okay.

MR. MATHIS: Well, if there are no other questions or comments, that is the part that we have been proposed to discuss as far as the low-power test program.

The next item is the discussion of the feed and bleed process for decay heat removal. I'll call on TVA.

Larry?

MR. MILLS: We'll ask Russ Morgan, from our engineering design organization, to lead this discussion off.

(Pause)

DR. MOELLER: Mr. Chairman, while he's getting ready to speak, I have a, I'm sure a naive, question on this. But you bleed through the PORV, which, I presume, discharges into the quench tank. And my question was, how long can the quench tank handle feed and bleed?

MR. MILL: Are you asking me?

DR. MOELLER: Yes.

MR. MILLS: I think it might be better for Russ to handle that a few minutes later.

DR. MOELLER: Okay. If it's going -- if someone later --

MR. MORGAN: I'm going to give a brief introduction and then Westinghouse will --

DR. MOELLER: All right.

MR. MORGAN: -- try to give more detail.

MR. MOELLER: If someone could just help me with that, I'd appreciate it, later.

MR. MORGAN: Sure. I think we'll take care of that.

I'm Russ Morgan.

MR. MATHIS: Morgan?

MR. MORGAN: Russ Morgan. I'm Russ Morgan, from engineering design of TVA. I'm going to give just a brief introduction to familiarize you with the systems at Sequoyah that would be used for such a feed and bleed operation. And then Westinghouse in a moment will talk about the details and results of their analysis.

Concepts, of course, of feed and bleed in PWRs is several years old. And as a result of TMI, the work -- and the work under way for inadequate core cooling has motivated consideration of feed and bleed as a backup mode of getting decay heat out of the system.

Late last year consideration of feed and bleed was recommended to the Westinghouse owners group by a subcommittee of the owners group. TVA, along with the other owners, voted to ask Westinghouse to investigate this feasibility on Westinghouse plants, using equipment existing in those plants.

A preliminary analysis of feed and bleed has been completed by Westinghouse. And the results as they apply to existing features of Sequoyah will be presented by Westinghouse in a moment and will be published to the owners group.

At the conclusion of the owners group feed and bleed program, generic procedures and guidelines for the utilization of feed and bleed are expected to be produced by a joint effort of the owners group and Westinghouse. This guidance will be taken under consideration by TVA, and if the procedures and guidelines are deemed to enhance plant safety, they'll be tailored to Sequoyah and adopted as appropriate.

With that little bit of introduction, I'd like to take a -- make a brief presentation of the Sequoyah systems that'll be used. And then Westinghouse will discuss the details of their results.

Sequoyah is a Westinghouse (WORD UNINTELLIGIBLE) plant. We have the traditional two-train redundant ECCS systems. You have high-head and low-head pumps. The fueling water storage tanks are the primary source of the injection water. We pump into the system in a feed and bleed mode. Cooling into the system would lead to the pressurizer through the PORVs, the power operated relief valves, shown here, the block valves and the PORVs. This fluid would be discharged down to the, what we call the, pressurizer relief tank, PRT.

When the amount of mass discharged began to overflow into the containment, it would go -- be in the containment emergency sump and would -- you'd establish a recirculation path and you'd have your loop for decay heat removal.

The system, from the fueling water storage tanks all the way through, is safety grade basic ECCS systems, except, as we discussed in the subcommittee meeting on Monday, the PORVs and their control circuits are not fully safety grade.

And that's as brief as we wanted to make the intro'. If there are no questions, we'll go to Westinghouse.

DR. CARBON: One question. Are the owners groups doing this strictly on their own? Have you been urged to do this by the staff?

MR. MORGAN: I'm not familiar, myself, with the details of the owners group background. Possibly Westinghouse could answer that.

MR. JOHNSON: The initial portion of the feed and bleed analyses was performed in WCAP-9600. That was part of a response to NRC staff questions regarding the viability of that mode. Our subsequent work --

DR. CARBON: Is that a recent report?

MR. JOHNSON: No. WCAP-9600 was submitted in -- July? -- I believe July of last year. Okay, the subsequent work that has been done since WCAP-9600 has, to some extent, been prompted by actions of NRC but has been a cooperative venture, really, with the owners group to establish what differences, if any, or what non-bounding aspects of the analyses in 9600, might relate to all the plants in the owners group.

DR. CARBON: Thank you.

(Pause)

MR. TAUCHE: On Monday I presented to the subcommittee the results -- beg pardon? Oh. My name is Walt Tauche, for Westinghouse. On Monday I presented the results of a loss-of-feed-water-induced LOCA analysis to the subcommittee. In that case, if you lose your main feed water system and your auxiliary feed water system is unavailable, because it's valved out or for some other reason, you will get into a situation where you will create a small loss of coolant accident by lifting the PORVs. If nothing is done to mitigate these events, you can get yourself into a situation where you'll have a rather deep core uncovery, deep and prolonged.

As Bill Johnson mentioned, in WCAP-9600 we presented some preliminary results. And in the handout there is the pressure transient for those preliminary results. In that case, you can see that it blows down rather rapidly.

Subsequent to that analysis, Westinghouse examined many of the plant parameters which are important to a loss-of-feed-water-induced LOCA transient. You see here for WCAP-9600 we had the smallest volume-to-power ratio type plant, which tends to get to core uncovery the earliest and (WORD UNINTELLIGIBLE) the PORVs the earliest. But the PORV capacity was relatively large. So Westinghouse looked at some common designs, and we see down here, for the Watts Bar type of plant, which is very similar to the Sequoyah analysis -- or to the Sequoyah plant, a 3411 megawatt plant with a relatively small volume-to-power ratio and minimum PORV capacity.

So Westinghouse decided to perform an analysis on that generic type of configuration -- a plant which has 3411 megawatts, a relatively small volume-to-power ratio, and the minimum PORV capacity.

You'll notice here that in this analysis we incorporated a Model 51 steam generator, which is typical for the Sequoyah unit.

Okay, briefly I just want to discuss what the feed and bleed type of analysis entails. There are, basically, two modes of recovery from a loss-of-feed-water-induced accident. What I'd like to discuss first of all is the bleed and feed situation.

In this case, we bleed the plant by holding the PORVs open continuously, and we feed the plant by assuming an automatic

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safety injection operation.

In this particular analysis case, we assumed minimum safeguards with one train failing but no spill.

Okay, this is the bleed and feed type of LOCA analysis.

Briefly, just touching upon this type of analysis, we see that there's basically six portions to this type of pressure transient. On the very early portion, here, you see a rapid spike in depressurization, which isn't really too visible. But early in this portion you have the reactor still at power, you are still draining off mass to the turbine. And then it trips and then you get a rapid depressurization. Basically, a very brief period that doesn't have a great deal of impact on the later portions of the transient.

The next phase that you enter into is this long period, here, where you're in a quasi steady state. You're bleeding mass off through the secondary; your throttle valve is now closed; you're pressurized to your secondary safety point. So you're bleeding mass off through the -- or secondary mass off and you're removing decay heat to the secondary.

Okay? So you go through a -- effectively, a stable period of stable temperatures and pressures in the primary system.

The next phase is a primary heat-up situation in which you have uncovered about 70 percent of the tubes, you're beginning to heat up the primary system, and you're beginning to have a big surge into the pressurizer, rapidly filling it with subcool liquid.

The next phase that you enter into, once this pressurizer very nears filling, you'll begin to rise very rapidly in pressure, up to the PORV set point, at this point. In this particular case, for the bleed and feed type of recovery, we held open the PORVs here continuously at just a slight period after the PORVs are first calculated to open; and then you get a subsequent subcool depressurization.

Now, Westinghouse has calculations which indicate that once the PORVs fail in an open position, or are held open in that position, that it would be about four minutes before the ruptured disc would blow and you would be putting primary coolant to the containment directly.

Okay, so some period in here, after they are held open, you expect that. And I'll discuss what happens in the other situation in a little bit.

Okay, so you go through a period in which you have a subcool blowdown. And then you see here, once the core becomes saturated you begin generating voids in the core; the specific volume increases exceed the specific volume removal from the system; and you have a very rapid repressurization.

There are three or four phases of repressurization. First of all, you're discharging subcooled fluid from the pressurizer, and that gives you a very rapid repressurization phase. Next, once some of these voids have been propagated to the pressurizer, you go into a two-phase repressurization period. Your decay heat still exceeds the amount of -- the decay-heat-produced specific volume increases still exceed the amount that you can remove from the pressurizer, even in a two-phase case, and you're still pressurized. Finally, once you've bled off enough mass, you've increased the void fraction here enough, and you've reached a maximum void fraction in your pressurizer, you'll have depressed this level and your core level down low enough so that you'll be going into a steam break flow situation.

In that case, you're still in a situation where the specific volume increases in the core exceed the specific volume removal through the PORVs. In this case there just isn't enough PORV capacity to continue with depressurization once you've started forming voids in your core.

You can see here that your level is being depressed and you're still in a repressurization phase, even though you have full steam break flow.

Now, once you've drained your system a great deal and you're out on the decay heat curve a lot, you'll enter into the final phase, which is the depressurization of the system.

You can see now that you can vent steam effectively in a continuous manner by going straight to the pressurizer, and you effectively have direct steam break flow communication through the PORVs, and you begin to cut down the pressure.

Out here, about 3,000 seconds, your break flow effectively equals your safety injection flow and you begin to refill and recover the plant.

MR. BENDER: In that picture, where is the fuel in there? Or are you -- does that line show it, show the top of the --

MR. TAUCHE: Okay, here we have the core -- or vessel mixture level. And we see that this is just about the hotleg elevation here. The fuel -- active fuel height is right here, at about 12 feet.

MR. BENDER: In none of these analyses does the water get down below the active fuel height?

MR. TAUCHE: That's correct.

Okay, in the next particular case that we'll go into, the feed and bleed type of situation, you still maintain a covered core.

Okay? But in this bleed and feed situation where we hold open the valves continuously we don't even approach core uncovery and we begin refilling the system out here, late in time.

MR. BENDER: What is the premise on which you never uncover the core, that you've got enough water inventory so you'll never boil it all away, or you're adding enough to prevent it? What is the premise?

MR. TAUCHE: The premise was to take some operator action at a time early enough in the transient -- or the basic premise was to determine how much time was available for an operator to take action so that you wouldn't get to a situation

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where we'd have destructive core uncovery.

MR. BENDER: I see. So this action increases the time available?

MR. TAUCHE: Well, this particular action is relatively early compared to a feed and bleed, as we'll get into in just a moment.

MR. BENDER: Okay. Go ahead. I'm sorry, I (WORDS UN-INTELLIGIBLE).

DR. OKRENT: (WORDS UNINTELLIGIBLE) assumption go along with the (WORD UNINTELLIGIBLE) of part two you just showed us?

MR. TAUCHE: Okay, the first basic assumption was that you lose all secondary heat sink, you lose all feed water, both main and auxiliary; then some action was taken, such as holding the PORVs fully open, both of them in this case. We assumed only minimum safeguard safety injection flow.

Okay?

You'll notice earlier I had some analytic assumptions, which I didn't want to touch on today, because we'd go into a great deal of detail. But there are a number of conservatisms built into this type of analysis.

DR. OKRENT: No, I meant the physical assumptions that you --

MR. TAUCHE: Okay.

DR. OKRENT: Thank you.

MR. TAUCHE: Basically we reached these type of conclusions: that if you open all PORVs prior to steam generator dry-out you will maintain a covered core; safety injection, if you are going to operate in this mode of opening the PORVs, you should initiate and verify that safety injection is available prior to opening the PORVs; and finally, something which may be of some interest is that the reactor coolant pump operation may need to be precluded during the time at which the PORVs are held open.

You noticed before that our repressurization phase was governed, basically, by the fact that we're putting two-phaser subcooled fluid to the pressurizer unable to depressurize.

In the case where you keep the reactor coolant pumps running, you effectively maintain the vessel mixture level artificially high and, therefore, keep a longer two-phase and/or subcooled fluid flowing to the pressurizer, therefore extending your repressurization phase.

So it may be necessary to preclude reactor coolant pump operation in this particular case.

MR. EBERSOLE: Would you care to discuss the shortcomings of this operation, that is, those aspects of the design that may preclude your operating this way?

Or are you aware of those?

MR. TAUCHE: For example?

MR. EBERSOLE: Well, then I'll explain to the committee. I want to make sure that you understand that prolonged opening of

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the PORV and the associated block valves implies that you have already lost the relief disc on the suppression tank, the dump tank, and you are now operating in an environment which is steam and high temperature in the containment; in the ice condenser it will be a lot more modest than it would have been in dry containments, nevertheless, it'll be beyond the design basis, especially in the lower compartment, of the electrical aspects of the PORV valve as well as the block valves. So after operation, at some unknown length of time, like this, one must conclude that these valves go into some shorted or faulty mode and their intrinsic tendency is to always close; that is, if you lose power to these valves, the block valve or the -- or the PORV, the natural tendency of the designer has always been to ensure that these close in the fail mode. This is an effective mechanism to say that you can no longer feed/bleed. And it, there is no other way of having an exit path of coolant from the core. So you must then resort, if you are in this predicament, to getting some secondary water back and invoke the other process, which I think you're going to discuss later, which is reflux condensation.

END TAPE 7

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But this process then has a problem in that you can't rightfully expect it to be prolonged for any particular length of time.

I might also comment that I hear by the grapevine that Arkansas Nuclear One Unit 2 has effectively by-passed this problem by putting new valves in, which are not of this design, and presumably would be qualified for this environment. These are new valves on the pressurizer which are of a ball or plug design that can handle two-phase flow without any particular concern. And I presume, but I do not know, that they are fully environmentally qualified.

I would like to note the staff has investigated this Arkansas design and has any comments to make on how well it works or whatever.

MR. TEDESCO: At this point, Jesse, I am not aware of it. We are standing on the requirement from lessons learned in the short term about qualifying -- -- by July of 1981, and that program is in effect now.

MR. BENDER: Could you break the answer into two pieces? Has Arkansas really done something different?

SPEAKER: I really don't know.

MR. BENDER: Thank you. I think that is the first question I would ask. And the second question is if they have, are the valves they put in qualified?

DR. OKRENT: This is a little bit of a tricky proposal. You are deliberately opening the PORV's at a certain time, thereby taking a chance --

MR. TAUCHE: You are creating a LOCA yourself.

DR. OKRENT: You are creating a LOCA, and now you have to have the charging pumps to make up water.

MR. TAUCHE: Right. We have assumed that one train does fail though.

DR. OKRENT: But you know, we really don't want to play the single failure criterion game when we are talking about this. You know there is some chance you may lose that system, in which case you are in sort of awkward situation. So I think when you present a thing like this and give conclusions it would be interesting to give some other perspectives of the same thing.

MR. TAUCHE: Well, because of the possibility of losing charging safety injection we ask you to verify if you are going to take this type of action, we ask you to verify that it is available.

DR. OKRENT: Well, even available initially doesn't mean you know that something will be available on a continuing basis. We have you know diesels start and fail after 30 minutes or whatever.

MR. TAUCHE: All right.

DR. OKRENT: Okay?

MR. TAUCHE: The second method of recovery from this type of transient is a case of a feed and bleed situation in which you feed the system by continuously injecting safety injection by manually initiating it at some point in time and letting the PORV's operate in a normal mode of operation. Therefore, they flutter continuously.

In this particular analysis, Westinghouse used the best charging flow, we used the compos[illegible] curves for determining the best charging flow available to any Westinghouse-designed plant, and then we compared that to what TVA has, and we see that the best values are given here and the TVA values are given at this point.

Okay, so the TVA values are pretty comparable to the best analysis values used in this case.

In this case we see the in flutter at the PORV's and at this point, 3000 seconds, we initiate manually the safety injection.

In this particular case we would expect the rupture disc to blow maybe in about 10 minutes. You are not putting nearly as much mass into the system right away because it is just sitting there fluttering. So there is a significant period of time before the rupture disc would blow and you would get into the situation where the containment would be subjected to a steam environment. Effectively you have bought yourself a great deal of time from that particular aspect, but you have also bought yourself a great deal of time from another aspect.

With both trains of safety injection operating, you see in this case that there is also no core uncovery. Okay. But unlike the prior case where the system is tending to refill, even out to 10,000 seconds, the system is still tending to drain in this particular analysis.

The PORV's are fluttering open and close. When they are open they are putting out about 75 pounds per second of mass. You are replacing it with about 40 pounds per second of the best safety injection flow. The integrated effect of the PORV's opening and closing is about 45 pounds mass per second being taken away from the primary system at this point.

Okay, so you are still even to 10,000 seconds no fully replacing the system mass with the best safety injection. Consequently, we reached this conclusion: that in the feed and bleed case manually initiating the best safety grade charging flow only maintains a covered core -- well, it gives you a marginal ability to maintain a covered core to 10,000 seconds. We can't categorically say that this is going to lead to core uncovery, nor can we categorically say that this will result in full mitigation of these types of events.

Finally, we concede that there are these type of results. In the bleed and feed situation we hold the valves open at 2500 seconds, we had minimum safeguards automatically injected as opposed to being manually initiated when the valves are open, the core remain covered, and the system begins refilling at about 8000 seconds.

In the feed and bleed case, where we just manually initiated safety injection in the valves flutter we find that the best safety injection flow results in keeping the core covered to 10,000 seconds and the system is only slowly drained.

So in this case you have bought yourself a lot of time, if you follow that course of action.

MR. EBERSOLE: At this point I would like to mention the incident at Crystal River, an aspect to experiencing the transient where you do have a leaking PORV and you do not in fact close it as occurred down there, mostly an aspect as to what would be implied in the context of ice melt if the Crystal River incident had happened at say Sequoyah? Would you have a substantial melt of the ice pack and would in essence it be a messy and costly process to fix it?

MR. TAUCHE: Well, you are not going to get into an ice melt situation until after you have blown your rupture disc, correct?

MR. EBERSOLE: Well, they erupted. That is in fact what they did.

MR. TAUCHE: Right, but -- okay, another point is that if the PORV is leaking a significant period of time, since you are not putting a full discharge into that ruptured tank, if auxiliary feedwater is started you can probably preclude a great deal of pressure and liquid being subjected to the containment.

Okay, you would get the ice condenser doors to open. I believe you would get some significant --

MR. EBERSOLE: Would the accident be compounded by the fact it should have a substantial ice melt? It would be?

And so the operator would then have simply a long and messy job of repacking the ice.

MR. JOHNSON: That is correct, but recall that this situation is only being addressed during an extreme emergency under loss of all people.

MR. EBERSOLE: Yes. Well, you know like Crystal River.

Well, that was an electric power plant.

MR. JOHNSON: Well, the Crystal River event, yes, that would also --

MR. EBERSOLE: All right.

MR. TAUCHE: Finally, some overall conclusions. This particular analysis is directly in a sense applicable to TVA. You can recover the plant in a bleed and feed mode of operating using the existing hardware. The operators have sufficient time to recognize what is going on and perform the necessary functions.

The second case, where you feed and bleed the system, is an acceptable means to buy you a great deal of time, but as we state here, it is not the preferred mode of decay heat removal.

Finally, Westinghouse and the Owners' Group will be writing procedures to govern the loss of secondary heat sink situations.

MR. EBERSOLE: I think it is a little bit unfair, and I can't help but think of that old statement about you can be sure if it is Westinghouse. But you do qualify Statement B and say --

(Laughter.)

-- you can be sure that you have the hardware they have provided, it works against circumstances for which it is not designed.

MR. TAUCHE: Well, many of the systems as we found in the TMI -- --

MR. EBERSOLE: True, just a matter of getting down to seeing whether they will or not.

MR. TAUCHE: Any questions?

DR. MOELLER: Several slides back you mentioned under the bleed and feed conclusions your third conclusion was that reactor coolant pump operation may need to be precluded during the open PORV period.

MR. TAUCHE: Yes, sir.

DR. MOELLER: Could you tell me why?

MR. TAUCHE: Okay, let me flip back to two slides prior to that in which we can look at this pressure transient once again.

Okay, we see that as the core level, vessel level becomes depressed you are going through a period here of repressurization where you are putting basically either subcold or two-phase fluid out the PORV's. During that case, the decay heat, the specific volume by producing steam, the specific volume increases in the core exceed the specific volume reduction out of the system through the PORV's, simply because the PORV capacity in this case is not large enough.

Okay, so you go through this repressurization phase. Now if the reactor coolant pumps are left running, you will artificially maintain this level above your surge line. In that case you will have a much longer period of two-phase flow to the pressurizer and therefore a much longer period of repressurization.

It is not till after we drop down below the surge line connection where we can effectively have a direct communication of steam to the PORV break that you will get into a depressurization type of mode.

Okay, so if you do leave the reactor coolant pumps running you will keep the level artificially high, you may extend this repressurization phase a long distance. You may get into a situation where eventually when it does tend to depressurize you will get a core uncovery.

DR. MOELLER: Thank you.

DR. OKRENT: And could I ask how important is it that the pumps are running in your analysis?

MR. TAUCHE: Well, in the analysis we only assumed that the pumps were running up until the time that we got the steam generator dryout. We left the pumps running that particular case to get a more uniform heatup of the system and to perform a conservative calculation of the dryout time of the steam generators.

Okay, so as soon as the stream generators dried out we effectively tripped the pumps.

Any other questions? Yes, sir.

MR. BENDER: Just to clarify, at least in my mind, what is happening, you specified a 2500-second point at which the PORV's are automatically open. What is the signal that decides, that takes that action?

MR. TAUCHE: They were manually held open at 2500 seconds.

MR. BENDER: What does the operator have to know to take that manual action?

MR. TAUCHE: He has to know that he is in a situation where he has no second or he has lost all feedwater, can't get it back or doesn't believe that he is going to be able to get any type of auxiliary feedwater.

Okay, and then he can try and watch his secondary conditions to determine when or know when he is going to get about steam generator dryout.

MR. BENDER: I guess I'm trying to address my attention to the matter of his diagnostic capability.

MR. TAUCHE: Okay.

MR. BENDER: And I am not really sure yet that you have told me enough so that I can be trustful that he won't take the wrong actions at the wrong time.

MR. TAUCHE: Procedures are being written on this, but let me just try to briefly address the situation. He has lost the main feedwater. He has looked to see if auxiliary feedwater is there, it is not. He sees that he still has an integral steam generator system because the pressure is at the set point and all the steam generators, it is high. Okay, he sees either a level or no level, depending on, you know, where this level is. He may see a level or it may be exceedingly low. Okay, so he will know that he is in a situation, he is not in a steambreak situation where he is losing the secondary in that case because of a low pressure situation. He will know basically the pressure is still high and he doesn't have his feedwater available.

He should see some rise in his --

MR. BENDER: You are not generating great comfort in my mind, Mr. Tauche, because there are too many "because's."

MR. TAUCHE: All right.

MR. BENDER: Is the procedure going to be such that he won't have to test his logic too much, if you understand what I am saying?

MR. JOHNSON: Right. The first indication that he would have, of course, during this kind of an event would be an automatic reactor trip caused by a steam generator low level.

MR. BENDER: You got to have it enunciated?

MR. JOHNSON: Yes. Yes, it is a reactor trip, and it is enunciated, would be a first out.

MR. BENDER: All right, the enunciation has to be. We tripped because of low level in the steam generator?

MR. JOHNSON: That is correct.

MR. BENDER: Is that what the signal is?

MR. JOHNSON: That is correct.

The system would then subsequently be in that quasi-steady state following this reactor trip, and he would also have indications that he had loss of feedwater, main feedwater. Okay, he would verify, he attempts to verify then that his auxiliary feedwater is running and providing flow to the steam generators. That is another one of his procedures.

He would attempt to verify under this case that auxiliary feedwater was running and providing flow to the steam generators as verified by level, and what he would see is his level indications on a wide range steam generator level slowly decreasing, and he would not be able to verify that he had auxiliary feedwater flow running, delivering to the steam generators.

At that point then he would have a clear indication that he had lost his capability to provide cooling to the secondary side of the steam generators. When the steam generator heat transfer then subsequently decays sufficiently, he would see a rapid system pressurization to the pressurizer PORV set point.

So those would be the clear indications that he had lost the secondary site heat sink.

MR. BENDER: Well, let me postulate a couple of things just to see how smart the operator has to be. If the trip turned out to be for some other reason, would that interfere with his understanding of the circumstance?

MR. JOHNSON: During any of these events, the operator is always instructed to verify that his decay heat removal mechanism via the steam generators is available, and he must verify that as part of his immediate response to any of these events.

So he would be keying in on those particular systems immediately under any situation under which the plant would be undergoing a transient such as this.

MR. BENDER: Well, any time the reactor trips, that is the first action he takes, is to see whether he has got --

MR. JOHNSON: Well, there are a number --

MR. BENDER: -- emergency --

MR. JOHNSON: I don't know whether it is the first, and I am sure it is somewhat different, but there are a number of immediate actions which the operator must take. That is always one of them.

MR. BENDER: Are there any instrumentation signals that could confuse him if they responded in the wrong way? If pressure caused something to indicate a level that was different than he should have seen? Have you looked at those kinds of things, to see whether the indications could confuse the operator?

MR. JOHNSON: We have evaluated what indications that the operator uses to take action, which are the post-accident monitoring indications essentially, and those are the ones which he utilizes primarily to diagnose and mitigate these types of events. And in looking at those parameters, those do respond in a manner which seems to us to be a clear indication of the event and would not be confusing to the operator.

We are also providing training to the operators for this situation.

MR. BENDER: Well, I am a general proponent of this concept you presented. My concern really is with any mindset which seems to be a term around here that people use, which makes the operator think in a certain pattern. And if that pattern doesn't show up, he gets confused. And the other is the possibility that the instrumentation could give false signals. And while I accept in principle what you are propc sing, the fact that the operator has to take the action manual makes me say that I would be happier if there were more evaluation of what could go wrong with the instrumentation.

And that is just an observation.

MR. MILLS: Mr. Bender, Larry Mills, TVA. I would like to mention that this sequence is on our simulator and is one of the normal transients that our operators go through in their normal training program.

MR. BENDER: That is good.

MR. RAY: The significance of this 2500 seconds in which to hold the PORV open, do I interpret correctly what I understand that that means the operator has three-quarters of an hour approximately within which to conduct his diagnosis and make these observations and so on and still resort to this method of cooling?

MR. TAUCHE: Well, our evaluation effectively shows that the operator in this bounding case as a minimum time determination has effectively five minutes after steam generator dryout to open the PORV's and maintain a fully covered core.

MR. RAY: So what you are saying is then that the steam generator will dry out within that 2500 seconds and he has just a margin of 5 then?

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MR. TAUCHE: Well, it depends on what type of steam generator that the operator has there, and that determines the time available. Like I said, in a bounding calculation, from the time that the steam generator drys out he has about five minutes to take that particular action of holding open the PORV's fully.

MR. RAY: Well, you tell me what the 2500 seconds means.

MR. TAUCHE: Okay. If you would look back to probably the second or third slide in that sequence, you see the steam generator dryout times are plotted for some various plants and various steam generators.

Okay, in this particular case we performed a bounding calculation again for a number of key plant parameters, and you will note that in this particular case the steam generator drys out about 2100, 2200 seconds.

So effectively, in a limiting case, in this very limiting case, he had five minutes after the steam generator dryout time.

Now a plant which has a higher PORV capacity and a much shorter dryout time had the same time available, 2500 seconds, to open the PORV's. But in this WCAP-9600 case we effectively could hold the PORV's open at 10 minutes after steam generator dryout and still maintain a covered core because of the PORV capacity.

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Now we have examined the case where we have the minimum PORV capacity and we found that it is about five minutes after steam generator dryout that he has to take some action.

So if a plant has your minimum capacity, it depends on what type of steam generator he also has. So he has about five minutes after dryout.

Okay? So for some plants it could be a fairly long period of time. And again we did do a bounding calculation, and the numbers indicated here are very early conservative dryout times also.

MR. EBERSOLE: This analysis would apply, I take it, if you had some case which I take it that TVA says is not applicable to them, where you in fact had a dc power failure and therefore the auxiliary feedwater pump was not available, is that correct?

Does this imply --

MR. TAUCHE: Well, you are also assuming no steam --

MR. EBERSOLE: That is right.

MR. TAUCHE: -- aux feeds too then?

MR. EBERSOLE: That is right.

MR. TAUCHE: Okay, yes. This --

MR. EBERSOLE: This would be applicable to that?

MR. TAUCHE: Probably.

SPEAKER: There is no feedwater period.

MR. EBERSOLE: Well, it wasn't on here; it is just that portion of this accident he is talking about, just the dryout interval?

MR. TAUCHE: Right.

MR. EBERSOLE: No, this is before you initiate pumping?

MR. TAUCHE: The point, I think, is that you have at least half an hour or so before you get into a situation where you are going to start getting into trouble.

MR. EBERSOLE: Which is a reflection of need of the dc system?

MR. TAUCHE: I can't address that.

MR. EBERSOLE: Yes. What I am saying, you must do something in the period of half an hour to get dc power back to get the aux feed if you lost it.

MR. TAUCHE: That is the minimum time.

MR. EBERSOLE: Yes, right.

MR. TAUCHE: Any more questions.

MR. MATHIS: Okay, let's move on then.

DR. OKRENT: Well, the only thing is our experience is that the real events don't tend to go the way one models them for this kind of analysis and you might have a situation, you know, the feedwater pump comes on for a bit, the auxiliary feedwater, then he loses it, and then it comes on -- a scramble situation, and you are more likely to have the operator, you know, not be able to say, gee, this resembles the exercise 6A at the simulator exactly and now is the time to open these valves. It leaves me somewhat doubtful that it is all so nice and plausible. Let me put it that way.

MR. TAUCHE: That is very true, but any time that that does happen you are effectively extending your period of time in which he has to recognize that he has to take action, because even a minuscule amount of feedwater in there does provide a significant decay heat removal source.

DR. OKRENT: Yes, but again --

MR. MATHIS: Well, Dave, if you are uncomfortable with this, would you be more comfortable if you had it on automatic?

DR. OKRENT: What on automatic?

MR. MATHIS: Well, whatever.

DR. OKRENT: There are various things I would be more comfortable with.

MR. MATHIS: The automatic system must be going crazy. That is all I am trying to point out.

MR. EBERSOLE: Can you put that table up again that showed the minimum times? I believe you said you had about 30 minutes to do something. Is that right?

MR. TAUCHE: Effectively, most of the steam generator dryout time is -- --

MR. EBERSOLE: Well, okay, 30 minutes to an hour or thereabouts.

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MR. TAUCHE: Okay, so you have as a very minimum five minutes additional steam generator time.

MR. EBERSOLE: Well, what I want to do is illustrate this and refer back to the TVA question on the dc power question and also to the generic study that is being done on dc.

You recall if you have a dc system which is composed of just two batteries, as well may be the case within the TVA design, although they have numerous batteries there may be just two batteries in a particular configuration, such that if these two are lost you have effectively lost dc power and you have lost simultaneously, because you have no control, you have lost the aux feed pumps.

You have this time interval within which to do something, whatever you are going to do, get dc back or get some water from some magic source.

But it focuses on the strict need for continuity of dc power and the significance of the question to TVA as well as to the generic question on plants that just have two batteries as to how in fact reliable they believe their dc system is.

I think this was one of the questions that you were going to go back and look at, and you have an answer forthcoming that I hope will say that you are better than just a two-battery configuration, that you have something to draw on beyond just two batteries which simultaneously influence the ac power supply as well as the control power to the aux feedwater system.

But it is a point just in your discussion here which emphasizes the problem later on coming up about the reliability of the dc system. I am just using it for that purpose.

DR. OKRENT: I guess in response to the point you raised earlier, when you factor in comments like Jesse's -- -- and when you think about other aspects of this, I guess I get inexorably driven toward having a separate dedicated shutdown heat removal system.

In addition to these things, you have got this and then you have this other one, I keep getting led to the path that Jesse put me on quite a few years ago.

MR. EBERSOLE: Or a less ambitious program would be to say let's take aux feedwater and make it absolutely independent of the normal battery complex by making it a unified system in its own right, either by having its own battery packs or else by making it fully mechanically competent, or whatever, because it is such an important system.

MR. MATHIS: So much for that. We will go on with the NRC comment on this particular topic.

MR. STAHLE: A few comments were made Monday on this subject. However, the most substantive comment that I can make at this time is this matter is an ongoing generic study by the staff, and it will report this at a later time. I think it is premature that the comment with respect to (inaudible) at this

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time.

MR. MATHIS: The next topic was the discussion of the upper head injection nitrogen -- -- problem.

MR. MILLS: We will ask Mr. Dick Lyparulo from Westinghouse to address this.

DR. OKRENT: Could I ask one question of the last speaker? Do the temperatures in the feed and bleed method in the reactor vessel drop in the first 10,000 seconds to a point where the reactor vessel itself is cooled considerably in the scenario you showed?

MR. JOHNSON: In the feed and bleed mode?

DR. OKRENT: Yes.

MR. JOHNSON: Where you are operating at very high pressure?

DR. OKRENT: Yes.

MR. JOHNSON: No, it really doesn't because at high pressure the flow into the system is not sufficient to significantly cool it off.

DR. OKRENT: All right, and when you are on the recovery path and you are starting to drop the pressure, but you still are at substantial pressure, do the temperatures in the vessel drop to an uncomfortable region corresponding to the pressure you are at?

MR. JOHNSON: Safety injection is left on. Yes, the vessel does begin to cool. This situation is analagous, however,

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to a, and really is at this point a small hotleg break, if you will. And this issue on the effect of cooling of the reactor vessel in terms of vessel integrity considerations for small hotleg breaks was addressed on the Sequoyah unit specifically and was demonstrated sufficient capability for reactor vessel integrity even under limiting situations of the worst possible break size in the hotleg, which bounds this case.

DR. OKRENT: I will let it pass now.

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MR. LYPARULO: My name is Nick Lyparulo. I am from Westinghouse, and I hope Dr. Ebersole can say you can be sure if it is from Westinghouse.

What I am going to talk about today is a concern that was raised at the March 25th subcommittee meeting on the effect of UHI nitrogen being injected into the reactor system on a break which is subsequently isolated.

Before I get into that discussion I would like to make a point here. We feel that the UHI system is designed to perform reliably and does assure isolation of nitrogen.

We have redundant isolation valves. We feel that the probability of the failure of these valves is very low.

Put the schematic of the UHI system here. What we have is a nitrogen tank injecting into a water tank. Downstream we have two sets available series. The valves that we are talking about failing would be set of those two valves.

The scenario that was looked at (inaudible)

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pressurizer PORV valve lift, and they cause a loss of primary system inventory, on which that we have associated depressurization and activation of our safety systems, among them the UHI.

The primary system for stabilizing some pressure at which UHI valves fail and nitrogen is injected into the primary system.

The pressurizer valves subsequently close and the system begins to repressurize. The nitrogen blocks loop flow and forms a bubble at the top of the steam generator, and following that the primary system will stabilize some pressure which decay heat can be removed by condensation in the steam generator.

Now the acceptance criteria, as long as your pressure is below the safety valve set point, which is about 2400 PSIA, you can maintain system inventory as long as you are pulling the system at that point. You have no problem. Okay?

The way you perform the analysis is as follows. The first thing you need to know is the amount of nitrogen injected in the primary system. This is of course the function of the pressure of the primary system pump goes down to. Therefore, you need a sophisticated computer calculation to find its depressurization. We utilized the notrump code to perform this. This is a thermal hydraulic code.

After you note amounts of nitrogen that can be injected into the primary system, what you want to find is the bubble size in the steam generator.

And once you know the bubble size you can calculate the heat transfer area that you have available for condensation.

Knowing the heat transfer area and decay heat, you can calculate what kind of heat transfer coefficient you need to remove decay heat.

I want to talk a little bit about the notrump assumptions that we did using this analysis. We used minimum safeguards.

This is an important assumption, and I want to get back to that on a later slide, what the results would have been if we had used a best estimate safeguards calculation.

The second thing we did was assume the steam generator was at the safety valve set point. We used best estimate decay heat, and we used a break size corresponding to having both PORV's stuck open, not just one.

This is the associated primary system pressure curve with that calculation.

MR. EBERSOLE: Pardon me. Would it have mattered if there were only one?

MR. LYPARULO: Yes, it would have mattered. We would have stabilized at higher pressure, but there is more break size (inaudible) at higher pressure --

MR. EBERSOLE: But in the long run would that have made any difference?

MR. LYPARULO: Yes, that makes a good deal of difference because then you can't get as much nitrogen into the UHI --

MR. EBERSOLE: Okay, it would be better?

MR. LYPARULO: Yes, much, much better. I think you probably, if one PORV stuck open -- I am guessing a little now -- you have no nitrogen injected into the system, none whatsoever. So you need a double failure there, of the two PORV lines.

The pressurization transient goes like this: rapid depressurization going from subcooled to saturated. You set up here on your steam generator safety at that point. UHI injects in and stabilization.

This pressure right here at the UHI injection is about 570 psia's, also stabilization pressure. We used a pressure slightly lower than that in our calculations for nitrogen, I used 540 first time through and I didn't go back and redo it. So we have slightly conservative pressure.

As I mentioned, we are going to talk a little bit about the best estimate SI versus what we used in calculation. The scale didn't turn out here. This is flow rates in pounds per second on the X axis. On the Y axis you have RCS pressure.

This part right here is the best estimate SI flow. This part here is the break flow from the notrump calculation

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this SW applies for notrump -- at various pressures at near the end of the calculation.

As you can see, what happens on a small break is you calibrate at pressure where flow in equals flow out, and if we would have used the best estimate SI flows, where the break flows crossed the line is where we would calibrate, and it is estimated to be at about 1100 psia.

At that pressure we would have no nitrogen injected into the system. So in order to have nitrogen injected into the system you have to have both PORV's stuck open and to use the minimum safeguards.

MR. EBERSOLE: Would that correspond to say a small break case with the subsequent operation of PORV and the sticking process?

MR. LYPARULO: Well, if you have a break it can't go away.

MR. EBERSOLE: Yes. So then you may be in what, better shape or worse shape?

MR. LYPARULO: You would be in better shape if the break doesn't go away --

MR. EBERSOLE: All right.

MR. LYPARULO: -- because the nitrogen can't form the bubble.

Getting back to the situation that we are analyzing, what we have here is a bubble blocking flow in the steam generator, bubbles composed of steam nitrogen. You have a steam condensation on the hot side of the steam generator with the reflux. On the cold side of the steam generator, since you don't have any flow on that side, you don't have any heat removal. So the only heat transfer area you can take credit for is the heat transfer area on the hot side.

So you have already cut the heat transfer area in half for (inaudible).

The way we calculate the nitrogen bubble size is right here. It is pretty simple, but I just wanted to put it up so there was no misunderstanding of how we do it.

The amount of nitrogen remaining in the UHI tanks can be calculated once you know the pressure of the tanks it goes to, assuming a simple isothermal expansion. That pressure in this calculation was 540. The computer code said it would be about 570. So it would have been larger.

Once you know the mass, finding the mass is right here, UHI initial minus S -- sometimes you see the mass into the RCS. Once you know the mass, if you assume that the gas bubble is at the secondary side temperature, which is consistent with the no heat removal function, you can find the partial pressure of the nitrogen by the difference in total pressure and steam saturation pressure at the secondary side temperature.

That is a simple matter to use ideal gas to calculate the volume -- -- size of the nitrogen bubble.

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MR. EBERSOLE: Pardon me. Before we get too far away from it, you just made a statement a moment ago that I haven't been able to digest.

MR. LYPARULO: Okay.

MR. EBERSOLE: If I start this whole process off by assuming a likely small break, something small, like say in the capacity range of a PORV --

MR. LYPARULO: Okay.

MR. EBERSOLE: -- I am going to start the whole process with that. The natural response of the system is to operate HPCI systems and to recharge the system, right? You will recharge?

MR. LYPARULO: That is right. We will begin to --

MR. EBERSOLE: You are going to recharge?

MR. LYPARULO: -- depressurize and SI will actuate.

MR. EBERSOLE: Right, it will actuate. Now it will actuate to a capacity rate in excess of this leak that I just postulated, and so it will charge the system solid?

MR. LYPARULO: Well, you know, actually, to a point it will be exactly that first curve right -- that curve I showed you, SI?

MR. EBERSOLE: Yes.

MR. LYPARULO: It may not be --

MR. EBERSOLE: Well, I am just getting at the higher probability aspect of the case than having two PORV's. I think

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you cheated yourself there.

On the other hand, I think the scenario didn't need to be that way, that it could have started with a small break and then in the natural sequence of events you would have charged it with HCPI, and that would have rendered two-phase discharge through the PORV's, which is not a healthy state for them to be in, and they would have locked out. And one of them, just one of them, I will be fair, wouldn't reshut.

MR. LYPARULO: Well, yes, but let's carry your sequence a step further.

MR. EBERSOLE: Okay.

MR. LYPARULO: You now have a hole in the --

MR. EBERSOLE: I got two holes.

MR. LYPARULO: You got two holes. Okay, but one hole is --

MR. EBERSOLE: Is liquid.

MR. LYPARULO: -- off the isolater. It will remove decay heat.

MR. EBERSOLE: Right.

MR. LYPARULO: If you have a hole -- --

MR. EBERSOLE: But it is going to be low in the system. Therefore, it will be losing inventory but not heat.

MR. LYPARULO: Well, it would be losing heat --

MR. EBERSOLE: Not much.

MR. LYPARULO: It would -- -- a mass of energy.

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MR. EBERSOLE: Yes, but if it is unevaporated water its net heat transport out of the system is insignificant.

MR. LYPARULO: Well, there may be -- Bill, you have a comment there?

I think we did analyze that case.

MR. JOHNSON: Well, there are two considerations here. If the break size was large enough to initially actuate ECCS without the capability of the charging system to keep up with that leak, it would be large enough that the system would not repressurize by the PORV to begin with.

So that is something very important. So for breaks that are large enough not to be able to be handled by normal charging or charging flow without an SI signal, you would not repressurize by the PORV setpoint.

MR. EBERSOLE: Right, but it is not that large.

MR. JOHNSON: Okay, if it is not that large, then the emergency procedures would permit the operator to terminate safety injection in places charging system back in service to maintain system pressure and level, since the break size was of that magnitude that the normal charging system could handle it.

MR. EBERSOLE: If the break size is such that the normal charging system can't handle it, it requires UHI.

MR. JOHNSON: If the break size is large enough that the charging system can't handle it, it is a break size large enough that the ECCS won't repressurize you up above the PORV setpoint.

MR. EBERSOLE: I see. Thank you.

MR. LYPARULO: Here I have a table. What it is is based upon that 540 psia depressurization. We have primary system pressures, corresponding partial pressure of nitrogen in the bubble, and the volume of gas of the bubble, volume of the bubble.

All right, this calculation, when you calculate how much nitrogen was injected into the RCS system, worked out to be about 1490 pounds, and we assumed the bubble size at the secondary side at the safety valve setpoint.

So we looked at, based upon our acceptance criteria which is stabilization and pressure less than are equal to 2400, you see that the gas bubble size with the 488 cubic feet.

Once you have a gas bubble size you can back up the corresponding heat transfer area, based upon just the geometry of the steam generator.

Again I have the same (inaudible) system pressures is based upon the same depressurization, and I assume decay heat, Appendix K decay heat, or one hour, to calculate my heat transfer coefficients, but first, you can see the heat transfer areas. At 2400 you have a very large amount of heat transfer in an area, 86,500-some odd cubic feet.

If I do the balance between decay heat and my available heat transfer area and use my delta t, also assuming

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liquid boiling and 2000 on the steam generator side, I worked out a required condensation coefficient of 26.3.

Now this is not even in the range of what kind of coefficients you see for condensation. A typical condensation and heat transfer coefficients are in order of magnitude high.

Now I also did the calculation where I performed the balance at the tube entrance. I included the effect of shear, and I verified that the tube doesn't block. That could also be of concern. But I have done that calculation.

MR. EBERSOLE: Well, is it not true that what you used up there at the 2400-pound case was the heat transfer area that you associated with nonblockage by the gas?

MR. LYPARULO: That is right.

MR. EBERSOLE: But in fact because there is some limiting aspects of this reflux flow system you are only entitled to a fraction of that 86,000 feet?

MR. LYPARULO: No, I don't think so. What it works out to, you are going to stabilize at some pressure corresponding to some aids which will remove decay heat, at which your mass into the tube is whatever corresponds to that pressure.

MR. EBERSOLE: Yes.

MR. LYPARULO: So it is really a mass balance at the entrance of the tube that determines what your pressure. As long as you have a high void fraction at the tube inlet you aren't going to block. And I can go through that calculation if you

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want.

MR. EBERSOLE: Well, how do you have a high void fraction there when you must have some sort of --

MR. LYPARULO: Well, you have 80 pounds of steam coming in.

MR. EBERSOLE: Yes. And you are going to have 80 pounds of water coming out?

MR. LYPARULO: Right. If you do a balance between the masses and the shear force, you can back out the thickness of that layer, and that is what I have done.

MR. EBERSOLE: Yes.

MR. LYPARULO: And that is what I have done, and that worked out to be -- I forget, I think del was 1.8 times 10 to the minus three feet, and it worked out to an 87 percent void fraction at the tube entrance, which is -- I did that calculation of 2400.

Now I agree that pressure system might not equillibrate to 2400, but it can equillibrate to 2400, and at 2400 we don't have a problem, is what I am saying.

MR. EBERSOLE: So you have some supporting analyses?

MR. LYPARULO: I have some supporting analysis on that.

MR. EBERSOLE: Would you offer us some copies of that?

MR. LYPARULO: I can do it two ways. I can show it now as a slide, or they are handwritten. I would be happy to give you a copy.

MR. EBERSOLE: Oh, that will be fine. If they are handwritten, that is fine.

MR. LYPARULO: Okay, I want to stress that it is not yet a signed-off calculation.

MR. EBERSOLE: When did you do that?

MR. LYPARULO: I had started on it prior to last meeting. But after discussion -- -- I decided it was something I had better have for this meeting.

MR. EBERSOLE: So you did it since Monday then?

MR. LYPARULO: I finished it off since Monday.

MR. EBERSOLE: Okay, thank you.

MR. LYPARULO: I want to summarize here. Our calculations estimate that with utilization of best SI flow, I can also add with one PORV stuck open, we would have no nitrogen injected into the system.

However, with two PORV's stuck open, minimum SI, you equilibrate at pressure at about 570 psia. Based on this depressurization, you have about 1500 pounds of nitrogen in the UH injected, and we also say that this is a nondesign basis sort of probability event. But even so, with all nitrogen as a bubble in the steam generator, you need a very small heat transfer coefficient.

MR. EBERSOLE: Now having done this, and looking at

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this system here which you have used in contrast to feed-bleed, and if we don't compound your problem in this particular presentation by the nitrogen presence, can it not be argued that the reflux condensation process is a lot better than bleed-feed?

MR. LYPARULO: Well, I am not so sure it is better. I would say the reflux condensation process is a good process to remove decay heat. I think we can make that statement.

Now you got to remember with Walt's calculations on the feed-bleed he had no feedwater.

MR. EBERSOLE: Oh, I know.

MR. LYPARULO: I don't have any feedwater either, I am not going to --

MR. EBERSOLE: Yes. Feed-bleed is the only door open if you don't have feedwater.

MR. LYPARULO: That is right. I think it has its place.

MR. EBERSOLE: But then this system, whether or not you have feedwater, but of course you need feedwater here, might offer an attractive alternative to bleed-feed.

MR. LYPARULO: It is an alternative, but I think it is an alternative between this and single phase natural circulation.

MR. EBERSOLE: Single phase?

MR. LYPARULO: Well, you have all water.

MR. EBERSOLE: Well, you don't have the privilege of doing that.

MR. LYPARULO: Well, if you can fill your system with water, you will get natural circulation.

MR. EBERSOLE: Oh, yes, right. Of course, but --

MR. LYPARULO: So those are the two alternatives you have to weigh.

MR. EBERSOLE: Yes.

MR. LYPARULO: I think if you have a blocked tube, for some reason your tubes are blocked, that you have to go to reflux, I think then at that point, it becomes an attractive means to remove decay heat.

MR. EBERSOLE: Yes.

MR. LYPARULO: I would rather have a single phase primary system, just forced circulation.

MR. EBERSOLE: All right, would you --

MR. LYPARULO I have no real reason for saying that other than I just feel a little safer.

MR. EBERSOLE: Would you argue that in order to use this process in fact you do have to have a level indication to follow your course of events?

MR. LYPARULO: Well, anytime you are in a reflux mode, you are boiling off, you would certainly like to know core level.

MR. EBERSOLE: Right.

MR. LYPARULO: I don't say that you have to to use this process.

MR. EBERSOLE: One final question. You are losing a little liquid through various paths like seal leakage and so forth, at this condition of 2400 pounds, and you got to make it up even though it doesn't contribute to the heat removal process. Is the injection system capable of coping with this at that --

MR. LYPARULO: Yes.

MR. EBERSOLE: Okay, so you will keep inventory even though you are not removing heat with it?

MR. LYPARULO: Of course, right.

MR. EBERSOLE: Thank you.

MR. MATHIS: Any other questions on this topic?

If not we will move on to the next one, and I would propose here, there was a series of questions that came up somewhere along the line. These were addressed in our subcommittee meeting. I don't think there was any particular problem with them.

I think you have a list of those, and rather than go through them item by item I would suggest that we, if you have specific questions, we will address those and otherwise we will pass by the others. Dave?

DR. OKRENT: Let's see, these are the questions that were sent to TVA and to which they supplied a response?

MR. MATHIS: Right.

DR. OKRENT: Okay, well I would like to ask the staff first whether they have reviewed the answers to the questions and find them all, A, fully answered, B, leaving no issues open in the staff's mind. Maybe I will think of a C.

MR. MATHIS: Bob?

MR. STAHLE: In the subcommittee meeting we went over each question and one by one, and provided comments at that point. I am not sure if it would be beneficial to do so again.

I would bow to the Chairman's wishes here, but we did go over and had the staff available at that time.

DR. OKRENT: Well, I don't want to repeat what was done in detail at the subcommittee meeting. Can you give me a general statement?

MR. STAHLE: I think we can generally say we were in accord with the responses by TVA, and we added different comments to specific questions, like in general our comments were that we agreed with TVA, Westinghouse's responses.

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MR. EBERSOLE: Dr. Plesset, as a matter of fact, was engaged in grading the answers and I think his answer was D- on that one or something like that. So I think the applicant was going to come back to answer that to a better degree.

DR. OKRENT: I don't need an answer in detail at this meeting. There is going to be another time.

MR. EBERSOLE: It's whether or not the applicant wants really to do it. Do you want to talk to the answer to that question on the battery?

That's 13.

MR. MILLS: Mr. Ebersole, would you like to ask the question specifically, or like for us to --

MR. EBERSOLE: Yes, I will ask it specifically.

We have ongoing the generic examination on D.C. availability and reliability. This is based on the fact that there are many plants across the country here that have just two batteries -- that's all they've got to do switchyard functions and everything.

Well, I'm perfectly well acquainted with the fact thast you all maybe have a dozen batteries, but buried in that dozen you might have a configuration in which just two batteries, in fact, could, if you could isolate them and look at them carefully.

They, in essence, are no better or no worse than the present plants that have just two batteries. Do you follow me?

I want to know if you have that case, what recourse do you have if, for some reason, you deliberately do work on one of those batteries and cascade the second one. Do you have recoverability, which these other plants do not?

MR. PAGANO: Tony Pagano, TVA.

On the systems that are being looked at with respect to I&E Bulletin 7927 in great extent to analyze the complete loss of bus, looking at safety systems and nonsafety systems loads as well, and determining the effects of the positions assumed by the components in their loss of power mode.

When we lose the power, the system is being analyzed to show that we can indeed effect a safe cold shutdown.

In this way, we are addressing every bus and its complete loss of power.

Also, on the aux feedwater pump situation, we use a third battery. We have a Train A, Train B for two aux feedwater motor driven pump controls and we go to the turbine-driven pump and have diversity in going to a third battery force.

MR. EBERSOLE: Mainly that was the issue.

Do you have the aux feedwater system padded up so that it doesn't become a party to battery cascade?

MR. PAGANO: Yes, sir.

MR. EBERSOLE: Fine. It's a lot better than many.

MR. PAGANO: The fan also is driven off the battery.

MR. EBERSOLE: Yes.

MR. PAGANO: It recirculates from the general --

MR. EBERSOLE: So you are going to claim electrical independence from the usual AC/DC power system in respect to operation of the auxiliary feedwater system, turbine driven?

MR. PAGANO: Yes, sir.

MR. EBERSOLE: Thank you. That's good enough. I think that's fine. I think it's a model.

There was another question that I think the full committee needs to know about. It came up awhile ago when we started talking about the coincidence of seismic events and LOCAs.

This gets around to the answer to question number -- just a minute, please -- question numer seven.

The question says, "To what extent has the release of radioactivity from the containment into the auxiliary building do in an accident by way of pentration seal failures been considered? How would access to the aux building and adjacent structures be affected? What capability exists for short-term clean-up? To what extent is the control room environment protected from this and other accidents having potential consequences beyond the design basis?"

Well, that's no more than extrapolating TMI-2 to TVA and looking at the condition that prevailed in the containment, compounded by something that didn't happen at TMI-2, which is a seal failure, which made things a lot more colorful at TMI-2.

Now, remember we were talking earlier about the seismic aspect and I'd really like to use that as a trigger to illustrate how the containment seal failures can occur.

If we have a LOCA, we have a large number of circuits, or you may be -- and somebody may shoot me down if he wishes, that there might as many as 50 to 100 of these, which derive their power from ordinary AC power systems protected by ordinary batteries, not seismically or otherwise qualified.

These feed into the containmet through circuits and they go through electrical penetrations. Those penetrations may or may not be the weakest current-carrying systems in the whole particular circuit.

When you have a LOCA, since those systems are not designed for survival inside the containment, they presumably will all simulataneously, or near simultaneously, go to a fault mode. Therefore, all of these 50 systems within some sort of interval of time, will go to a faulty condition.

There is no rationale that I am presently aware of that deliberately disconnects these circuits and I think that might be given consideration. So that actually this connection is going to be performed by the overload systems in that circuit. This is the short circuit and inverse time systems.

These are not seismically qualified, so therefore, they've lost their battery capacity to execute trips. So, one then is confronted with the realization that these circuits may, in fact, if those penetrations are the weakest current-carrying links in them, be the precise point at which a burn-out will occur either through short circuit overloading at that point, or through faulting of another carrier.

MR. BENDER: Jesse, what kind of a LOCA do you have in mind that will cause a --

MR. EBERSOLE: Any which involves disruption of the coolant loop and contaminates the primary containment. To some degree, something like that at TMI-2.

MR. BENDER: Are you envisioning that the release of the water will cause the failure of the penetration? Is that or some sort circuit condition arising from high humidity?

MR. EBERSOLE: Yes. It's the fact that there are pieces of equipment inside the containment which are not environmentally qualified. These, presumably, would go to a faulty electrical mode and necessitate clearing them from their respective supply buses.

If that clearance is not executed, it may be that the penetration constitutes the actual fuse and it will go. In essence, the effect of that is loss of that penetration in a physical context and feeding of the effluent from that failure right into the aux building.

MR. BENDER: Well, you're inferring a high overturn of --

MR. EBERSOLE: Yes. Either that, or a ground fault.

MR. BENDER: -- leading to what amounts to a melting of some sort or a weakening of the penetration.

MR. EBERSOLE: Yes.

There are two general failures of that sort, Mike. It's a high fault current, in which case, if the penetration is not cleared before damping and some other part of the circuit doesn't clear because it failed first, then it becomes the failed point in the circuit, and it fails mechanically.

Another system -- and I think this may be provided for here in the low fire circuits -- is a flaring ground, which is a persistent overturn to ground, which burns a hole in the penetration which the overturn systems never wee.

In any case, under the seismic case, the protective systems are not functional anymore, and the breakers don't clear. So I have the compounded problem in the seismic event of spacing penetration failures.

MR. BENDER: I'm troubled by the combination of circumstances you are postulating. A LOCA, and thereafter a seismic event --

MR. EBERSOLE: No, no. Mike, that old thing just went out the window. We were talking earlier about seismic events and agreeing that the rationale of the systems were to protect against this by assuming at least a small (inaudible).

All the ECCS systems are so qualified.

I am merely telling you that the penetration protection system failures are not qualified.

MR. BENDER: Well, they may not be qualified environmentally. I won't debate that point. But you are describing a sequence of events that bothers me because they involve a number of assumptions --

MR. EBERSOLE: They are like dominos, Mike. They fall right in order.

This is a cascade. It is not a set of random events and I think we always have to distinguish between random events and legitimate cascades, although GE doesn't do that.

MR. BENDER: I've watched what you can do with dominos and I understand the principal, all right.

MR. EBERSOLE: This is a domino.

MR. BENDER: The problem is that if there are a couple of misaligned ones, you don't get the effect.

MR. EBERSOLE: True, and the idea is to put one deliberately misaligned in the chain so it doesn't occur.

I'd just like to ask TVA how they stand on this aspect of penetration viability and I heard earlier that in respect to the main coolant pump penetration that your first well fixed up by having provided multiple circuit breaker capability, if not seismically qualified at least you have multiple capacity to do this, I don't know whether you have D.C. trip functions which are protected or not.

I can't remember -- is the question clear to the parties at TVA who understand what I'm talking about?

MR. DILWORTH: This is George Dilworth, TVA.

In regard to your question, Mr. Ebersole, of the leakage path from the penetration into the auxiliary building, I believe the annulus area between the containment and the shield building is under a negative pressure where all these penetrations go through, would prevent direct leakage into the auxiliary building in a post-accident situation.

MR. EBERSOLE: You are saying that the annulus is a scavenge system that faces the exterior of the penetration?

MR. DILWORTH: That's correct.

MR. EBERSOLE: And if you have a postulating containment penetration figure at this point, at least it will simply go to atmosphere and will not be --

MR. DILWORTH: Through charcoal filters.

MR. EBERSOLE: It will not be put into the aux building?

MR. DILWORTH: That's correct.

MR. EBERSOLE: I think that's fine.

If you've got that, I think this, in fact, is fine. You only now have the problem of the atmospheric release problem.

DR. OKRENT: What is the leak size that you are postulating in giving the answer to Mr. Ebersole?

MR. DILWORTH: I cannot give you the answer on that.

DR. OKRENT: Because there is some leak size that you cannot tolerate in that annulus.

MR. DILWORTH: That's true, but I don't know that it would be bounded by the electrical penetrations that he's speaking to.

DR. OKRENT: I don't know, but I'm sure your answer doesn't hold for all leak sizes.

MR. DILWORTH: That's correct, but we can come back later with an answer on that, Dr. Okrent.

MR. EBERSOLE: All right.

The whole thing is, there is a multiplicity of penetrations there that, under the seismic circumstance are going to be challenged and may not work -- that is the protective system may not work, which will then lead to blow-out of the penetrations. That is the problem.

And how many of them must you consider, if any? And why don't you clear the nonessential loads deliberately, which go into containment and intercept this domino effect before it really occurs?

I see no reason why you shouldn't clear those circuits upon the currents of any event that makes it unnecessary to continue a circuit into the containment and just make this problem go away. Do you follow me.

MR. BENDER: I keep getting confused about what you're saying. I don't know whether other people are or not.

Do you require a seismic event for all of this?

MR. EBERSOLE: You do, because that is the trigger that deactivates the electrical trip function. If you didn't do that, Mike, then you wouldn't have a real problem other than the fact that you would not, in many cases, have redundant functions normal required by safety circuitry due to 279. You would be riding on single track circuitry for clearing these.

MR. DILWORTH: Mr. Ebersole, to get an understanding of what you are asking, are you saying should we not consider isolating all circuits that would not be fully environmentally qualified for loss of coolant action?

MR. EBERSOLE: Yes, just trip them.

MR. DILWORTH: Before they get into a degraded condition that would harm a penetration seal?

MR. EBERSOLE: Yes. You just operationally sidestep the problem.

MR. DILWORTH: I think we could address both of these questions. You've really got two questions -- or Dr. Okrent has got --

DR. OKRENT: I've got another one. I was just trying to make sure that we understood the bound on that.

MR. DILWORTH: I feel sure that your question that the size of that filter system is much greater than the larger electrical penetration would have, but we can confirm that.

MR. EBERSOLE: Could you tell me, by any chance, if you have electrical people here, how many circuits are there in which the penetration constitutes the weakest current-carrying link in the entire circuit and has the shortest time constant? How many such circuits are there?

MR. PAGANO: To my knowledge there are none. I think all our penetrations of capable of withstanding the maximum current ratings that could incur inside, considering they're backed up with breakers.

MR. EBERSOLE: No, no, no. If I don't back them up with bracers and I have got the conductor solidly barred together, in how many cases do I have the penetration as the actual fuse.

MR. PAGANO: I can't answer that.

MR. EBERSOLE: Well, it would be well if you said none of them, but I don't think you can.

MR. PAGANO: I thinkit's none, but I don't know.

MR. MILLS: Mr. Ebersole, we'll try to respond to that in the July meeting and take it back and have a better response for you.

MR. EBERSOLE: There was one other little thing left hanging a little bit on that question. You said, and I think the committee should be interested, that your containment purge isolation valves, you had ascertained they would close under full LOCA flow because you had compared -- they were the same models as the valves of D.C. Cook and D.C. Cook has actually performed blowdown from a higher pressure through these valves during their actual closing function and then your position is you've got the same valve , so you are performing type tests. That's the way I heard it. Is that correct?

MR. DILWORTH: I believe that was a question that was put to the staff and the staff answered, Jess.

MR. EBERSOLE: Did the staff answer that?

MR. SCHWENCER: Yes, we did.

MR. DILWORTH: I think the staff's answer was based, essentially, on a confirmation that we had from TVA that these valves indeed were the same on that basis. As I recall, Mr. John Zudans indicated we did have a couple of confirmatory things to do with TVA to insure ourselves that indeed they were the same.

But on the basis that our understanding is that they are the same valves, I believe the record would show that they had no problems with it.

MR. EBERSOLE: You did, however, when you did the D.C. Cook falure, you pumped the containment up with nice, clean air and then all you had going through it was air. In real life, if you have a LOCA you are going to have a lot more than air flying around and so you are not going to be closing with just a stream of air, and it will be against a mixture of steam, air, water and any other loose debris that happens to be going that way.

So are you not bothered by that departure from the test basis?

MR. SCHWENCER: You were here, Mr. Hajun, could you answer that?

MR. HAJUN: Hajun from staff.

There probably would be a difference in the two-phase flow associated with steam in an actual environment and the dust carried out at D. C. Cook. However, we do not feel that it would interfere with the operation of the valve since it has the pressures we are dealing in the ice condenser containment are fairly low.

MR. EBERSOLE: You think maybe this would be more pertinent to containment that has 50 pounds in it, then you have a bigger problem?

DR. HAJUN: Yes, sir.

MR. EBERSOLE: So here it is the low-pressure containment that makes you feel better?

DR. HAJUN: That's the basis of our --

MR. EBERSOLE: Well, fine.

In that test of D. C. Cook, you had rigged it, I take it, so that in the interval of closure this valve discharged through certain ductwork to some point -- I don't know what. In real life, it will discharge to certain in closed spaces, including ductwork and possibly filters and in the time interval of closing, a positive pressure pulse will occur on the discharge out of this valve, which may or may not lead to damaging influence there.

In the case of TVA, if this valve is closing and you have a real life discharge, on the discharge of the valve itself, is there any ductwork or filtration or rooms or structures that can't withstand the modest pressures of two PSI or three PSI or whatever it is down there, or will it simply blow away what is there and you won't mind? What is there?

MR. MORGAN: This is Russ Morgan, TVA.

There will be a positive pressure downstream in the valves for a short period of time. We have looked both at the ductwork failure -- we are not worried about the ductwork coming apart. That part of the systems, the filters themselves are not safety related. The back-up purge capability is a different part of the system.

And the amount of air mass that goes out during the, I believe the five second closure time, is not significant to the buildings.

MR. EBERSOLE: Have you satisfied yourself that interval discharge, you're happy with it?

MR. MORGAN: That's correct.

MR. EBERSOLE: Thank you.

I have no further questions.

MR. MATHIS: Any other questions?

DR. OKRENT: On these or other topics?

MR. MATHIS: I was talking about that specific list fo: right now.

The next one, I've got the doors open -- the topics for the next meeting.

DR. OKRENT: I would just make the comment that the question that Mr. Ebersole raised with regard to nonseismically qualified batteries, and things that might depend on their being available, what he has posed is a kind of synergistic situation where an earthquake leads you to lose these batteries and also, let's say, causes some kind of a LOCA leading to situations in the containment where you want things to occur that need the batteries, like certain breakers which depend on that.

It may not be an important question for Sequoyah; they may, in fact, have a design such that the penetration is not the weak link -- in other words, it is a lower resistance pass and other things, and so forth.

But it is not at all clear to me that this question in general has been looked at for previous plants and whether there may be situations worthy of more examination. I don't think the question is that you might discharge into the auxiliary building. I know he is particularly concerned about that, but, in fact, the containment is supposed to maintain its integrity under this situation and, in fact, for certain analyses, you assume it has maintained its integrity.

But there is some need, maybe for some combination of deterministic and probablistic look. I would suggest not really deterinistic, I think, and maybe not purely probablistic.

MR. SCHWENCER: Dr. Okrent, I'm not sure that we understood the text of the question.

DR. OKRENT: All right, let me restate it.

What he has suggested is that, due to an earthquake, you could lose D. C. functions that are not seismic classified.

MR. SCHWENCER: All right.

Are we postulating that the earthquake causes a LOCA?

DR. OKRENT: Yes.

MR. SCHWENCER: That's your postulation, that the earthquake causes a LOCA and causes the --

DR. OKRENT: A large enough LOCA to produce an environment inside the primary system, inside the containment, which could lead to electrical faults and again, in nonqualified systems, systems that you ordinarily would not think about needing, given a LOCA, but nevertheless systems that carry substantial power.

MR. EBERSOLE: By the way, that postulation is already intrinsic to all the designs, although it has never been admitted. It is in all the millions of dollars that we have spent to seismically qualify the LOCA mitigation systems.

I realize the staff has never been willing to associate a LOCA with an earthquake because it carried with it the stigma of saying if an earthquake can damage a seismically qualified system, then it can also go out and damage aux feed water or circ water, or any of the other seismically characterized systems.

In a short interval of time then in these systems, you have the possibility of failures of redundant systems.

So the staff has carefully steered clear of that and has invoked the miraculous combination of a LOCA instantaneously followed by an earthquake.

And I think reason now is prevailing and we are looking at it in a different light.

MR. SCHWENCER: Dr. Okrent, pursuing your question further --

DR. OKRENT: Again, what he has suggested is that, in the event of an earthquake, you have reason to think you might lose your nonseismic Class I D. C. system and you may be depending on this to be able to operate certain circuit breakers on large AC power systems.

Now, if you have a moderate size LOCA as a result of the earthquake, which may not be probablistically unreasonable to assume, you will produce an environment in the containment for which some of this equipment is not qualified.

Now, he has further suggested that there could be a fault as a result of this which is in the nature of a short circuit and that then, again -- and this is still the possibility, we don't know, that this fault might need to the loss of the electrical penetration, because that's where you have the overheating and you've already lost the ability for the circuitbreaker to go, because you've lost the battery.

That's why I said I think you need to look at it probablistically. These are related events, but they don't automatically occur one on the other, okay?

MR. SCHWENCER: Okay. Say your focus is on the loss of the ability of the breakers and the eventual lost, or the postulated loss, of the containment electrical penetrations. Okay. Let me sure I've got the scope of the question.

DR. OKRENT: Okay, but I don't want you to postulate these all to happen automatically. I don't want you to postulate they are all completely independent if you want to look at this. I think of some things -- I wouldn't give it the highest priority that you have, but something that somebody should think about.

MR. SCHWENCER: Okay. I'd just make one comment.

I know in general that the staff looks at containment penetrations. I believe IEEE-37(3) is the requirement for all the current design plants. They must be designed to take short circuits and I recall some of the analysis that has been done over the past two or three years that the staff satisfies itself that there are at least two levels of protection, so the question really narrows down, do we believe that we would lose all levels of protection, and then look at the capability of the penetrations beyond that.

MR. EBERSOLE: Does that IEEE require that that protection be carried out by seismically competent DC power supplies?

MR. SCHWENCER: It doesn't speak to that, Mr. Ebersole. . What it speaks to is it must take whatever the design short circuit capability of that circuit is.

MR. EBERSOLE: Maybe TVA could say something about that.

Does that particular criteria require competent seismic trip circuits?

MR. SCHWENCER: I don't think it does.

MR. EBERSOLE: I don't think it does.

So in essence that's the focus.

MR. RAY: I'd like to come back to Dr. Okrent's suggestion, or reminder, that you examine the possibility of losing the DC source in a plant due to a seismic event.

You have in a plant safeguard systems which must be qualified seismically and yet every one of them depends on a DC source of energy. Either they close a breaker to actuate it or they open the breaker to turn systems off in the event of a seismic event.

Really, you're kidding yourselves. Those systems are not seismically qualified if the DC source to them is not seismically qualified, and it's that simple.

You don't have to postulate a LOCA or any of these other things.

MR. DUNNING: I'm Tom Dunning from the NRC staff.

The subject that you've been addressing here on the protection of circuits for the category which you would say are non-IE circuits feeding into the containment penetrations where you'd be worried about damage on the other end and causing an overload condition -- there is a regulatory guide that does address the over-current protection.

It does not require that the circuits need to be seismic as far as the protection goes.

However, for a majority of the circuits, the breakers that are used are the same type of breakers that they use in safety-related systems. Generally you will find that there is a switch gear at a plant which is all one make, so therefore whether one classifies one section as safety-related and another one as not, it's pretty much the same system.

MR. EBERSOLE: I couldn't --

MR. DUNNING: Probably the area where you get into some concern is something like reactor cooling pump, certainly at large electrical loads, and when you get into large, electrical loads you get into the categories where you are not using thermal overload devices of the wall-type circuitbreaker which don't require any external power source, you are getting into where you do get into schemes that are relying on DC power.

If, in old plants, you have a two-battery system, those batteries that are used for engineering safeguards are seismically qualified. Probably the same batteries would work the breakers that would find this function, so inherently in a real old plant design, since it only starts out with two batteries, they are seismically qualified and you've got a seismically qualified battery source.

Also, I don't think the impression should be left that any of the engineering safeguards operate from a nonseismic category, one battery source. That is certainly not the case.

It is only a question with new battery systems where you might be splitting up the batteries, would a system now use perhaps a battery source that is a nonseismic source for a DC power source to trip something like the reactor pump breakers where those dual breakers do give you this overcurrent protection.

I think that is one kind of an aspect that can be looked at and it is probably one of the areas that might be of the greatest concern with this type of a subject.

As I said, circuitbreakers on thermal overload type devices are generally all the same type of devices that are used typically throughout the plant and there is probably a great deal of similarity as far as their seismic capabilities goes, from those that are used for Class IE systems versus those that are not used for systems that might not be classified as iEA.

MR. EBERSOLE: I couldn't agree with you more. You're talking about mode breakers that have internal circuit carrying features inside, and they really don't depend on external tripping supply. They look just like the ones that have been qualified. In fact, they're the same breakers.

On the other hand, those that have the circuit that winds around through, say, a turbine haul and eventually terminates and a battery that stands up on the side of the tracks that is not seismically qualified may well be -- the first event in an earthquake event is that the battery turns over.

Now, when a battery turns over, you really don't know what is going to happen. The circuit may remain energized and the pump keeps on going, or it may trip and you just got a tremendous possibility in front of you as to what may happen.

If the seismic event has, in fact, been sufficient not only to overturn the battery but to say, break the condenser neck, one of the things that could happen is that you have a continuous river of water coming into the plant and you can't turn it off, because you don't have any competent circuitry to go do it.

You'll have to take a shotgun to turn it off.

And so the whole picture becomes very complicated when you use the nonseismically qualified DC source.

I certainly agree that the older plants which have all the horrible problems associated with just having two batteries do have the one good feature that the two they have are very good. However, that is compounded by the fact that those circuits which they serve which are non-IE, they meander out in nonseismically qualified areas of the plant, all over the case, and in a seismically event they are simultaneously challenged to clear a great many breakers because the circuits have gone into faulted modes. Therefore, they become -- although I guess Dave Henauer wouldn't agree -- they become parts of interchanged systems and both battery banks are challenged by multiple failures if they are circuit terminals and they must clear in order to survive.

MR. MATHIS: That's a generic issue and I don't think we should take any more Sequoyah time on it.

MR. EBERSOLE: It's not Sequoyah's problem. Sequoyah is a heck of a lot better off.

MR. MATHIS: Let's go to the next topic, and that is items to be discussed at the next meeting.

We've got the TMI issues that were scheduled to be brought up at that time. In other words, the Lessons Learned and that sort of thing as it applies to Sequoyah. Whatever other items you feel from today's discussions you want to hear more about that you have specific questions on, whatever.

DR. MARK: I think a number of things have been identified in the course of the discussion. We can probably assume that those should be adjoined, such as the nozzle cracking, information on it would be a point.

DR. OKRENT: I think next time I'd like to hear what the applicant and the staff -- what the status is on their studies of hydrogen control and vented filtered containment. The Committee, you may recall, recommended a general waiver of NTOL's initiated studies on this as well as other plants.

We also recommended that the staff not keep the IREP program completely within its own pocket but that each reactor initiate some practical but expeditious ways what I'll call reliability-probability type analyses and I'd be interested to hear next time whether TVA is doing something of that sort and, if so, what.

One other point --

MR. BENDER: Dave, do you mean that to apply to Sequoyah, or are you thinking in terms of the broader --

DR. OKRENT: If they can do it as some industry group that is all right with me, but I would like to hear whether they have done anything, or plan to do anything, along these lines.

DR. SHEWMON: While you're interrupted, the Committee did write a letter urging the research people to take up the design options for vented filtered containment. I couldn't understand or remember just what it was you said about our requiring every NTOL to do a design, do a study, just what your memory of what we said we wanted them to do there?

DR. OKRENT: Well, if somebody can find a letter, if you want, on the final report of the Lessons Learned task force, probably. The Committee recommended that each reactor operator do a study either by itself or as a member of a group of possible designs and the pros and cons.

One other topic that --

DR. SHEWMON: But you don't foresee that as a limit on when we can give Sequoyah a license?

DR. OKRENT: Exactly. You're perfectly right.

I don't think the Committee, in fact, in its letter it said it did not consider this something that needed to be done before the beginning of the operation or so forth. I think we are quite careful and it is the same, obviously, on an IREP program.

One other thing I'm a little curious about, it's been a long time since we looked at the flood situation on Sequoyah and what steps they thought they would take in the event of a flood.

If I remember back to the construction permit stage, there was a disagreement between Sequoyah and the staff as to what level the plant should be designed for. Sequoyah argued that they could take certain steps in the event of a flood as big as the staff was saying. I think, in fact, the Committee sort of agreed with Sequoyah, it is my recollection.

Is there a statement of what they need to do and how they need to do it?

MR. EBERSOLE: There is one in here relative to the matter of how they are going to cope with the release of combustible oils and fluids.

DR. OKRENT: Well, if it's practical, just a three-minute summary of what would be involved and, in other words, are there any after-effects on the plant and so forth and next time, I think -- I have to assume, we will give them time to prepare for it. It's something not too hard for them to do, because it was supposedly something that was going to be worked out and by now, it must be worked out -- right?

They're all nodding their heads yes.

DR. MARK: I think it's possible that the main effect of the flood they are prepared to handle at the plant, there would be no workers houses left anywhere, nobody to come to work.

DR. OKRENT: In other words, for example, I am interested, you know, in addition to what happens to the power when the crest was there, is there any problem in recovering over days and weeks and so forth and maintaining shutdown.

I think they've got that worked out. I'd just like to hear about it briefly.

MR. MATHIS: Another thing that I think we touched on earlier that is certainly important for our next meeting, and that is a discussion and some kind of a decision as to whether we are talking about one units or two units.

DR. MARK: Or the change as to broadening the picture, probably not a Unit I licensing thing, but there was also then, of course, comments which will be obvious on the then-known status of the low-power tests.

MR. MATHIS: Well, we can come back and define this later on.

Does anybody have any other ideas?

DR. SHEWMON: I would like to make a specific request to the staff, if I could, for me to get a copy of this report on the nozzle-cracking that TVA sent in in February or March and also a copy of the Westinghouse Report which explains what they think the origin of this cracking is and their study of it.

Is that -- okay. Thank you.

DR. MARK: I think, if there is nothing further, I would like to thank the representatives of the applicant and staff for pulling this together. We'll hear more of it again.

If there is nothing else on Sequoyah, we had better adjourn for lunch and reconvene in one hour from now.

(Whereupon, at 1:35 p.m. the meeting recessed to reconvene at 2:30 p.m. this same day.)

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DR. MARKS: The meeting will resume.

I'm asked to remind everyone to be sure to use the microphone -- at least, if he hopes to have any remarks he makes preserved for posterity; otherwise they will be ignored.

We will go on with the program as it's laid out. And the first report from the staff is the recent event at Davis-Besse, which we'll get an account of from Nat Villalva.

(Pause)

MR. VILLALVA: Can you hear me all right?

My name is Villalva, and I'm with Inspection and Enforcement, Technical Programs. I'm going to discuss the recent event where a loss of decay heat removal capability at Davis-Besse. I have a set of slides, which I think you all have copies of material contained therein.

If I may, I'll go to the second slide and use that while I talk to some of the items contained in what's in your first sheet. You can be referring to the condition of the plant prior to the event.

The event was, the plant was in the refueling mode; it was not in complete refueling mode in that the head was not removed, although the bolts were detensioned. The reactor coolant system level was slightly below the flange head. The temperature at the particular time was about 90 degrees Fahrenheit -- ultimately it rose to 170, based on the heat rise due to the loss of decay heat removal capability. The manway cover on the top of the steam generator was removed -- and that would be up in this particular location, it's the upper manway. And the decay heat at that particular time was being removed by decay heat removal system number two. Number one was down for maintenance.

As is quite common during the times of either refueling shutdowns or during the cold shutdown mode, there are many systems taken out of service. At this particular time, the systems that were, indeed, out of service included the source range channel number two. And some of the systems were out of service for maintenance activities, while others were there to preclude their inadvertent operation -- there were some systems that you would not want to accidentally come on while the system was in the refueling mode. And the high pressure injection system, for example, was out of service because you did not have the need for said system and you didn't want it to accidentally come on. Likewise there would be no need for containment spray; that was deactivated. And for maintenance purposes, decay heat loop removal number one was down. Now, the station battery number one, which consists of, actually, a 250-volt battery with a plus-125 and a minus-125 system, was down for test purposes. The -- that is a very, very big contributor to this event, as I'll discuss later -- the emergency diesel generator number one likewise was down; that had no effect on the event. 4.16 Kv essential switchgear number bus C1 was down. And as I will show in the single-line diagrams later, 13.8 Kv switchgear bus A was energized but all the breakers emanating from that bus were open, so it was not feeding its loads at all.

MR. EBERSOLE: Could you comment on how many hours you were away from shutdown from full power and what would have been the minimum time within which you could have gotten the volt heads off in case you were in a hurry?

MR. VILLALVA: In this particular case, the plant had been in a refueling mode for many weeks; I believe it might have been as much as a month.

Do we have anyone from Davis-Besse here?

MR. JORDAN: This is Jordan. I think it is four weeks.

MR. VILLALVA: Four weeks.

MR. EBERSOLE: Is it fair to say that this accident could have happened within ten, twelve hours after full power run?

MR. VILLALVA: No, sir, because before you can get into this mode you shall be in a cold shutdown condition for 72 hours.

MR. EBERSOLE: So it takes 72 plus something?

MR. VILLALVA: Plus something, right. And then, furthermore, plus something, they would not have gotten in this mode until quite a bit later, because, as I indicated previously, they also removed the manway on the --

MR. EBERSOLE: All right. So it could have been, then, maybe three or --

MR. VILLALVA: A hundred hours, or something like that.

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MR. EBERSOLE: It may have been, could have been a hundred hours, in which case it might have been a little more complex.

MR. VILLALVA: It could have been a little more -- the consequences, instead to rising to that in the time that they recovered it, could have been a little higher or higher, yes.

MR. EBERSOLE: (UNINTELLIGIBLE)?

MR. VILLAVA: I won't talk to that.

(Laughter)

MR. EBERSOLE: Okay.

MR. JORDAN: This is Jordan. Can I make a correction? That was 13 days, was the duration of the outage, up to the point of this particular occurrence.

DR. LAWROSKI: Any estimate of how much longer the decay heat (WORDS UNINTELLIGIBLE) would have been unavailable?

MR. VILLALVA: They were doing some maintenance, as I understand it, on one of the valves in that loop. It is not clear at this time to me how long that would have been. But it -- conceivably, they could have got -- they did get it back in the line later on in the sequence but as part of their corrective action.

And as we pointed out, we perceive the major contributors to the event were, indeed, the extensive maintenance and/or testing activities that are conducted when you' , relatively forgiving mode for the plant, but, ne~erth ess, they

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do perhaps conduct too many activities at that particular time.

I will talk to the inadequate procedures and/or administrative controls later, as related to the event.

And to a lesser degree, this becomes a standoff. They have a two-out-of-four SFAS logic. In some views, that is considered to be the ultimate in that that will make sure that it will actuate for all events. It will perhaps actuate for events that might not require their action. Whereas the other alternative might be a one-out-of-two taken twice. Had they have used that system, they might not have gotten into the situation that they were ultimately in.

As a result of the event, IE has taken several actions to preclude it. One, they issued an information notice describing the events, which you have all received; and it was merely to alert licensees of the potential for losing decay heat removal capability while either in the cold shutdown or refueling mode. As a quick follow-up to that, we issued Information Bulletin No. 80-12 the following day, requiring licensees to take specific action which would tend to preclude repetition of this event.

Just for illustrative purposes, the steam generator. As we indicated before, the level in the RCS was slightly below the head flange, which would also bring it down into the lower level of this (WORDS UNINTELLIGIBLE). The upper manway cover is at the top of the one-screw steam generator. The reason for the system being down so low, that was a reason, even though we caught

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it in a refueling mode, the refueling cavity was not filled, because the water would in that case be at a higher elevation, and at this particular time they were conducting some eddy-current tests on the tubes in the steam generator.

With respect to the extensive maintenance that was going on, I'd like to use this very simplified diagram to illustrate that they were, indeed, operating on essentially a shoestring. Namely, this feeder, this particular line from the 13.8 Kv system B, was feeding all the plant auxiliaries. The counterpart, or its redundant 13.8 Kv bus A, was, indeed, energized, but, as we stated, all the breakers were open. And the reason for showing some of these other systems is to show that they do have capability for a lot of intertie but all of this capability for intertie is, indeed, lost if they are only providing power from one source.

In brief, the net result is that they later in the event, the precipitating event was, indeed, what appeared to be at first a ground on this circuit which tripped this breaker. It has become more apparent that it was some maintenance activity, somebody knocked the relay, or hit it, while doing some maintenance work, such that it tripped the breaker.

Irrespective of the cause, they did lose the only source of power down to instrumentation channels YAR and YBR, channels A and B. These, in turn, do not get us in trouble yet, but lead to it to this degree. We indicated earlier this is actually the alignment of this particular battery, the one that I said was being tested; this represents battery number one, consisting of a 125-volt plus side and a 125-volt minus side of the battery. The breakers emanating, again, from this battery were all open. They were conducting some load tests on it. They were testing to see -- I think they were conducting some tests on the batteries themselves. Such that instead of feeding in through the inverter to channel one and through channel three, through the batteries, they were providing power from distribution panels YAR, YAR, and also from YAR through the two important channels, such that when they tripped that breaker, YHBBF 2, they lost power to these two channels.

This channel, in conjunction with this, initiated the two-out-of-four SFAS logic. A loss of power to that would be the equivalent of an actuation or a positive step in that direction. And it actually caused actuation of the counterparts at channels two and four, which were, indeed, the ones that were controlling the operating system.

In brief, the five channels of -- I mean, the five safety features actuation systems that were actuated were level one, which would be the equivalent to high radiation; level two, that would say we have need for high-pressure safety injection; level number three would say that we need low-pressure safety injection system; level number four, which would say we need containment spray; and then finally level number five, that would indicate that we have a low level in the borated water storage tank, which would say let's go into a recirculation mode. That is finally the one that got us into the problem here.

I might add, as we pointed out previously at this point, that we had by-passed high-pressure safety injection number one, because it wasn't needed; we also had by-passed -- by by-passing they literally racked out the breakers that would operate those systems, they did the same thing for containment spray. And they couldn't do that for low-pressure safety injection, of course, because the decay heat removal pumps are the same ones that are used for that purpose. So that particular loop was still in operation.

As I alluded to earlier, I said administrative procedures and/or controls were inadequate. If they had've by-passed the resert mode of operation, pulled out the breaker to get you in that particular system, as they had previously done -- or as they had usually done in all cases for high-pressure safety injection and for containment spray, they would have never gotten into this particular situation. So that was one place where the procedures were inadequate.

Likewise, it's very apparent had they not been doing maintenance on both of these -- or testing both of these batteries simultaneously, say, if they'd've just had this battery in operation, they could have well lost this battery, and not losing this, they'd've only lost one out of the four.

So, again, it's that whole shoestring effect that was the major contributor to this event.

MR. RAY: Did you say they lost two out of four and that was all was necessary?

MR. VILLALVA: Yes, sir.

MR. RAY: Because they still had battery channel D.

MR. VILLALVA: Yes. The point is that on this to actuate SFAS level it needs two of the four signals to actuate. That is the logic. And these are the two channels that were actuated.

There are other plants that would take a one-of-two taken twice daily, it would take one from this and one from the counterpart.

Yes?

DR. SIESS: Could the high-pressure injection system have been operable, could it have been used to cool the core part of the seven hours?

You made quite a point that it was locked out.

MR. VILLALVA: I made a point that it was locked out because there was never any perceived need for it in the mode in which you were operating the plant.

DR. SIESS: I know that. But I'm saying for the incident that occurred, what is the significance of the HP injection being locked out? If it had not been locked out would it have been usable?

MR. VILLALVA: Well, if it had been -- if it had not

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been locked out, it would have gone through the same throes that the low-pressure safety injection pump was in, namely, it would have become airbound, because it would have been sucking air from a dry sump, eventually. It would also get its boost from the --

DR. SIESS: So there's no real significance to the fact that it was not operable?

MR. VILLALVA: No, sir, not as a contributing event to the factor. I was just using that as an illustration of the fact that some systems that were not needed were, indeed, locked out. And I indicated two systems that were not needed were --

DR. SIESS: It was, indeed, not needed?

MR. VILLALVA: Yes.

DR. SIESS: So that was appropriate?

MR. VILLALVA: Yes, sir.

DR. SIESS: But the other things you mentioned that were out of service for maintenance, that was not appropriate, shall we say?

MR. VILLALVA: Yes.

DR. SIESS: The other decay heat removal.

MR. VILLALVA: That is a moot point. Had it been in operation, they might, in the manner in which they were operating right in here, they might have knocked both of them out or got them both airbound.

DR. SIESS: Well, now, is it -- how long would it take to -- I understand that if something is out of operation, out of service for maintenance or repair, it might take quite a bit of time to put it back in service. But if you've deliberately taken something out by removing the breakers, it shouldn't take seven hours to put it back. So they could have put the HPI back in in a matter of minutes.

MR. VILLALVA: Yes, sir.

DR. SIESS: Am I right?

MR. VILLALVA: Yes, sir.

DR. SIESS: If it would have, indeed, been useful.

MR. VILLALVA: Yes.

DR. SIESS: By that time they knew that they couldn't get the pumps action.

MR. VILLALVA: Well, if you recognize that the HPI would have been at -- indeed, I'm speculating right now, to this point, there's absolutely no pressure on the system, whether you be in the run out condition for those particular pumps or not, I don't know.

(BRIEF PORTION INAUDIBLE)

MR. RAY: Did it actually take them seven hours to come back, get cooling?

MR. VILLALVA: The actual sequence of complete restoring --

DR. SIESS: I'm sorry, two-and-a-half hours they had decay heat flow established. I'm sorry.

MR. VILLALVA: That was decay heat flow established, at

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that particular time they did not have the decay heat removal heat exchanger in operation, they got it back in at a later time.

DR. SIESS: Complete recovery was in seven hours?

MR. VILLALVA: Yes. Well, that, that power completely recovered, if you remember, that was putting back in some of the power systems that had been taken out previously for tests and things of that nature.

MR. EBERSOLE: Could you comment right now, because it's related, as to how these pumps are designed to perform or not perform at full runout condition for any period of time? I don't think any of them are. And I don't think any of them, certainly, are designed to hold to a NPSH failure for any length of time. Are there any monitoring systems or protectors that (WORDS UNINTELLIGIBLE) to prevent permanent damage to these pumps if this situation should occur?

MR. VILLALVA: I don't know what's in them to protect them. Do you, Ed?

MR. JORDAN: No, you're -- this is Jordan -- you're asking is there protection for the high-head safety injection pumps against a runout condition?

MR. VILLALVA: Any pumps, I think.

MR. EBERSOLE: Any pumps. Are they protected against full runout conditions, if they're not supposed to operate there, or against cavitation on the suction side, so that they'll shutdown before they ruin themselves?

MR. JORDAN: No.

MR. EBERSOLE: So, then, it's essential --

MR. JORDAN: Not to my knowledge.

MR. EBERSOLE: -- that we stop both these processes quickly, before damage ensues, right?

MR. JORDAN: Yes.

MR. VILLALVA: Yes.

MR. EBERSOLE: Thank you.

MR. VILLALVA: Well, I don't know whether they would be excess power in the situation that would cause them to trip.

Let me go through some of the sequence of events that occurred.

This is the line-up of the decay heat removal system just prior to losing of the instrumentation power, and to give you some kind of a line diagram of what occurred.

Originally, we were running through a decay heat removal mode, through these two valves taking suction into the decay heat removal pump and back into the reactor coolant system. At the time that we actuated all five SFAS levels, actions one, two, three, and four, as I identified here, all occurred simultaneously. Action number one occurred due to the high-pressure injection signal and low-pressure safety injection signal being received, telling the system to isolate; so you try to isolate containment, you block these valves, closing suction in from this line. Action number two was also low-pressure safety

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injection was set, this opened this valve and takes suction from the borated water storage tank, so you're pumping water in through the borated water storage tank for a particular length of time. Action number three, of course, comes in from the SFAS level number five that said, hey, our borated water storage tank level is low, let's block flow through that system, and simultaneously let's open -- let's close this valve and open this. Eventually we closed this valve, losing all water flow into the pump, and finally opened this valve which, in turn, starts sucking air.

Time sequence of the events is approximately as follows. This is crude. Your first normal decay heat removal pumps which were isolated, they'd close very, very rapidly. Secondly -- in approximately 20 seconds -- in about 30 seconds the valve that was to provide water from the borated water storage tank opened. Meanwhile the other one, that's blocking water flow from the borated storage tank, that was opened to begin with, starts closing; and that closes in about 30 seconds. Such that at this particular time you have lost all sources of water. And meanwhile, at zero time also, your sump pump -- your valve at the sump starts opening. And from here on in you're trying to take suction from a dry sump.

MR. EBERSOLE: Are these pumps equipped with water-lubricated seals, such that just a brief interval of time will burn out the seals?

MR. VILLALVA: I don't know what the particulars are on the pumps.

MR. EBERSOLE: Sometimes their journals are lubricated --

MR. VILLALVA: I don't know.

MR. EBERSOLE: -- with water.

MR. VILLALVA: I don't know if they're hydrodynamic bearings or what kind of journals they have on them.

MR. EBERSOLE: It might be a factor to consider.

MR. VILLALVA: But the event, when these pumps did go through, there was water coming out of some of the Tigon (phonetic) tubing that they were using as manometer, and so they promptly stopped them. Also, it was probably -- I understand it was even coming out of the manway up on top. I can't perceive it getting that high, but I have indications that it did flow from there.

To recap', some of the actions which we have taken are the following. We indicated that we notified all licensees of the event by the information notice. That was followed by the bulletin, which asked them to review in great detail the Davis-Besse event and any similar event that might have occurred at their particular plant, to have a better understanding of the configurational problems that they could get into, also to review their hardware capability, including, oh, what kinds of diversities or other alternative methods that they might possibly employ to prevent loss of DHR capability while either in a cold shutdown

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or refueling mode. They should analyze their procedures, and also with respect to guarding against the loss of redundancy or diversity possible responding to loss of decay heat removal during times when activities that could degrade the DHR capability are being conducted, in other words, when they're in the refueling mode or when there is an extensive amount of maintenance, are they really looking at all the associated circuits, what's the effect of some control circuit or on some power circuit on this particular system.

Finally, to implement at this particular time, as soon as practicable, administrative controls to assure that redundant or diverse DHR methods are available during all modes of operation. That's very desirable, but whether we can actually get any more than assurance I don't know. To determine -- be sure that means of decay heat removal are available or that we might have means for restoring decay heat removal capability on a very, very expedited basis whenever they're in those particular conditions.

DR. MARKS: Chet, you had a question?

DR. SIESS: I've got a couple of questions. One is, in the licensee event report from, the licensee event report from Davis-Besse, there's a note, under "corrective action," that warning signs will be placed in the high-voltage switchgear rooms to warn personnel in the area the cabinets are sensitive to mechanical vibrations. Was something happened in there that contributed to this?

MR. VILLALVA: Yes. That --

DR. SIESS: That's question one. Question two: Is it seismically qualified equipment?

As if I needed the --

MR. VILLALVA: I'll answer the first. I won't touch the second.

There has been some speculation that, indeed -- and I -- I was -- I shudder to think that that's what caused it -- that if they could juggle or jostle that big cabinet that would be housing the relay for that particular -- it's a heavy-duty piece of equipment, 13.8 switchgear is, indeed, very heavy switchgear equipment, and if its cabinet was that sensitive to being jostled to get the relay to operate, I --

DR. SIESS: Okay.

MR. VILLALVA: -- I shudder.

MR. RAY: Was there electrical maintenance going on with it?

MR. VILLALVA: There were a lot of things going on. They were testing the transfer scheme to power to that alternate bus to the bus that was out of service, I think, in addition.

MR. RAY: Well, the simple act of slamming a door, if they had opening relays were mounted on the panel door, if they opened that and the person was going in the wrong door and they said, "No, I don't belong here," and slammed it shut, that would

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operate those relays.

MR. VILLALVA: Yes. Let me suggest that if I were using any 13.8 Kv relay I would not mount same on a door.

MR. RAY: Well, it's down at --

MR. VILLALVA: Yes, I know.

DR. SIESS: I have another question. The temperature was 140 degrees at the beginning and, as near as I can tell, 170 degrees when --

MR. VILLALVA: Ninety, I believe, at the beginning.

DR. SIESS: Okay, I'll take your word for it. Suppose this had occurred after the minimum shutdown time of 72 hours, same time without decay heat removal. Has the staff made any estimate, or the applicant made any estimate, of what temperature would have been reached?

MR. JORDAN: This is Jordan. Yeah, you would have had boiling, I believe.

DR. SIESS: Any other consequences? I mean, would boiling --

MR. JORDAN: As long as you can resupply water --

DR. SIESS: Water.

MR. JORDAN: -- then boiling would be a heat removal mode which wouldn't damage fuel, as I understand it.

DR. SIESS: At what point could they resupply water here, at the 1630 hours? Decay heat -- decay heat flow was re-established at 1630. Now, you said they didn't have cooling, but if you're just going to boil, put water in there --

DR. OKRENT: If you're going to boil you have to have new water.

DR. SIESS: Well, that's what I said. But flow was re-established at 1630; that was two hours and a half into the incident.

MR. VILLALVA: All that merely did is probably got rid of that stagnant water, to the degree that it was stagnant, because you could not get natural circulation through an open loop.

DR. SIESS: No, I'm not talking about that.

MR. VILLALVA: I understand.

DR. SIESS: You said boiling, so if you could have gotten water back in at two-and-a-half hours, even if it were boiling at two-and-a-half hours, you could, at least, maintain a steady state.

MR. VILLALVA: Yes.

DR. SIESS: Let me ask one other question. It's not clear to me from the description, any of them, or what I've heard, just how many faults there were to contribute, you know, to get us into this situation, like an event tree or fault tree, I guess, because this, things are mixed up in here. I got the feeling there were three or four and none of them -- let's say, some of them, I guess, relatively improbable and some highly probable. Has anybody worked that out?

MR. VILLALVA: I didn't go through a fault -- I personally did not --

DR. SIESS: Because this, this thing won't happen again, but I think it's an excellent example of how three or four, or maybe even five, seemingly innocuous things, by themselves, can build you up to something that is potentially serious.

MR. EBERSOLE: Well, this thing can happen again. You can have inadvertent closure of these valves --

DR. SIESS: Well, this parti~ular thing won't happen again if people read the -- no, that's what I'm talking about, but you could have other four things happen. And if it doesn't do any more than impress people that you've got to look down these multiple little failure things, including the non-seismically qualified thing that you can bump.

SPEAKER: Is the 13.8 non-seismically qualified, that switchgear?

MR. VILLALVA: I do not believe it would be. And I'll say this: because it's not part of the engineered safety feature system. They start getting in at the 4.16 Kv stuff, where you had your diesel generators connected to. And there are --

DR. SIESS: But the failure of a non-seismically qualified system -- the decay heat removal system is not seismically qualified.

MR. VILLALVA: The decay heat removal system is seismically qualified.

DR. SIESS: Well, I'd have to call what happened a failure of the decay heat removal system.

MR. VILLALVA: Okay.

DR. SIESS: That is, it was unable to remove heat. Right?

MR. VILLALVA: Let me back off on that.

DR. SIESS: And so the failure of a non-seismically qualified system caused the failure of a seismically qualified one.

MF VILLALVA: In that particular mode and that particular configuration, recognizing that had that power to the decay heat removal system been lost, it would be no different than, say, they had lost the -- lost off-site power, in which case, as a backup to it, you would come in through your diesel engine generator.

DR. SIESS: Which didn't work.

MR. VILLALVA: Which was no need for it to work. The pump never went out, as a matter of fact, from loss of power, if you would.

DR. SIESS: I didn't say the pump went out. I said the decay heat removal system failed.

MR. VILLALVA: Yes, sir.

DR. SIESS: And what caused it to fail?

MR. VILLALVA: The manner by which they were connected

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at that particular time.

DR. SIESS: Involving a non-seismic system, okay.

MR. VILLALVA: In that mode of operation, yes, sir.

DR. SIESS: But, I mean, no matter how you got there, they were hooked up in such a way that the failure of a non-seismic related system took out a needed seismic qualified system.

MR. VILLALVA: Yes, sir.

MR. EBERSOLE: Yeah, sure did.

DR. SIESS: I mean, I think it'd be interesting to try to diagram it as an example. Somebody might even be able to find a couple of more paths through that system; I don't know.

MR. EBERSOLE: Well, I think it's a good example of system interactions.

MR. VILLALVA: Right, absolutely.

MR. EBERSOLE: In this connection, this matter has been discussed time and again for many years in aspect to the potential for losing a two-track redundant system RHR mainly because of that single suction system they've got. You know, there's just two valves in series; and one thing, you can lock them out, for some reason or other, and lose suction. And this leads to a thesis that, okay, suppose you had, in fact, had this accident happen much earlier in time after shutdown and you, in fact, did damage the pumps, because they had a seal peculiarity or a bearing peculiarity, they didn't even run a few minutes, and

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now you don't have any RHR removal and you're faced with this, what looks at first to be a very simple method of cooling, which is boiling -- well, fine, it looks good until you look at it pretty hard and then it doesn't look so good any more, and that is, you have quite a few megawatts left by the time you can get this far, if you're in a hurry, and the clouds of steam that come out are not small, and they can go through the open containment and go into the auxiliary building and, first thing you know, the whole plant is in a Turkish bath and you have condensation problems that affect all of those systems which are not so environmentally qualified, and trouble mounts on top of trouble.

I think there probably should be a criterion that we should be able to cool by just straight out boiling, but there is nonexistent -- it doesn't exist at this time.

And this accident has a little bit of a peculiar configuration in that you had unbolted the head but you hadn't removed it. And if you had gone into the boiling mode -- which you were about 50 degrees away from -- it seems that you could have created a vapor bubble under the lid and dried the core out, even though you were boiling in the macroscopics case.

Now, I don't know how you would have prevented that, unless you propped open the PORVs. Or does anyone --

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MR. VILLALVA: Well, the PORVs would have been useless to you, because your (WORDS UNINTELLIGIBLE) which are operating in the location --

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MR. EBERSOLE: Well, if you could have electrically opened them, though, you would --

MR. VILLALVA: You don't have water in that system over there. Your pressurizer voided.

MR. EBERSOLE: I know that. But I'm saying --

MR. VILLALVA: You're at very low level.

MR. EBERSOLE: -- suppose, though, that you had went on to the boiling condition here. You said you had the lid on.

MR. VILLALVA: Yes, but what good would the PORVs opening do that you're not already doing with the open manhole? That would just be a tiny, microscopic opening.

MR. EBERSOLE: You had a manhole open --

MR. VILLALVA: The manhole was open, yes, sir.

MR. EBERSOLE: -- into the primary system?

MR. VILLALVA: Yes. That was --

MR. EBERSOLE: Okay.

MR. VILLALVA: -- that manway that was open.

MR. EBERSOLE: Okay.

MR. VILLALVA: Yes.

MR. EBERSOLE: It was. Had it been closed --

MR. VILLALVA: That was a scenario that Rancho Seco is concerned with: Do they have to open it to provide enough cooling by boiling?

MR. EBERSOLE: It might be a good idea to open the manhole before you loosen the lid.

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MR. VILLALVA: Right. To at least be able to dispel that --

MR. EBERSOLE: In fact, I think that it might be a criterion well worth considering, that we should be able to boil by no more than getting a fire truck to fill the system.

MR. JORDAN: This is Jordan. Certainly boiling is not the preferred way of cooling the core under that circumstance. And what the bulletin was trying to convey and the actions I think staff wants are to assure that the plant doesn't get to the situation where it only has one mode of cooling in the outage. So that, for instance, later on in the refueling, when they have a very large volume of water in the refueling cavity over the reactor, the heat rise rate, based on that large volume and the relatively low heat in the core, gives you lots of time.

In this particular situation, it's a mode that I don't think we'd scrutinized very carefully, staff had not, where you have a very small volume of water. And we don't have sufficient restrictions on the operation or on the operability of the equivalents. And so we feel that the actions that have been taken and are still in progress will fill that gap.

MR. RAY: Is there any prohibition to having instrument channels, essential instrument channels, one and three fed from diverse batteries? For instance, could I have channel one fed as it is now and channel three fed from battery number two?

MR. VILLALVA: That particular design is a very, very --

I might add, is -- I would consider it a very good design. It was the fact that both batteries were, indeed, being tested simultaneously --

MR. RAY: No. No, no. I mean, no, it was only IP and 1N were being tested, wasn't it?

MR. VILLALVA: Yes, but I consider that two batteries. One is a plus-125-volt battery and the other one is a minus-125-volt battery.

MR. RAY: Yes, I know. But I don't think physically they're that separated, are they?

MR. VILLALVA: In reality, they are. They're --

MR. RAY: Aren't they in (WORDS UNINTELLIGIBLE)?

MR. VILLALVA: They're in the same room, but one is on one side of the room and the other is on the other.

MR. RAY: Would it be wrong to have channel one fed from 1P as it is and channel three fed from, say, 2N? Is there any (WORDS UNINTELLIGIBLE)?

MR. VILLALVA: Yeah, there would be crossfeeding on those.

MR. RAY: That's prohibitive?

MR. VILLALVA: Well, yes.

MR. EBERSOLE: Are you telling me you derive two DC sources from a (WORDS UNINTELLIGIBLE) arrangement?

MR. VILLALVA: That's what they are doing, I think.

MR. EBERSOLE: Well, that's what, it's one physical battery that --

MR. VILLALVA: That's one --

MR. EBERSOLE: That looked like two batteries.

MR. RAY: That's the way I see it. That's one battery.

MR. EBERSOLE: That's one battery. And then you (WORDS UNINTELLIGIBLE) saying, that there's a third battery because you take a 250-volt pass.

MR. VILLILVA: No, I say that is, the battery is, a 250, but that 250-volt battery, one side of it is on one side of the room, the other side is on the other side of the room.

MR. EBERSOLE: Well, are you telling me that the whole DC function is contained in one room?

MR. VILLALVA: No, there's another counterpart just like it, that is just -- there are two batteries just exactly like that one we just discussed.

MR. EBERSOLE: With two (WORDS UNINTELLIGIBLE)?

MR. VILLALVA: Right.

MR. RAY: Well, I see barriers of some sort between 1P and 1N. Even if they're in the same room, I would feel that they were both subject to the same hazards.

MR. VILLALVA: Well, if they did you'd get the same situation here, of course. And that's one half of a system, for which you have 100 percent redundancy, 2P and 2N.

MR. RAY: Yeah, but you can't -- you're prohibited from taking advantage of that to supply the two channels (WORDS

UNINTELLIGIBLE).... if you wanted to assure supply of the channels one and three, then you should protect yourself against the failure of those 1P and 1N batteries. And that would mean crossing the two batteries (WORDS UNINTELLIGIBLE) the essential buses. The essential buses aren't communicative in any way. So (WORDS UNINTELLIGIBLE) why you prohibit them. See what I mean?

MR. VILLALVA: We're not prohibiting.

MR. RAY: (WORDS UNINTELLIGIBLE) a moment ago you said (WORD UNINTELLIGIBLE). I would like to see, if this were my installation, I would like to see channel one supplied as it is, from battery 1P, the first half, the positive half of battery one. Okay? And channel three inverters supplied not from battery 1N but from battery 2N. For diversity.

Why do you say that's prohibited?

MR. VILLALVA: I'm not going to discuss that right now, on regulatory viewpoint in here. I'm not reviewing the design. But whenever you start crossing, the same manner that you are here --

MR. RAY: (WORDS UNINTELLIGIBLE).

MR. VILLALVA: It has -- it has -- there's two sides to that story.

MR. RAY: Sure. But if -- but if the inverters are not connected in any way on the AC side, then I don't think there's a community of hazard in that respect. But there surely is a community of hazards between batteries 1P and 1N if they're in the same room and they're not (WORDS UNINTELLIGIBLE).

MR. VILLALVA: But we have a counterpart to it, Mr. Ray. And what that would do, if you lose that, from our, let's go ahead and say our archaic thinking in what we've been regulating to, it's not going to preclude it from performing its function, namely, you have another redundant battery. Both of them would have to go out, to perform any safety-related function.

MR. RAY: If you lost both of your -- your channels one and channel three essential instrument buses here --

MR. VILLALVA: And caused an action to take place.

MR. RAY: Right.

MR. VILLALVA: And that action, presumably, from our narrow viewpoint, is to start a safe action, in other words, a -- in this case, if the plant were in operation, it would have caused a scram.

MR. EBERSOLE: Jerry, I think his defense is that battery in the other room.

MR. VILLALVA: Microphone.

MR. EBERSOLE: Thank you.

The battery in the other room is effective 100 percent in effecting the operation of one protective system, or redundant train.

MR. VILLALVA: Yes. Yes.

MR. EBERSOLE: On the other hand, it is not independently competent to preclude actuation of that train.

MR. VILLALVA: Right.

MR. EBERSOLE: Is that right?

MR. VILLALVA: Yes, sir.

MR. EBERSOLE: So he is willing to sacrifice the activation of a train if he loses something in the room but not willing to crisscross and provide a common jeopardy.

MR. VILLALVA: Right. I'm not willing to. That's --

MR. EBERSOLE: Yes. Well, that is --

MR. VILLALVA: -- the license. We designed it that way. And we are not designing, we're reviewing, is to me a criteria.

MR. EBERSOLE: This same analogy applies in multiple-unit designs, where the trains are crisscrossed.

MR. VILLALVA: I will say without reservation, what you are discussing is a more reliable viewpoint. Whether it is more safe is the moot point. And that's what the --

(Pause)

DR. LAWROSKI: Is there ever a question of how many kilowatts we could generate by the core at that point?

MR. VILLALVA: No, I don't recall. It was low-level (WORD UNINTELLIGIBLE).

MR. EBERSOLE: Do you intend to look at the characteristics of the seals in a general way, to determine whether they have instantaneous damage potential or they have some persistence to function while you shut them down?

MR. VILLALVA: Ed would you care to talk to this?

MR. EBERSOLE: I can envision that you might have some pumps that couldn't even stand a momentary loss of the wet condition.

MR. JORDAN: The RHR pumps have been somewhat tolerant. We've had --

MR. EBERSOLE: Say it again?

MR. JORDAN: The RHR/DHR pumps have been somewhat tolerant of, well, becoming airbound and surviving.

MR. EBERSOLE: Was that because you more or less randomly kept the journals and seals wet?

MR. JORDAN: I'm like Nat insofar as being able to describe the detail design of that pump seal. But we've had experiences already, and in the recent past, where the pumps weren't damaged by becoming airbound for some period of time.

MR. EBERSOLE: Yeah. Well, that's a different case from loss of lubricant or seal cooling. That's, you're talking about dynamic aspects of the pump. I'm talking about loss of lubrication and sealing functions.

MR. VILLALVA: We haven't lost that in this particular pump -- this particular operation.

MR. EBERSOLE: Well, you may have kept them wet.

MR. VILLALVA: Well, no, we did not lose any service to that particular pump.

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MR. EBERSOLE: I see.

MR. VILLALVA: The only thing that we lost to that pump was suction. We were sucking air. All the other services -- it was just that one line that was lost, and that affected instrumentation. It did not affect any of the power operations of the pump or its auxiliaries.

MR. EBERSOLE: And you kept your -- you kept the journals and seals wet, too.

MR. VILLALVA: The auxiliary systems were always in operation, yes.

DR. MARKS: Does that meet your point, Izzy?

Perhaps we should let Mr. Villalva finish the account here. Otherwise we'll be around till eight-thirty.

MR. VILLALVA: Well, that had concluded my part of the presentation. I wanted to indicate I think we went through this particular slide indicating the actions that we had taken to try to minimize the likelihood of the event from occurring at other places.

DR. MARKS: Well, any other questions on this? Mike?

MR. BENDER: Just one. One point, Carson. This is one of several events that have ensued because of maintenance operations. And most of what I hear are technical fixes, but what administrative actions are envisioned to cut down on the number of times that the maintenance organization creates situations that have safety implications?

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MR. JORDAN: Okay, with this particular licensee, of course, this has been an object lesson. And the regional inspection has identified some weaknesses in procedures and controls that have conveyed to the licensee and he is taking actions on.

In terms of a more general corrective action, in other words, conveying to all licensees "Be more careful with maintenance," the bulletin is, I think, more specific than general in that action. So at this point we don't have a broad, sweeping action on administrative controls of maintenance associated with this particular event.

MR. BENDER: It seems to me that is perhaps called for as much as the technical control protections you're calling attention to. I'll stop there.

MR. JORDAN: Okay.

MR. VILLALVA: I think that's what we are talking about on their implementation. We're asking them to implement their own administrative controls, to try to be aware of the positions in which they can be. And they are going to report to us what they are doing. They haven't reported as yet.

Davis-Besse has made some -- some revisions to their procedures already.

DR. MARKS: If there's no more -- just a question. Jesse, you had a letter which, I think, related to the questions raised here. Does this presentation obviate the need of --

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MR. EBERSOLE: Earlier on, I said, to, I believe, Ray, or somebody, that we (WORDS UNINTELLIGIBLE).

DR. MARKS: Very good.

That's all. Thank you, Mr. Villalva.

Shall we go on, then, to the next item, which is to discuss the present state of the emergency planning rule.

I think at the last meeting there was some intention to comment on draft two of 10 CFR 50, and by the time those comments had been given some thought, it was pointed out that draft three already existed. Since then, I think it is true that there's been a subcommittee meeting looking at draft three. I'm not sure whether there's a draft four somewhere.

Do you want to just make a comment on the status of that discussion date?

DR. MOELLER: Yes. Thank you, Mr. Chairman. I'm hopeful that perhaps in the next hour we can review this matter and wrap it up.

You have recently been -- there has recently been distributed to you, by Peter Tam, an excerpt from the minutes of our May the 21st and 22nd meeting, when we did review this latest up-dated draft. We also have distributed to each of you a copy of the latest draft of the emergency planning rule. And you have this pink sheets, the three pages distributed to you, which will bring you up to date on the subcommittee's thoughts on this subject.

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Let me briefly tell you where we stand and then invite Mr. Jamgochian, who is here from the NRC staff with his colleagues, to briefly bring us further up to date on this subject.

Our review by the subcommittee, on May the 21st, showed us that the NRC staff had very seriously considered all of our remarks in our letter of last month. Indeed, they had incorporated most of the comments which we had suggested. Nonetheless, there are several items remaining which we would like today for the committee to consider whether they want to adopt the positions that the subcommittee is suggesting.

First of all, the committee continues to believe that the NRC-FEMA approach to emergency preparedness for nuclear reactor accidents should be developed and implemented in a manner so as to encourage the state and local agencies to incorporate these efforts into their plans for coping with all types of emergency situations.

In the subcommittee's review of this subject, we found, for example, that there were very close ties between the planning for reactor accidents and regular civil defense. And there are other similarities, such as handling of transportation accidents, that's closely related to reactor accident planning, one of the best examples being the evacuation that recently occurred in Canada due to a transportation accident, and many of the procedures there would have been similar to a nuclear incident.

So we're simply urging once again, we suggest the committee urge once again, that the NRC staff encourage the state and local groups to look at total emergency planning in their coping -- or in their developing a competence for dealing with nuclear emergencies.

The second item -- and this is a new item that -- yes?

DR. SIESS: Why wouldn't that admonition be addressed also to FEMA, which is --

DR. MOELLER: It should be. It should be. And we probably would want to say it that way.

DR. SIESS: Because they're really the ones that are going to deal with the state and local groups, too.

DR. MOELLER: Yes.

DR. SIESS: Chiefly.

DR. MOELLER: Yes. Thank you.

The second item --

DR. SIESS: I notice you didn't refer to the Mount St. Helens evacuation as a model.

DR. MOELLER: No. We didn't.

The second item, which is a new one, is one that came to our attention during the meeting on May the 21st. And again I believe we need some clarification, perhaps from the NRC staff. But here's the way the subcommittee sees it.

The draft final review that -- rule that we reviewed requires licensees possessing research reactors with a power level of 500 kW, kilowatts, or more, to develop emergency plans

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that comply with Appendix E of the rule. Now, if you read Appendix E of the rule, it says that if you have a research or training reactor that operates at 100 kilowatts or more, you simply abide by regulatory guide 2.6. And I think this is what most of the universities and others who operate such reactors have been complying with. But the new final rule says if it's a 500-kilowatt or more, you comply with Appendix E. Now, if we interpret that correctly, if the subcommittee understood it correctly, the NRC staff is telling a university, or any group operating a research or training reactor 500 kW or more, to go through almost verbatim everything that a commercial nuclear power plant has to do in the way of emergency planning.

So, as I say, if we understand that, we think it's an excessive request.

Thirdly, we did once again raise the question which you heard debated and discussed extensively last month, about this capability for notifying the population within the EPZ within 15 minutes should an accident occur and at a level where such notification was necessary. The subcommittee -- and, indeed, the full committee in the letter last month -- stated that we thought a graded scale of action was more appropriate, that the people still, even though they are within the EPZ, the plume exposure EPZ, if they're between the nine- and ten-mile distance from the reactor, you might take a few minutes more than for the people within one and two miles from the reactor.

And our last, and fourth, item, that the subcommittee still recommends that the full committee hold firm on, is the fact that under the present arrangement, FEMA will most likely have the authority to judge whether a state or local plan is acceptable. Well, in a sense, then, if you had a noncooperative state or local agency that just refused to assist at all in helping with emergency planning for a commercial nuclear power plant, they could, in many ways, have veto power on the operation of the plant. And we simply say that we believe that this is a matter which the NRC staff and Commissioners may want to discuss further with appropriate Congressional committees.

Now, we said "discuss further" because in the packet that has just been distributed to you this afternoon is the letter from Chairman Ahearne to The Honorable Alan K. Simpson in the U.S. Senate, the letter of April the 30th, 1980, which reviews this matter of FEMA's authority for the review acceptance, evaluation and acceptance of state and local plans. So they have been negotiating on it to some degree, and so that's why we inserted the word that it may need "further" consideration.

Mr. Chairman, that is all I have to say, unless other members of the subcommittee -- Jerry Ray and others -- decide to offer comments. Jesse was there. And if there are questions.

DR. MARKS: Paul?

DR. SHEWMON: Is it agreed or decided how one can reach a 80-square mile -- all the people in 80 square miles in ten or

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fifteen minutes?

DR. MOELLER: The discussion, and as I understand it from the subcommittee meeting, is that this would be done with audible sirens, some system of this nature, which, of course, would be very expensive. And I won't, you know, respond for the staff, but, again, as I understand it, they can correct me if I'm wrong, they want to educate the public so that if they hear the signal, they then turn on their radios for further instructions.

SPEAKER: I wish them good luck.

SPEAKER: Everybody will have a radio.

DR. MOELLER: Everybody will have a radio, courtesy of NRC.

Are there --

SPEAKER: Courtesy of the utility.

DR. MOELLER: Of the utility.

Are there other questions or comments by subcommittee members?

SPEAKER: Will these be battery-operated or will they p' g into relay systems?

(Laughter)

DR. MARKS: I might mention that just distributed is draft three-prime or four. While draft three was only about a quarter as thick as this, don't be alarmed -- that's largely because of additional material appended rather than changes.

DR. MOELLER: Well, I think, again, Mr. Chairman, that we are prepared to comment on the draft that the subcommittee reviewed. We are not prepared to comment on the newest one.

DR. MARKS: And I understand that there's not much --

DR. MOELLER: Right. We appreciate the copy. And I'm sure Mr. Jamgochian will tell us what changes have been incorporated.

MR. EBERSOLE: Before we go any further, I'd like to call out to the committee that the last three sentences, I think, may be more important than the others. It says that "Since it could give veto power on the operation of nuclear power plants to noncooperative state and local agencies," which may or may not be influenced by splinter groups who are antagonistic to nuclear power, and then, it goes on to say, "this could be especially serious if it forces utilities to develop alternate sources of electricity that result in a greater stress on public safety."

When resistance is, to nuclear plant operation is, seen, in the public and so forth, it's more often than not done by groups who don't look at any alternative sources but, rather, just look at the presence of nuclear energy. I think that's an important sentence, that it may force the utilities to generate power from alternate sources which, in fact, are -- would result in a greater stress on public health or safety. And I just want to reinforce that sentence and so you be sure you read it.

And the last sentence then takes up a suggestion.

DR. MARKS: You're speaking of the letter?

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MR. EBERSOLE: Yes.

DR. MARKS: I'm sure we'll come back to the text of this. But we might perhaps best go ahead as you suggest.

DR. SIESS: One question, Mr. Chairman, before the staff makes its presentation.

I have in front of me a report from one of our fellows on a short course he attended at Harvard University. And there was a conclusion drawn by one author, or by the author of the report, I'm not sure, that within NRC there is not a consensus of opinion on an acceptable emergency plan. I&E appears to audit reactors based on one interpretation of the rules, while DOR licenses reactors based on another interpretation of the rules.

In view of that, I'd like for the speaker to identify with which of those branches he's associated.

DR. MARKS: Then we'll let him proceed.

DR. SIESS: Probably from Standards.

DR. MARKS: You're right.

END TAPE 12

DR. SIESS: When Standards writes rules that two other branches of the agency interpret differently, that gives me a problem, too.

MR. JAMGOCHIAN: When Standards writes the rules, sir, I&E and NRR are very intimately involved in the development of the rules.

DR. MOELLER: Why don't we let Mr. Jamgocnian present his statement. Roughly how long will it require?

MR. JAMGOCHIAN: Without any interruption, about ten minutes.

DR. MOELLER: That is great. And would you address at some point -- if we are confused on this thing of the 500 KW research reactors, we would appreciate, you know, your straightening us out.

MR. JAMGOCHIAN: Fine.

DR. MARKS: I propose we take a check on that statement we just had, that it would take ten minutes without interruption, and find out if that is really true.

MR. JAMGOCHIAN: Fine. Good afternoon. My name is Mike Jamgochian. I am the task leader for the emergency planning rulemaking effort in the Office of Standards Development.

I will give a brief presentation on the status of the staff's proposed final emergency planning regulation. This presentation will include discussions of, one, our schedule, two, the number and types of comments received in comment letters and the regional workshops; three, the bases that the staff used in developing the final regulation; four, the major elements of the rule; five, the NRC/FEMA entry relationship; and lastly, I was going to discuss the May 6th ACRS comments along with the proposed staff resolution.

Since Dade had mentioned that all of those comments were resolved except for the few that were mentioned, I quickly took notes as to those that you mentioned, and I will try to address each one of those specifically.

During this presentation, I may be discussing items and showing slides that may be repetitive from the last committee meeting. I will be doing this quickly, within ten minutes, but I do feel that it is necessary to go over this material in order to build a solid basis for the overall discussion as well as your question period.

Relative to the package that was just handed out to you, that is the entire Commission package that was sent to the Commission on June 3rd, two days ago. It contains a lot of enclosures, backup material for the Commission to deliberate on. It is essentially the same as the Federal Register notice and the regulation that the Subcommittee reviewed the end of May, other than editorial type changes.

First slide, please.

Note that the proposed rule changes were presented to the ACRS on May 1st, 1980, and is now being reviewed in its final form. The staff's proposed final regulation was submitted to the Commission on June 3rd, 1980. Comments by the ACRS on the staff's proposed final regulation will be addressed either in a supplement to the Commission paper or during the Commission briefing, during the Commission meeting, when the staff makes its presentation.

Next slide, please.

This slide is self-explanatory. All comments received before mid-May were evaluated and considered in drafting the proposed final regulation. A NUREG document will be published at a later date summarizing all the comments received, along with providing the staff's evaluation of all issues raised by the commentors.

Next slide, please.

The bases that were used in developing the rule changes resulting from real or perceived emergency preparedness problems experienced at Three Mile Island are, one, that adequate on-site and off-site emergency preparedness as well as proper siting and engineered design features are needed for the protection of the public health and safety.

Two, that NRC, other governmetal authorities, and the public must be notified promptly; and three, that protective actions are capable of being implemented in case of an emergency. These conclusions shown on this slide were fundamental in the development of the staff's proposed final regulation.

Next slide, please.

Let's now look at the major changes from the present regulation. One, the new regulation requires an overall adequate state of emergency preparedness. Two, the new regulation requires research reactors to establish and submit emergency plans. Three, it requires that emergency planning considerations now be extended out to emergency planning zones.

Four, requires that the detailed licensee's implementing procedures be submitted for NRC review. And five, provides an upgrading and expansion of 10 CFR Part 50 Appendix E.

Next slide, please.

I would now like to discuss the areas that were expanded and clarified in the new Appendix E. They are, one, specification of emergency action levels. In the development of this regulation, this was done primarily to stress the need for intense coordination between state and local governments and the licensees.

Another change or second change was the

requirement for the dissemination to the public of basic emergency planning information. Three, provisions for the capability -- please note the emphasis on capability -- of prompt alerting of the public and instructions for public protection.

Four, the requirement for one on-site technical support center and one near-site emergency operations facility.

Five, redundant communications systems.

Six, specialized training.

And last, provisions for an up-to-date planned maintenance.

Next slide, please.

This slide shows the working relationship agreed upon by NRC and FEMA. In order to determine the overall adequacy of emergency preparedness, the NRC will make a determination as to the adequacy of on-site emergency plans. FEMA will make a finding and determination of the adequacy of state and local emergency response plans. Lastly, NRC will make in its licensing a finding on the adequacy of the overall on-site and off-site emergency response preparedness.

NUREG-0654, which is an NRC and FEMA document, and 10 CFR Part 50 Appendix E will be used in making these findings and determinations.

I would like to now -- As I said previously, I was prepared to address the original set of comments submitted by the ACRS, but I will try as best as possible to discuss the comments that Dade mentioned a few minutes ago.

The first comment concerned itself, I believe, with the FEMA/NRC working relationship. During the subcommittee's discussions, we did agree to put in the supplemental information of the Federal Register notice a statement saying that this emergency planning effort should be a part of the overall nuclear as well as non-nuclear emergency planning effort throughout a state.

As I listened to Dade's comment, I believe that you would like this expanded a little bit in the regulation itself. I don't see any problem with accommodating that comment at all.

The second comment was relative to -- related to research reactors, I believe. Now, evidently there is something not clear. I really didn't understand your problem, Dade.

DR. MOELLER: Let me repeat it, and as I say, we could easily be confused. As we read the body of the rule, it says that any research reactor or test reactor with an authorized power level of 500 KW or more must abide by Appendix E.

Now, if you read Appendix E, it says any research or test reactor with a power level of 100 kilowatts.

VOICE: Where is that?

DR. MOELLER: That is at the back of the draft rule.

VOICE: I went through Appendix E, and I did not see it.

MR. JAMGOCHIAN: That was my problem, too, Dade. Appendix E says, "Regulatory Guide 2.6 will be used as guidance for acceptability of research and test reactors emergency response plans."

VOICE: Where does it say that?

MR. JAMGOCHIAN: That is on -- it is Enclosure B, Page 31.

VOICE: Page 31?

MR. JAMGOCHIAN: Now, don't look at that --

VOICE: Is that Appendix E?

MR. JAMGOCHIAN: It is Page 40 of the new document that was just passed out.

DR. MOELLER: Yes, it says Regulatory Guide 2.6 will be used as guidance, what, for the preparation of research and test reactor emergency response plans?

MR. JAMGOCHIAN: For the acceptability of --

DR. MOELLER: Oh, okay, for the acceptability.

MR. JAMGOCHIAN: Right.

DR. MOELLER: Now, and I gather that is for a 100 kilowatt or greater.

MR. JAMGOCHIAN: No, in Regulatory Guide 2.6, if I recall -- this has been a while since that developed --

DR. MOELLER: Right, and I have it here, and it says --

MR. JAMGOCHIAN: Yes, it breaks it down --

DR. MOELLER: It says that Reg. Guide 2.6 has an Appendix B, and it says applicable to research reactors authorized to operate at power levels approximating 100 kw or greater --

MR. JAMGOCHIAN: Right.

DR. MOELLER: -- and then, in an earlier -- in Part C(2), it says the scope and content of emergency plans for research reactors authorized to operate at power levels of approximately 100 kw or more, and research facilities presenting comparable risks should be substantially equivalent to those described in Annex A to this guide.

MR. JAMGOCHIAN: Right.

DR. MOELLER: The way we interpreted that, I believe, is, if you were 100 kilowatt but less than 500 you followed 2.6. If you were 500 or more, you did everything in Appendix E.

MR. JAMGOCHIAN: Oh, no. Paragraph R of 5054, the breakdown was 500 kw they have to submit within a year of the effective date.

DR. MOELLER: Right. That was the only difference. If they are less than 500 it is within two years.

MR. JAMGOCHIAN: It is within two years. That is simply the time in which they have to submit their emergency plan. All --

DR. MOELLER: But they are still under Reg. Guide 2.6.

MR. JAMGOCHIAN: All research and test reactors are under 2.6.

DR. MOELLER: Well, then --

MR. JAMGOCHIAN: That can be clarified. I see the confusion.

DR. MOELLER: You follow what our problem was? Okay.

MR. JAMGOCHIAN: I don't see any problem in --

DR. MOELLER: So what he is telling us is that research and test reactors --

MR. JAMGOCHIAN: Do not have to completely comply with the new Appendix E. They have to use --

DR. MOELLER: Comply with Reg. Guide 2.6 --

MR. JAMGOCHIAN: -- 2.6 --

DR. MOELLER: -- as a guide for the acceptability of their emergency plans.

MR. JAMGOCHIAN: That is correct.

DR. MOELLER: Okay. That is helpful.

MR. JAMGOCHIAN: Your third comment, I don't recall what that one was. Oh, the graded scale. Right. Now, during the subcommittee meeting, during the subcommittee meeting, there was quite a bit of discussion relative to the graded scale of alerting. This we feel is really a refinement of the overall requirement to have a capability to notify the public within 15 minutes.

The staff did put in the supplemental information of the Federal Register notice wording that was agreed upon by the subcommittee and the staff. Evidently, the subcommittee feels that this same wording should also be placed in the regulation.

DR. MOELLER: That is correct. Let me repeat what he said. They have agreed to what we have said, but they have put it into the supplementary material accompanying the rule rather than in the rule itself. Now, whether the committee wants to push the point of having it within the rule itself is a question, but the subcommittee felt that it should be in the rule itself.

MR. JAMGOCHIAN: Okay.

DR. MOELLER: You shouldn't have to find it in the supplementary material.

MR. JAMGOCHIAN: That requirement in the

regulation can be expanded to be similar to the wording that was agreed upon in the supplemental information.

The fourth comment that Dade mentioned relates to the veto power. This question has been discussed by the Commission, has been brought to the Commission's attention by the staff, and was discussed at some length at the subcommittee hearing.

What was your recommendation, Dade?

DR. MOELLER: Our recommendation really is not addressed to you.

MR. JAMGOCHIAN: Okay.

DR. MOELLER: It is addressed to the Commissioners, and it suggests that this is perhaps something they would want to discuss further with appropriate Congressional Committees, and I think you probably would support us in that.

MR. JAMGOCHIAN: All right.

MR. BENDER: Is your position limited by the way in which the law is written. Is the fact that you have to work through the local governments the reason why you can't directly be responsive to that, to the concern that has been expressed?

MR. GRIMES: Bryan Grimes. Our statutory authority is limited to control over licensees, so we must work through licensees to accomplish anything that we wish to with respect to granting licenses. We have no authority, nor does FEMA have any direct authority over state and local governments to require things directly of those governments.

MR. BENDER: Have you given any thought to what kind of legislation might be needed to improve the controls you should have?

MR. GRIMES: Well, I can't speak for the Commissioners, but the flavor I get is that I think they would view it that if there was to be control in this area, it should be by FEMA rather than by NRC, but I am not sure whether you could exercise direct control in this area. In most Federal programs, the only penalty is withdrawal of money, for example. One could have a system where Federal money was supplied as an incentive directly to the state and local governments, and withdrawal of that money would be the penalty for not complying with certain things, but I don't think we have legal --

DR. SIESS: That is the way the Federal Highway Administration works.

MR. BENDER: Well, I don't want to pursue it further, but it seems to me --

DR. MOELLER: What is your proposal, Mike, that NRC control local government emergency planning rather than FEMA?

MR. BENDER: As a matter of fact, I don't have a proposal. It seems to me that it would be useful to know what the possibilities are.

DR. SIESS: It seems to me that the thrust of Dade's recommendation is that FEMA should be responsible for all of it, because evacuation for nuclear instead of evacuation for some other incident should be coordinated, at least, and might be the same type of planning, and to give FEMA control over one type of emergency and NRC over another would probably end up with the local agencies doing everything double.

MR. BENDER: I am certainly not trying to promote one scheme over another. I suspect FEMA ought to have it all. But it seems to me that this barrier that has a potential of being set up where some local governmental authority at a fairly low level could prevent the implementation of an emergency plan would seem to me to be something that deserves more than casual attention.

MR. GRIMES: I expect if it does in reality turn out to be something which has a significant impact, then there would be Congressional attention.

MR. BENDER: Well, maybe so.

MR. GRIMES: On that item, to date, we have not had -- the problems we have had have been related to funding, in terms of cooperation of state and local governments with utilities in developing these plans for new plants. There may be more of a political situation involved than just the funding, but for operating plants, I can say across the board we have had very good cooperation from everyone involved, but the theoretical possibility does exist.

MR. BENDER: I happen to be aware of the situation that exists at Zimmer, where there is some difference of viewpoint from one side of the river to the other. The power plant happens to be on the Ohio River, but the State of Kentucky is right across the way, and I am not really -- I have become aware of the fact that the State of Kentucky is less than enthusiastic about providing emergency response provision on the other side of the river, and I think that is indicative. I have seen some of the correspondence.

DR. MOELLER: Jerry Ray has a comment.

MR. RAY: At the subcommittee meeting, this was brought up, Mike, and you responded to a question we raised. For instance, we postulated a case where the state agencies and the county agencies were completely cooperative and had set up a plan, but the local township or borough, whatever it might be, was refusing to cooperate. And I had an impression, although I can't quote what you said, that under such circumstances, you would have discretionary capability or power to resolve that without letting it hang in the air indefinitely because the local potentate was not cooperative. Did I misread that?

MR. GRIMES: No. I think what we discussed was the possibility of compensatory measures, in other words, provision of resources from the state or county, or from the utility to compensate for a lack of involvement of the local police jurisdiction or something.

MR. RAY: Yes. The state police, for instance, could move in and direct traffic in an area where the local police refuse to cooperate.

MR. GRIMES: Yes, in specific situations, you would look at the overall state of preparedness, and not necessarily require each individual entity to be totally in compliance with all the criteria.

MR. RAY: Well, to make sure we are not misconstruing something, what I read into what you said then and now is that the NRC has the authority to intercede in a case like that and resolve it in conjunction with FEMA.

MR. GRIMES: I wouldn't say authority, but we certainly would work with FEMA to try to resolve that, but I can't rule out the case totally where a big enough entity, a county and a state, perhaps, would refuse to cooperate, and would thereby prevent implementation of response plans off-site, but I think in most cases, most real cases, you would be able to find compensatory measures, especially if they are very small political entities.

MR. MATHIS: Well, I don't know that that is so real. I happen to live in the State of Washington, and we get along with nuclear real well. Right across the river is the State of Oregon, and they are not interested in anything nuclear, period. Epwell Springs is on the agenda as a potential plant, which is basically on the river, on the Oregon side, and if that plant were to come into being, there would be some problems, unless things changed drastically.

MR. GRIMES: Well, if you are speaking of the State of Oregon, I would have to disagree with you, because Trojan -- the State of Oregon plant for Trojan is probably the most advanced of any state in meeting our new criteria, and as a matter of fact, Washington is lagging behind in that particular case --

(General laughter.)

MR. GRIMES: -- but there may be a local jurisdiction on the Oregon side --

MR. MATHIS: I am talking about public attitudes and the thinking that is prevailing at the moment. When Trojan came into being, things weren't that bad, but the difference of opinion, really, among the public today is quite drastic.

MR. GRIMES: I must say, the Oregon state government has been very active --

MR. MATHIS: That is good.

MR. GRIMES: The Governor has participated in an exercise at Trojan last fall. I think they have the government's attention.

VOICE: If, as now appears the case, there is an additional letter of comments from the Committee to the Commission on this rulemaking action, then as soon as we are in receipt of this, we will submit a supplement to our paper to the Commission addressing each of these points, and as Mike indicated on at least several of these, we anticipate no problems and our recommendations to the Commission will be compatible or essentially should resolve your comments.

The final action on these, of course, is the Commission's, as is the overall action on this rulemaking action.

On this last point, as has already been mentioned, the Commission themselves has considered this important point in some detail, and I am sure they will be considering it further. It is a difficult problem. As they themselves indicated in a previous briefing that we had with them on this, they believe that it is their mandate to assure the health and safety of the public, and that that is overriding, and that they cannot license a facility to operate unless that is assured.

By the same token, they are constrained by certain legislative limitations, and the rule as presently proposed would seem to go as far as the Commission is authorized to do in that regard. I think perhaps the saving grace in this is what Bryan Grimes has been trying to point out, that in real life this does not appear to be the problem that it potentially could be.

DR. OKRENT: I seem to have read somewhere what is probably a secondhand news item to the effect that FEMA's ability to staff up to discharge whatever responsibilities it is being given in this area is under question from the point of view of there being adequate staff. Is that news item close to the facts? Is it relevant to anything? If it is?

MR. GRIMES: I will try to address that. I think it is a potential problem. The NRC has detailed a number of people to FEMA for officially until the end of June. Some of those may be extended until the end of the fiscal year. That is to FEMA headquarters. Most of the reviews that are going on are being done by the regional offices. However, there is a problem in terms of money. FEMA had asked for a supplemental appropriation which it did not receive from the Congress. They had hoped to be able to give some monetary systems to various impacted -- at least some impacted state areas.

They do have a fairly new staff in terms of this area that is going through a learning process. There are problems of consistency from FEMA region to FEMA region.

I guess we will have to by experience find out whether it is a very serious problem or not. There is nothing in the rule, in the latest version of the rule for operating plants that will require a FEMA finding by a certain date. In other words, the rule as it is now written for operating plants requires that state and local and licensee plants be implemented by January 1, 1981, for the most part, and there is a later date for the public notification system.

It does not require a positive FEMA or NRC finding before that date. It provides that any time after that date, if significant deficiencies are found by FEMA or NRC, then a four-month period starts within which the deficiencies can be corrected, and we will indeed be looking at the plants where we think there are likely to be the most problems first in that regard.

But there is enough flexibility to allow for review experience and some less than 100 percent efficiency on the part of FEMA before we get the whole thing straightened out. We do have commitments from FEMA verbally and in writing to actively pursue this, and I think only time will tell if they are going to be able to continue to apply resources. They have diverted a number of resources in their region to this effort, and I guess time will tell whether they are able to do a ban--up job or not.

DR. SHEWMON: In this discussion or consideration of what would happen to the populus, does the NRC have any better defined rules as to when it should declare a state of emergency and ask for evacuation than it did before, or is it still whenever somebody decides the public health and safety is endangered, that that's it?

MR. GRIMES: We have tried to set that out in NUREG 610 which was published last September which defined the various classes of emergencies, when the public should be notified and when protective action should be taken and the likely action that you would take.

I think that will take a lot of the subjectivity out of calling for off-site action. It still does not make the final decision. It requires a final decision on evacuation and direction of evacuation and distance based on the specifics of any case, but you will at least be in the emergency class when you are telling people to take shelter and there are examples of different distances, or different circumstances.

DR. SHEWMON: Thank you.

MR. GRIMES: I think we're making progress.

DR. OKRENT: If I could continue a little bit on the point I was exploring, is there any real likelihood or future OL's -- or I guess what you would call near-term OL's, or anyway, those don't fall into this first category, that there could be a problem in FEMA of not having adequate resources to deal with the problem?

MR. GRIMES: That we will find out somewhat sooner because we will be coming to decision points on full power licenses this fall on several plants.

DR. OKRENT: But the rule says FEMA would have to do certain things, make findings before those are granted?

MR. GRIMES: So it is important that they at least have adequate staff, even if they have trouble making decisions?

DR. OKRENT: Well, I think they should be able to divert enough staff to those several cases that they will be able to make recommendations and complete reviews for those plants, and they do have those priorities from us, and the times we have sent a letter from the Chairman to Mr. Macey outlining the next several plants at the top that we think should be given priority, and among those are the next four oerating license decisions for full power -- for example, Sequoyah, Salem, North Anna, which now have low power licenses will have to have findings under the new rule before they go to power.

Now, the rule may not be in effect necessarily by the time those decisions are required, but the Commission has indicated that they would essentially follow the proposed rule, or perhaps this final rule, for those new plants even though the regulation has not become officially effective.

DR. OKRENT: Under this new rule, if and when the NRC has no more questions for Diablo Canyon, could the city of San Luis Obispo, for example, effectively keep the reactor from running by not setting up emergency plans and the Governor support them by saying he wouldn't make any state police available?

MR. GRIMES: That's a possibility. We'd have to look at the particular case and see what was deficient.

DR. OKRENT: Is there something --

MR. GRIMES: I'm not sure exactly where San Luis Obispo is in terms of distance, if it's within the ten-mile zone or not.

DR. OKRENT: Oceala Beach. That's within ten miles.

MR. GRIMES: But if everyone refused to make plans off-site, that could well affect the issuance of the license.

DR. SIESS: The Commissioners have considered this? Have they heard the pros and cons on this?

MR. GRIMES: Yes.

DR. OKRENT: A different question. Have you any basis for judging whether the steps that FEMA is taking for other hazards for which it has responsibility for emergency preparedness, whether these are better? Will they exist?

Do they have simliar stringencies, so forth?

Do you have any basis at all for judging?

MR. GRIMES: No, just general knowledge, but my general impression is that they are not nearly as detailed or as thorough as what we are asking for for the nuclear power plant hazard.

DR. OKRENT: Now, suppose FEMA found that the Corps of Engineers had found some dams were unsafe in some state due to their inspection programs and presumably certainly needed emergency plans. Of course, they should have them even if they are "safe".

But the state, in fact, took no action in this regard, they would still nevertheless be required to have a plan for a nuclear power plant?

MR. GRIMES: FEMA has no authority to require either one. The only requirement and the only real leverage by the Federal government in the current situation is the NRC's role in being able to withhold a license for a utility.

DR. OKRENT: But what I'm --

MR. GRIMES: FEMA has agreed to review the off-site plans for us in our making our decision. There is no comparable license for a dam that is built.

DR. OKRENT: I realize that there are comparable risks, let us say. I am just trying to --

MR. GRIMES: My personal opinion is that a lot more resources could be devoted to things like chemical hazards, but it's also my personal opinion that what we are doing on emergency preparedness for nuclear plants is a condition of generating power by nuclear means.

DR. OKRENT: Has anybody done a cost-benefit study on these? I'm sort of curious.

What are the costs per plant? Is there some estimate per year and what are the initial costs?

MR. GRIMES: Yes, there have been -- not cost benefits, but there has been a cost study that was done just before the Three Mile Island accident by our Office of State Programs.

Mike, do you have the NUREG number?

MR. GAMGO: There is an an analysis of cost. There is a value-impact assessment in the paper that you received this afternoon, as well as --

That is the value-impact assessment.

Also on page 5 of the Commission paper that Mr. Minogue signed, it talks of cost of implementation.

DR. OKRENT: Yes, I saw that figure.

MR. GRIMES: NUREG-0553 is the study that was done and there are estimates I see in one of the enclosures of $1 million per plant. That would be the total cost of the plans. I would say, in addition to that, the public notification system might run something of that order. The

Diablo Canyon system, I believe, has been ordered for a little over $400,000 but that has the ocean on one side and has no people immediately near the plant, so it is perhaps three-quarters --

DR. SIESS: What about those people in boats?

MR. GRIMES: I beg your pardon?

DR. SIESS: What about those people on the ocean?

MR. GRIMES: They would have to be notifed in some less prompt fashion, probably by a Coast Guard helicopter.

DR. SIESS: Is that spelled out in the rule?

MR. GRIMES: It says essentially complete.

DR. SIESS: Okay. Got to learn how to read those things.

DR. MARKS: Are there other questions on this topic?

MR. GAMGO: I'd like to make one more point.

Since there was some concern relative to FEMA, I'd like to simply point out that FEMA was involved with the drafting and development of the regulation and, in fact, before the regulation went to the Commission they did formally concur in the regulation.

DR. MOELLER: And there were FEMA representatives at the subcommittee meeting.

Mr. Chairman, as is our policy with the Subcommittee on Site Evaluation, we always leave ten minutes for a break.

DR. MARKS:: Yes. I think you've done very well.

Before following that suggestion, in the staff meeting which was to bring up recent events, one question has been asked -- and there may be nothing to say or perhaps even just saying there is nothing to say would cover the point -- as to whether the recent affair at Mt. St. Helen's has caused any perceptible problems at either nuclear power plants, which would mean Trojan, I guess, or whether the earthquakes which seem to have been going on recently have called for any attention?

Gary, are you prepared to tell us what's going on there?

DR. ZECH: Yes, sir.

I did get some information since you asked that question this morning. I talked to the Project Manager for the Trojan plant. When the volcano did erupt, of course, Trojan was, and has been, shut down for some time, so as far as impact from an operational standpoint, there was none.

However, they did receive from about an eighth to a quarter of an inch of ash in the form of mud, as it was described, so evidently there was some mixture with rain in the area.

This did deposit on the site area. It did not cause any problem from the standpoint of off-site power, however, which would be the situation -- that situation would be the same if it were operating or not operating.

So from that standpoint, there was a positive point.

However, the PG&E network did suffer some distribution problems in the Oregon area. They did have some switching problems in local power failures due to insulation shorting out on the transmission lines, and things of that nature.

The sta'f does plan a trip to the Trojan plant and the area around there to discuss with the licensee some systems problems, or potential problems, such as silting in the river which they did note a decrease in the depth of the river near the plant from 75 feet to about 48 feet. So there was some silting that did occur.

They will be discussing that aspect with the licensee as they will with regard to potential ventilation problems, which is an area that is of interest, of course, and also this flashover on insulation that I mentioned occurred in other areas of the grid network substations for the licensee.

That is the extent of our information, really, at this point, unless there is any question.

QUESION: None of the filters on the plant were affected by any of this?

DR. ZECH: That is correct. They were not affected with this particular type of silting that they experienced. However, the reason the staff is going, of course, is because there is some question as to what may occur in the future and we want to look into that area.

DR. OKRENT: Would the diesels have had any problem with air supply if they had been in the thick of the (inaudible)?

DR. ZECH: I think that is a good question and that is one item they are going to look into, look at the filters for the diesels.

DR. LAWROSKI: Does the staff know, for the period that immediately followed this (inaudible), whether the wind patterns were as they were estimated in the old environmental impact statement, or were they more lucky or less lucky?

DR. ZECH: I recall hearing something, in fact, right shortly after that. The wind patterns were generally in the prevailing direction, which means towards the east, yes.

And, of course, the plant is south of the volcano and slightly west.

DR. MARKS: I guess if there is nothing else on that, we will follow Dave's suggestion and have an emergency planning break for ten minutes.

(Whereupon, at 4:30 p.m., the Committee proceeded to closed session.)

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NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

____

in the matter of: ACRS - 242nd Meeting

Date of Proceeding: June 5, 1980

Docket Number: ________________

Place of Proceeding: Washington, D. C.

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

Suzanne Babineau

Official Reporter (Typed)

Suzanne R. Babineau

Official Reporter (Signature)

6/5/80
Tape 2
of 3
#1

STAFF POSITION
HYDROGEN CONTROL MEASURES
FOR
FULL POWER LICENSING
OF
SEQUOYAH, UNIT 1
AND OTHER
ICE CONDENSER PLANTS

CURRENT STATUS

1. EXISTING SYSTEM SATISFIED CURRENT PROVISIONS OF 10 CFR PART 50.44

   1.1 REDUNDANT RECOMBINERS

   1.2 BACKUP PURGE SYSTEM

   1.3 BASED ON 1.5% M-W REACTION

2. BEST ESTIMATE OF EXISTING CAPABILITY

   2.1 CONTAINMENT DESIGN PRESSURE = 12 PSIG

   2.2 CONTAINMENT FAILURE PRESSURE = 36 PSIG

   2.3 METAL-WATER REACTION FOR FAILURE PRESSURE = 25%

STAFF POSITION

BECAUSE:

1. RECENT CHANGES HAVE MADE LIKELIHOOD OF SEVERE ACCIDENTS REMOTE;

2. CAPABILITY EXISTS TO ACCOMMODATE HYDROGEN GENERATION WELL ABOVE DESIGN BASIS LEVEL;

3. SUBSTANTIAL STUDIES ON ACCELERATED SCHEDULES WILL BE UNDERTAKEN BY STAFF AND APPLICANT;

4. CLEARLY BENEFICIAL MITIGATION SYSTEMS HAVE NOT YET BEEN DEFINED;

STAFF CONCLUDES THAT:

1. NO ADDITIONAL PROVISIONS FOR HYDROGEN CONTROL SHOULD BE REQUIRED FOR FULL POWER LICENSING OF THE SEQUOYAH PLANT, PENDING RESULTS FROM THE STAFF'S AND APPLICANT'S STUDY PROGRAMS AND/OR THE RULEMAKING PROCEEDING.

BASES FOR STAFF POSITION

1. ACCIDENTS INVOLVING SEVERELY DEGRADED CORES ARE MADE MORE REMOTE BY IMPLEMENTATION OF TMI LESSONS LEARNED

   1.1 HARDWARE IMPROVEMENTS

   1.2 IMPROVEMENTS IN OPERATING PROCEDURES

   1.3 IMPROVEMENTS IN OPERATOR TRAINING

2. BEST ESTIMATE ANALYSES SHOW THAT CAPABILITY EXISTS TO ACCOMMODATE UP TO 25% METAL-WATER REACTION WITHOUT FAILURE OF CONTAINMENT.

3. SUBSTANTIAL STUDY PROGRAMS ON AN ACCELERATED SCHEDULE WILL BE PERFORMED BY THE STAFF AND BY THE OWNERS OF ICE CONDENSER PLANTS.

4. ANY NEEDED CHANGES IN PLANT DESIGN INDICATED BY RESULTS OF ABOVE STUDIES WILL BE IMPOSED IN A TIMELY MANNER.

June 2, 1980 #2
6/5/80
Tape =

STAFF POSITION

Hydrogen Control Measures for Sequoyah

I INTRODUCTION

In the staff's Safety Evaluation Report on the Sequoyah Nuclear Plant, Units 1 and 2, dated March 1979, we stated that the combustible gas control systems for the Sequoyah station were acceptable. In its letter, "Report on TMI-2 Lessons Learned Task Force Final Report," dated December 13, 1979, the ACRS recommended with respect to hydrogen control measures that ".... special attention be given to making a timely decision on possible interim measures for ice-condenser containments."

The staff has reviewed the matter of hydrogen control requirements in light of the TMI-2 experience. The staff's findings are reported in SECY 80-107 dated February 22, 1980. With respect to the Sequoyah and other ice condenser plants, the staff determined that the existing hydrogen control measures that satisfy Section 50.44 of 10 CFR Part 50 are acceptable for full power operation, pending completion of certain studies to be performed by the staff, the Sequoyah applicant and other ice condenser owners.

II DISCUSSION

In this section, the current status of the hydrogen issue, certain related study programs, a rulemaking proceeding, and TMI related safety improvements will be discussed.

A. CURRENT STATUS

1. SECY 80-107

In the staff's paper, "Proposed Interim Hydrogen Control Requirements for Small Containments," SECY 80-107, dated February 22, 1980, scoping analyses were performed starting with the assumption that an accident involving a severely degraded core existed in each of the six classes of containments considered. These classes of containments include the Mark I, II, and III containments for BWR's and the ice condenser, sub-atmospheric, and dry containments for PWR's. We concluded that inerting should be made a requirement for the Mark I and II classes of containments and that no additional requirements should be required for the other classes of containments pending the upcoming rulemaking proceeding outlined in Task II.B.8 of the TMI Action Plan, NUREG-0660, dated May 1980.

In its risk-based studies, the NRC's Probabilistic Analysis Staff concluded that inerting the Mark I and II containments would not reduce overall risk. It was also their finding, however, that overall risk would be reduced by inerting of the ice condenser plants.

Other elements of the NRC staff believe that although risk-based studies are worthwhile supportive studies, there remain substantial uncertainties in their ability to adequately treat actual accident sequences and operator intervention.

The NRC staff concludes on balance that the actions called for in the above cited SECY 80-107 relative to ice condensers, and particularly Sequoyah, Unit 1 should proceed pending the outcome of the continuing studies in this area.

2. Hydrogen

Each of the Sequoyah units is provided with a pair of redundant electrically heated thermal recombiners that satisfy the provisions of 10 CFR Part 50.44. Moreover, the purge system in these units can serve as backup systems should the redundant recombiners be unavailable. This combustible gas control system can accommodate up to about 1.5% metal-water reaction in the reactor core while maintaining the hydrogen concentrations below the lower flammability limit of four percent.

3. Best Estimate of Existing Capability

In the above cited SECY 80-107, we reported that the failure pressure for the Sequoyah containment was estimated to be 36 psig (the design pressure is 12 psig). We find that as much as 25% metal-water reaction can occur without exceeding the failure pressure of the Sequoyah containment, even assuming combustion of the hydrogen.

B. PROPOSED STUDY PROGRAMS

1. Staff's Program

The NRR staff is preparing a User's Request to have its Office of Nuclear Regulatory Research augment the existing programs on hydrogen control. This will be a substantial program of studies directed at developing an information base for use in the upcoming rulemaking proceeding, cited above. It will also call for early treatment of those hydrogen mitigation measures suitable for use in hydrogen control at ice condenser plants, with a completion milestone targeted for the end of 1981.

Among the mitigation measures that will be investigated in the early phase for ice condenser containments are:

a. Hydrogen combustion systems;

b. Atmospheric fogging systems;

c. Halon suppression systems;

d. Inerting;

e. Filtered-vent systems; and

f. Other systems.

The advantages, disadvantages, and functional capabilities of each of these mitigation systems need to be determined in terms of their use in ice condenser containments. The inerting approach for example, which has been demonstrated to be a workable system for the Mark I/BWR containments, may not be a good choice for the ice condenser containments. The ice condenser containment, being about four times larger than the Mark I containment, has much more equipment located inside containment. Containment entries need to be made several times a week for the ice condenser (maintenance purposes) versus about five times a year for the Mark I containment. In our view, selection of the inerting approach or any of the other approaches at this time would be premature and inappropriate.

C. RULEMAKING PROCEEDING

In accordance with Task II.B.8 of the TMI Action Plan (NUREG-0660), rulemaking proceedings will be conducted to determine whether and how the staff's existing design bases need to be changed to accommodate those accidents involving severely degraded cores and melted cores. One of the principal items in this rulemaking proceeding is the matter of hydrogen management for all classes of containments. Although not yet established, the schedule for this proceeding is expected to range over two to four years.

D. TMI RELATED SAFETY IMPROVEMENTS

As a result of the recommendations made by the staff's TMI Lessons Learned Task Force, and actions taken by the staff's Bulletins and Orders Task Force, a substantial number of safety improvements have already been implemented and will continue to be implemented at all operating and new reactor plants. These improvements include changes in hardware, operating procedures, and operator training, which contribute to making more remote and acceptable the likelihood of accidents that involve severely degraded cores. Details of these improvements are described in:

1) NUREG-0578, "TMI-2 Lessons Learned Task Force Status Report and Short-Term Recommendations," July 1979;
2) Letter to All Operating Nuclear Power Plants from D. Eisenhut, Acting Director, DOR, September 13, 1979 (transmitted L^2 requirements and clarification); and
3) Letter to All Operating Nuclear Power Plants from H. Denton, Director, NRR, October 30, 1979 (further clarification of requirements).

III CONCLUSION

On the basis of the above discussion which indicates that the likelihood of severely degraded accidents has been made acceptably remote, and that a substantial study program will be undertaken on an accelerated schedule by the NRC staff as well as by TVA and other owners of ice condenser plants, the staff concludes that no additional requirements beyond those of the currently effective 10 CFR Part 50.44 need be implemented for the Sequoyah plant and other ice condenser plants, pending completion of the study programs identified above and possibly the rulemaking proceeding also identified above.

Since the matter of full power licensing for the Sequoyah plant will have to be considered by the Commission, we request a statement of the ACRS views on the staff's position as outlined above.

6/5/80
3
Tape 11

DESCRIPTION OF THE LOSS OF DECAY HEAT REMOVAL CAPABILITY AT DAVIS-BESSE UNIT 1 ON APRIL 19, 1980

SLIDES PRESENTED AT THE

JUNE 5, 1980 ACRS MEETING BY

I. VILLALVA

SUMMARY OF THE EVENT

I. STATUS OF PLANT AT TIME OF EVENT - PLANT IN REFUELING MODE; HEAD DETENSIONED WITH BOLTS IN PLACE; RCS LEVEL SLIGHTLY BELOW HEAD FLANGE; RCS TEMPERATURE 90F (ROSE TO 170F); MANWAY COVER ON TOP OF STEAM GENERATOR REMOVED; AND DECAY HEAT BEING REMOVED BY DHR LOOP NO. 2.

II. EQUIPMENT OUT OF SERVICE FOR MAINTENANCE/TESTING PURPOSES OR TO PRECLUDE INADVERTENT ACTUATION - SOURCE RANGE CHANNEL 2; HIGH PRESSURE INJECTION SYSTEM; CONTAINMENT SPRAY SYSTEM; DECAY HEAT REMOVAL LOOP NO. 1; STATION BATTERY NO. 1 (125 VOLT BATTERIES 1P AND 1N): EMERGENCY DIESEL GENERATOR NO. 1; 4.16 KV ESSENTIAL SWITCHGEAR BUS CL; 13.8 KV SWITCHGEAR BUS A (THIS BUS WAS ENERGIZED BUT NOT ALIGNED TO SERVE ITS LOADS.)

III. MAJOR CONTRIBUTORS TO THE EVENT:

A. EXTENSIVE MAINTENANCE AND/OR TESTING ACTIVITIES;

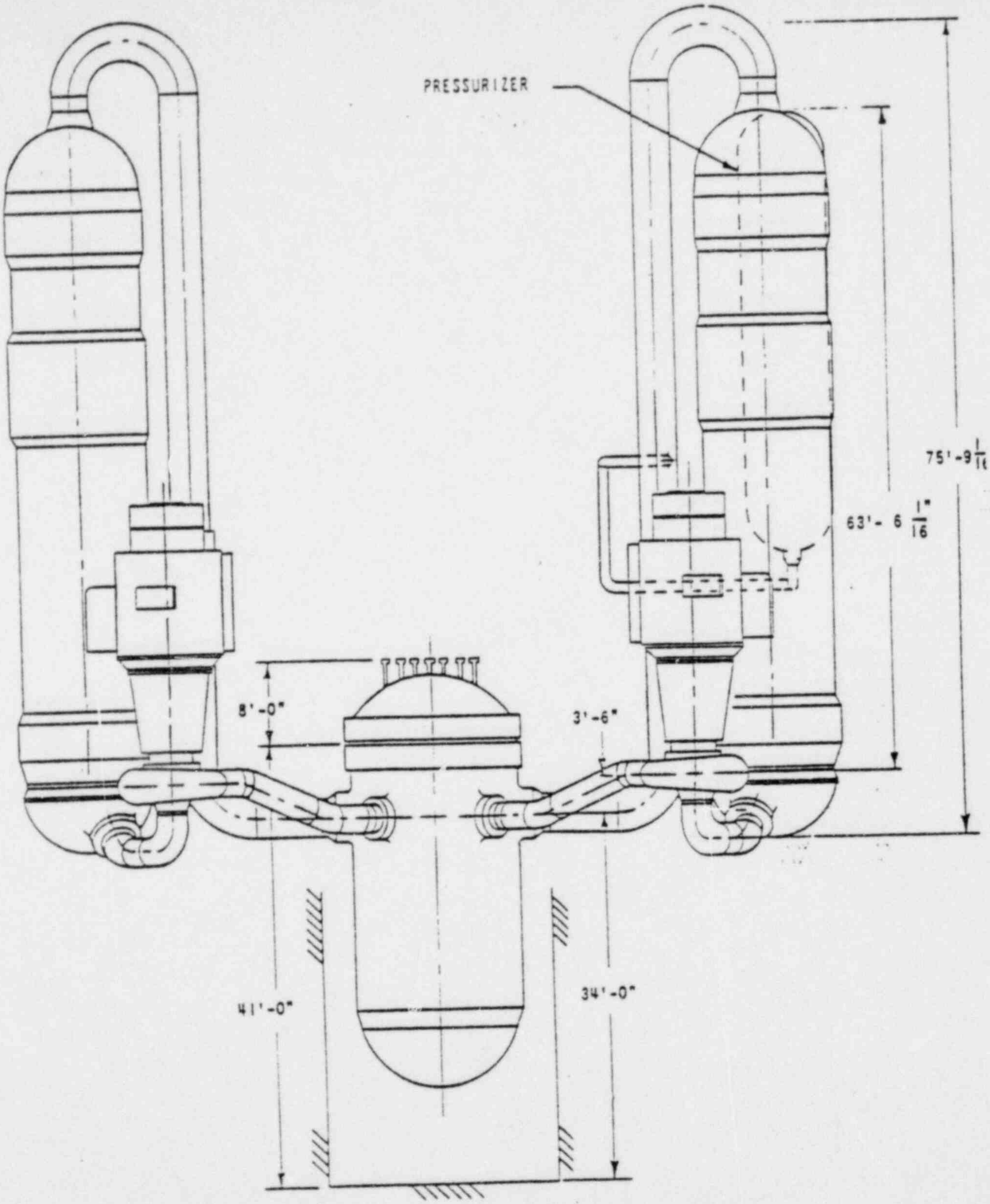
B. INADEQUATE PROCEDURES AND/OR ADMINISTRATIVE CONTROLS; AND

C. TWO-OUT-OF-FOUR SFAS LOGIC.

IV. ACTIONS TAKEN TO PRECLUDE EVENT:

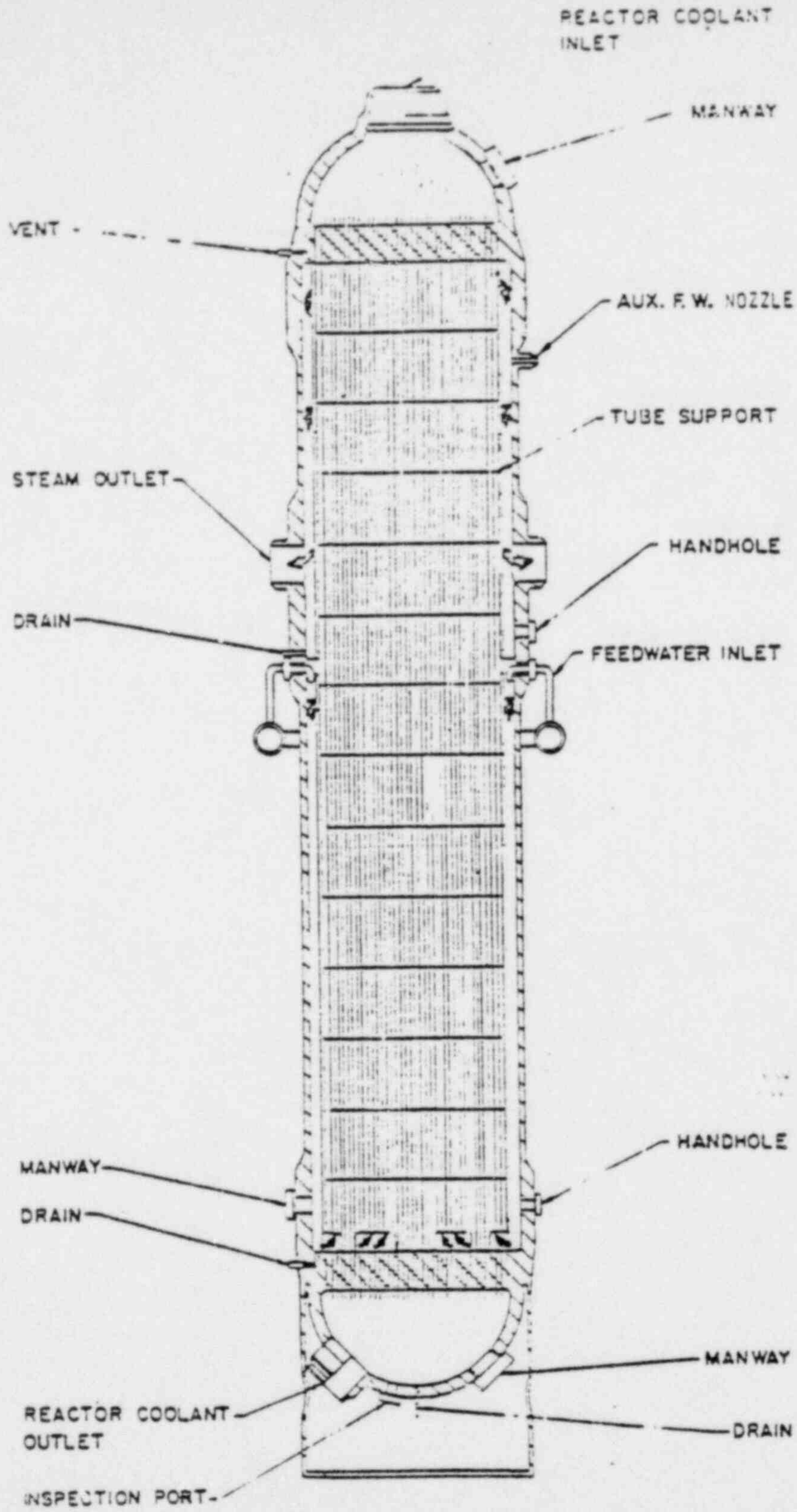
A. ISSUED IE INFORMATION NOTICE 80-20 ON MAY 8, 1980 INFORMING LICENSEES OF EVENT.

B. ISSUED IE BULLETIN NO. 80-12 ON MAY 9, 1980 REQUIRING LICENSEES TO TAKE ACTIONS TO REDUCE THE LIKELIHOOD OF LOSING DHR CAPABILITY WHILE IN COLD SHUTDOWN OR REFUELING MODE.



DAVIS-BESSE NUCLEAR POWER STATION
REACTOR COOLANT SYSTEM
ARRANGEMENT - ELEVATION

2

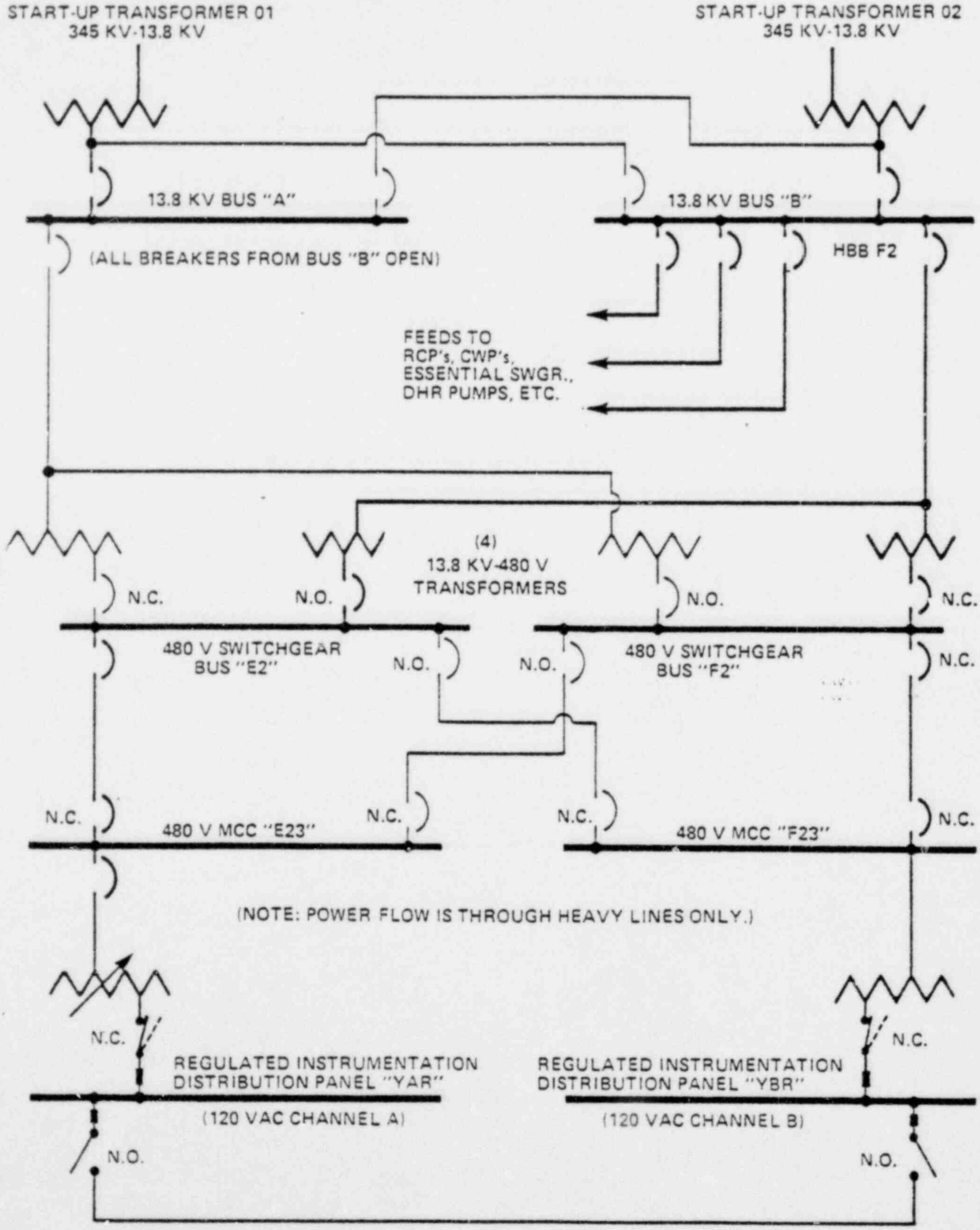


STEAM GENERATOR

DAVIS-BESSE NUCLEAR POWER STATION
STEAM GENERATOR

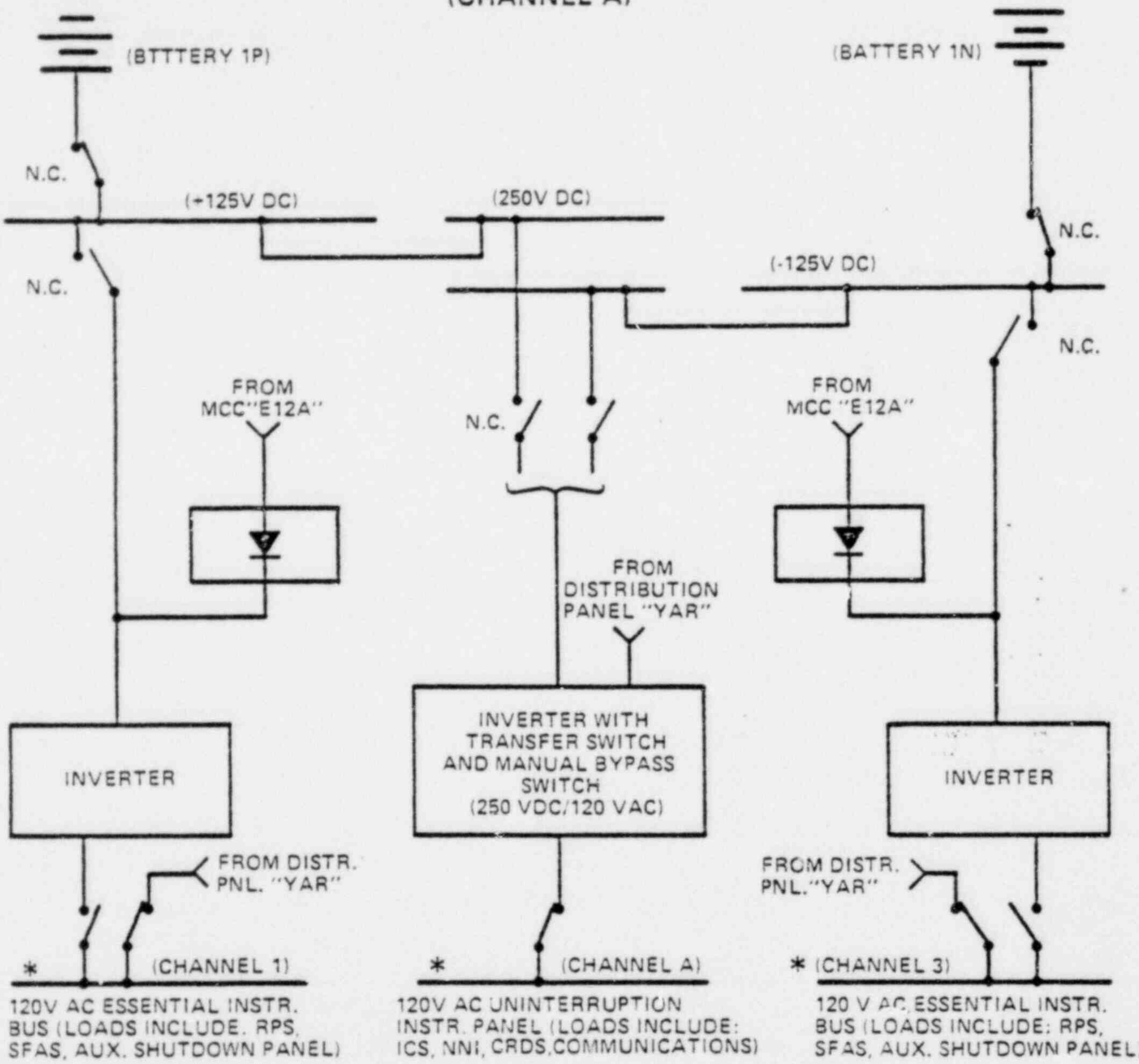
3

SIMPLIFIED AC DISTRIBUTION SYSTEM AT DAVIS-BESSE UNIT 1 DURING LOSS OF DECAY HEAT REMOVAL EVENT



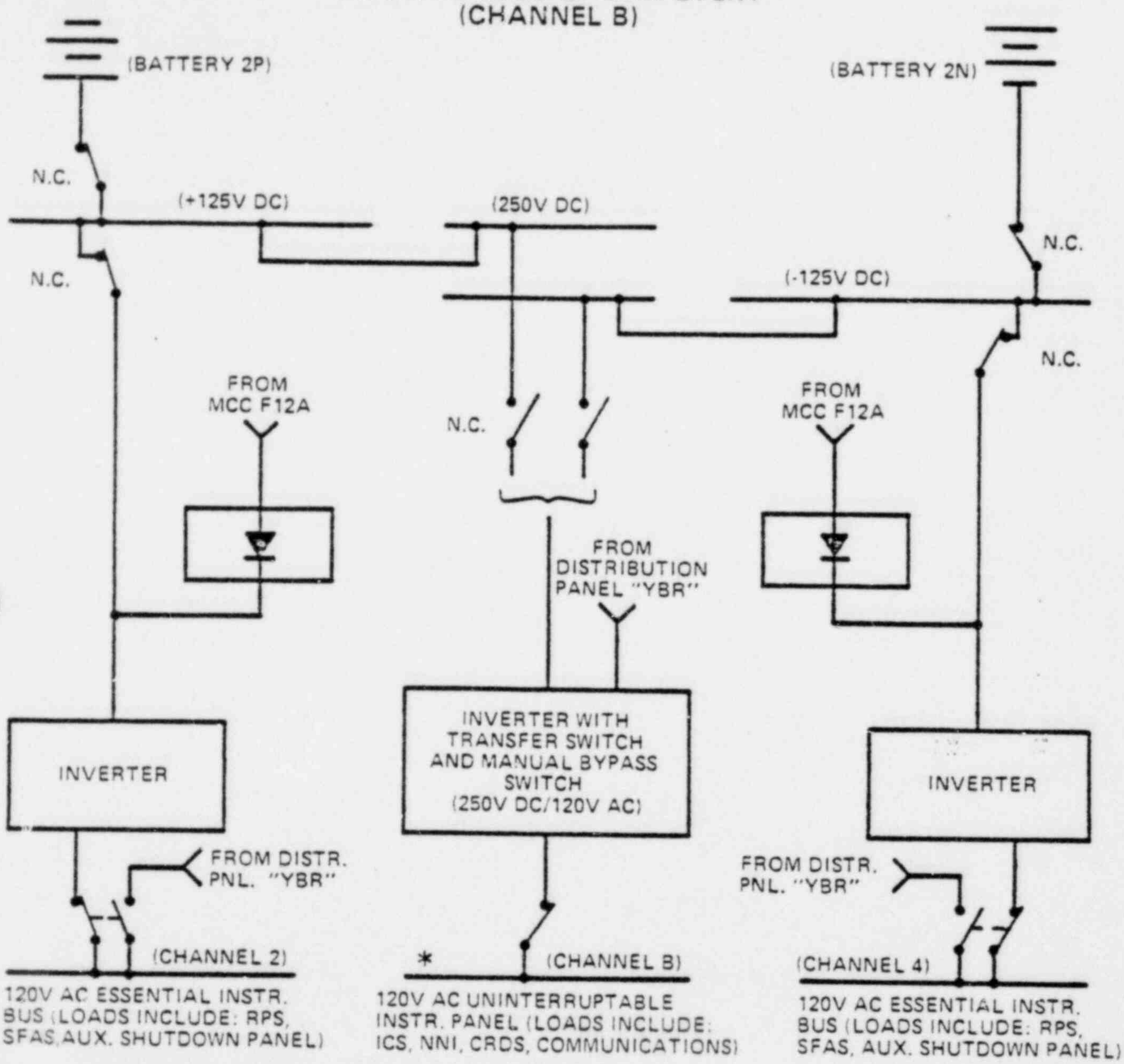
4

SIMPLIFIED 250/125 VOLT DC AND 120 VOLT AC INSTRUMENTATION DISTRIBUTION SYSTEM AT DAVIS-BESSE PRIOR TO LOSS OF DHR EVENT (CHANNEL A)



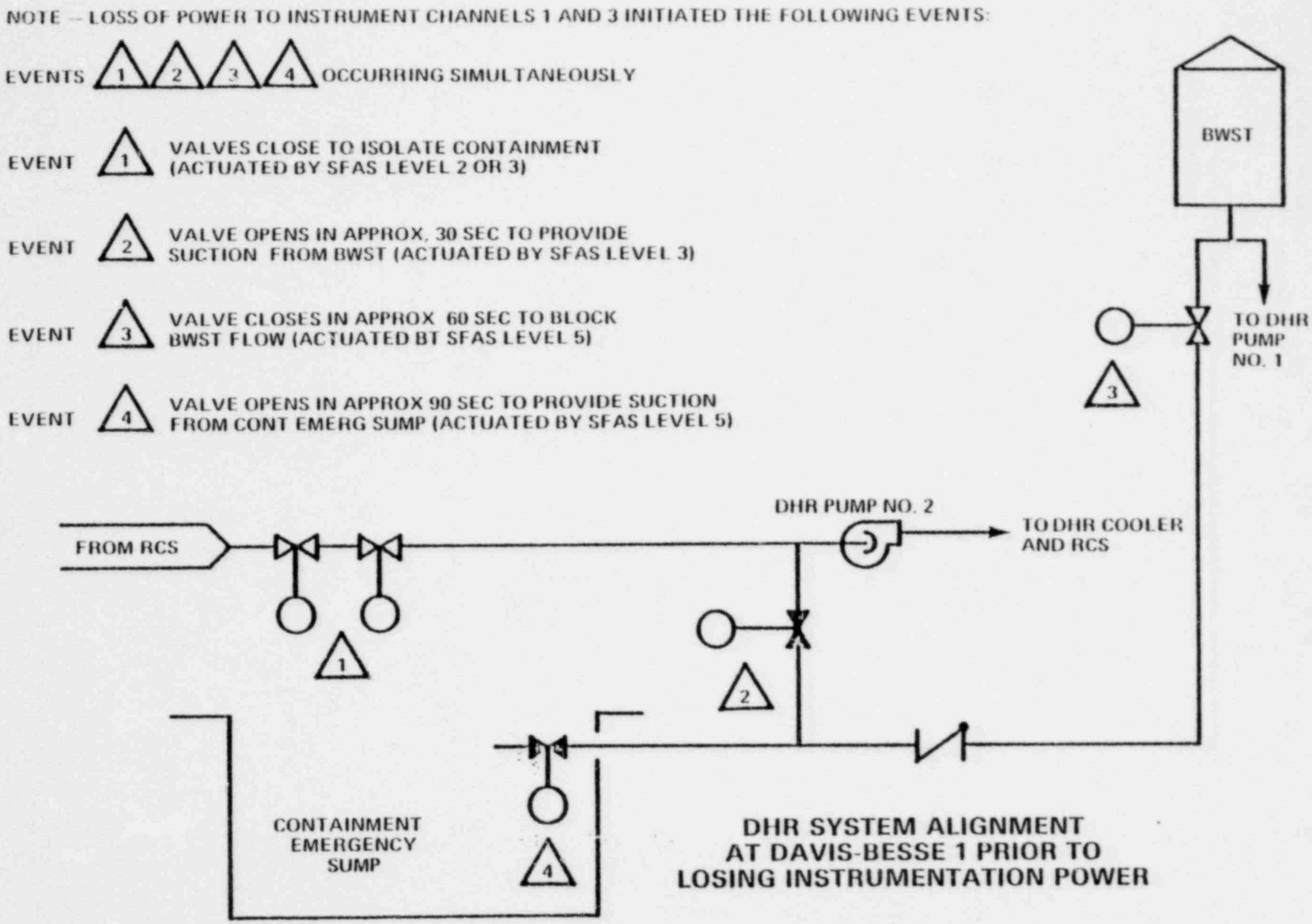
* INSTRUMENT BUSES LOST UPON TRIPPING 13.8 KV BREAKER "HBBF2"

SIMPLIFIED 250/125 VOLT DC AND 120 VOLT AC INSTRUMENTATION DISTRIBUTION SYSTEM AT DAVIS-BESSE PRIOR TO LOSS OF DHR EVENT (CHANNEL B)



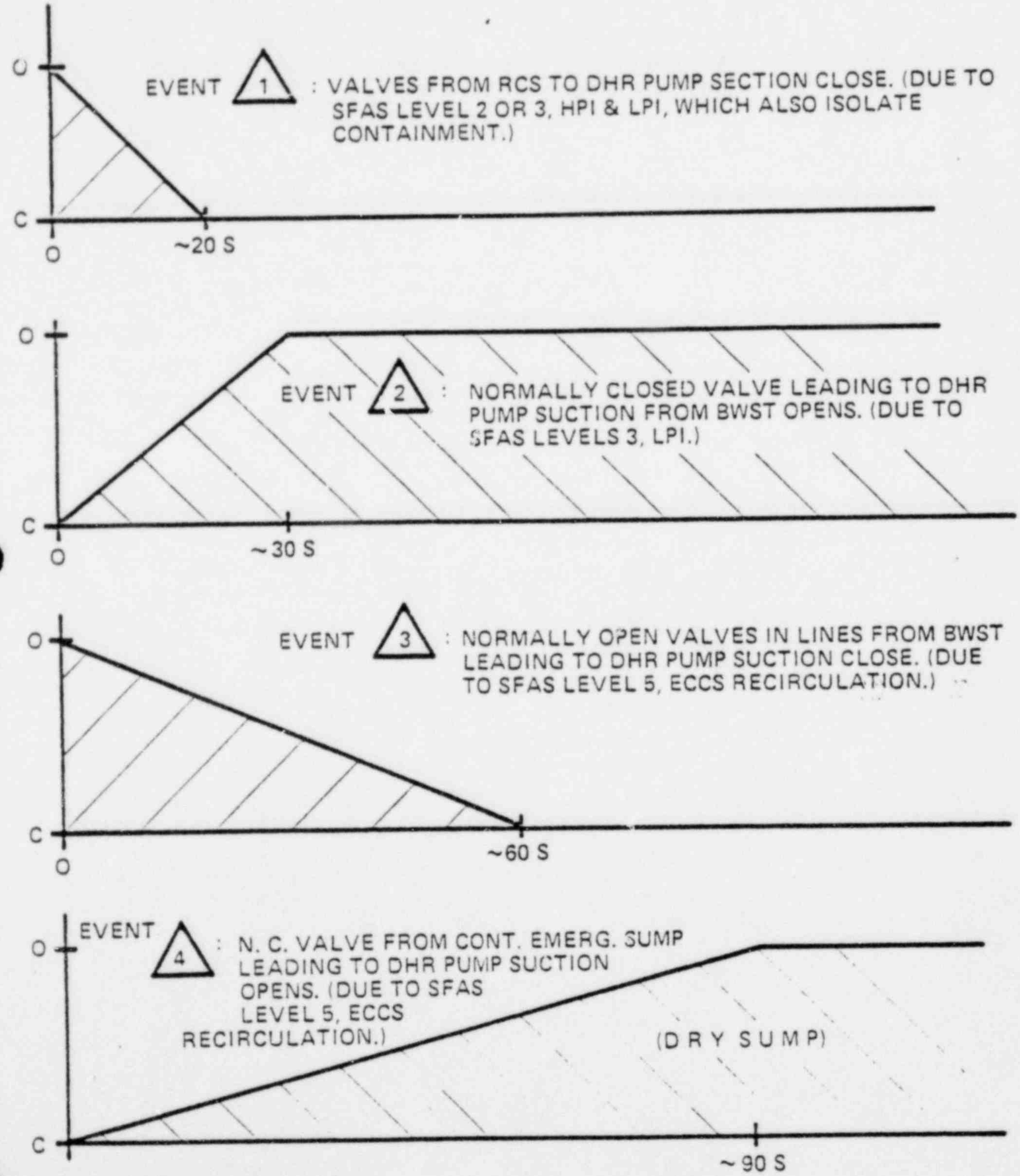
* INSTRUMENT BUSES LOST UPON TRIPPING 13.8 KV BREAKER "HBBF2"

6



DHR SYSTEM ALIGNMENT AT DAVIS-BESSE 1 PRIOR TO LOSING INSTRUMENTATION POWER

VALVE ACTIONS AND STROKE TIMES DUE TO ACTUATING SFAS LEVELS 2, 3, AND 5 UPON LOSING POWER TO INSTRUMENTATION CHANNELS 1 AND 3



LICENSEE ACTIONS REQUIRED BY IE BULLETIN 80-12

- REVIEW OF THE DAVIS-BESSE LOSS OF DHR EVENT AND OTHER SIMILAR DHR DEGRADATION EVENTS.

- REVIEW OF THE HARDWARE CAPABILITY, EQUIPMENT REDUNDANCY AND DIVERSITY, AND OVERALL DHR RELIABILITY IN PREVENTING THE LOSS OF DHR CAPABILITY WHILE IN A COLD SHUTDOWN OR REFUELING MODE.

- ANALYSES OF THE ADEQUACY OF PROCEDURES WITH RESPECT TO:
  (A) GUARDING AGAINST LOSS OF REDUNDANCY OR DIVERSITY OF DHR SYSTEMS;
  (B) RESPONDING TO LOSS OF DHR EVENTS DURING TIMES WHEN ACTIVITIES THAT COULD DEGRADE DHR CAPABILITY ARE BEING CONDUCTED, (E.G., WHEN MAINTENANCE ACTIVITIES IN RELATED SYSTEMS ARE BEING PERFORMED OR DURING REFUELING).

- IMPLEMENTATION, AS SOON AS PRACTICABLE, OF ADMINISTRATIVE CONTROLS TO ASSURE THAT:
  (A) REDUNDANT OR DIVERSE DHR METHODS ARE AVAILABLE DURING ALL MODES OF OPERATION;
  (B) ALTERNATE MEANS OF DHR ARE AVAILABLE OR THAT RESTORATION OF THE LOST TRAIN IS EXPEDITED IN THOSE CASES WHERE SINGLE FAILURES OR OTHER ACTIONS CAN RESULT IN ONLY ONE DHR TRAIN BEING AVAILABLE.