NRC PDR

UNITED STATES
NUCLEAR REGULATORY COMMISSION

In the matter of:

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS,
SUBCOMMITTEE MEETING ON BABCOCK AND
WILCOX WATER REACTORS

POOR ORIGINAL

Place: Washington, D. C.

Date: April 8, 1980 **Pages:** 1 - 196

INTERNATIONAL VERBATIM REPORTERS, INC.
499 SOUTH CAPITOL STREET, S. W. SUITE 107
WASHINGTON, D. C. 20002
202 484-3550

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UNITED STATES

NUCLEAR REGULATORY COMMISSION

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

Tuesday, April 8, 1980

The Advisory Committee on Reactor Safeguards, Babcock & Wilcox Water Reactors Subcommittee, met, pursuant to notice, at 8:30 a.m., Mr. Harold Etherington, Chairman of the Subcommittee, presiding.

PRESENT:

Mr. Jesse C. Ebersole

Dr. Steven Lawroski

Mr. William Mathis

Mr. Jeremiah J. Ray

Dr. Ivan Catton

Dr. T. Theofanous

Dr. Z. Zudans

and others

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P R O C E E D I N G S

CHAIRMAN ETHERINGTON: The meeting of the Advisory Committee on Reactor Safeguards Subcommittee on B&W Water Reactors will now come to order. I am Harold Etherington, Subcommitte Chairman. The other members present today are Mr. Mathis -- I guess that is all so far. Later we expect to have Mr. Ebersole, Dr. Lawroski, and Mr. Ray.

Also present today are ACRS consultants: Dr. Catton, Dr. Theofanous, and Dr. Zudans. Oh, excuse me. Mr. Ray is here.

MR. RAY: That's all right, Harold. My wife overlooks me, too.

CHAIRMAN ETHERINGTON: The purpose of this meeting is to continue the Subcommittee review of the sensitivity of B&W reactor systems to feedwater transients. The NRC Regulatory Staff has been considering halting construction on B&W plants because of such presumed sensitivity.

Mr. Harold Denton, NRR Director, has decided that "based on preliminary information on the status of plant construction and design changes already made, construction of these plants should be permitted to continue pending evaluation of plant-specific information."

This decision is contained in his letter to the

Commission, dated January 22, 1980. The Subcommittee will review this decision and the full ACRS will provide its recommendation in a letter to the Commission.

It may be necessary for the Subcommittee to hold one or more closed sessions for the purpose of exploring matters involving proprietary information. This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act and the Government in the Sunshine Act.

Mr. Peter Tam is the Designated Federal Employee for the meeting. The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register on Monday, March 24, 1980.

A transcript of the meeting is being kept, and it is requested that each speaker first identify himself or herself and speak with sufficient clarity and volume so that he or she can be readily heard.

We have received no written statements or requests for time to make oral statements from any member of the public. Do members and consultants have any comments regarding the meeting schedule or contents? I think we'll pick this up in executive session. We'll have a short executive session which will be [illegible] of course, but not recorded. I think this has reminded the Committee of the purpose of this meeting. I think I'll make a few further comments on the history leading up to the meeting.

(Whereupon, an off-the-record discussion ensued.)

MR. NOVAK: I guess I'm just wondering -- will the staff be provided with copies of this fellow's report? I don't know the title. I have to apologize --

CHAIRMAN ETHERINGTON: I think, Tom, this is a matter of policy. The person's draft is a first draft. It is going to be rewritten, and I think we'll have to leave it to perhaps Mr. Frailey or the Chairman of the Committee to decide whether it is a public document or not.

MR. NOVAK: Okay. Certainly the only point in bringing it up is as I listen to the presentations, I can expect that as you listen to the staff's discussions today, you may sense some differences. Now, in truth, they may be able to be put together. You may -- the differences may be decipherable once all the facts are known.

My only point is saying that certainly all of the information that we are providing to the Committee, we would welcome that the fellow's group look at for the purpose of joining together the two reports. I think this is the only problem I would see is that if we don't have an opportunity to look at each report, there are going to be differences, and they will not be explainable. I think that's the problem I see. I think as you see our discussions, you'll see a different flavor. Even the characteristics of the plant might be described differently. And then you're going to say, well, look, we just saw this report, and we saw that report. Are we analyzing the same plant or not?

And in an attempt to keep this to a minimum -- I don't think we'll ever get it all out of there -- but I think that would be the only reason I would suggest if possible the staff be provided with a copy of the fellow's report when it's appropriate only to try to reconcile certain differences. We might want to keep that as we go on.

You will see some differences between our understanding -- the way we have described the performance of the plant versus what the fellows have described although we supposedly are all using the same data base. That being the safety analysis reports.

DR. THEOFANOUS: Tom, those differences may be instructive themselves?

MR. NOVAK: Oh, they're instructive, yes.

DR. THEOFANOUS: We don't want to eliminate the differences. I think the whole idea is to give some independence and learn from those differences. If you use the same data base, then either the differences are semantic or they are substantial. If they are substantial, you learn something from it. If they're only semantic, again, we learn something from it.

MR. NOVAK: I agree. I think the only point I was making is I would like to see that the differences are explainable. The record should not suggest that there is -- that the differences are there, but for some reason they were never explained.

DR. CATTON: I've read both reports. I can't find differences that are so great that I would have trouble trying to explain them.

MR. NOVAK: Well, all I was doing was I was -- perhaps being a little premature, but when I saw some of the performance characteristics -- CE, Westinghouse, B&W plants -- for example -- we have some other performance characteristics. The curves do not -- they need not fall on top of one another.

There are differences, and perhaps sometime this morning we will take a few minutes, and there are some summary slides that we can show which show different characteristics. They are different, but as I say, I think they can be explained.

DR. CATTON: They looked at a little different characteristics, but the conclusions that they came to were roughly the same.

MR. NOVAK: Fine. Okay. I'm willing to be wrong. I just sensed that the direction that I saw was that there may be some residual functions that would not be explainable.

CHAIRMAN ETHERINGTON: I think we recognize, Tom, there have been some discussions internally somewhat along those lines.

MR. NOVAK: Well, are you prepared now to go on with the staff's presentation? Thank you. First of all, I think it would be useful, at least, for me to bring this up to today. And then I'll ask Bob Tedesco to discuss the first topic on the agenda.

As you recall, the purpose of this Subcommittee meeting was to continue our discussions regarding the staff's view of B&W plants presently under construction. On January 22, 1980, Mr. Denton sent a memo to the Commission commenting on whether there was a need to halt portions of construction of plants, of B&W nuclear steam supply plants.

The conclusion being looking at the stages of construction of all of the plants which presently have CP's and for the work that was presently underway by each of the licensees, the staff concluded that there was no basis at this time to halt construction.

We were looking forward, then, to discussing these views with the Committee and obtaining their comments on going ahead with construction of the plants at this time with an ongoing review to see where improvements in the plants can be made to reduce what we have termed sensitivity of the ones which are steam generator designed.

CHAIRMAN ETHERINGTON: Tom, in the letter of January 22, Mr. Denton said he chose to go ahead -- to let construction go ahead. Is that the condition now? They are going ahead, or is there any hold?

MR. NOVAK: No, they are continuing.

CHAIRMAN ETHERINGTON: Okay.

MR. NOVAK: And our view today is that they should continue.

CHAIRMAN ETHERINGTON: Yes.

MR. NOVAK: Now, at the time we wrote that letter, the work that was being done in terms of -- well, it's been termed an IREP study, or a mini reactor safety study, was being performed at the Crystal River plant.

This was an attempt, in my view, to try to highlight those particular scenarios that presented the greatest risk in terms of accident consequences for a B&W design. On the agenda today, you will see that we will be discussing the results as they are today of that work.

During the interim period, of course, there was what's been termed the Crystal River incident which was an event wherein you had a secondary side transient resulting in HPI actuation, and I think you're very familiar with that transient. It resulted in some 40,000 gallons of water being pumped through the pressurizer relief and safety valves and being discharged into containment.

That plant is presently shut down, and it's scheduled to -- there is a reload going on -- refueling, and it's scheduled for restart at the earliest May 15, and hopefully no later than June 1.

Now, in about the middle of March, Mr. Denton, reviewing the operating experience of B&W plants and particularly the incident at Crystal River, formulated a task force to be chaired by Mr. Tedesco. I was a member of it. And a number of people who worked on the sensitivity studies of the plant still under construction provided their views to this task force.

We've attempted to maintain the continuity in this area. I think it's proper now to let Mr. Tedesco to bring the Subcommittee up to date as to the background and where we are today with the task force. You have been provided a report, I understand, and we're prepared to highlight that, summarize the recommendations of that report and answer as many questions as we can.

It's my understanding that most of the members of the task force are here today.

CHAIRMAN ETHERINGTON: Tom, who is going to tell us what the Committee should address in its letter to the Commission?

MR. NOVAK: That's my responsibility. We can do it now. At least, let me start. I think as I go on, you'll probably have more questions. As I said, the original intent of this meeting and the full Committee meeting later this week was to obtain the views from the Committee with regard to their support or non-support for continued construction of B&W plants.

We would like to enlarge that scope today. We would like to enlarge it to have you also comment, and we think there is a single letter that can be written which addresses also the requirements, or recommendations of this task force report for plants in operation.

And it would seem very obvious at least to me that many of these recommendations to some degree would be backfit recommendations. They're not backfit. They would be forward-fit in a sense to plants under construction.

But I see a molding of the views that were presented in Mr. Denton's letter to the Commission in early January regarding plants under construction and the recommendations now that are being made to Mr. Denton via this task force report.

We expect that -- Mr. Tedesco will mention the schedule. We expect to discuss this report with the

Commission later this month. It may be just a week or two off.

CHAIRMAN ETHERINGTON: Tom, this report -- are you referring to New Reg 0667?

MR. NOVAK: Yes, I am.

CHAIRMAN ETHERINGTON: Of course, we've only just received that, and I don't think the Committee -- well, the Committee may be willing --

MR. NOVAK: I recognize that you may decide that based on the fact that we're asking you to integrate the views expressed by our report into the views that you would express with regard to plants under construction would say we're going to have to continue these discussions. And we are prepared to continue these discussions.

I don't practically see how you could write a letter on the complete story this month.

CHAIRMAN ETHERINGTON: All right. That's clear. Thank you.

MR. NOVAK: Mr. Tedesco is prepared to summarize.

CHAIRMAN ETHERINGTON: Could I ask just one more question? Permitting construction to continue is without prejudice to any ultimate decision that changes must be made, of course?

MR. NOVAK: That's correct.

CHAIRMAN ETHERINGTON: Thank you.

MR. NOVAK: I would view it that construction today is preceding at the applicant's risk in a sense. If there is a backfit requirement, it would be so included.

MR. MATHIS: Tom, one other question. Aren't the plants under construction today subject to the orders that have been issued for the older plants?

MR. NOVAK: No, they're not.

MR. MATHIS: They're not.

MR. NOVAK: No. That's a technicality, but --

MR. MATHIS: I thought the modifications applied --

MR. NOVAK: Well, many of those plants have already gone ahead and made modification that would be certainly in tune with the orders that I think you're referring to which permitted the restart of the B&W plants.

MR. MATHIS: Yes.

MR. NOVAK: Yes. I think the flavor of those orders are certainly contained within the design of these plants presently under construction.

MR. MATHIS: Thank you.

MR. TEDESCO: Good morning. Bob Tedesco from the staff. And I have been designated to be the chairman of the B&W task force. It started with Mr. Denton's concern regarding the acceptability of the recent events that have occurred at the B&W plant. Namely, the Crystal River event of February 26 and then the OCONEE event last November.

And while the Crystal River event itself is not one that we would consider to have endangered or caused great concern about the health and safety of the public, Mr. Denton expressed an unwillingness to accept such a plant response for a transient event.

In other words, one that would lead to a challenge of the engineered safety feature resulting in the release of about 40,000 gallons of water from a primary system into the containment. Considering foremost in the relatively short period of operation of the B&W plant which is estimated to be on the order of 38 reactor years, there does seem to have been too many of these undesirable events involved in the B&W plants.

Further, since the TMI-2 accident, additional hardware and operational cha ges have been imposed upon the B&W plant. They certainly have contributed to improve safety in their operational performance. Namely, the lessons learned and the owner's action that we have all discussed over the past year. So with the background we have been faced with about the operational history and the actions that we have taken, Mr. Denton set forth to establish our present task force to get him a prompt assessment of the acceptability of the plant's operations with regard to their sensitivity in the secondary side perturbations. Namely, we're dealing with transients involving under and overflowing types of events.

And to this end, we have issued a draft of our report of New Reg 0667 that Mr. Etherington referred to. And this report was issued to the public on April 2 of this year. Now, we have no -- well, Mr. Denton, I should say -- has no formal position as yet regarding the recommendations that the task force has made in this report. And the reason being that Section 7 of the report had not been completed yet.

Section 7 of the report will deal with an attempt to make a qualitative assessment of the risk reduction potential of each of the recommendations that the task force has made. And Section 7 is being developed with the assistance of the probablistic analysis staff.

Now, if you get in conversation with B&W operating plant owners to be ambitious and vigorous in their pursuit of ways to improve the plant response, to anticipate a transient such as the loss of feedwater event. And so we are looking to actions that would both prevent and mitigate the consequences of the various transients.

I'll think you'll find that the thrust of our report tends to rely more towards the mitigation aspect. But we certainly don't want to indicate at any point that we're saying that ways to prevent should be not be encouraged; and continue to look at ways of prevention.

Now, from a longer-term look, the task force believes that acceptance criteria should be established to give us a little better insight on how we're approaching the outcome of anticipated transient on a uniform basis for all plants.

I think one of the things that we're finding is that we're having transients. And the recovery aspect varies from plant to plant. Some are perhaps more sensitive that others based on their B&W experience.

And we feel that in the long term the best way to approach that, and we've identified this in our report -- was to encourage the development of criteria to deal with anticipated transients. And our report contains several examples of such an approach that we have put in there as suggestions and not really as an exhaustive recommendations at this point.

We also would encourage B&W to take a lead toward developing such criteria. Mr. Denton is going to request or is requesting the advice of the ACRS regarding the recommendations that are set forth in our report.

And as Tom has pointed out earlier, we'd like to consider the advice of the Committee on a broad basis to not only include the operating plants but also the plants that are under construction. Realizing that Section 7 to our report has not been made available yet, it's probably wise to look forward to another meeting with the Subcommittee and the full Committee.

Now, we do expect in our Sect. n 7 to be made available within a week or two, and that's roughly a time scale that we are looking forward to. Now, the report that you have has been given to Babcock and Wilcox. It has also been given to the owners of the operating plant at a meeting that we had with them on April 3.

But today we are prepared to discuss the result with the Subcommittee and the full Committee on Friday of this week. Our Commission briefings have been established for the 16th of April, and we are again planning to meet with the owners on the 23rd of April. And that's the time that we would hope that our complete report will have been provided for their review.

So with the background I established, I would like to now start to brief the Committee about where we are on this task force. And you have been given handouts so we can run through it.

DR. ZUDANS: Are you going to explain later by what you meant by qualitative risk assessment?

MR. TEDESCO: Yes, sir, that will come up as we go along. All right. Here is a little background of the task force that it was established by Mr. Denton, the

Director of the Office of NRR, on 12th of March. The charge was to provide a short-term assessment regarding the B&W plant experiences we have had, and then to set forth any additional licensee requirements to give us assurance regarding the capability of the plant in a safe operation to respond to the anticipated transient.

Now, the main areas of review that the task force addressed were as follows: (1) regarding the sensitivity of the plant response; (2) and the recovery from each type of transient involved in the overcooling and undercooling event. We were considering the effect of consequences of malfunctions and failures in the ICS, the integrated control system, that we have all heard so much about in the past year.

Then, of course, the non-nuclear instrumentation system which manifested itself at OCONEE and RANCHO SECO most recently, and the Crystal River event, too. Then add the effectiveness of all the on-going actions that we have been given since TMI looked at our Lessons Learned Task Force, our Bulletins and Orders Task Force, concerning the efforts of the industry, the Commission Review Group by Mr. Rogovin, the Presidential Commission, our staff action plan -- all these things have been brought into the picture since TMI, and we want to overlay these things upon the operating history to see where we are.

So we're given a very, very ambitious charter for a very short period of time. I think you have to perhaps give a perspective that this is not the end of all review on the situation. There is an ongoing review of the Crystal River event itself, and you'll hear more about it some other time.

Now, the results of our review, as we discussed earlier, are presented in part in New Reg 0667 entitled "The Transient Response of Babcock and Wilcox Designed Reactors." It was released on the second of April of this year.

Section 7 which is a implementation of the recommendation based on risk reduction potential will be provided later. And this is the work that we have done by Frank Ralston and his company in the probablistic assessment branch.

CHAIRMAN ETHERINGTON: Are handouts of these transparencies available, Bob?

MR. TEDESCO: Yes, sir. Bryon?

CHAIRMAN ETHERINGTON: Oh, I'm sorry. We have them already. I didn't realize.

MR. TEDESCO: All right. The members of the task force -- the next slide I'll run through briefly --

(A slide presentation ensued.)

MR. TEDESCO: They are representative from major segments of NRC within the Office of Nuclear Reactor

Regulation and the Division of Operating Reactors, myself as chairman. And then Vince Panciera and Brian Sheron from Reactor Safety; and Dominic Tondi from Plant Systems. Again, from the Division of Systems Safety, we have Tom Novak and Dale Thatcher.

From the Division of Project Management Bob Capra and Brook Wilson. Then from the other offices -- the Office of Inspection and Enforcement, Ed Blckwood from Headquarters and Don Quick from Region II have been following Crystal River pretty much.

From our Office of Research, Mark Cunningham. Then we have the special assistance of Frank Rowsome and Matt Taylor who are doing Section 7. We have a consultant from Oak Ridge, John Anderson. I'm sure you have been in contact with before.

The next slide gives a general finding about the B&W plants that the task force has come up with. We have found that the B&W designed plants do indeed express a more responsive aspect to secondary side perturbations than the other light water reactors. In this regard, we have identified the once through steam generator design that is basically a sound design in our opinion.

But yet because of its inherent design aspect it does require or it is highly interactive and responsive to code. It does require a rapid reponding to code systems to maintain its capability.

DR. CATTON: Bob, in the design of the once-through steam generator, how do they decide on the water volume? Is there some criterion for responsiveness that leads to a particular volume

MR. TEDESCO: It deals mainly with the availability of the plant to operate in a designed condition that the response of the transient. Now, the design condition, the plant does respond properly. When you have off set conditicns plus failures on top of it that the thing really manifests itself in a very responsive way. The [illegible]ngs have a tendency to respond in another system. You know, if you keep water in your steam generator, it should be all right. But there are other demands placed upon the system that kind of interact in a way that, you know, it s kind of hard to keep up with it.

If you want a control system itself and not a safety system. And therefore, it is not designed for failures, and therefore when a failure does occur, it does interact with the plant. And that's what you're seeing happening.

DR. CATTON: I understand. The amount of water that is in the steam generator is a result of a normal operating characteristic that you want it to have. And then it gets into trouble or it becomes more sensitive for these off normal transients.

MR. TEDESCO: You have a much shorter time response upon which you have to resort.

DR. CATTON: So the increase in the volume of water in the steam generator, you would lose the nice characteristics of the ICS.

MR. TEDESCO: That question has come up, and we have faced it. And I don't think we're in the position to say just having more water would make the steam behave differently because there may be other interreacting aspects that we're not aware of that may affect it.

But I don't -- I guess I'm going to hesitate in giving an overwhelming acceptance of the suggestion that you had more water, and we're all right. That would make another aspect of it.

DR. CATTON: I didn't mean to suggest that either.

MR. TEDESCO: This certainly is an appealing approach. And I think indirectly we're saying yeah. And therefore we want to put our emphasis in making available more water for the steam generator.

The next one has to do with the high degree of overall plant interaction is, indeed, inherent in the ICS than it was through the steam generator. Now, based upon the design features and the faster response to transient in the off-set conditions, there is also an effect on the operator. And we have found that the operators are perhaps required to take more rapid action and have a better understanding of the instrumentation that the face.

They're responding to the fast response on the plant compared to operators of other plants of levers and guides. And I think that is shown up pretty well in Crystal River and also -- even during normal transients, the operators are instructed to take certain actions of terminating the one and having them make up another pump right away.

So they're called upon here to respond more promptly than the other would have to do it. But those are kind of general findings that we had. We can go into more details as contained in the report of where we are.

And our recommendations are given on the next slide with the purpose being to minimize the frequency and the consequences of the secondary side perturbation. That we have found that, you know, we want to provide more reliable instrumentation at the control systems. We want to really focus and give great emphasis to maintaining the availability of that heat sink.

And we want to really focus our attention -- our whole review upon that heat sink. As we really come down the whole issue of the steam generator to keep water, the plant responds all right.

And then also it continues through the trip action into the recovery program. And that bears heavily upon what the operating experience is showing us. The areas that we have looked at involving the auxiliary people on the system, the INC system, the valiant operational matters -- the general area of improvement that came out of our task force efforts as we went into our review.

Now, you might ask a question about -- well, what will I do with all these things again, and the task force looked at that in the sense that we would make a recommendation that it is our recommendation that came out of review should be incorporated into our task action plan that the NRC is developing at this time.

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MR. TEDESCO: The auxiliary feedwater system is what you see on this slide here is that first recommendation that the system be operated to meet the requirement of the engineer safety criteria that it be safety graded. And the question regarding the hydrogen I requirement that we are indeed dealing with flash and arc wheel with our operators and have for a number of years, our placing and fixing of their original design base. And we're asking of the assistance of the probabilistic analysis staff to give us an assessment of the effectiveness and benefits that you might derive or might not derive from the requirement of firm hydrogen requirement.

So, that of the task force held in abeyance any particular recommendation at this time that the upgrading is too seismic designed.

Now, your basic situation to upgrading may not be a feasible option concerning the plant. And in this regard we would certainly be open and give consideration to the admission of a dedicated system. A dedicated system being -- being a separate train system different from what exists or what may be upgraded already, but add a third train to it.

Now, that speaks roughly to your fluid system. So, along with that we would look for automatically initiated

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and controlled engineered safety features that are completely at this point independent of the ICS and Non-Nuclear Instrumentation and other nonsafety systems. That we want to now cut this system out from any interaction with the plant that really gives it full visibility and full requirements of an engineering safety feature from the mechanical fluid system all the way through the control system.

Now, in this regard we also recognize -- or -- well, if you liken the word task force to the bulletins and task forces, they have taken some action to upgrade certain aspects of the off feedwater system. Namely, the auto start and the indication of feedwater fall. So, we would say, "Look, we want to get another look to how to go about selecting the auto-start signal to insure obstimentation of the provision to get the feedwater system non-aligned in the loss of anticipatofy. So, you want to get as much lead time as possible to inhance the availability of feedwater by proper selection of the start signal. Now, that might be a trip of the feedwater pump. It might be some other aspect that deals with the level of the steam generator.

Now, as far as the level controlled, this would be, again, an engineered safety procedure in a manner to prevent overcooling during recovery of that from feedwater transient.

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Then, Item C deals with a recent Park-21 notification by TVA that the manner of the task force is somewhat in parallel with the notification by TVA.

Here we are looking at means to prevent the spill at the steam generator not only to prevent over-cooling but to prevent filling up the -- the main steam line.

The letter that we got from TVA in reponse to a B&W concern indicates that if you overfill the steam generator in the steam line that the potential for failure exists, and failing of all the steam lines would be an event that has not been evaluated. So, we are recommending that a high level trip -- well, something like a high level trip be provided to insure that we would not overfill the steam generators or steam lines. And there would be something to terminate the steam water flow. And this is not the capability.

Now, Item 3 here is a rather specific recommendation that focuses on one particular plant--the David-Besse Plant--on this particular plant there's a design presently includes two steam-driven feedwater pumps. There are no provisions at this point for an electrically-driven pump.

So, we are, perhaps, clarifying and reaffirming the concerns expressed by B&W concerning that diverse-drive pump provided for the Davis-Besse Plant due to diversity and

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one that would not place continued reliance upon the availability of steam from the steam generators for off feedwater.

Number 4, our experience at Crystal River show that adverse interaction was from the system that we called a steam line break detection and mitigation system. The system that was supposed to terminate the feedwater flow to a portion of the steam generator that had experienced a steam line break. That this system will isolate that part of the plant where you get a low pressure indication. A system of breaking the steam line.

Well, it so happened that Crystal River that we did not have a steam line break, but we did get an indication of low pressure, and therefore, that told the feedwater system to not cause the feedwater to flow into the generator. Well, we want to eliminate that adverse interaction and indeed provide a system that, you know, we have to reevaluate and modify these systems that it would be capable of differentiating between a steam line break and the over-cooling and undercooling transients. So, that when there is a need for feedwater we would have it. And that there is a need for feedwater -- or a feed line break -- or a feedwater line break that we should notify the plant.

Now, we have a couple of notes down here that

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we have interacted with the reports from IMPO on the Crystal River event. And the items that would go through here do parallel many objectives of IMPO. Also, we have referenced a section in our Task Action Plan with recommendations found in general ways of where we would also include them and very specifically.

CHAIRMAN ETHERINGTON: Would Item 3, Bob, most of the time have two motor driven pumps; do they?

MR. TEDESCO: No, most of the plants have diverse systems. And they have steam and electric.

CHAIRMAN ETHERINGTON: Most of them do?

MR. TEDESCO: Yeah. Now, OCONEE presently has only stream-driven pumps. And they have -- they have committed to install electrically-driven pumps.

Tom, do you know the schedules on that? For OCONEE?

MR. NOVAK: For OCONEE?

MR. TEDESCO: Yeah. When it --

MR. NOVAK: They are installed. OCONEE has actually six motor-driven pumps and three steam-driven that will cover the three units. They've -- I'm not quite sure yet whether a complete separation has occurred but eventually the auxiliary feedwater system for each unit then would be composed of one steam-driven and two-motor driven.

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Traditionally, though, the other operating B&W plants have one steam, one motor-driven with the exception of the Davis-Besse Plant which has two steam driven.

The next area is instrumentation and control features.

Incidentally, the numbers you see along the margins here are the numbers that also correspond with our reports. I've lined them up here that way.

Now, in this particular category about improving the reliability of the instrumentation and the plant control system some -- the lessons learned on Crystal River that we have as a task force looked at, has led us to a recommendation of improving the separation and channelizing the power buses and the signal paths for non-nuclear instrumentation so that you meet -- try to expect much better independence of these power buses so that a failure of one bus does not give you a failure of the system. You have a channelized capabilities. So that if one bus would fail you would still have indication from the other buses.

The question came up about the consequences of the failure of some of these instruments after their motor failure when it failed at mid-scale and really what -- what effect did that have on the operators' response. Would there be a preferable way for failing at the zero scale or full scale. So, this had to be considered.

Also, that whenever failures of this type occur the operator should have proper information to tell him which instrument went -- had failed so that therefore his corrective action would not be impeded by the failed instrument.

Control systems should have the inherent design capability so that any detection of gross failures in their mode of operation, that they should be able to terminate their action automatically and not just run wild.

Next one would be a review and a rearrangement as necessary of the non-nuclear instrumentation power buses to provide a redundancy of indication for each reactor coolant and secondary system loop.

MR. EBERSOLE: Bob, may I comment?

MR. TEDESCO: Yes, sir.

MR. EBERSOLE: I always have a problem when you mention redundancy when you're talking about indicating instruments because by and large they have a bi-directional potential. They tell the operator to do the right thing or the wrong thing. And when he has contradictory instrumentation he frequently, when he's just dealing with just one instrument at a time and not for the wholesale collapse of the division, he won't know which instrument is correct. So, what do you do

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about that. It's different when you're indicating to an operator what to do than it is when you're telling a control system what to do and you're obligated to tell it what to do. Here the operator must make the choice between two signals that he sees.

MR. TEDESCO: Yes. Well, that -- you know, that is kind of related to B and C that when he does have a failure when it's difficult to tell by some system --

MR. EBERSOLE: Which is correct?

MR. TEDESCO: -- where --

MR. EBERSOLE: Which is the failure.

MR. TEDESCO: Yeah. Because, you know, how do they fail?

MR. EBERSOLE: Yeah.

MR. TEDESCO: And which ones are they?

MR. EBERSOLE: Well, the simple-minded solution, of course, is to auctioneer and have three-channel systems and believe two and reject one. But that's pretty expensive. And diversity, I think, ought to be mentioned someplace.

MR. TEDESCO: Well, if you get down to Number 6 you might find some of our --

MR. EBERSOLE: Okay.

MR. TEDESCO: -- into that. If not, we'll talk about it again.

Item F here deals on the prompt followup action

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that we believe that should be taken. In our review of the B&W report regarding the SCS reliability analysis, also the NSAC and INPO recommendations of Crystal River, and their IE Bulletin 79-27 which deals with the event when we begin to lose our non-nuclear instrumentation power supplies.

And Number 6, which I referred to, also in response to Mr. Ebersole, sets up a condition here that we would like to have a select data set, safety grade, made available to the operator that would give him high quality indication of select set of data regarding the principal plant parameters and these would be available to him independent of a non-nuclear instrumentation. And they would show forth certain of the critical parameters that he would use in assessing the event as well as the current and recovery action. And I think we have all referred to at different times our discussions with you on the task action plan and on the lessons learned that we call it the basic stage factor or the system stage factor consisting of Number D -- I.D.2 in the

We're looking more and more favorable upon the preferred set of data that IMPO has also made direct references to this too. We're dealing with items on reactor coolant system pressure, pressure on the level, reactant coolant system temperatures, makeup tank level, reactor building pressure and temperature, our once-through steam generator level and pressure and some of our nuclear instrumentation.

Now, these things would be available to the operator. When it starts getting abnormal or unusual indications in the control room of an event, these systems would be available to him to enable him to make an assessment in very reliable ways.

DR. ZUDANS: Do you think this also the rate tank is an indication to the same category?

MR. TEDESCO: Well, I'm not sure. You have a certain cutoff level.

DR. ZUDANS: Well, supposing you had the same type of event in TMI --

MR. TEDESCO: All right. So you have your reactor building section --

DR. ZUDANS: But that is subsequent. That's already a consequence after you have something: overcooling or undercooling. That means that later in the history I would think --

MR. TEDESCO: No. We were really at that point of trying to be selective in asking ourselves what does he really need quickly to identify it.

DR. ZUDANS: I think that's quicker than the actual building --

DR. TEDESCO: We also have acquired the indication by the safety valve and the relief valve. A valve indication telling you no -- whether or not you're pouring out water through your valve.

DR. ZUDANS: But you don't list it here.

DR. TEDESCO: No, that's a given. That's already required.

DR. ZUDANS: It's already required.

DR. TEDESCO: Yes, sir. That's a requirement that's already implemented in all the plants.

DR. ZUDANS: I think the maintain level or something for pressure --

DR. CATTON: The response to the reactor building temperature pressure is very slow.

MR. TEDESCO: Well, once you rupture that tank, you do see a change after that.

DR. CATTON: But it's a lot slower than what tookplace in the tank.

DR. ZUDANS: I'm not saying that we should exclude "E" -- no, it's an important one.

MR. TEDESCO: Yeah, right. Okay.

DR. CATTON: I have anotherquestion. In reading your report, it mentioned -- I believe it's your report that one should be able to distinguish between undercooling and overcooling. I don't see any instrumentation here that's going to allow you to do that, or is that going to be brought up somewhere else?

MR. TEDESCO: I don't remember that about the cooling.

MR. SHERON: Brian Sheron from the staff. I don't think we've actually looked at the instrumentation with respect to fully distinguish between overcooling and undercooling event.

DR. CATTON: You said something about establishing a method determining whether the RCS is undergoing an overcooling or undercooling event. Would instrumentation required to do that be added to this recommended list once you determine how you're going to do it?

MR. TEDESCO: Do you have a reference in our report you're referring to?

DR. CATTON: Your report kind of --

MR. TEDESCO: Yeah, I know. We can check it during the break.

DR. CATTON: I think it had to do with inadvertent pumps on, pumps off -- somewhere in that section.

MR. TEDESCO: No, in ours, the reactor coolant pump question -- that certainly is one that hasn't been resolved yet by many, many people. And one of the recommendations we did make in our report is that industry and NRC try to look at it together and try to resolve the restart criteria as well as for NRC staff -- and though I'd have to review the whole question on this hand pump trip. Tom, do you have something?

MR. NOVAK: Well, I don't want to spend much time. I think you would agree that in terms of undercooling versus overcooling that if one were to take a snapshot of those parameters and read them one would be able to make a very educated guess as to whether you're undergoing a particular transient one way or another, specifically reactor coolant system pressure.

Now, I agree, once you have reactor trips and where you are in time -- these sets of parameters depending -- we'd like them to be trend type parameters. That's what you're looking for, I think, is to follow the trend of these parameters so that you can, then, evaluate the transient that is ongoing.

But there is really no great sophistication. We feel that those parameters are a snapshot that an operator can go to and look at the state of the plant, primary and secondary. He'll know pressure level, temperatures, primary, secondary. That's what I think we're trying to do. Just tell him what his plant is; what the state is at that time.

As you try to go beyond and say, all right, now give us information to help diagnose the transient, then you have to go to -- you may have to go to more information.

You know -- the small steam generator tube -- steam generator tube rupture, for example, could you diagnose that from that piece of information you have there? You may or may not depending on what time you're at when you took that snapshot in terms of parameters.

There is, and I think you appreciate -- there is a shadowing of events. Every event does not just come out and give you a description that is unique. There are many events that look alike at certain times, and I don't intend to say that this is going to help the operator to determine all of it.

But he will know what the state of his plant is at that time, and it's an attempt, then, to let him move over and distinguish what other information in that control room is also good.

That's what I would personally think is one of the attributes of that list there.

DR. CATTON: When I look at your snapshot, I don't see how I would make energy columns across the steam generator?

MR. NOVAK: I don't. I agree.

DR. CATTON: And it seems to me that that's just a few more temperature measurements.

MR. TEDESCO: Now, he would know if he had water in the steam generator. He would know what the pressure is of the parameters You know, what we don't want to end up doing is taking every data in the control room and introducing it as a special set of data.

When you ask yourself the question -- what can I give the operator for prompt indication so that he would make the input to enable him to make a prompt assessment of what is going on, not to run the whole event from here, but introduce a direction.

DR. CATTON: I understand. Maybe it's just my rather narrow view, but I feel that being able to make a heat balance quickly from the various components in your system would be very informative.

MR. SHERON: Dr. Catton, I don't -- some of the transients that have been experience in these plants have been a combination of initially being an undercooling event which then leads to some other trip or some sort of protective function, the set point being reached.

And then it carries over to an overcooling transient. I think it would be very difficult to ask an operator to be sitting there and continuously assessing whether he is overcooling or undercooling.

I think Crystal River was to some extent the example of that where the initial loss of the steam generator inventory, and the fact that the PORV was stuck open, and they reached a high pressure set-point, and then once they SCRAMed the plan, because the valve remained open, it just depressurized all the way down; kicked on the HPI to pump the system back up again.

So it's not clear that you have one type of event or another, I think, during the initial stages.

DR. CATTON: For the sake of being stubborn, I cannot -- I just can't believe that a heat balance won't help.

MR. EBERSOLE: As a matter of fact, the heat balance is the root of everything you're looking for.

DR. CATTON: Exactly. And I don't understand the resistance.

MR. TEDESCO: Wait. We do not preclude a heat balance. But, you know, the heat balance in less than a minute -- in a fraction of a second -- this is the stuff that the operator responds to. Recovery action to find out what the heck is going on when they're not in the heat balance is going to take a little longer.

MR. EBERSOLE: But if you're going to respond to this instrumentation to a heat -- water heat effect which is an overcooling transient --

MR. TEDESCO: You would certainly find out from what happened to the temperatures that the reactor coolant and the amount of the pressure.

MR. EBERSOLE: You wouldn't know what caused it.

MR. NOVAK: That's correct.

MR. TEDESCO: No, he's gotten the system. He sees a change happening -- change that's outside his normal operating limits. He knows -- he has the directions that he can start to follow in his diagnostic -- you know -- he's depicting events that take everything away from him even though he has to run around the whole control room into the cabinet to find out what is happening. We're trying to give him, now, something that would enable him to give him a direction.

MR. EBERSOLE: Bob, can you interface this list there with other instrumentation that we have talked about in the past like this level and the saturation meter or the void meter? I can't put this batch of instruments in conjunction with other things which are going to be --

MR. TEDESCO: No, we're not -- this is not a substitute. Now, the saturation meter is an operational instrument right now, and the safety rate -- it's already there. He has that. Now, the water in the vessels -- that was a long-term action from which is learned that is at the stage now of review. We're not removing any of those requirements here.

DR. ZUDANS: This set of instruments is equivalent, say, to an altitude meter in an airplane? It's something that you have to know all the time -- visible. This is a fixed type of deal, and you may need a lot of other things to tell you where you are.

MR. TEDESCO: It won't fly the airplane, but it sure as heck helps if you know when you're in it.

DR. ZUDANS: It's a good thing. It's a 100 feet from that. In addition to that one tank information, I thought, say, reactor building is very important some information as to it --

MR NOVAK: One last point, and I don't think we disagree. I think it's a question of what the objective was of this list. As we reviewed the operating history of Crystal River, OCONEE units, and the RANCHO SECO event, what we saw was events that resulted in an operator not knowing what instrumentation in the control room was believable versus non-believable.

And I view that list as simply a minimum set of information that he can turn to and say, all right. This list tells me what the state is in the primary system and the secondary system. It would tell him obvicusly that he has an reactor trip.

It would indicate to him whether or not he has a dried out steam generator. It may suggest to him other actions that he should go ahead and take before he has to undertake the point of trying to decipher or regain certain other information in the control room. I think if your objective could be -- if you define the objective, then the different data set would be required, and I don't disagree with your point, Dr. Catton, that depending on what you're trying to do, you may need a larger data set.

This is not intended to diagnose the event. I think it would suggest to him -- go on there and manually turn on and off speed water system, if for some reason it hasn't come down because he could tell that he has lost a steam generator, or it's dried out.

I think that information is there to him. And I think that's the kinds of actions he can go ahead and take. He's got a problem in the fact that his control room has suffered some transient event where he has lost instrumentation, and now he is confused as to what is believable versus non-believable.

And I think the Crystal River event which I'm harping on, the action there of the operator was to leave the engineer safety feactures actuate and go about recovering the control room, and then take actions necessary to bring the plant to a normal safe shut down.

Now, this would be a very useful set of

information to suggest to him that perhaps some control aspect is preventing continued feedwater or some other transient characteristic is there that he may go ahead and manually start a pump or secure a pump. It may work both ways.

DR. CATTON: I guess I'm still a little perplexed about this resistance on the heat balance. And I see these sort of recommendations being made today, and what are you going to do in six months? Are you going to come in with another set of recommendations that will allow one to actually make the heat balances that are necessary to determine whether or not you should turn the pumps on or off. Shouldn't they be done together?

MR. NOVAK: Not necessarily. I would argue this way. I think what we --

DR. CATTON: The control rooms are a disaster now because of the piecemeal modifications. Are they going to get worse or better if you do this?

MR. NOVAK: Well, it depends on the timing. I think that's the point.

DR. CATTON: Well, of course, that's why I'm bringing it up.

MR. NOVAK: Okay. And I think we are feeling that this is a minimum set which would suggest a minimum implementation time. Now, as you look at long-term lessons learned and the concept of a safety vector, I'm sure you'll talk about two orders of magnitude in terms of data.

You may be -- certainly at least one order of magnitude more data, and this can be done. It will be done in a more sophisticated manner. What we are saying here is recognizing the interlacing of control system information and responses of the control system, and the information that flows back to the control room, and that single failures both initiate transients as well as give you improper data if nothing -- for choice of a better term -- in the control room, that leaves the operator with a difficult situation.

One, you've had a transient; and two, he's not sure exactly what information he can believe in the control room. This is an attempt to come to grips with the second half of the problem as early as we can and give him a set of information that he says I know I've had a transient. But I know that that transient and that -- whatever initiated it cannot have a feedback on the validity of the parameters that I'm measuring.

Those parameters or whatever they're measuring I'm going to believe them. I think that's the approach.

DR. CATTON: I can't disagree with that. I would just like to see the heat balance up there as well.

DR. TEDESCO: Now, wait -- I think you're going to run the heat balance, you need a lot more than what we're talking about here. The heat balance involves the whole plant, and if you want to understand everything wrong, you can assume it's the whole plant.

And you can still do that. You're not precluded from doing that. But that's not in the same time scale as this. If you want to know about your relief valve, your safety valve, the flow rates through there, or the flow rate might be off to your secondary; the atmospheric pump valve. A heat balance is a very involved process.

This is not focused in that direction, and yet the instrumentation for such an action is available.

DR. CATTON: I'm not talking about a heat balance, I think, that's in that kind of detail. It seems to me if I had a heat balance across the steam in primary and the fluid in the steam generator, the primary fluid in the vessel itself, I would know with very little more information what kind of incident is occurring.

MR. TEDESCO: But you don't want to be misleading either. If you don't do it right, this is very misleading on your diagnosis.

DR. CATTON: You can do anything though. You can use those there.

I think that may be the point. In a rather stubborn fashion I'll stop.

MR. NOVAK: I think this is a very useful discussion. I would like to introduce Bruce Wilson who is a member of the task force and his normal function in Operating Licensing Branch. He conducts the examinations of operator licensees.

And I think perhaps he has a flavor with regard to this and what we were trying to accomplish on the task force.

MR. WILSON: Excuse my voice. I'm on about six different types of pills including a cold so -- there are instances where a heat balance will be very beneficial -- I agree with you. But there are a lot of instances, particularly in the case we're talking about here where it would be impossible to have a heat balance.

I'm thinking specifically -- it's identified in the report -- of the RANCHO-SECO complete loss of NNI procedure where the ultimately wind up, and this is assuming that no instrumentation is ever re-gained is at a throttle one auxiliary feed pump. They let one steam generator go dry. They throttle the other feed pump to allow primary system temperature to be controlled between 540 and 560 degrees.

When it gets to 560, they stop the pump; let it dry out. When it gets to 540, they fill it up again. So there is no way that the use of heat balance could be useful in that point.

The only point is that they have to keep in this mode of core cooling until they can ultimately get their instrumentation back.

DR. CATTON: I think you could find examples of where every given piece of information up there is useless.

MR. BRUCE: That's true.

DR. CATTON: I don't really buy those arguments.

DR. ZUDANS: Until this recommendation, which parameters were measured with safety gradient?

MR. TEDESCO: Before this time?

DR. ZUDANS: Yes.

MR. TEDESCO: Well, the Lessons Learned people required that feed water flow be in that category. There are a couple. Reactor pressure. Most of the indications are not safety gradients, but they're on the board. But they're available on the cabinet.

DR. ZUDANS: In other words, while the instruments themselves are not taking place, the sensors in boiling and information cabinets --

MR. TEDESCO: Yeah. You see you take off from your safety gradient to the second system, or your engineered safety feature -- then you buffer them and you ultimately are now looking at instrumentation of it. Somewhere prior to that isolation you have capability for a safety gradient --

DR. ZUDANS: Try to sensor themselves in this study without already --

MR. TEDESCO: They're already.

DR. ZUDANS: That means the information is sitting someplace in some cabinet that you would have to go and measure --

MR. BEARD: One example that might be -- might illustrate the thing -- your first item up there -- wide range RCS pressure is the actuating parameter for the high pressure injection system. Therefore, at Crystal River, when they had the event they turned around and plopped open two cabinet doors and right inside are two wide range pressure meters.

I think what the task force is saying is make sure that very prompt availability and good instruments for these parameters is available in the control room.

DR. CATTON: Well, what was inside the cabinet with safety gradients?

MR. BEARD: That was safety grade instrumentation. That's what turned on the --

DR. CATTON: You know there was not a safety grade on the panel; inside the cabinet was safety grade.

DR. ZUDANS: My current reaction seems to be unthinkable not to have had safety grade instruments all this time. But then again, I guess the reasoning is that you could have gone back to the cabinet and stuck the meters or whatever you had to stick up the terminals.

MR. FACTEED: That is why the recommendation is here.

DR. ZUDANS: I'm surprised that it took you so much time.

MR. TEDESCO: Now, the next slide is on items on the instrumentation and control. We want to improve the capabilities ofthe operator to use the incore thermocopules that they do have in the B&W plants; that there be a capability that the operator selected to use incore thermocouple as input to the saturation meter.

And these would be in lieu of the reactor coolant test tube operator. This would give greater indication of this margin of subcooling. The second part being that you should have the capability for better trending or continued display of the incore thermocouple; that this capability should be made available to the operator.

Number eight -- I'm probably raising the question how come -- but it is a requirement to require a safety-grade containment high radiation signal to initiate containment vent and purge isolation. A lot of the plants are operating in a situation where they're required or have to purge periodically. There are instances where, if you have a small break, you may not reach the isolation signal corresponding to high containment pressure or safety test of initiation.

So we feel that to provide this capability with a radiation signal for isolation and to provide the capability to avoid a release a radioactivity during this period when you may have a small break.

CHAIRMAN ETHERINGTON: Do the thermocouples indicate on their own power, or is the transmission through advanced use?

MR. BEARD: I think if you have a station blackout, or something like that -- gross power failure, thermocouple data may get lost.

CHAIRMAN ETHERINGTON: In other words, they don't read directly?

MR. BEARD: No. I think that they give normally a millibulb output, but you have millibulb to bulb ridge converters. And those kinds of things require power.

DR. ZUDANS: Bob, I'm not impressed. Since you do have -- since the operators do have to decide whether it's undercooling or overcooling on the break, what is it that you really have to make a quick judgment -- I mean it's obvious that some actions are different from break from those others?

MR. TEDESCO: Now, you probably wouldn't have secondary guides, complete inventory indications of safety break -- that's probably what's happening.

DR. ZUDANS: From reactor building, it's similar to a delayed type of response including the radiation monitor that is much more delayed because it means you have to go some way.

MR. TEDESCO: Well, on your residual activity, the water is cooling activity --

DR. ZUDANS: Well, if a break occurs, where would the water go? It -- the water, of course, it might be steam. Something would collect, right?

MR. TEDESCO: But you have certain amount of flashing to do in the airborne, and that would try to do it. And you're dealing with flashing that gives you a rather high airborne activity level.

DR. ZUDANS: So you would see in drain pool and also in the atmosphere.

MR. TEDESCO: With the radiation detector --

MR. EBERSOLE: Bob, it seems to me, and correct me if I'm wrong, that the bottom line of all of this is really what we're trying to do is to carry out volume metric control of primary coolant whether it's produced by inbalance heat input-output or whatever; and regardless of the amount of instrumentation, there will be transients which you call swell which are going to dump water through the PORV's unless the system is redesigned.

And there is going to be overcooling transients which will shrink so that the operator will get very nervous and inadvisedly refill beyond a level that he should, and then he -- he's also desparately trying to get the overcooling event fixed, and when he does, then he's going to immediately overfill again.

I'm reminded of the popular device we have on automobile radiators which cope with this thing because the primary system is not designed to deal with intrinsically. Regardless of what you have in instrumentation, you got to have the facilities to do something with it when you get it done.

I haven't seen much that relates to what you're going to do with what you read.

MR. TEDESCO: I hope the next slide may enable you to get some further insight into what our thinking has been.

MR. RAY: Bob, before you leave the Instrumentation and Control, you have a note on the bottom of the sheet that preceded this referring to INPO. Would you tell us what that means?

MR. TEDESCO: This note over here, sir?

MR. RAY: Yes.

MR. TEDESCO: Now, the report that INPO issued in conjunction with NSAC evaluation of the Crystal River event -- they made some recommendations. And certain of the recommendations were included in this type of action -- not the identical one, but the thrust -- the point that they were making is very much like this one.

MR. RAY: So you have been influenced, then, by the INPO feed?

MR. TEDESCO: I don't know which camefirst. I mean obviously --

MR. RAY: I don't care.

MR. TEDESCO: But we are -- we do recognize similarity in terms of this. Yes. And we certainly want to give proper premise to info -- we've all made a lot of effort to get industry to provide this type of capability.

MR. TEDESCO: You can take this one here. We take the next category. It deals with design and operational matters. I hope I can speak to what you're concerned with.

Looking at the plan, operating and control function that could be modified to maintain a pressurized level on scale and the pressure above the actuation point, now that's given a situation in the plant that doesn't assume any failure or from the regular transients that fall upon the reactor trip.

We do maintain pressurized levels and don't have to -- API actuation. Now, this could be modified in different ways, including relocating the trip, the level of the indication on the pressurizer.

Now, there's another aspect -- find out where it is before I get into it. It has to do with the recommendations made by Consumer's Power Company.

Well, okay. As far as -- On that one there, deals with the consideration that B&W is giving now to perhaps increase in the -- safety valves at that point in secondary to allow the secondary higher pressure and temperature, therefore allowing the primary system to go up too, and that would tend to reduce or shrink the primary system, which would be a mitigating type of effect against shrink down of the pressurized level.

And now, that proposal has been talked about in being evaluated, first by B&W and by us.

I'm not saying that's the only way to do it, that's an example of a way, but, perhaps modifying certain pressurizers in the wider range, indication.

The other one would encourage B&W and the owners of the operating plants to look at sensitivity studies that would give greater visibility to possible modificatic to reduce the response from the steam generators.

We feel that, you know, they're the owners and the operators and they have good insight to what's happening and we're asking them to perform this evaluation for us.

And then to modify to the extent practicable, to reduce or eliminate any manual, immediate action for emergency proceedure -- The plant is requiring operators to do certain things in a very short time scale. We're asking that the only thing that are really required, that no modifications have been made to make them automatic, and to remove that requirement from a short-term response of the operators.

Number 12, should be providing a qualified instrumentation and control technician on duty on each

Right now they are not all required to have a technician on duty. From the experience that we got

Crystal River, had a technician been there, you would have been able to make the proper diagnosis, in our opinion, earlier than what had been and probably reduced the amount of loss of water.

The next one, recommending operators training provided on Crystal River event on each plant, considering the specific design of a nuclear instrumentation and integrated control system and analysis and proceedure, how each plant is designed, and how each operator is directed to respond and he should be given this type of training.

14, B&W should develop the generic guidelines where the loss of the instrumentation and the control system.

15, there should be a one-week stimulator training for the operators as part of the re-qualifications program.

Some of the utilities are doing this right now as an option, which should be required.

16, the Staff in it's evaluation of the reactor coolant -- restart criteria for small breaks shouldn't continue continue when accelerated.

The Staff should review alternate solutions to the unreliability aspect of safety system challenges, the real concerns.

This is an example, not to be --

MR. ZUDANS: But, before you take that out. I am -- I'd like to have, if you could, explain the 9 little bit more than 10.

What can you do and what's not being done right now under 9. This is no failures, in otherwords, during normal transient.

MR. TEDESCO: Go ahead, Brian.

MR. SHERON: On number 9, there was a recent letter issued out by B&W to their customers which put forth a number of proposed modifications that should be considered by their customers to help minimize the shrinkage during reactor trips to keep the pressurize a little on scale.

The fixes that number 9 refers to are basically those which can be done, perhaps, in a short term, for example, using a set of taps on the pressurizer that are farther apart so that the level will indeed stay on scale.

I think that --

MR. ZUDANS: That means no physical change, just a change in indicator or indication?

MR. SHERON: Yes, sir, I think what we --

As we understand it, now, most of these transients that have occurred, although the pressurizer level has gone off scale, all analysis indicate the pressurizer has not drained.

This is -- This is one -- This is one possibility. The other is on the secondary side, the pressure relieves sub-points. When the plant trips and turbine stop valves close, the pressure immediately rides up and opens these release valves until the steam dumps can take over.

The temperature and pressure on the secondary side in turn control the temperature and pressure towards the primary side drop, so if the secondary side is raised up slightly, the primary side will be raised up slightly.

This in turn will reduce the amount of primary size shrinkage and hopefully tend to keep the level up in the pressurizer during initial stages in the transient.

These are a couple short-term actions which 9, I guess, is geared to.

10 is --

MR. ZUDANS: Just on 9.

MR. SHERON: Okay.

MR. ZUDANS: Wouldn't you have said before, this point you have discovered, that such set points should have been already optimized with respect to pressurizer or the primary coolant system behavior.

In otherwords, they think that if they raise it, it will improve one thing. What will it hurt?

MR. SHERON: Well, this is part of the evaluation that has to be done. One question I can think of off hand is by raising secondary side pressure at sub-points, one would have to take another look at actual circulation, for example, since the -- assuming a loss of off-side power or a loss of heat in the condensor, so that one must relieve steam through the exert relief valves, then they will be -- that the secondary side will be riding at a higher pressure, which means the primary side would ultimately come down to a slightly higher pressure than what's presently predicted.

So, this as an example would have to be looked at.

MR. ZUDANS: In otherwords, it's not just a blinding implementation. There's some study or some analysis being made?

MR. SHERON: Yes, we believe that any change of this nature would have to be accompanied by some sort of evaluation.

MR. ZUDANS: Okay. Now, on 10?

MR. SHERON: On 10, there are -- For example, sensitivity studies may show that -- But one of the things considered might be the location of the auxilliary feed water in a steam generator.

The B&W plan of the lower loop -- lower loop plans, the auxilliary feed water enters into the steam generator at a relatively high elevation and sprays out through tubes.

This in turn, we feel causes some unquantified degree of over-cooling of the primary system, perhaps more than is necessary because you're exposing so much tube area to a cold secondary side, heat sink.

One part of the sensitivity may be to look at the possibility of adding auxilliary feed water through the main feed water nozzles and only having to add feed water at the high elevation through existing auxilliary nozzles, in the event there's some degradation with regard to natural circulation.

Obviously putting the auxilliary feed water in high, increases the thermal driving center from the steam generator. But, it also produces a very -- a potentially more severe secondary side over-cooling.

So, that's one part of the sensitivity. Another I'm vaguely aware of is the -- looking -- what -- I believe it's called the virtual mass tank, that might be attached to a once through type of steam generator which would provide additional mass, liquid mass to the steam generator in the event of any sort of feed water degradation.

I don't know if the feasibility of such a system is still, I think, in question, and certainly needs to be evaluated.

MR. ZUDANS: If you added that, it would change the entire system completely, right?

MR. SHERON: Yeah. This is not something you want to rush into.

MR. ZUDANS: I thank you.

MR. CATTON: How lo:.g has that design in operation? Could I ask again what the design basis for a pressurizer is? Somebody designed it, and what was the basis for that design?

Well, then -- Then I guess I don't understand why they go off scale all the time. Or, was it that the transients that it was designed to were too limited?

MR. TEDESCO: Well, going off scale doesn't mean it drained. It just hadn't gotten the indication of it. You've got water in there, and I think from the analysis of showing it, you don't necessarily drain the pressure. It's still functional.

MR. SHERON: The point -- You know, the pressurizer doesn't drain on all transients or, I shouldn't -- It doesn't even go off scale on all transients.

The ones we've seen have usually to some extent been, I guess you might say, helped along by some sort of over-cooling to some degree on the secondary side.

MR. CATTON: Well, that's transient. So, over-cooling transients were not considered?

MR. EBERSOLE: Doesn't the vendor have a set of design criteria for the pressurizer volume and the number of heaters and the amount of spray, et cetera, et cetera, et cetera, which will meet many transients but not meet other anticipated transients?

I mean, there's a whole field of probability in anticipated transients and you're not gonna meet them all.

MR. CATTON: I'm wondering which one it is they designed to?

MR. TAYLOR: Jim Taylor from B&W. We certainly do have a set of design criteria, and one of the things I think that it's very very important for us to get across here, to understand today, is to clarify the perception that some people have when they say, well, why does the pressurizer level go off-scale all the time.

It does not go off-scale all the time. We have looked at -- We are in the process of looking at 350 some reactor trips and we believe that at this time we have indication of 18 occurrences of off-scale behavior have happened. And it's usually when something has happened that was outside the design range that caused it to go off-scale.

So, in 90 percent of the time plus, you go through a reactor trip, and it does not go off scale. And the original design criteria were based on maintaining it on-scale for turbine trip, reactor trip type of transients.

MR. CATTON: So, that answers my question, then limiting transient or turbine trip, and reactor trip?

MR. TAYLOR: I believe that was the pressurizer basis.

MR. KARRASCH: Yes, the pressurizer basis was turbine trip and reactor trip and then about 25 percent margin over and above those transients.

MR. TAYLOR: If things like the safety valves or the atmospheric dump valves blow down a little further than they're supposed to, then you're gonna get a little bit more cooling in the primary system, a little more shrinkage in the primary system.

MR. CATTON: So, a 5 percent blowdown?

MR. TAYLOR: That was the design basis.

MR. CATTON: Reactor trip and turbine trip?

MR. TAYLOR: Yes.

MR. EBERSOLE: Do you have single track closure of the by-pass valves? The instrumentation of it, is it a single track instrumentation group that closes that by-pass and prevents overcooling?

MR. TAYLOR: Yes.

MR. EBERSOLE: Then the single track failure will give you overcooling from a locked open by-pass, right?

MR. TAYLOR: There are such failures -- Yeah, yes, sir, that's --

MR. TEDESCO: Going back to our number 17, which was alternative solutions to the PORV question, one of the licensees or the applicant provided a recommendation of what they considered to be an alternative solution to our approach, the NRV question submitted by Consumer Power Company.

And they're looking at -- filed by safety grade, PORV, and would have reliable safety reg indications of valve positions. There would be duel safety reg blocked valves with automatic closures for mal -- upon mal-function of the PORV.

They would complete the test program to demonstrate the valve operability. This is a test program that has been required as a result of the lesson learned task force requirement.

And then install a safety reg and sometimes install a trip, to tunnel off the feed water and along with it could be a restudying of the PORV of high pressure strip to the original value, if we remember that part of the short-term action from (UNINTELLIGILBE) would have required that the PORV (UNINTELLIGILBE) above the cram point.

And, as a result of this, we have seen greater evidence of a high challenge of the reactor protection system in the past year and alot of reactor trips.

And the concern that we had dealt with the PORV problem. So, Consumer Power Company felt that with an approach to upgrade the PORV guide and safety system, would enable them to then go back to the original test point, which was originally designed in the test, and we certainly are looking favorable upon the objection and the recommendation that we do indeed review this proposal for it's potential (UNINTELLIGIBLE).

MR. ZUDANS: Bob, could you explain a little bit this (UNINTELLIGIBLE) reactor trip in greater detail?

MR. TEDESCO: Well, right now we do have a trip, a turbine trip that is secondary, a requirement we put in for new owners by the plant.

And, because the B&W plant didn't have input to the reactor protection system, secondary site and services, we felt that that was one way of improving the response of the plant and reducing the challenges of the PORV. (UNINTELLIGILBE) -- trip in.

All the B&W plants that are operating today have a (UNINTELLIGIBLE) trip by the secondary.

Now, this one here is for a total loss of feed water.

Tom, do you want to say some more about the reaction by the owners in charge of it?

MR. NOVAK: I guess the question is what do we mean by anticipatory and I think that's what --

MR. ZUDANS: No, what you mean by it, I'd just like to hear the implications of having that thing, what does it do and what is suppose to prevent and what else it doesn't do?

What's your main reason for --

MR. NOVAK: It extends the dry-out time of a steam generator.

You remember the earlier discussion?

It's an element -- It's a suggestion that says I can anticipate that eventually I'm going to have a reactor trip if the transient continues because other parameters have been initiated, and the anticipatory trip then is just, in a sense, an early warning device. But to trip the reactor now, you're on the way to a transient which would result in reactor trip several seconds later anyway.

MR. ZUDANS: So you reduce the challenges to the PORV's, that's a positive indication?

MR. NOVAK: Well, it's --

MR. ZUDANS: Is it possible to have --

MR. NOVAK: It's attempt to dampen out the response in one sense. It dampens out the high response because by tripping the reactor very early, you preclude a buildup of energy in the primary system before you get the reactor tripped.

MR. ZUDANS: How do you conclude that you lost total feedwater, -- total loss of feedwater?

MR. NOVAK: Well, again, this is done basically -- There are some differences, from plant to plant, but basically, a signal is derived from the pump itself that says, pump this trip for some reason, you are not -- The pump is not operating and that initiates the trip.

It's not based on zero flow or some parameter of that nature. Now, that can -- One can look at different senses, different signals to sense loss of feedwater, that is one of the things we're looking at.

There have been experiences where you have lost -- you have had a loss of feedwater without the specific signal being initiated.

In otherwords, if you close a valve, the pump is running, you did not initiate a single trip, the reactor says I've lost feedwater and yet indeed you could have lost feedwater because the valve closed on the downside, on the downstream side of the pump.

So, I don't know that it's that important. We think it adds. The experience suggests that most feedwater transients, loss of feedwater transients are related to the performance of the pump.

The pump tripped off more often than other things, but that doesn't include all events, so therefore you must recognize by just going to the pump, you permit the possibility of other feedwater transients being initiated for which that specific signal would not cause a reactor trip.

MR. ZUDANS: And in that case you would have a reactor trip say 3 seconds or so later, anyway?

And these three seconds are enough to close or not to close the PORV's to open it?

MR. NOVAK: No, that's not correct either. In today's operation, you can rely on the high pressure signal, which is the safety grade signal, the primary coolant system high pressure signal is set low enough that even for that transient we've just identified, the pressure response would turnover before you got to the PORV system, they're set far enough apart.

MR. ZUDANS: In that case, what is the point of this anticipatory trip if the PORV's are set higher than the ample trip, the reactor will trip anyway?

MR. NOVAK: It's an attempt to dampen out, to reduce the swing of the way the system responds. It's not safety grade, so -- I can't argue that without it the plant is unsafe.

What I'm saying is that it's an attempt to add more defense in depth. By going to an anticipatory trip, you're just going after the problem a little earlier.

MR. ZUDANS: Okay, I accept that now.

But that raises another question. What are the hazards associated with this anticipatory trip? Have you analyzed all the possible hazards?

MR. NOVAK: Again, hazards would require a definition. I would include the fact that it's probably atleast -- would suggest that you might result in -- You might have some additional reactor trips just because a sperry signal could be generated. Indeed the pumps did not trip off, but the signal suggesting that the pumps tripped off was generated and which caused the reactor trip.

So, you may have -- That may be one of the prices you pay for this kind of a signal. Now, we've always faced that situation in any kind of a device you are anticipating, you must assume that it's possible for it to come on when it shouldn't have.

MR. ZUDANS: By asking for this anticipatory trip, you reduced the swing of the transient which you predefined as a reason for this anticipatory trip, yet you may have produced another transient that has a lot larger swing, like you trip reactor from full power, everything running.

MR. NOVAK: No, because that's the same thing, with or without the pump. If I trip the reactor out, I may have an overcooling, that's what I'm probably going to end up with, because I haven't lost feedwater, but I sense the loss of feedwater.

MR. EBERSOLE: Bob, before you go to the next slide, item 1, those 4 words, I think there can be a world of confusion buried in those words, -- Safety grade, PORV, what does it mean? Are they safe in the context of opening? Are they safe in the context of closing?

Do they have qualified external wiring and part supplies? What does that really mean?

MR. TEDESCO: Whenever you (UNINTELLIGIBLE) a valve, you cannot establish QA practices on the pedigree of --

MR. EBERSOLE: So, it'll get a pedigree?

MR. TEDESCO: A pedigree, yes. And the other part deals with the system to actuate the proposal, be single failure proof.

MR. EBERSOLE: Well, from item 3, I gather that it is thought to be safe in aspect to opening, that it is has pedigree aspect to opening, but apparently somebody's suspicious to whether it will close or not, so they put a couple redundant valves behind.

MR. TEDESCO: You know, you're really gonna go all the way, but I certainly see 279, and it maybe needs more than one PORV.

MR. EBERSOLE: Yes, right. I mean, obviously since it's stated in the singular there, it can fail of itself.

MR. TEDESCO: Therefore with dual block valve, you have single failure protection to insure the isolation, yes.

MR. EBERSOLE: But there may be cases where you want guaranteed opening. For instance, if you contemplate bleed feed, you've got to open.

MR. TEDESCO: No, a single failure that's gonna prevent this from functioning in the way it's intended.

MR. ZUDANS: Just one more question. In your estimate, going back to the original set point on PORV's and reactor trip, with the anticipatory reactor trip, do you think that oral SCRAM numbers will be reduced as they are -- compared to what they are now?

MR. NOVAK: We have someone that has more factual data than I have and I'll let him speak.

MR. QUICK: My name is Don Quick from region 2. I think there's a section in our report that addresses that and I think the answer to that question lies in the trip data that was analyzed pre-TMI.

I don't think anything that we're doirg here with this anticipatory loss of feedwater trip is going to change the frequency of the trip occurrences significantly.

MR. ZUDANS: You also -- According to Item 6, you also want to change set points on PORV and the reactor.

MR. QUICK: That's correct, we want to --

MR. ZUDANS: That will eliminate, or let's say, make the trips less frequent. The anticipatory trip will make them more frequent, the question is what is the balance, are you going to in average increase the number of trips or reduce, as compared to current -- current setting, without anticipatory trip?

MR. QUICK: I understand your question and my response is that we do not see the anticipatory total loss of feed water reactor trip signal which as being one which is going to generate a significantly higher number of trips that would not have occurred otherwise.

The plant was never designed to ride out a total loss of feedwater.

MR. ZUDANS: Okay, okay.

MR. QUICK: It was, however, designed to ride out load rejections, which is what we're attempting to do here.

MR. ZUDANS: Okay. That means that you will essentially return to a number of SCRAMS that are somewhat compatible to what was the (UNINTELLIGIBLE).

And that means reduction to what exists now, is that?

MR. QUICK: As we see it today, by atleast a factor 2, or greater --

MR. ZUDANS: That is then the real reason for this anticipatory trip, as I can see it, a real good reason.

Okay, thank you.

MR. ETHERINGTON: We are falling very much behind schedule. We haven't had our 10:30 break.

Go ahead, please.

MR. TEDESCO: I'm through. The last item on this one here is number 18, that we're recommending that we finish up our Crystal River (UNINTELLIGIBLE) review and assess the impact on the B&W plant, they could find these results.

Some general areas for improvement they talk about was -- I mentioned earlier about the need to develop some performance criteria on a uniform basis for all reactors to deal with anticipated transients, are important based on examples, that we have some indication of what our safety was, and they deal with the availability -- They deal with the issue that you should not actually engineer safety features or transient -- a couple of examples.

And then as far as the tripping of the (UN-INTELLIGIBLE), I can continue that study, (UNINTELLIGIBLE), recommended by (UNINTELLIGIBLE).

21, about the location of the water going into the steam generator from the aux feed water, -- an evaluation of whether we're doing the best thing by putting them in at the top, maybe the bottom's better.

22, we have come up with some preliminary findings that there appears to be a number of LER's due to operator error on the B&W plant that appears to be higher than others and we're -- We want to look into that a little more. That's something that we would look at as a Staff.

Now, the last line is just a summary of our task force present situation. Recommendations, we have 22 of them. We believe that the instrumentation of these recommendations along with what's going on already in the task force and lesson learned (UNINTELLIGIBLE), to improve the safety of the plant, our recommendations on the task force should be included in the reaction plan. We find to continue plant operations permissable, however we're expediting task force action regarding their operators training, (UNINTELLIGIBLE) -- implemented right away, based upon our Crystal River 3 event evaluation.

(UNINTELLIGIBLE) -- at Crystal River that when they come out and be evaluated and applied where applicable to all the operating plants, and that we at NRC should be (UNINTELLIGIBLE) in our review of the Crystal River 3 event, as well as a licensing response and the licensing response to the NRC letter of March 6 by Crystal River.

Now, that summarizes where we are on the task force. A question earlier came up of what we're gonna do about section 7, how we go about evaluating it, (UNINTELLIGIBLE) reduction potential, and I wonder if I could call on Frank (UNINTELLIGIBLE) --

MR. ZUDANS: Could I ask another question before that?

Is your item 21 actually a part of item 10?

MR. TEDESCO: Yes.

FRANK ?: My name is Frank (UNINTELLIGIBLE) in probablistic analysis --

MR. ETHERINGTON: I think we better have that missing break first. All right, 10-minute break.

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MR. ROWSOME: You would like me to proceed.

CHAIRMAN ETHERINGON: Yes.

MR. ROWSOME: My name is Frank Rowsome with the probabilistic analysis staff. We have been collaborating in the effort to address the B&W sensitivity issue in several ways.

A member of the probabilistic analysis staff has been working on the Tedesco task force of Mark Cunningham. In addition we are now in the concluding phases of a small scale probabilistic safety analysis effort on the Crystal River Plant, which has been going on since last November, and which had among its original goals to be, first of all, a prototype of the IREP studies of the intergrated reliability evaluation program studies.

And second of all, to address the sensitivity issue as it was then perceived in the fall of last year.

At this point we are expecting to have a preliminary draft of that study at the end of the month. Joe Murphy is scheduled, I believe, the schedule we saw had him on about 1:30 or 2 o'clock this afternoon. He will be around after lunch to give you preliminary indications of the risk picture emerging from the study of Crystal River.

And the third facet of their effort to address this issue is an effort within PAS itself to evalute the risk

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reduction effectiveness of the 22 recommendations that the task force has put forth, and ultimately and probably on a longer time scale, to use the framework of eventury analysis that is emerging from our study of Crystal River to identify LIQUENI in these recommendations--places where they do not get to substantial risk reduction. There are areas in which the probability of core damage might still be high after those recommendations are in place will attempt to identify those with the aide of the eventury and system reliability framework produced in the study of Crystal River.

DR. ZUDANS: I understood that this study did not include all the environments. Like is not part of it.

MR. ROWSOME: That's correct.

DR. ZUDANS: So, that's not an integrated reliability study.

MR. ROWSOME: Yes. Interim, as we've discussed --

DR. ZUDANS: Agreed at the other meeting.

MR. ROWSOME: -- before. Agreed in the other meeting. Yes.

Joe Murphy's slated to talk to you about it this afternoon, and so I think unless you have questions dealing with other than our study of Crystal River, it might make sense to go on since we're behind schedule already.

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MR. NOVAK: Mr. Etherington, oh, are we going to --

CHAIRMAN ETHERINGTON: Well, Joe Murphy was scheduled for this morning.

MR. NOVAK: Okay.

I think the thing, then, now is to go -- move over into the utility area and let the licensees --

CHAIRMAN ETHERINGTON: Okay. That's Mr. Taylor then? From B&W; is that right?

MR. TAYLOR: I think Mr. Domeck from Toledo Edison was interested in speaking next.

CHAIRMAN ETHERINGTON: Okay.

MR. DOMECK: Mr. Chairman, I'm Chuch Domeck, Davis-Besse, Unit 1, Nuclear Project Engineer, Toledo Edison Company. With me today are Terry Murry, Davis-Besse station superintendent and Fred Miller, plant nuclear systems engineer.

I appreciate the opportunity to meet today with the subcommittee and hear the discussion by the ACRS Staff and the NRC staff and to provide our brief comments.

As you know, we received copies of the Reg 0667. Transient response of B&W design reactors on Thursday, April 3rd. We have reviewed the report and consider it a commendable effort, especially because of the

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short time available between March 12th and April 2nd.

The report is quite generic, and we believe should be more plant specific. And several of the major 22 recommendations in Section 222, Davis-Besse already meets the recommendations in whole or in part.

It appears to us that the NRC staff has not yet reviewed our response to Crystal 3 -- Crystal River 3 incident of March -- I'm sorry, of February 26th. There are three letters in the docket on there.

We find some overlapping of the recommendations and will obviously require further discussion with the NRC staff to define a scope for summer conditions.

We believe there should be active owner participation in the preparation of Section 7. Implementation of Recommendation based upon risk reduction potential.

I believe Section 7, draft, will be available the week of April 14, and a meeting with the B&W owners scheduled on April 23rd. We believe these items might be in reverse order.

We obviously would like to provide our input on the implementation schedule. As we indicated to the staff on April 3rd, with respect to recommendation 3, we are planning to install a diesel generator driven auxiliary feedwater pump at Davis-Besse 1. This is consistent with

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our July 6, 1979, letter from Mr. Denton's authorization to resume power operation. And it is consistent with staff recommendation 3 dated today.

We agree with the ACRS staff position on re-looking at turbine trip in the anticipatory active trip system. We reference that as recommendation 17e.

We suggest that the owners actively participate in the establishment of plant performance criteria for anticipated transients in the four areas mentioned in the report. We are prepared to work in cooperation with the NRC staff and the support task. The new requirements that are not intermittently significant can -- can detract from protecting the public health and safety and it could be counterproductive to overall safety.

Mr. Chairman, I appreciate this opportunity. And I'm prepared to answer your questions.

DR. ZUDANS: On this -- you said you are going to install diesel generators driven on auxiliary feedwater pump. That's to satisfy the diversity requirement you made reference to in item 3; right?

MR. DOMECK: Yes, sir.

DR. ZUDANS: How quick can it start when you need it? How quickly can it be started?

Or is it -- is it to run continuously, or what?

MR. DOMECK: Fred.

MR. MILLER: Well, less than 10 seconds

DR. ZUDANS: If the diesel -- if the diesel starts?

MR. MILLER: I -- excuse me. What did you -- I didn't catch that.

DR. ZUDANS: I said if the diesel starts.

MR. MILLER: Well, we are assuming the reason why we lost the two other auxiliary feed pumps is because those diesels didn't start. How many diesels don't start?

DR. ZUDANS: I guess I cannot answer that question. You know the answer better than I. But that means that you're putting now in a better perspective. You have already two diesels that failed to start, and you have a third one. And they are kind of totally independent systems.

MR. MILLER: Totally independent. This will be a totally independent of their existing auxiliary feedwater pumps piping into the feed generator.

DR. ZUDANS: And if the third one doesn't start, then you just have a normal feedwater loss transient; right?

MR. MILLER: Well, it's not normal when we lose both main and three auxiliary feed pumps.

This is a backup system to the presently totally safety grade auxiliary feedwater system that we have.

DR. ZUDANS: Now, I am just trying to understand.

Now, I'm not critical, please, don't misinterpret this. Your other feedwater pumps run on what power now?

MR. MILLER: They're turbine driven. That's why we are going to a diverse drive for the third pump.

DR. ZUDANS: Turbine driven. That's for the main feedwater?

MR. MILLER: No, auxiliary feedwater.

DR. ZUDANS: Where --

MR. MILLER: The main is turbine driven also.

DR. ZUDANS: Where did the other two diesels come in then?

MR. MILLER: They are used for providing the AC power or auxiliary for the auxiliary feed pumps that presently are available.

DR. ZUDANS: For the auxiliaries for the auxiliary feed pump.

MR. MILLER: That's right.

DR. ZUDANS: And this additional feedwater pump -- water pump, diesel driven, will have its own auxiliaries --

MR. MILLER: Correct.

DR. ZUDANS: Okay. Thank you.

CHAIRMAN ETHERINGTON: Are there any further questions?

Thank you very much --

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MR. DOMECK: Thank you.

CHAIRMAN ETHERINGTON: -- Mr. Domeck.

I understand that some of the utility people may have a problem with the train schedules this afternoon. If this is the case we'll be happy to reschedule the items on the agenda.

Does anyone have problems?

MR.TERRILL: We have to leave about 4:15. TVA.

CHAIRMAN ETHERINGTON: That's -- that's -- the TVA. The TVA. You're scheduled last, and we'll have your presentation immediately after lunch then.

MR. TERRILL: All right, sir. Thank you.

CHAIRMAN ETHERINGTON: The next item on the -- is Mr Taylor planning to make a presentation here?

MR. TAYLOR: Yes, sir.

Peter Tam admonished me that we didn't really have to speak, but if we wanted to we could. And if it only took one minute, why, that would be okay because we are behind.

B&W doesn't have a very lengthy comment to make. But we did want to say a few words about the report about the staff's efforts. I just want to make some general comments about the overall effort that's going on in connection with the sensitivity issue. Then, we wanted to make some general

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suggestions, or specifically a general suggestion with regard to an orderly process for moving forward on the resolutation of the sensitivity issue. And then the third thing was to make some very brief comments in a few areas about the report itself.

And to just make sure that comments that will come in a minute or so are misunderstood, I just want to say at the outset that we are very supportive of all of the efforts that have gone on in the last 3 or 4 weeks. We think that the staff's efforts are very commendable. I think the efforts that went on in that two week -- two-and-a-half week period are of yeoman style and they turned out a good report in general.

We do have some concerns about it, and I'll talk about that. And I also want to commend the fellows for their report. I think they did a very balanced investigation, and we look forward to getting a copy of it in its final form.

I think the most widely learned lesson that the industry has -- has gotten out of the TMI incident is that we should pay attention to things that are happening in the field, and particularly to things that involve actual operating transients that have some significance.

And we believe that these -- by paying close attention to these events like the Crystal River event and

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like other transients that are of significance, we can learn lessons, and they can become a springboard for good, corrective action. And we support this idea of paying closer attention to the actual transients that are occurring in the field.

Now, the staff, is obviously, on the basis of the report that has been discussed here this morning by Bob Tedesco, the staff is obviously paying a lot of attention to these types of transients, and particularly those of greater significance.

The staff is currently placing a lot of emphasis on the imbalance between the primary and the secondary systems in the B&W plants. And this ties into the responsiveness issue. Now, as increased attention is paid to this sensitivity issue, we feel that an orderly way to go about the process would be in a -- in a simple three-step manner.

First of all -- not first of all, but very early in the process, we feel that it's very important to get on the table a set of criteria that everybody can agree to and work for. Then, we know where the target is that we're shooting at.

And the second thing that we need to do is to use those criteria and -- and the criteria I'm talking about now are the criteria by which you would define acceptable sensitivity or acceptable insensitivity; however you want to define it.

But to define the criteria so that we can look at each of the things that we might be doing in the way of plant changes in an integrated way and to look at both the pros and cons of them and look at them in a cenogistic way and not just individually.

And then the second thing after establishing the criteria would be to go back and look in depth -- or in sufficient depth at the actual operating experiences so that you can see how the plants are operating in -- in comparison to this criteria. And then utilize the results of the actual plant operating experience review in comparison to the criteria to decide what kinds of changes are most effective and which ones will bring about the most -- most significant improvement in safety and operation.

Now, we clearly expect and -- and we see signs of it already and -- and in many areas we support these efforts. We fully expect -- we can see that the staff is developing criteria that, as Bob Tedesco discussed this morning, that are beyond the existing regulatory criteria.

And so the idea for these criteria is that eventually they are going to led to changes.

I think also just on the basis of the pure fact

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that the task force did turn out this very significant amount of work in a short period of time. And as a matter of fact, Bob mentioned it, this is not going to be the end of the road for criteria changes or for physical changes.

And so we think that it's important as these criteria are finalized that they contain really two elements. They contain both the element of what's acceptable or unacceptable and also since we are talking about events that are going to happen in the field, that there is going to be a certain frequency in which the criteria that you would establish for these moderate frequency transients -- are going to be exceeded.

I think we need to recognize that.

We are -- we don't want to give the impression that the events Crystal River and other significant transients should not be tended to. They really should. But there are going to be events like that, and there are going to be Perry Island tube ruptures, and there are going to be North Anna events, and there are going to be other events--Brunswick transient events and so on, B&W plants are going to have transients. I think as we establish these criterias say, okay, now, we are going to look forward to a long-term resolution of the sensitivity issue. We need to recognize that there are going to be some times when these criteria that we agree upon, or are imposed on us, are going to be violated.

Now, as a result of looking at the experience of -- in the field, we think that these criteria can be made more meaningful, and we think that there is sufficient experience on the table right now, or in back of us right now to cover a pretty broad spectrum of anticipated transients.

We think that in the staff's report in new Reg. 0667 there's a very significant step forward in terms of developing the required criteria. And we also can see that these criteria have some far-reaching implications. If we talk about -- if we start talking about changing auxiliary feedwater systems from what they are now to safety grade systems and other things like that, these criteria can have some very far-reaching implications. And we think that we must try, at this point, to make the criteria complete and to make sure that we are able to measure success or failure in meeting them.

We have not yet review new Reg. 0667 in depth, but we do believe that it presents a balanced perspective on the sensitivity issue and on the once-through steam generator in general. And we believe that this balanced prespective is very important.

We feel it's important to recognize that the

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B&W NSS's have a good history of thermally efficient -- thermally efficient performance; a good history of load following capability; and a good history of tube integrity. And those are all very important issues.

The OTSG does represent a close coupling between the primary and secondary system. And this is by design. And it is one of the intended advantages of the OTSG. But because of this characteristic it is very important to have properly controlled and available feedwater.

Now, we have made a number of specific recommendations to our utility customers to improve plant performance in light of Crystal River and other transients. And the utilities are currently evaluating these recommendations for plant specific applicability. And as time goes on they will get cranked into the plant in the form of changes as they are appropriate.

Now, one of the other things that we want to make sure is recognized is the fact, and this will come out more in this afternoon's discussion on the part of the plants that are under construction, that there are very significant differences between the plants that are in operation and the plants that are under construction. The plants that are under construction now already have many of the features that Bob Tedesco and the task force addressed to this

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In the form of the older -- the operating plants, many of the customers, all of the customers as a matter of fact, are reviewing the recommendations that we have made. They are reviewing their own assessment of the Crystal River event, and are making changes that will improve the availability and the controllability of the auxiliary feedwater system.

Now, we believe that one of the things that has happened, and we think the ACRS -- that both the subcommitte and the full committee can make a very valuable contribution here. We believe the performance of the B&W NSS has been distorted in many respects. We think there is a general perception on the part of a lot of people that the pressurizer level does go off scale everytime the plant goes through a transient. And that that's -- that's wrong. And in this respect I commend both the task force report and the fellows' comments this morning in presenting this in a very objective and balanced way.

I think the ACRS can make a contribution in this area toward keeping the performance of B&W NSS which has its very significant advantages in proper perspective.

Now, Bob Tedesco made a comment this morning that -- he said, "I hope that industry and -- including B&W and the utilities will take the led in establishing some

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We intend to do this. And you know, if you talk about the -- the sensitivity issue, it started off quite a number of months ago with the concern about pressurizer level going off scale. The pressurizer level has gone off scale. And in some of those cases where the pressurizer level has not gone off scale, operator action has kept it on scale.

But we need to establish some criteria that we can work toward for what is acceptable behavior for these kinds of events. Is it acceptable, for example, for the pressurizer to go off scale never, or not at all, or one second off scale, or ten seconds off scale, or whatever. Right now we have no clear target to shoot at. And I think that we mutally need to agree that -- on criteria that would represent acceptability. Is it acceptable, for example, for the -- for one steam generator to dry out. We don't see any particular safety significance to that at all. But it is their -- is that going to be the tarket we shoot at or is it necessary that neither steam generator ever dry off for certain classes of transients.

Well, in reviewing the performance of our plant, we had -- we would like to take a first cut at identifying some criteria which we think constitute normal behavior.

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And those criteria fall into six items. And some of them are very much the same as those that are in the task force's report.

The first one is that the reactor coolant system pressure remains above high pressure injection automatic actuation point.

The second one is that the reactor coolant system pressure remains below the set point of the code safety valves.

The third one is that the reactor coolant system temperature does not decrease at a rate which exceeds the tech spec limits.

The fourth one is that the reactor coolant system -- the reactor coolant itself is contained within the reactor coolant system and the quench tank.

The fifth one is that the indicated pressurizer level remains on scale.

And the sixth one is that the indicated OTSG level remains on scale.

Now, we have, as I mentioned earlier in commenting on Dr. Catton's -- or Mr. Ebersole's questions about pressurizer design criteria, we have underway a review of 346 trips on B&W plants. These trips cover the period all the way from startup. They don't just start at

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commerical operation, but they cover the period all the way from startup -- up to very recent times.

And our review indicates that in 90 percent of the cases those -- those criteria that I just mentioned were met.

Now, that -- that's an ongoing review and I -- I don't want to give you the impression that it's all done; it's not.

But -- and in those cases where performance has been outside those criteria, in many cases some actions have already been taken to minimize the possiblity that those criteria would be exceeded again, and in other cases the activities or actions are being studied that would help to keep more of the post-trip behavior within those criteria.

Now, many of the actions -- yes, Mr. Ebersole?

MR. EBERSOLE: Could you comment on the time frequency of the 10 percent that -- or you -- where you didn't hold the fixed criteria? Was it once -- once a year, once every two years? What is it?

MR. TAYLOR: Bruce, can you comment on that?

You're talking about on a particular plant?

MR. EBERSOLE: Well, whatever. You -- you said in 90 percent of the cases you did this. What is suggested as a frequency distribution of some sort?

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MR. TAYLOR: Can you comment on that, Bruce?

MR. KARRASCH: Well, a good number of the abnormal occurrences occurred during the initial startup of our first plant. The OTSG dryouts, for instance, were quite prelevant on the OCONEE 1 unit during the initial year of startup. On the loss of indicated pressurizer levels have occurred on one or two of the plants during the early -- during the early years.

MR. EBERSOLE: So, that even a second time distribution --

MR. KARRASCH: Right. Right. We haven't done enough analysis to date to specifically answer your question. But I think the trend is like I just described.

A VOICE: I think he's also referring to your overall figure, I believe, it was .7 trips per reactor year.

MR. EBERSOLE: Thank you.

MR. TAYLOR: Okay.

Many of the actions that have -- that have been taken or are to be taken to try to bring more of the post-trip behavior into the -- inside these criteria have been previously described both orally and in writing to the staff and to the ACRS. Some of them were discussed, and you'll hear some more about that this afternoon from the

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utilities who have plants under construction. Things to improve the auxiliaries for the main feedwater system, the offspeed water reliability and so on.

And we clearly support these efforts.

Now, in the -- the final part of my comments would deal with some specific items in the report which we have not reviewed the report in depth. We got it last Thursday, and we have intentions to review it more in detail, but generally we believe the report is -- presents a balanced perspective. We think that there is merit in all of the recommendations and that they should be given serious consideration.

We believe that the criteria type items need further development as mentioned earlier. And that they represent an essential early step in the orderly resolution of the sensitivity issue. The criteria have got to be developed now, or we do run the risk of putting in some piecemeal items which we would later feel were unwise.

We support the effort that Frank Rowsome talked about, which will be described in the final version of Chapter 7 regarding a risk assessment prioritization of whatever actions are to be taken, and we, like Toledo-Edison, believe that both B&W and the utilities can make a meaningful contribution to this prioritization effort. And we certainly

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would hope to be able to get involved in that before the information is published in final form.

And also we support a reliability oriented upgrading of auxiliary feedwater systems as opposed to just safety grade type classification upgrade. And we believe that this is the staff's intent to do this. That -- and we think that that's the only practical way to do it in view of the fact that all the auxiliary feedwater systems are in non-scismic buildings and so on.

We believe, also, that emphasis should be placed on improved main feedwater system performance; again, along the lines of some of the things that the -- that the ACRS and the staff have already heard from from the utilities. And what we are saying really is that we believe that prevention should be given equal emphasis to mitigation so that we do not concentrate too much effort -- or concentrate an excessive amount of attention on the offspeed water system to the exclusion of the main feedwater system, but rather try to do things that would make the offspeed water system itself less important as improving the reliability of the main feedwater system.

So, in summary, then, we would hope that the ACRS would support the need for the development of a comprehensive set of criteria to resolve the sensitivity issue . We would hope that they would underscore the importance of a balanced per -- perception of the behavior of the B&W NSS. And we also support the position that was taken by the staff in Mr. Denton's January 22 letter that Mr. Etherington read at the beginning of the meeting which says we don't believe that there's any basis at all for stopping construction on the plants that are under construction right now.

Sorry, Peter, I took more than one minute.

CHAIRMAN ETHERINGTON: You -- do you want to clarify one thing for me. Regarding the level range. The taps on nearly all of your plants, I think, are made close to the knuckle on the -- between the hemispherical heads and the cylindrical parts.

MR. TAYLOR: The taps on the -- I guess it's about half of the units, have a 400 inch range in dimension.

CHAIRMAN ETHERINGTON: That's right. Now, you have that potential range. Do I understand that you don't have that range on your indicators?

MR. TAYLOR: Oh, yes. The -- the --

CHAIRMAN ETHERINGTON: Oh, well, then that --

MR. TAYLOR: The taps -- the indicators cover the full range of the taps.

CHAIRMAN ETHERINGTON: Okay. That -- that

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answers it.

Well, you might continue. Well, what -- what about the other plants that don't have this 400 inch range?

MR. TAYLOR: Let me describe it to you very briefly. Several plants have a 400 inch range. The -- all the 177 fuel assembly B&W plants have the same pressurizer with the exception of the level indication range. There are two different ranges. The earlier plants have a 400 inch range. The later plants have a 320 inch range, but the configuration of the vessel is exactly the same. As you go to the 205 fuel assembly plants, the taps are on the hemispheres. So, it covers the -- essentially the full pressurizer. So, we went through a period in the middle where we shrunk the visible range; didn't change the configuration, and then enlarged both the volume and the visible range on the later plants.

CHAIRMAN ETHERINGTON: And those were the 320 inch range. The last ranges were equally divided between the upper and the lower part?

MR. TAYLOR: I think it is primarily off scale and low.

MR. KARRASCH: Well, when Jim mentioned the number 18 before which is the total we have already found as far as loss of indicated level, he was talking about loss of indicated level low.

CHAIRMAN ETHERINGTON: Yes, I understood that.

MR. KARRASCH: And of those loss of indicated level low over 90% of them have occurred on the plants with the shorter range.

To answer your question, the invisible range over the 320 inch plants is approximately in the middle of the pressurizer vessel.

MR. ETHERINGTON: Is approximately what?

MR. KARRASCH: Approximately in the middle of the pressurizer vessel.

MR. TAYLOR: So when the range was reduced it was taken half from top and half from the bottom.

Thank you.

CHAIRMAN ETHERINGTON: Thank you, Mr. Taylor.

Okay, go right ahead.

MR. ROWSOME: It occurred to me in response to Jim Taylor's mentioning the seismic issue that PAS has prepared a recommendation on seismic qualification.

Our feeling is that one does need a system or a repair of redundant systems that are capable of cooling the core in the event of a seismically induced loss of mainfeedwater.

We think it would be perfectly satisfactory to use feed and bleed under those circumstances but you would probably have to assure that the high pressure safety injection system were qualified to function in that mode.

Some system must be available to address loss of feedwater in the event of a seismic event.

It need not be the auxiliary feedwater system. We will recommend that the utilities be given a choice of qualifying either feed and bleed or emergency feedwater as the success path for that event.

CHAIRMAN ETHERINGTON: It seems my agenda doesn't seem to mean very much, none of the names are the same, the titles of the presentations seems to have changed.

The next one I have here is progress report ANL plant sensitivity program. Does this mean anything to any of the staff?

MR. NOVAK: To a certain degree.

Mr. Etherington, I think we have an opportunity here to pick up some time as well.

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The two next discussions by Walt Jensen which will come first followed by Byron Segull are going to go back and try to update the work that was done back in January on some analysis performed by B&W for the plants under construction and then some independent analysis performed by the staff on the overcooling transients.

Walt, why don't you go on up now and -- what we have tried to do, I would hope, we have tried to clear up some of the differences that appeared in our January 8th presentation of overcooling transient response.

The staff analysis of a 177 fuel plant versus the B&W submittal. At that time it was on the Midland Plant.

So, Walt has some additional work and we just want to get it on the record now to perhaps clear up that point.

MR. JENSEN: Good morning, my name is Walter Jensen and I am from the Analysis Branch of the NRC staff and I would like to show you some recent analysis on a B&W overcooling transient, that we have done using the relap code.

I believe at the last meeting you were shown an analysis that was done using the IRP codes by the Brookhaven National Lab, and the results were a great deal different from the analysis by B&W, and we have gone back and looked at this IRP analysis and we found there are some basic deficiencies in the code itself and it does not calculate natural circulation, it does not have a pump model, it does not allow for seam separation in the primary system and it has a pancaking effect in the steam generator that makes the primary to secondary loop transfers.

Also, the analysis is somewhat different than what was done by B&W that assumed a fairly large number of areas, they assumed that after the reactor trip, the main feedwater failed to throttle back and then the turbine stop valve stayed open and then later on the main feedwater system and the main steam system failed to isolate and the aux feedwater was an additional conservatism seemed to come on almost immediately into the transient.

The results of all these assumptions and the overcooling effect of the steam line break and the valve of the transient.

We have gone back a.. done the thing again using the relap code and tried to use more realistic assumptions after the reactor and turbine trips.

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We again assumed that the feedwater failed to throttle back on the high level that the secondary systems pressurizes up to the turbine bypass set point to the system, the secondary system isolates on a safety injection signal.

This would be difficult typical of the middle.

This diagram shows the relap model used here. It has most of the detail located in the secondary system.

Where the temperature gradients exist between the subcooled water coming into the steam generator and the steam leaving the steam generator.

The feedwater downcomer is mixed with steam from the shelf region passes up to the steam generator and is exited through the steam system into the turbine.

The reactor coolant pumps are set to trip following a safety injection signal giving a short time delay for the operator to manually trip the pumps.

The steam formed in the limps are allowed to separate and seek the highest point. This is the top of the candycane using the Wilson bubblerized model. The reactor vessel is modeled with the downcomer, lower plenum, core, upper plenum and upper head region.

DR. CATTON: Do the voids collect in 64?

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MR. JENSEN: The voids would -- they would first collect in three and then they would be swept over and collect in 64.

That would be the worst place for the voids to be in terms of natural circulation.

DR. CATTON: So, you do not have enough nodes to let it block the top of the pipe, the top of the candycane?

MR. JENSEN: I have done analyses of this model that yes if you have a severe enough overcooling transient similar to the one that was done by Brookhaven, natural circulation will cease primarily because the head of natural circulation which is caused by a lesser density on the riser side, the downcomer side is blocked by having a collection of steam waters formed and this hot node on this backside of the candycane.

All it does is lose natural circulation because it has not been verified against test data and that is something that needs to be done on a model like this.

Then comparing this analysis to that done by B&W we see that the pressure on the secondary is very similar.

After the turbine trip, the secondary pressure rises to the tube out of the first back of safety valves and then follows to say that the relief valve setpoint until the steam generator isolates following a safety injection signal.

The pressure then rises to the second back of safety valves and then follows that of the first back and then stays at the pressure of the relief valve.

In the relap analysis reaches the safety injection signal a little bit sooner than the B&W analysis does that is the reason for the location.

The primary system temperature was slightly less than the relap calculation, about seven degrees, about again very close, and the primary system pressure is also very close. The inflexion point in the system pressure is caused by the draining of the pressurizer which did completely drain in both the B&W and NRC analysis for this overfeed transient.

This is seen in the pressurizer level versus time curve.

The pressurizer -- well, actually though the curve does not go to zero as far as the physical occurrences in the model. The pressurizer is drained so it drained a little bit quicker than NRC analysis and the B&W analysis.

Then again, we began to refill of course by the action of the HPI system.

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My conclusions here in both models is that the pressurizer emptied and no voids were formed in the primary system.

DR. ZUDANS: In your diagram that showed core average temperature versus time, there is a little shelf on the draft two analysis and there is none on relap what is the meaning of that level plateau?

MR. JENSEN: I really do not know it might have been the relap analysis and I just did not stop to -- this is a hand slide curve for relap and I might have missed it.

DR. ZUDANS: Well, in either case, do you have any kind of a physical significance to that plateau then?

MR. JENSEN: This transient started with an undercooling transient. After the turbine tripped, the pressure went up on the secondary side briefly and reduced the amount of primary system pressure and probably raised the temperature, but no, sir I do not know the reason for that.

DR. ZUDANS: If you look in the chart that shows the pressure, where would that portion of this transient be, it is about what -- 25 seconds or so? These are different scales?

MR. JENSEN: We can overlay them.

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DR. ZUDANS: No, you cannot, they are different scales.

MR. JENSEN: I think they are the same scales, but there is a multiplier on the one scale. How close we can come. I do not know.

DR. ZUDANS: All right, I do not know either.

MR. EBERSOLE: In the worst case of the moderator temperature coefficent, were you always subcritical?

MR. JENSEN: Yes, it was subcritical system for reactor trips immediately --

MR. EBERSOLE: I know, but some of them will come back if you overcool them even though the rods are in. Is that generally true that for the worst overcooling transients, you always stay subcritical in B&W plants?

Do you always stay subcritical for the worst overcooling transients, including main steam line failures.

MR. TAYLOR: Yes.

MR. EBERSOLE: Thank you.

DR. THEOFANOUS: I wonder, are we supposed to learn something from the agreement between relap four and the top.

I think you were trying to make a point and you emphasized the agreement between the two calculations?

MR. JENSEN: Yes.

DR. THEOFANOUS: What is your point, what does this agreement tell us?

MR. JENSE: My point is the agreement and that B&W's analytical methods which has not been reviewed, the trap code which has not been reviewed completely by the NRC staff appears to be in fair agreement with the NRC's calculations.

DR. THEOFANOUS: Is in good agreement with relap?

MR. JENSEN: And this is opposed to the -- I believe the disagreement and you are saying the last time between B&W calculations and the IRP code.

MR. NOVAK: Go ahead, I think I have a couple of comments that I think I would add to Dr. Theofanous' statement --

DR. THEOFANOUS: Let me go to the middle of my point and then maybe come back.

It is certainly a question of precision here you have some calculations before with another and you said disagreement and it seems to me then after you saw the disagreement it is very easy to go back and rationalize because of this and that it would

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seem to me to be just as easy to rationalize the expectation of not being able to obtain agreement before you did the calculations.

I am a little bit bothered by an approach that is kind of hit or miss but take any available core that can do a particular calculation, make a run if you get agreement, it is fine, if you get disagreement rationalize disagreement then go pick up another and you keep doing that until you get an agreement.

It seems to me what would be a little more orderly would be look at the transient that you want to calculate and say okay, now, this transient has no essential features in it and then you look at the causes that are av?ilable and now to lose a verbal course you find out which are the ones that can portray those essential features. Then you say, therefore, the further you get into the exercise and into the calculation, you say I find through my review and in my notes, I find that this is available to do the job, and then you go ahead and you do your calculations and then if you get disagreements you try to learn something from them and presumably you arrive to different kinds of

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conclusions than the kind of thing that you are seeing here.

Now, make your comment.

MR. NOVAK: I agree with your comment, first of all.

I think what you are suggesting is a logical orderly way of doing business.

What we were trying to do and sometimes you rush to judgment. The IRT code has been labled the transient code and within its range of all applicability it may be a very good code.

I think what we have described today is one piece of evidence where mis-application can come in. You decided to use the IRT code and you knew the transient that you were going to run and you just went ahead and ran it without recognizing whether or not the expected performance of the plant would stay within the range of application of the plant.

If you get voids in the hot leg IRT does not have a model that treats large voids in the system.

Now, we used the code because it was more available than the relap code.

It has a shorter running time to study some sensitivity characteristics of the plant recognizing that absolutely the code might have some shortcomings.

There may be a risk in even doing that but we want ahead and tried it anyway.

We looked at how important was moderator temperature, how important was moderator temperature how important was the sizing of the pressurizer, how important was HPI actuation, a number of things were done, but we left a trail of misunderstanding behind which said the transient that we are analyzing does not look at all like the transient that was analyzed by the licensee, two reasons. One, the boundary conditions or the expected behavior of the plant was substantially different in our model than what the licensee was taking credit for as Walt suggested in one of his earlier slides.

So, when you clean up some of that then you still have a residual that maybe even your model has some shortcomings which you ought to investigate.

Now, one of the shortcomings across the board is that you have very little verification of transient codes, they have been traditionally thought of as rather well-behaved events which really does not tax the analysist. LOCA is challenged. Who wants to develop transient codes. You are going to be short running and handle the whole primary, secondary side,

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you cannot be very sophisticated.

So, the IRT program is an attempt to come up with a workable day-to-day, day in, day out, type of transient code.

Relap, especially I think the model Walt is talking about is a modified version which we think is suitable for some limited transient analysis. It certainly probably is a more expensive tool to use day in and day out for transient analysis.

I don't know his running time, but I would expect by the basic nature of the code it would stay on the computer longer.

MR. JENSEN: 20 to 1.

MR. NOVAK: How much?

MR. JENSEN: 20 to 1. Well, when in the days of inflation we all try to cut back.

The problem then was that I viewed that relap has some degree of credibility, we have studied it through the standard problem and while you may be modifying it, there is some degree of relevance to using relap as a better benchmark.

Now, what this says to me is that the agreement suggests to us at least that the two proposed by B&W for analyzing transients is not that bad, I

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get some confidence out of this agreement. It suggests to me then that the ongoing work that plants under construction still have in terms of some system modifications to reduce sensitivity can be tested with a code like this.

Somebody is going to have to select a setpoint. Somebody is going to have to do a lot of design work in advance of the actual operation of the plant. Therefore, using a code like trap is probably a reasonable tool and the analysis that we have seen today, the comparisons at this stage of the game says to me that there isn't an obvious defect in the analytical technique.

That is not one of the early milestones that I am looking for that we have to get resolutions for before you can even begin to think about some of the system design changes, you have to develop a system transient code.

I do not think that is our first priority. Obviously, it will have to be looked at in more detail but I am willing not to put all of our emphasis at this time hold'ng up any design changes or considerations of design changes based on the thorough review of trap.

DR. THEOFANOUS: Tom, I find you very responsive and that is all well taken. I am just going to tell you from my point of view, I still have remaining, I guess I could call it remaining worry in the sense that little spot checks like this one might leave one with, really with a misinterpretation or could even be misleading in a certain respect.

And that is all that these kind of comparisons tell me that for that particular calculation, he were able to hear some agreement between four and --

I guess we have some still -- One can raise serious questions here about four. And I think yourself, in your report, you raise some questions concerning the application of some of those of those codes for deciding when to trip the reactor pumps, for example.

And, in that light, therefore, I think little spot checks like that, without putting all the additional , all the additional qualifications, all the kinds of things that might be relevant and pertinent, to helping somebody decide what kind of way to give into this kind of comparison.

Then I think it's a little bit of a dangerous kind of thing to really present. So, I recognize that that it is better than nothing to have this kind of comparison and it is something, you're always gratified to see the two different codes produce the same results. because atleast we can say that there are no obvious new medical evidence in there or something like a misfortunate statement.

On the other hand, if there is any different basic physics that are different in the two codes, and if those physics are relevant to the phenomena that you are trying to calculate, and if the code gives you -- provides you a little bit more flexibility, you have maybe a better

of physics, while the other one maybe is not as sophisticated but maybe by showing agreement you see that you're really not sensitive to that kind of physics.

These are the kinds of lessons that I think that one would like to learn from this kind of comparisons more. And, I don't see that. I don't see it coming in many other quotas, that I think is overdue, has to be done, because some of those things, people look at these kinds of comparisons and they draw conclusions as to what to do.

Operators, there, for example, that's all they can get by with. And then there's a possibility that some of those things may not be exactly right.

MR. NOVAK: Okay, I think, and we agree. And we are trying to make a step. I think the next is in that direction.

When we looked at, basically the B&W design and system response, it became obvious to us that the transient code, the code that you're going to use, you better understand the steam generator dynamics.

And so, we're sort of taking that element out of -- out of the program that Walter said and we got a special tech assistant's program set up with Argonne to sort of say, look at how one should model the steam generator, the heat transfer characteristics, because that's at the heart of it.

If you don't really believe you can understand it's response characteristics, then alot of your system codes are going to be worthless in the long run. Some day you'll learn the right way to model it.

So, we thought the first thing to do was go after the heart of the problem and examine the characteristics that one has to recognize in terms of a once-through steam generator design.

Look at the modeling that would be required to say that's an acceptable model for transient response of a once-through steam generator.

If you can get that, then I think the other elements of the code, transient code, fall into place alot easier. I think that always the key will be, how good is your modeling between primary and secondary, especially in a once-through steam generator.

MR. THEOFANOUS: Yeah, I would agree with that. That's fine and a good start in the right direction. I wouldn't go as far as to say that the other steps in the primary system are trivial, especially if you deal with base separations and -- and things like that.

MR. NOVAK: If you let them happen. But we don't -- That's the problem. Transients in my mind should be well-behaved events.

MR. THEOFANOUS: So you're gonna keep them in single phase then, is that it?

MR. NOVAK: Well, ideally I'd like to. I mean, that's a problem. Most anticipated transients do not result in significant voiding in the primary cooling system.

MR. THEORFANOUS: Right, some will.

MR. NOVAK: That's right.

MR. THEORFANOUS: I think they fall within the same kind of ballpark.

MR. EBERSOLE: Will you through the second slide up there please, I just want to ask a question about the reality of your sequence of events there.

That's the best estimate, overcooling analysis which is far less overcooling than the first sheet you had. There you go.

At 1600 PSI in the primary system, HPCI's initiated -- That's automatic, isn't it?

MR. JENSEN: Yes.

MR. EBERSOLE: RC coolant -- Oh, I'm sorry, TREPS operator -- By the way, this is at about 150 seconds, about 3 minutes, right, if I look at your curve on primary coolant pressure versus time.

MR. JENSEN: Yes, it was about 150 seconds.

MR. EBERSOLE: 150 seconds? And then, Item C, steam generators are isolated also at 1600 PSIG. Well, isn't it true that at that time that various horrible things that have taken place, like the steam generators are now full of water and the steam lines are also full and you're going to be isolating in the face of solid water flow and I hear from Belefont that maybe the steam pipes will fall down for that case, and so there's alot of unreality about the mechanical evolution.

MR. JENSEN: That might be, but you are absolutely correct and the steam generators were full of water, in this analysis of about 100 seconds.

MR. EBERSOLE: So, really, what kept you from having an overcooling transient was the thesis that you were gonna close up and isolate and hold pressure, which you really probably couldn't do in the real case.

MR. JENSEN: Because of system failure of the solid water?

MR. EBERSOLE: Right, you would have been in a secondary system LOCA because of blown-out pipes and I very much doubt that the main steam isolation valves were ever hope to close under that hydraulic load.

Is that right?

MR. JENSEN: I wouldn't doubt you. I -- This is --

MR. EBERSOLE: So, this is a very artificial way to study a response characteristic. Maybe it's good enough, but it doesn't have a very solid mechanical base.

MR. JENSEN: Well, this is primarily to compare the two analysis and Dr. --

MR. EBERSOLE: I mean, it's an exercise.

MR. JENSEN: Well, maybe it is, but it's a firs step and this is kind of a progress report, this is what we've done so far and we do mean to do alot more analysis and would like to verify these codes by comparison to --

MR. EBERSOLE: You verify the code, but you're sure a long way from reality.

MR. NOVAK: We agree, yes. I think the point is that the best estimate -- We're not trying to model or predict the true behavior of an overcooling transient.

What we're trying to study is the primary system response to some -- some assumed secondary forcing function.

MR. EBERSOLE: That's right. Okay, that's fine. You could have said that without trying to put a configuration here of -- people might think works, but it doesn't.

MR. CATTON: I would comment. There have been several papers that have appeared in the literature, one that I remember in particular, nuclear engineering and design, on transient steam generator modeling.

And, also, they have comparisons with data. It's my feeling that comparing one code to another really doesn't mean as much and I'm wondering why aren't you digging out this data and comparing the codes with the data?

MR. JENSEN: Well, I would like to do that, but I just chose to compare the codes first and this is all I've had time to do in the last month.

MR. ZUDANS: Are any of the power plants adequately instrumented that you could collect data from?

MR. NOVAK: Well, have have started -- This effort, speaking generically across all white water reactors, in the BWR's, I think we've made more inroads. There were a specific set of tests run at Peach Bottom, which I think showed some of the shortcomings of some of the transient response tools and showed where there was a better tool to be used in terms of analysis.

The problem is that in order to test the code, you've got to push the plant. I mean, -- Well, okay.

MR. ZUDANS: You have had all kinds of feed water related transients in power plants.

The question is, is any one of these power plants -- Has any one of these power plants been instrumented adequately for you to define the boundary conditions and do the analysis?

MR. NOVAK: Let me just -- I'm gonna ask Mr. Sheron. One of the things -- There's been alot of transients and there's been certain descriptions then provided which said this was the response characteristic of that plant.

I'm thinking of the review work that you did with regard to Darling Hunters concerned, on the response of the plant.

Is it -- I guess my question is, you really --- You don't have all the information you desire, but I think it's fair to say that if you could have all of the transient characteristics explained to you, there are certain things that happened that you can't put a time on, when did a valve open or close, when did a pump start.

And, in order to go back and reanalyze, you have to make assump.ions with regards to some of those characteristics, perhaps.

MR. ZUDANS: Well, that's the question. The question is, what is it more for the future, let's say, consider the future. What would be more cost-effective, to proceed in developing computer codes or in fact going and installing instrumentation that will adequately describe boundary conditions and sitting back and waiting for a natural experiment?

MR. NOVAK: Well, I think we're gonna go both directions.

Actually, we intend to require certain startup tests, I think wherein we will get information on transient characteristics.

I think we will also consider to develop analytical techniques to the system responses.

MR. ZUDANS: That's right. And then you test your codes against stuch experiences and they don't have to be tragic.

MR. NOVAK: No, I didn't mean to be tragic.

MR. ZUDANS: You used the word.

MR. NOVAK: I recall, sometimes, for example, several years ago there was an attempt to try to gain credit for the mixing that goes on within an open line of (UNINTELLIGIBLE)-- pressurized water reactor.

And, it was very difficult to force the plant to a set of conditions wherein one could measure a non-uniform exist water temperature distribution because the plant mixed the water very well and you would have to continue to or perhaps generate a very non-typical power distribution.

In otherwords, you had to force the system in order to measure differences. And, I think perhaps there's some of that even in transient responses.

But there is information that can be gained and I think the staff is going after it.

MR. CATTON: Won't you have to specify somehow so that proper measurements are made? I think now there's always something missing whenever you get a package of transient data.

Won't somebody have to sit down and decide, hey, we need all of these measurements and in the future all plants would give them to us?

MR. NOVAK: That's a good point, yes.

MR. EBERSOLE: Again, will you throw that second slide up, only this time for another purpose.

You have identified a sequence of events there. Is that a legitimate sequence with which we should deal realistically, except you have to eliminate the last line and say steam generators cannot be isolated.

MR. JENSEN: Well, -- For the Midland plant, and there may be some differences between other B&W plants.

MR. EBERSOLE: Yes, but if you change the last line, which is realistic, and say steam generators cannot be isolated, is that then an accident sequence that we have to deal with?

MR. JENSEN: This assumes a single carrier in a control system that allows the feed water to continue flowing.

MR. EBERSOLE: Your answer's yes? Right?

MR. JENSEN: As far as I know.

MR. EBERSOLE: Have we done that?

That's the worst overcooling transient? I think in this case you do go super-critical again, do you know, B&W?

This is a depressurized secondary side with full feed water flow.

MR. NOVAK: The question, I think, -- While they're thinking, are you assuming all the rods go in, or do we -

MR. EBERSOLE: Oh yeah, sure.

MR. NOVAK: We're not going to stick out a worse rod?

MR. EBERSOLE: No, no, no, all except the classical 1 out of 100 or whatever.

MR. NOVAK: That classical 1 though, can be worth very, you know, it's worth several, depending on which one you pick.

MR. EBERSOLE: No, I mean, that looks like a single instrumentation failure, and I think -- Let's see, right now --

I think that's a legitimate transient that we have to deal with, but I don't know that we do.

MR. MATHIS: Well, isn't there a time frame there Jesse, when you might go critical again?

MR. EBERSOLE: No, it's temperature depended. It depends on temperature, and the characteristics of the cores.

MR. TEDESCO: But you also transients in exhibit 2 -- That's right.

MR. EBERSOLE: Well, anyway. I think this borders, if not, it may be the worst overcooling transient, a depressurized secondary with full feed water flow.

MR. TEDESCO: Your maximum heat --

MR. EBERSOLE: Right. And for this case, I guess, do we know the consequences.

MR. JENSEN: It depressurizes because it fails to isolate?

MR. EBERSOLE: Yes. You have knocked out the isolation capability because you have filled the system solid.

MR. JENSEN: Well, that would certainly have a different course in this analysis also.

MR. EBERSOLE: Because now you lose the pressure which is your pad that keeps the temperature up.

MR. JENSEN: And there'd be a greater, more severe overcooling transient and it might even require bubbles.

MR. EBERSOLE: Oh, far worse overcooling transient, right.

MR. TEDESCO: I think the other question is the effect of trip in the pump. If you kept the pumps running, you might be worse.

MR. EBERSOLE: Oh, if you failed to trip the main filling pump, it would be much worse.

MR. TEDESCO: You would really get an overcooling event.

MR. EBERSOLE: So, I guess you then get back to which transient should you analyze, this artificial one or the one more near reality.

MR. JENSEN: Maybe we would want to be sure that the steam generator could isolate it.

MR. EBERSOLE: Well, why don't you then change the last sentence to say that steam generators are not isolated and then analyze that one.

MR. CATTON: Jesse, does that mean there are some overcooling events where you want to trip the --

MR. EBERSOLE: Right.

MR. CATTON: Then, of course, there's a class --

MR. EBERSOLE: This is the one we've been looking for.

MR. CATTON: So not only do you have to determine whether it's overcooling or whatever, you have to determine the range.

MR. EBERSOLE: It's the MPB&W boilers with a full flow of main feed water on a depressurized secondary. That's I think the worst.

Isn't that correct?

MR. TAYLOR: Mr. Ebersole, on the -- The plants would normally isolate feed water upon the signal from the depressurized steam generator.

MR. EBERSOLE: Yes, I know. That's an instrumentation function. It's not normally even given a safety level catagorization.

MR. TAYLOR: Yes, yes, yes.

Yes, it is.

MR. EBERSOLE: Is it now?

MR. TAYLOR: Yes.

MR. EBERSOLE: There's been an improvement then since I last saw it. Okay. You tell me then the steam -- You have safety grade cut off of main feed water.

MR. TAYLOR: And on low pressure.

MR. EBERSOLE: On low pressure, depending on pump trip and valve closure?

MR. TAYLOR: Valve closure.

MR. EBERSOLE: Valve closure?

Have the valves -- Have they been tested under these depressurization flow rates at the differentials they will actually see?

MR. TAYLOR: The steam isolation valves?

MR. EBERSOLE: Feed water.

MR. TAYLOR: Feed water isolation valves.

MR. EBERSOLE: Remember now, you've got abnormally high differential now and extremely high flow rates.

MR. TAYLOR: I don't know whether they have been tested, I really can't answer that question.

MR. EBERSOLE: I think it would be worth putting it in the minutes for you to find out, I think.

Anyway, it's the quality level of the cut-off function.

MR. TAYLOR: I'd like to ask -- Pardon me, I'd like to ask if you could, just to clarify your precise concern about what Mr. Jensen is saying up here.

MR. EBERSOLE: Oh, I was -- I said that this is not a realistic sequence in that by the time he gets to 1600 pounds, which is about 150 minutes -- seconds, I'm sorry, three minutes, nearly.

He would have filled the steam generators and the steam pipes and he will be in solid water up to the by-pass valves and the turbine, main turbine stop valves and he will probably have knocked off the header.

MR. TAYLOR: If the instrumentation doesn't work?

MR. EBERSOLE: Well, that was his whole hypothesis, that right there in item 1 feed water fails to throttle on high level.

That was his hypothesis that I'm working on. He's got full feed water flow.

MR. TAYLOR: This is a hypothetical event.

MR. EBERSOLE: Well, it is.

Well, let's get back to the reality of it. Is this, and I ask the Staff again, a realistic event?

MR. TAYLOR: I think that one thing that needs to be brought out here is the fact that the feed water failing to throttle on high level is a controlled function, number one, and that failure we can accept.

MR. EBERSOLE: Well, he's telling me it's a safety function.

MR. TAYLOR: No, that's the feed water control system up there in number one.

Down in 3-C, I think that we could safely assume that that steam generator, the feed valve would in fact isolate before the steam generator was full.

MR. EBERSOLE: Is that so? Is there that much --

MR. TAYLOR: That system actuates at about 600 pounds. For the full steam generator water, there's no way you're gonna have 600 pounds in the steam lines.

MR. EBERSOLE: Isn't the steam system filling up hydraulically with the main --

Oh, well one of the saving graces here, these are turbine driven feed water pumps.

MR. TAYLOR: Yeah.

MR. EBERSOLE: So there's an automatic cut-off of sorts?

Anyway, I just get back to the realism or lack of it of this sequence here and whether we have to deal with the case when steam generators are not isolated because they can't isolate them.

I think I'll just leave it that way.

I realize you have to have a safety grade cut-off because of the question of main steam line failure versus containment pressure.

I think you do this by a promination of pump trips and valve closures.

However, I think of those, one of them, which is the valve closure, is not tested against the differentials which you see under the circumstance.

MR. MILLER: Fred Miller, Cleo Edison. We've had ours closed with 600 pounds of steam generator pressure and no problems, so we don't have any concern whatsoever about --

MR. EBERSOLE: You've never experienced the flows I'm talking about here?

MR. MILLER: What?

MR. EBERSOLE: You've never experienced the water flows?

MR. MILLER: There was full flow on the main feed pumps trying to keep up with the load in the steam generator and it drew the pressure down to 600 pounds and the main feed water isolated on both steam generators successfully.

MR. EBERSOLE: Well, you know, these are pipe break cases where you get predigious flows, compared with he normal flow.

MR. MILLER: The pressure had decreased rapidly on the steam generator and we were isolating at a feed pump for trying to maintain level in the steam generators, so they were putting out everything they could, regardless of what they pressure -- The pressure had decreased below 600 pounds at the time they were closing.

MR. EBERSOLE: I see. Thank you.

MR. NOVAK: Well, I think we saved a few minutes in one of those brief presentations again by the Staff.

MR. JENSEN: Well, if I could -- give me one more minute, I have a turbine trip analysis I would like to show you.

And, this one depressurizes to 1950 PSI, and the pressurizer does not empty but goes down to about 10 feed and then we got to fill again by the action of the charging system.

MR. ETHERINGTON: Mr. Jensen, I think we might break for lunch for one hour.

CHAIRMAN ETHERINGTON: The meeting will now reconvene. First we'll hear from the TVA representative.

MR. TERRILL: Good afternoon. My name is Dennis Terrill and I'm the Belafonte Nuclear Plant Licensing Project Engineer for TVA's office of power, located in Chattanooga. I plan to briefly outline the program at TVA as instituted for the resolution of the sensitivity concerns and -- to the secondary system for the Belafonte Nuclear Plant.

Accompanying me today are Doug Wilson, principal nuclear engineer and Lee Hack, nuclear engineer from our Division of Engineering Design Construction, located in Knoxville. The three of us will answer any questions that you might have regarding the status of the construction of Belafonte and TVA's evaluation of the sensitivity concern.

TVA's December 3rd response to Mr. Denton's October 25th letter included commitments to perform studies and evaluations and implement any changes proven to be appropriate. TVA program can be summarized as follows:

An area of analysis,we've recently received from B&W a complete analysis and a detailed review has been initiated inside TVA. This review will assure that the analysis is represented above Belafonte and is consistent with the past analyses performed. If the TVA reviews any major discrepancies in the analysis, the NRC and B&W will be notified and the problem will be resolved. We expect to finish our review and submit the completed analysis around mid-1980.

In the area of plant design, Belafonte is one of the newer 205 assembly type plant and we've already incorporated several modifications designed specifically to provide improved system performance and reliability over the older operating B&W plants. Also, as a result of the normal TVA design activities, several modifications to the 205 design have already been initiated before Mr. Denton's letter. I'm not going to repeat those here for the sake of brevity.

TVA has also undertaken extensive programs at B&W to study the feasibility and benefits of instituting additional modifications to further reduce the consequences of sensitivity and the frequency of challenges to safer systems. We are presently considering 16 different proposed modifications at this time. However, TVA's evaluation under these proposed modifications is not significant, sufficiently advanced to justify listing the hardware changes or operating procedures.

However, I believe Al Hosler in his presentation will probably touch a little bit more directly on the areas of work being performed by the owner's group.

TVA is going to determine desirability for each of these changes by performing evaluations in the following areas; the potential for the proposed modifications adversely affect the safety -- of the plant and response to postulated events other than over-cooling -- or else they are going to do computer analysis to determine the degree of effectiveness and dampening the response to the primary system to initiating events, look at studies and analytical efforts already underway by B&W. We are also going to look at operating plant experience and the reliability of the proposed modifications.

TVA's evaluation on these proposed modifications are expected to be completed around early 1981 and we're working with B&W right now to try to expedite that schedule.

The following related actions will also be taken by TVA in resolving these concerns and the first one is we're following the NRC's IREP study by our nuclear reliability and availability group. TVA's nuclear safety review staff is independently reviewing the concern and our program for its resolution and evaluation. TVA is also performing a review of the reactor trip at Crystal River 3 and related work done by B&W and NRC for -- at Belafonte. This review is expected to be completed by the mid-1980 timeframe.

All findings and recommendations which result from all of these studies will be examined for the potential-- adopted not only at Belafonte, but all of our nuclear plants.

In summary, as I said, it is still TVA's position that construction of all forces of the Belafonte Nuclear Plant should proceed, design,fabrication and construction at

Belafonte has advanced to the stage we're halting construction. we're not providing any foreseen advantage --

Potential modifications presently under study by TVA would not require significant changes in equipment or hardware and will not be made more difficult by continued construction. TVA believes that any hurried implementation of potential modifications would not be in the best interest of the overall safe operation at Belafonte and that each modification must be thoroughly examined for fear that new and as yet undefined safety questions are created.

Any questions?

CHAIRMAN ETHERINGTON: Any questions? Thank you very much.

Do the WMP and Midland people have any transportation problems?

MR. MOSLER: -- we can do it now or later. It doesn't matter.

CHAIRMAN ETHERINGTON: I'm sorry, I couldn't hear.

MR. MOSLER: We have no problems. We can do it now or later.

CHAIRMAN ETHERINGTON: We'll stay with the schedule then and we'll have it later.

The next item on the agenda I think is Mr. Siegel. Is that right?

MR. SIEGEL: That's correct.

CHAIRMAN ETHERINGTON: ANL Plant Sensitivity Program.

MR. SIEGEL: Good afternoon. Can everybody hear me? My name is Byron Siegel. I'm with the Reactor Systems Branch and I'm going to discuss this afternoon, a program that we recently initiated, a sensitivity program on the once-through steam generator.

Basically, based on what happened at TMI and as a result of Mr. Denton's request on the 5054F, the utilities have come up with some proposals for decreasing the sensitivity of the coupling between the primary and secondary side.

What we are going to try to do in this sensitivity study is in part evaluate or assess the adequacy of the utilities' recommendations and see whether or not they adequately do desensitize the coupling between the primary and secondary side. Obviously the criteria has not yet been established as to what will be acceptable and what will not be. However, based on the results of these studies, we'll have a better handle or understanding of exactly how the systems will respond and what we -- and relate this to what we decide as acceptable or not acceptable.

This is a long-range program. It's going to cover a year or a year and a half. The objectives are shown on this first view graph. The first thing that is going to be done is that the steam generator will be modeled and the purpose of this is to make sure that all the parameters necessary, all the parameters necessary to do a parametric study are included in the modeling that will be done by Oregon.

The second objective is to determine the sensitivity of the cooling dynamics to protovations in the secondary system. The third is to determine the effects of the proposed applicant's modifications on reducing sensitivity of the coupling of the primary to the secondary system, and the fourth one is to determine effects of the unique utilization of the secondary side of the Midland Plant has on the sensitivity of the coupling of the primary to secondary systems.

I should mention that this program was originally started before the transient response program that Mr. Tedesco reported on earlier was initiated and we decided on this program, it was based primarily on the responses of the applicants to the 5054F request. It probably now, I would guess, would cover not only the plants that are under construction, but the sensitivity study would probably relate back to operating reactors. This is one of the reasons why the Midland Plant is included.

We're actually going to pick the Midland Plant as the base plant and do primary and secondary coupling effects and by using the Midland Plant, then we can -- because of the unique nature of the Midland Plant, will then be able to use the same steam generator modeling to evaluate the coupling between the -- the process between the Midland Plant and the process steam that they are going to provide to Dow Chemical.

DR. THEOFANOUS: Excuse me, a question.

MR. SIEGEL: Yes?

DR. THEOFANOUS: Do you mean steam generator modeling, that means developing a model from scratch basically?

MR. SIEGEL: No, I don't think they are going to develop a model from scratch. They will probably start with the models that, for instance Walt Jensen has developed and then probably elaborate on that or make it -- adapt it so that it meets the requirements of this program.

DR. THEOFANOUS: Those studies will be done primarily with just one steam generator model and no other coupling to other --

MR. SIEGEL: No, the next slide sort of gets into that or the next two slides. I can discuss it now or you can wait a few minutes and I'll get into that.

MR. EBERSOLE: May I ask a question? When you said the word pertervations, would a pertervation be identified as the one that I just saw awhile ago, reactor trips, turbine trips, feedwater fails to puddle on high level?

MR. SIEGEL: These are primarily related to overcooling transients -- Yes, right, we are talking about primarily pertervations overcooling events, yes.

MR. EBERSOLE: Would that be then an admissible thing called pertervation?

MR. SIEGEL: Turbine trip and --

MR. EBERSOLE: Reactor trip, turbine trip, feedwater fails to puddle on high level.

MR. SIEGEL: That isn't really -- The pertervations I was talking about are basically initiating events.

MR. EBERSOLE: Well, this is an initiating event. It initiates --

MR. SIEGEL: No, I'm talking about, for instance, Chapter 15 events over failure of a feedwater control valve or failure of a steam generator.

MR. EBERSOLE: Relatively, a much higher probability then, is that what you're saying?

MR. NOVAK: I would expect so. I interpret pertervation to be --

MR. EBERSOLE: A minor pertervation.

MR. NOVAK: Well, starting that way, you are going to build an understanding of the steam, of your understanding of the steam generator and its response characteristics. You would first decide on what you think a good engineering definition is of a modeling and then move on and say, now I'm going to test the model and I would assume that your judgement as to the adequacy of your modeling would be easier to decide as to whether or not you got a good model based on small pertervations and then progressing to the more significant pertervations, which then might be what we call our classical initiating events. I look at this to be a development of a description of the steam generators from which eventually you would have the confidence to say, if indeed these transients are to be tolerated or expected, then the response characteristics of the plant can be described with this model and that's the way I would envision us moving.

I don't you can take a large step -- pertervation and convince yourself that the modeling you've developed at that -- I would expect that the more severe challenges in terms of pertervations are the large changes. So there would be an orderly progression to the more severe initiating trendings.

MR. EBERSOLE: Well Tom, can't you impose at least some pertervations deliberately on the real plant?

MR. NOVAK: Oh, okay, yes. Well, let's continue. I think what you are saying is -- I think you're ahead --

MR. SIEGEL: I think we're using basically the -- we are going to do a parametric study, but basically we're starting with the transients that result in overcooling events -- The events that we're essentially going to look at, the transients, these are in Chapter 15, these are the ones that result in overcooling events; decrease in feedwater temperature and this would result from a bypass of feedwater heaters, increase in feedwater flow which would be the result of a feedwater control valve malfunction, increase steam flow which could result from a steam pressure regulator failure, inadvertent opening of a safety relief valve or safety valve, steam generator safety valve and inadvertent operation of the feedwater system. These would all result in overcooling transients.

Some of the modifications proposed in response 5054F letter by the applicants were run back of -- feedwater, run back of the main feedwater -- and reactor trip and limiting steamed up capacity following integrating coal system failure. Not all the applicants are proposing all these fixes. It varies from applicant to applicant.

DR. ZUDANS: Could I -- Before you go any further.

MR. SIEGEL: Yes.

DR. ZUDANS: I don't need that slide.

MR. SIEGEL: Okay.

DR. ZUDANS: In the beginning you started out by saying that you established some criteria, how to deal with the sensitivity.

MR. SIEGEL: No, I didn't. I said that that will come out of the --

DR. ZUDANS: -- of the study?

MR. SIEGEL: Of the study, yes.

DR. ZUDANS: In other words, the study looking at certain inputs and outputs, you will determine what is important and that's about the --

MR. SIEGEL: No, I didn't mean that we were or whoever is performing the study is going to set up the criteria. I think the criteria will come out of what Mr. Tedesco presented this morning, the task force.

DR. ZUDANS: Okay. Thank you.

MR. NOVAK: Let me go back to your question because I thought you were suggesting that one of the best tests of your modeling would be to impose a certain type transient on a plant and check the response and then see how well you've been able to predict that performance.

MR. EBERSOLE: Yes, as long as it wasn't damaging or dangerous -- developing mathematical model or certainly if you develop one, you'll -- you can validate it by imposing such realistic trends.

MR. SIEGEL: Yes, well, one of the things that might be done is some of the transients that have been experienced on startup on B&W plants, those might be used to determine the accuracy of the modeling, compare the modeling with the actual transient.

At task 1 there is going to be a parametric study of the effectness of the proposed modifications on the transients that were identified in the previous slide, all the overcooling transients and we're going to include the effects of location of -- feedwater injection into the steam generator. I should mention that a lot, quite a few of the items that were identified with regard to sensitivity studies and parametric studies that Mr. Tedesco presented this morning, probably are covered by this study, but I think this is by no means close ended. I'm sure that it is probably going to be modified based on the recommendations that come out of that study and probably expanded to include everything that's in there, either in this program or in other programs.

The main feedwater, offs feedwater runback flow rates will be examined. Time of initiation of runback and also the effect of steam generator water level, what effect that would have on the transient.

Now, what we are going to use is a code that provides an energy balance, a code, to perform these studies and they are just going to model the secondary side first. Once they understand what is happening on the secondary side, they'll couple in the primary side and get feedback effects with the energy balance.

DR. THEOFANOUS: What do you mean an energy balance? -- balance is enough to do all this?

MR. SIEGEL: Yes, just to determine sensitivity. Later on they are going to use relap force for a confirmatory code and include hydrodynamic effects.

DR. THEOFANOUS: How are you going to keep track of levels and vapor -- or is that not important to know?

MR. SIEGEL: Initially, they are going to just model the secondary side and just put an input on the primary side as to -- at least that's my understanding.

DR. THEOFANOUS: Oh, excuse me, now I understand. You are going to model the secondary side.

MR. SIEGEL: Yes.

DR. THEOFANOUS: And what you talk about the energy balance is only as far as what goes in and what goes out --

MR. SIEGEL: Right, yes.

DR. THEOFANOUS: But you are going to make a model on the secondary --

MR. SIEGEL: On the secondary side, yes.

DR. THEOFANOUS: Okay, I misunderstood.

MR. SIEGEL: Okay. They will later on couple the primary side to get feedback effects and then we're going to confirm or use a relap 4 to do -- to get confirmatory results.

DR. THEOFANOUS: Who is going to do this work?

MR. SIEGEL: Do you want to know the person or --

DR. THEOFANOUS: The people in the company or --

MR. SIEGEL: The principal investigator is Paul Abramson from Oregon National Lab and he has a person that is working under him, Mike Kennedy who came from CE. The two of them are the principal investigators and I think there is going to be two or three other people that they will probably utilize.

The second task is related specifically to the Midland Plant and the coupling between the -- the unique features of the Midland Plant. It will determine the change in sensitivity of the primary. The secondary coupling will be assessed for the following features unique to Midland: The intertie between the secondary side and the Dow Chemical Plant through the -- air heat exchange there and the inner side of the steam lines between units 1 and 2.

The effects of overcooling transients resulting from both active failures and operator errors associated with both these features are going to be assessed.

As far as schedule, the next overhead shows the schedule. Completion for task 1, except for the primary and secondary feedbacks will be by August of 1980 and the completion of task 2 will be by July of 1981.

Anybody have any questions?

DR. CATTON: Will any part of this study include a comparison of external data?

MR. SIEGEL: I suspect that what you're talking about is, yes, using for instance some of the B&W's startup tests, some of the transients they have had and compare them with, for example. compare them with,model them with this model and see what the results are up there.

DR. CATTON: I was actually referring more to some of the great deal of data that exists in the literature on transient steam generator performance.

MR. SIEGEL: Right now we haven't discussed that. I think the program will probably be expanded, like I said before, we haven't really discussed that particular aspect as to whether or not. Right now it is not included, no.

DR. CATTON: It seems to me that before you do a whole series of computer studies, that you ought to make sure your model is correct using terminal data. I'm surprised that you have rotated the usual process, invert it.

DR. ZUDANS: I'm wondering, although you finished that discussion long ago, how can you determine sensitivity without coupling from primary, without feedback into primary?

MR. SIEGEL: Well because all the changes that are being proposed are primarily on the secondary side of the steam generator.

DR. ZUDANS: That means you have to maintain something in the primary --

MR. SIEGEL: In the primary side, yes.

DR. ZUDANS: That may effect your sensitivity, make it unstable or otherwise.

MR. SIEGEL: Well, that's what is going to be done initially. There will be a feedback of the primary side feedback, primary feedback -- the primary will be included later in the program to get the feedback --

DR. ZUDANS: In other words, you want to do the bulk of the analysis with the cheaper -- tools and then just make --

MR. SIEGEL: Right, to see what the effects are.

DR. ZUDANS: I see.

MR. ISRAIL: Can I break in? I would suspect you will have a simple hoop for the primary side and a measure -- will be the beta cooling that you get out of the steam generator.

DR. ZUDANS: You see, this one side alone can not be sensitive if the other one is infinitely strong.

MR. ISRAIL: But the pertervations, the forcing functions, pertervations coming on the secondary side, the dynamics of the main feedwater system, how quickly it delivers or doesn't deliver water, the dynamics of the pressure control system on the steam generator, the dynamics of the auxiliary feedwater system, these are the systems that essentially the applicants are going to look at, in terms of possibly modifying their dynamics to tune the deliver of feedwater and tune the secondary side of the steam generator to minimize the loss of functions --

DR. ZUDANS: In other words --

MR. ISRAIL: -- you recall the whole purpose of the 5054F 'etter was -- two kinds of couplings between the primary and secondary --

DR. ZUDANS: But you're eliminating that.

MR. ISRAIL: Pardon?

DR. ZUDANS: You are eliminating that in the --

MR. ISRAIL: No, we're not eliminating it, but we're seeing what pertervations on the secondary side do on the primary side. The primary side will just be a simple loop in this initial phase of the study.

DR. ZUDANS: I understood the primary side would only be accounted for by heat balance, right? -- that primary side will supply whatever the secondary side wants. It's infinitely faster response.

MR. ISRAIL: You will have a decaying heat source. You'll have a heat source in that little loop that goes around. It will be feeding back into the secondary. It has to be, but there won't be the elaborate description of the primary side in terms of natural circulation or what have you because the situations we want to be looking at are situations that would preclude getting a significant offset on the primary side.

DR. THEOFANOUS: When is the work starting? Has it started already?

MR. SIEGEL: Actually, the contract was just signed and it is supposed to start this week.

DR. THEOFANOUS: I guess I have a question -- of what Dr. Catton was driving at before. Is somebody going to provide guidance, maybe either from you or from them, as to what are the kinds of things that one needs to compilate and how well? You see, the goals seem to be a little bit elusive there. You see, how can this guy -- but you know, people think the compilating time is for a long time now and obviously, some things can not be done as well as you want them to be. Now you are trying to do something better. I guess what is missing is a little bit more focused effort in what is really it that you want to do and really what are the parameters of the -- and how well you are expecting them to be done and also how you are going to tell they are done sufficiently well.

MR. NOVAK: And how much time do you have to do this.

DR. THEOFANOUS: And the time that we have there because if you give me -- you see, the time scale I'm seeing there is very ambitious from the point of view of what I'm saying. On the other hand, -- weigh that against, you say I have one year, I will do the best I can, but if at the end of that one year or year and a half, if you can't make a statement as to how much of the credence or gravity or how much you are going to get out of what you've done, if you don't know that, I think what you've done is probably a lot of it wasted. I will say that probably your efforts should be more focused, maybe do one point or two points, but do them well instead of covering very large ground and find ourselves at the -- left with some results that we don't know exactly how to use. Do you see what I am saying? There may be some guidance from that point of view from the start. It might be helpful, even some guidance from the utilities and the vendors and maybe some discussion, so that what appears to be a very ambitious plan timewise, with the help of many people it can become quite realistic.

MR. NOVAK: I agree with you. I think what we're trying to do is certainly -- this task is not intended to develop a transient model. You can't do that. In other words, that's too an ambitious a task and people will criticize us for going back and reinventing the modeling necessary to do transient analysis.

The truth of the matter is that it takes a year for a man to learn how to use relap and even that's -- there is a criticism that's brought back, well, why go and teach new people how to use relap, why not just go ahead and run these calculations of people who know the relap program. These systems are very difficult to use. You have to be careful and it's easy to make mistakes, if you don't understand all of the facets of the code.

The approach that we sort of laid out for ourselves and I'm agreed, I'm encouraged by the discussion, was an attempt to pull out what we thought was a critical characteristic of the B&W design and that's the heat transfer fluid flow characteristic on the secondary side. We looked and we saw the availability of some, what I consider to be well-qualified heat transfer people and we said, can we get them to look at this problem as more or less a limited system dynamics where we could provide certain forcing functions in terms of primary and see how the secondary side responds to it in both ways.

Then when you think you've -- based on the literature that you've gotten, a reasonable engineering approximation to the steam generator, then fold that understanding into a system code and then go ahead and evaluate some of these proposed changes.

That's the way I viewed the program. Now, after we get into this program and I'm sure it's going to take a different turn, but initially we had a certain window of time. I don't realistically, if you want to evaluate some of these proposed changes that -- on the construction, at most you have probably two years at most to do the work and to say that's the solution. In the way we were looking at it, we would want to have an independent tool available to assess this. Obviously, the licensee is going to go to the nuclear steam supplier and they are going to do their own. But the ability of us to assess the validity of that analysis is going to be something like we're doing now. We're looking for some independent check to say, yes you would be doing --

do indeed understand the secondary characteristics and no, we think that there are some aspects that may have been over-looked.

DR. THEOFANOUS: Yes, that's fine. I agree with what you say, Tom. I think it's a good reference and all that. I think that just one little note there. Because you are cutting out a part of the system and you are looking at it in greater detail, implicitly you are assuming the additional burden for having to do a good job. You are naturally describing physically and physically in realistic terms that is going to -- what I am saying is, you might do yourself a favor from the beginning and also the people that are going to be working over there. If you try to give some guidance, because from our understanding, these people -- give some guidance as to what are the kinds of things a man should be looking for, so the thing becomes focused better, instead of just try to describe any drop and bubble -- that is the thrust of my point.

DR. ZUDANS: Does this program involve the -- new computer code?

MR. NOVAK: No.

CHAIRMAN ETHERINGTON: Will you continue, please, Dr. Siegel?

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CHAIRMAN ETHERINGTON: Dr. Murphy next then?

A VOICE: Yes, Dr. Murphy has a presentation.

DR. MURPHY: Can everybody hear me?

Basically, gentlemen, what I would like to give you is a brief description of where we stand in the study of Crystal River, which we are now doing.

The -- I spoke to the subcommittee in January, I believe, and went into the programatic aspects in some detail. I'll try to keep that short now.

Basically, we're as a pilot study for the IREP Program. We're doing a study of Crystal River at the present time.

The nature of the program was to initially do a survey of background data, LER's, various failure rates that have been observed. Go from there to the development of eventuries and faultries, qualify action in sequences from the eventuries, to perform sensitivity analyses, obtain quantitative results. The results are now scheduled in draft form at least by the first of May.

Following that we will do whatever additional detailed analyses are necessary based on the results of -- that are being obtained.

I should say at the start, I think, that there are two areas which are not in the study at the present time that are being considered for detailed analyses. One is the detailed analysis of the ICS and NNI to look for faults similar to that that occurred at Crystal River. And the second is the over-cooling transients, which are not in the program in any great depth at the moment. There was an initial survery where -- which led us to believe that there are other more dominant ways of getting the core melt than over-cooling transients. And we are still investigating the possibility of doing more work in this area.

The status of the program is that a preliminary analyses have been done and these are now under review. We've had considerable discussions with Florida Power Corporation and B&W. And they have provided us updated information, which -- while the information has been very good and it's very helpful to us in doing a good job, it has required us to modify several of our system models. And this is the reason we're behind the schedule that I had identified the last time I talked to you.

These modifications are underway and they are not yet completed. We do not have quantitative results at this time. However, based on the information we believe we can reach some qualitative judgments as to the significance of various actions and sequences, and I'll discuss those with you now.

We're finding system interactions are particularly

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significant. The -- in particular, where I have labeled here auxiliary cooling by which I mean two full-cycle cooling water systems at the Crystal River Plant, which combines to make up what I normally think of as a component cooling water system. DC power and then the obvious AC power interaction between various systems.

From what's been done todate it appears that the likelihood of core damage in high release categories -- release categories as defined by WASH 1400. May well exceed those predicted in WASH 1400. However, I caution that since we are using different analytical methods and improvements since those that have been used in '72 when the safety study started. And we are using updated data where it's available. It's difficult to compare the results of one study with the other. They're in the same units but they're obtained using different methodiology. And to some extent just comparing the numbers. You're comparing apples and oranges.

As a final point, we do have insights regarding significant accident sequences which I'll follow with.

First, I'd like to show you one other thing which I believe I showed the last time, but I think we have improved on the slide somewhat. Inside -- Systems Interactions. This is a rather busy view graph. However, it has the system functions--ECCS, reactor building experience,

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and reactor building cooling systems, low pressure, high pressure ECCS, and emergency feedwater system.

I am attempting to show here the inter-relationship between these closed-cycle cooling water systems--the K-heat closed-cycle cooling water system, A and B; and the Nuclear Services closed-cycle cooling water system.

These three systems serve all the various aspects of the plant. They in turn depend on electric power. In blue I've shown the AC dependencies of A and B. But in addition there's a DC power dependence, which is shown at the -- the faultry at the bottom of the page. Faultry may be too elegant of a word for what this is. It's a more logic description.

In addition to that we have the obvious things that are labeled in the box down at the bottom that you may not be able to see. Common valve coupling, location coupling, the coupling between humans, the coupling of the initiating event, the various effects of allowable tech specs outage times on systems; particularly as it effects the inter-relationship between systems; and other things such as the air-conditioning, instrument air, lubrication, et cetera.

We find that this kind of a diagram has been very helpful to us. It displays graphically quite well the interaction of these cooling water systems and the effect

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that they have on the various aspects of the plant.

I should identify on the system that is drawn, it shows a dependency on the cooling water systems and the Nuclear Services closed-cycle cooling water system on the curvatures of the pump of the emergency feedwater system, which in turn has an AC dependency. That dependency is being corrected and in the modeling we have done on this plant, we do not -- we have assumed that that dependency no longer exists.

The dependency is also being corrected in terms of the cooling requirements -- cooling water requirements for the electrical-driven pump in the auxiliary feedwater system. And again, that dependency is not in our analysis.

The --

CHAIRMAN ETHERINGTON: You didn't eliminate the DC dependency; did you?

DR. MURPHY: No.

In fact, I'll get to that in a moment.

In terms of our preliminary insights of various accident sequences, I apologize that this is handwritten. It literally was done last night and this morning. And I didn't have time to get it typed.

I put the thing up to eliminate the alphabet soup which I have on the left, which means something to those of us who have been working on the study, and probably means nothing to anybody else.

The sequences appeared to have significance either from a core damage potential or from a high risk potential. And by high risk potential it means that I believe that these sequences would fall in release categories 1, 2 or 3 as defined in the reactor safety study.

In other words, these are major releases of the bulk of the inventory efficient products to the atmosphere given a core melt accident.

The first one involves an accident where you lose the main feedwater system. But had accident coupling. Followed by loss of the emergency feedwater system and loss of the high pressure injection system.

You have processed coupling between the emergency feedwater system and HPI. As I said, the AC dependency is being corrected. And you do have an AC dependency obviously with the electric driven-pump.

The cooling water system is now being corrected and that shouldn't appear there once those corrections are in.

It appears that that will have medium -- medium importance from a risk standpoint but a high importance from a core damage standpoint.

The second sequence has been identified as the -- appears to be the dominent contributor to risk from what we have done today. This involves the loss of the grid; loss the AC power offsite, which in turn causes you to lose the main feedwater system.

But then follows it the -- following that you lose the emergency feedwater system, the high pressure injection system. So, you have no way of cooling the core. And finally the containment heat removal systems.

There is a process dependency here of AC/DC and cooling water on these systems. As I show, this is a dominant risk contributor and also a significant contributor to core melting.

I'll come back to this sli-- but let me throw this one up. It explains that last sequence and perhaps why it's as significant as it is. I think I can get all this on here.

The significance of this thing is that by the loss of the grid, I've lost my main feedwater system. If I track down through the system, I can find the battery B in the DC systems controls the steam emission valve for the turbine pump. It also controls the start of diesel B. So, if I lose battery B, I'm going to lose AC power B as well as my emergency feedwater pump.

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Then, if I follow with loss of diesel A, I'm into this action sequence. In effect, if I have either the two blue failures identified down here or the three green failures, the loss of the two diesels, and the loss of the turbine-driven pump, I'll succeed in getting the accident sequence that I've just described as being dominant.

Obviously, there are other failures that can get you to the same trap. But these are the upsets that appear to be the most significant in terms of the quantification of them all.

Going back to the other sequences that we found of importance, we have a similar sequence with the loss of grid which causes the loss of main feedwater. The loss of the emergency feedwater and the loss of HPI, but this time with the containment heat removal function still available.

It is obvious that we will be higher in probability than the last one, so it will be a higher contributor to core damage. But because you're containing heat removal, the equipment is still available, it shifts you into a lower release category. You will still melt the core, but you'll melt the core probably more through the melt through of the base mat rather than an over-pressure failure of the containment building.

Going down we have a sequence that has several but they're coupled with -- by system dependencies. Loss of grid, again, loss of the main feedwater as the result of it. Then, the emergency feedwater system is assumed to work, but to have a delayed start. A delayed start such that you lift the PORV, and that the PORV fails to reclose..

Then we assume that the operator fails to close the block valve, so he has a LOCA. And then the containment reactor building cooling and the reactor building spray fail, and the emergency core cooling system fails in the injection mode.

Again, there is a great deal of AC and DC couplings in these various systems where I have the arrows drawn.

We find this to be of medium significance from a risk standpoint. Low significance from a core damage standpoint.

The next sequence we have a loss of main feed-water with offsite power available. It's similar to the others in that, again, you have a delayed start on the emergency feedwater, the PORV opens and fails to close, the block valve fails to close -- fails to be closed by the operator, and you lose your emergency core cooling system in the recirculation mode.

Again, this one is of low significance from a

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risk standpoint and appears to be of medium significance from a core damage standpoint.

I might add in here, I know there are some B&W plants that are now operating with the block valves closed. The -- in that situation you shift this to the safety valves which would pop instead of the PORV's. And you would lose the probability element that's associated with closing the block valves since they're not there on the safetys. And these things would probably go up somewhat in -- in terms of significance. The low may well change to a medium and the medium may well change to a high in such a situation if you were operating with the block valve closed.

The sequences that are transient and not involving the loss of the main feedwater with an independent loss of the main feedwater system; followed again by loss of the emergency feedwater and loss of HPI where again you have AC and DC coupling, which is low -- appears to be of low significance from a risk standpoint, but at a medium significance from a core damage standpoint.

And finally the last sequence of the small LOCA list of four inches coupled with failure of the emergency core cooling system and the recircuit load, this is our more dominant LOCA that we have analyzed to date. But it still has low significance from a risk standpoint; low

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significance from a core damage standpoint in that it attracts the other analyses that we have done in the probabilistic analysis staff since WASH-1400 and, of course, in WASH-1400 itself.

MR. EBERSOLE: May I ask a question about the last one?

DR. MURPHY: Yes.

MR. EBERSOLE: There's sort of a subset of those in which the small LOCA is in fact an instrument line failure which loses a part of the mitigating functions, and at the same time is a small LOCA. Isn't that a somewhat more complex problem --

DR. MURPHY: Yes, it is.

MR. EBERSOLE: -- to deal with?

And yet isn't it more likely than most others?

You know, these are very small lines, like about one inch.

DR. MURPHY: It's of significance in that it puts you, I think, more on a transient tree than on the LOCA tree. The break is such that I wouldn't call it a LOCA in the true sense of the word, and you have to shift to a -- into a high pressure injection mode?

MR. EBERSOLE: Well, it's a small LOCA, very small LOCA, but it can not only lose some of the mitigating

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functions, it can compound the problems by introducing new signals which are invalid.

DR. MURPHY: That's true. That's a very valid point.

Are there any questions on these sequences?

Just to give you an idea of the types of information we have received from B&W and Florida Power Corp., which have effected our analyses; the effect that I'm talking about here is more effect in the terms of the time required to do the analyses and the amount of rework that was necessary rather than the effect on the results. But it's been -- information on various LPI pump characteristics, plant data regarding disel generators, testing, and maintenance, and use of Units 1 and 2 as an AC backup source; details on the DC power system interaction.

Until we had received this data, for instance, we had not identified the DC significance of the steam emission valve.

The updated procedures and procedure interpretation so we can better assess how the operator reacted when given transients. And finally some analyses that B&W had done regarding the system performance following the loss of all feedwater -- offspeed.

Our program plan for the continuation of IREP is

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to continue to develop a standarized procedural guides for the studies in terms of how to do the eventury and faultry analyses, common-cause failure analysis, quantification, human error modeling, and obviously the format for the report.

And I'll show you in a -- in a second, we hope to have about 6 teams working in parallel analyzing 6 plants at a time. Our goal is to make sure that all 6 teams are doing things basically the same way, to the same degree of depth, quantifying using the same data, the same analytical techniques and then when they come out that their reports look basically in the same format so we can easily understand them all.

The -- we will be starting shortly studies on Indian Point Zion, OCONEE, Calvert, West Browns Ferry, and Dresden 2 and 3. They will be done in parallel by a combination of people from research, from NRR and from our contractors.

The -- following the 6-plant study, we intend to reevaluate who should continue to be IREP, or actually, this will be done during the 6-plant study. Whether in the long term as we look at all operating plants whether it should be done by NRC and contractors as we're doing the first 6, whether the owners should do it, or whether it should be an amalgam of both of us. And again, based on

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the information that we learned ɔing the first 6, we will undoubtedly will have to revise their standard procedures so we can get those on to better insure that we are doing a good job.

I think the main improvements we are -- identified from our Crystal River-3 experience, from the study that we are now doing, is that we need to reorganize the way we're looking for common-cause failure procedures. We need to do thorough system dependency analyses very early in the game.

I think a good way to start that is drawing the type of figure that -- that I identified earlier that shows the dependencies with closed-cycle cooling water systems and the AC systems. And obviously that diagram could get much more detailed. And -- but ther is no way that you can put it on one figure without using up all available space in the viewgraph.

We hope to do a thorough search for susceptibility of core damage from single point failures. We want to make sure that the analyses will find a single point failure such as the TMI or the Rancho Seco area transient to identify things like the Brownsberry fire vulnerability.

As an important point we hope to deemphasize the quantitative risk assessment. By that I don't mean that we're not going to do quantitative risk assessment, but the

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importance is not the numbers that come out at the end, but rather the system dependencies that we find. The single point vulnerability is the common cause failures that we identify in doing this analysis, or it's going to be more important than the specific numbers that we generate.

The numbers will be used in qualitative sense to obtain qualitative information. But the nature of the analysis, as I said, is there are going to be large uncertainties on them. So, we want to deemphasize -- deemphasis on the numbers that are calculated, but rather look for the engineering insights that come from those analyses.

Finally, one thing that would be exceedingly helpful in doing the analysis is to have the licensee engineers on the IREP team from day one, rather than have us do an analysis and then as the time progresses have detailed talks with the -- the vendor and the owner of the plant and realize that we have to redo several of the analyses because the plant performed somewhat differently than the way we thought it did.

Well, that completes the presentation. Are there any questions?

DR. ZUDANS: I am very happy with what you said. Now, it clarifies the quantitative risk assessment that was mentioned in the morning. And I think this is the way to go.

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Thank you very much.

MR. EBERSOLE: Let me ask a question. This sounds like a -- an excellent long -- long-range -- or immediate range program. But one -- one of the things that came out rather sharply as a result of the CR-3 accident was the stark realization that we've got too many instruments on a single-channel failure. And we have inadequate instruments after tnat occurs. And isn't there something that we should do promptly so that wouldn't persist?

DR. MURPHY: Yes, I think so.

MR. EBERSOLE: Are we doing that?

DR. MURPHY: My own personal view of what's going to happen as we get onto this, is that we're going to do sort of a matrix analysis as we go.

The program I just explored, if you will, is a -- I'm trying to think of how to express this easily. As a series where we're going from plant to plant and going down the plant we're looking at various accident sequences which we believe are dominated. And we go down this way.

As we find dominant accident sequences we are going to have to go in and look at the plants vertically and look at one accident sequence through all plants. When we find something of significance we are not going to be able to wait two or three years to find out if they -- if that's

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significant somewhere else.

MR. EBERSOLE: Yes, and aren't you going to have to fire off to one side and action -- before you get done with all this? When -- as you find it. Not waiting until you finish.

A VOICE: They already did.

MR. EBERSOLE: And isn't that really one of the -- one of the Crystal River experiences, we have got too much instrumentation on one channel and not enough on recovery channels.

Isn't that -- isn't what's indicated there a prompt fix on that matter?

DR. MURPHY: I think so.

MR. EBERSOLE: What is the staff view on it?

MR. ISRAEL: Could you please rephrase the question?

MR. EBERSOLE: Yes.

The NNI instrumentation failure, Crystal River, and the earlier one at Rancho Seco showed dramatically that we have too much dependency on single channel supplies or critical instrumentation which we've always regarded in the past in a rather casual manner; don't we need to promptly upgrade the instrumentation system to remove that single-channel dependency?

MR. ISRAEL: Obviously, the answer is "yes." And

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with respect to the single house supplied instrumentation, the -- Bulletin that went out after the OCONEE incident, or was it after the Rancho Seco incident which occurred several years ago, but last November with OCONEE where they did lose the, I forget whether it was the NNI-Y or X, where they took out 80 or 90 percent of the instrumentation; a bulletin did go out. And all the licensees had about 90 days to respond to the bulletin. And in fact, Crystal River-3 occurred just about the time the 90 days had elapsed.

I guess there has to be more forthright action that comes to the obvious defects in the systems.

MR. RAY: Have you done any work yet in the area of human error modeling?

DR. MURPHY: On Crystal River we're relying basically on the types of human error modeling that was done in WASH-1400. We have a fairly extensive program in the probabilistic analysis staff on improving our understanding of human errors. I understand that Dr. Swane's Human Error Handbook will be out shortly.

In another month or two, Frank?

MR. ROWSOME: Something like that. I don't have the precise date. We have it in draft now.

DR. MURPHY: I'm the wrong person to go into a

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detailed description of where we stand on our work in human error modeling. There's considerable effort.

DR. ZUDANS: I guess you have plenty of errors without humans getting involved.

MR. MATHIS: One question. Back on your view-graph on interactions, you show all the activities of the cooling systems relating to the electric power source. Do you have a similar kind of interaction with regard to water availability -- water source? Is there more than one; and if so, what are they, and this kind of --

DR. MURPHY: We have a --

MR. MATHIS: Providing water for various cooling systems. And do you have more than source of water, or is that single? I --

DR. MURPHY: Okay. I understand what you're asking me.

We have not drawn such a figure. Basically, your water sources are your -- storage tank and your hot well, and the refueling water storage tank for these various systems.

And again, you can do -- this is what I meant, you take this type of figure and if you expand on this and for want of a better way, I'll describe it by overlays at this time. You can add on, for instance, lubrication systems.

You can add on your water sources. For instance, in the -- in the Crystal River incident in -- in March, they had problems with the K-heat cooling water system, Pump A, where they lost a coupling because of lubrication problems. The same lubrication problems existed in Pump B, but they didn't cause failure in Pump B, but there was a potential interaction between those two systems.

And if you look at what happens if you take out everything that's -- that depends on these two, you have a significant amount of equipment that can be affected.

MR. EBERSOLE: I think Mr. Ray is asking something that I'm -- I would also like to ask. What I didn't see up there, you mentioned closed-cooling water systems of all sorts. Nearly all those systems you show up there have a certain dependency on the ordinary old service water system that comes from the river and dumps over board.

DR. MURPHY: That's correct.

MR. EBERSOLE: On open -- open cycle systems it's not -- it's not there.

DR. MURPHY: No. Again, you have to extend this thing back. Obviously each one of these things has a source. And in these cases they depend on a salt-water system which circulates through the thing. And this is what I meant, you can extend this kind of drawing. It's not amenable to viewgraph presentation, but it's -- this type of an illustration of dependencies in graphical form I think is very powerful.

MR. EBERSOLE: As a matter of fact, I think you can say the root systems -- the service water systems draws the water from the ocean, or the river, or whatever.

DR. MURPHY: Yes. You eventually have to get back to your old --

DR. ZUDANS: But -- look at pieces. You know.

DR. MURPHY: Yeah.

DR. ZUDANS: You don't have to look at the whole thing to identify what's wrong with it.

DR. MURPHY: Right.

In the analyses we have done, we have taken these systems back to their -- their ultimate source. Again, you just can't squeeze more out of that viewgraph and have it intelligible. It may not be intelligible now as a matter of fact.

CHAIRMAN ETHERINGTON: Any more questions?

Yes, sir.

MR. TAYLOR: Mr. Etherington, may I make a comment about IREP on B&W's behalf?

CHAIRMAN ETHERINGTON: Yes, please do.

MR. TAYLOR: First of all, we support the effort in general. And we had hoped that we could be involved, as Mr. Murphy indicated at the tailend of his presentation from the beginning on the Crystal River study, that was not possible; not because we weren't willing but because of the way the program was being handled. And I think the way it's going to go the next time probably this will be possible, and we support that effort.

We support that involvement.

I think the thing that is important to us, and I would hope that the ACRS would also feel it was important, is that we can learn some lessons. It's very popular to try to learn lessons from everything we do. And one of the lessons that we learned from the WASH-1400 study is that we should turn out a scrutable report with documentation suitable for peer review. And we certainly want to do that because otherwise we in B&W are a little bit afraid that the first number, even though Mr. Murphy and Mr. Rowsome are dedicated to deemphasizing the quantitative results, the first number that hits the television station is going to say, you know, something very, very low probability, and we think that really there ought to be some extremely careful and extremely cautious action with regard to these results even to the point where we say maybe there ought not to be any results released until the six parallel studies

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are done, and we have learned a little bit more than just this one shot deal.

So, one, we support the effort, and we think it has a lot of merit, and we think it's the right way to go, but we're very concerned about the absolute values when -- when they first get released. And we think that it ought to be a scrutable report with sufficient documentation to have good peer review.

CHAIRMAN ETHERINGTON: Would you like to add a comment on that, Mr. Murphy?

DR. MURPHY: Well, basically, I agree with Mr. Taylor. I -- I also agree that scrutability is important. I worked on WASH-1400. I've got enough lumps on inscrutability without getting any more. The -- I also agree that I think if we have to start over again from the beginning we would have pushed harder for B&W involvement than -- had a much more of an early team relationship. We've learned lessons in the amount of rework we're doing now really stemming from the lack of communication earlier.

But I agree that -- with him in that area. I think we have a problem with the proper identification of error bounds, and again that's part of the scrutability question. This I think will do something to allay the concerns on quantitative numbers. But I also share the concerns of

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people who take the quantitative numbers and run with them without understanding what they are.

And as I said, then, the presentation is -- it is difficult to compare the numbers of one study with a second study when the methodology used differs. The -- in particular in IREP we hope that very soon after the first six plants we will reanalyze Surrey and Peach Bottom so that we will have more of a base if we have to get into comparison, that we will have more of a base to compare it to than we do now.

CHAIRMAN ETHERINGTON: Thank you.

MR. TAYLOR: I have one other comment briefly too, Mr. Etherington, in response to Mr. Ebersole's comment. I think we certainly would want to apply from the results of these studies the information as quickly as we can, but not too quickly. Because as we have looked more at the Crystal River event, it is now clear that there was much more instrumentation that could have been available to the operator than really was; without any changes, perhaps with different switch selections and so on. But I think we -- we want to -- as a principal, I don't think it would be right to say as soon as we learn something we are going to do something about it. That may be appropriate in some cases, but not in others.

CHAIRMAN ETHERINGTON: The next item is the report

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on the Crystal River accident or event.

Who is handling that?

A VOICE: I think that was the study that Mr. Tedesco presented this morning.

I think you --

CHAIRMAN ETHERINGTON: Oh, I thought -- then I misunderstood the --

A VOICE: No, actually -- I think you have an old schedule. I may be wrong.

CHAIRMAN ETHERINGTON: Yeah, I thought we were going to have -- I thought it was a recap of the day's events. It must not be in --

A VOICE: No.

CHAIRMAN ETHERINGTON: Well, I am reading the wrong schedule if -- okay. No wonder I was confused.

Let's see. Then we have -- we have the WPPSS and the consumer power presentations.

MR. HOSLER: My name is Alan Hosler, I'm a licensing engineer for the Washington Public Power Supply System. As told by -- emphasized by Mr. Tam that we were only to talk about new things since the last meeting, that all the previous handouts and what not would be circulated so, I'll only talk about update.

I don't want you to get concerned that this looks just like what I did last time. What I've done on these new graphs, I used the same set as before and I just added where we stand on status. That was the request on the part of the committee.

I won't talk anything about what the changes are, I think you've heard them. But if there are any questions please ask and probably before I leave that fuel graph.

In terms of qualification of the PORV, the Supply System will be participating in the EPRI program. We have also requested that B&W consider other valve types for the PORV and B&W has provided EPRI with performance and acceptance criteria for single and two-phase flow to the PORV.

We also recommended providing one E control on powered PORV, the status on that is the design changes are underway, wiring diagrams and control diagrams are being revised and we haven't encountered any major problems.

The third suggestion was to provide a one E pour of isolation block value for values actuated on low reactical and system pressure.

We are investigating the source of the actuation signal. We are awaiting B&W's recommendation on the number and types of valves of -- which is the same item that I mention in number one.

Right now it appears to us that two valves would probably be required. That's two block valves.

The second set of recommended considerations for one and four were to improve the secondary system reliability. This involves some work by B&W and some by are AE United Engineers.

One recommendation was to increase the make up capacity to the condenser during runback at the turbine generator trip. That study has been completed and the Supply System has accepted the AE's recommendation for a valve size increase to increase flow to the hot well from 15 to 4500 GPM. That increased the time from the low hot well trip from 4 to 11 minutes.

The second item under this category was the prevention of feriodeicia and providing steam dump capacity in excess of 25 percent. The analyses for that has been completed and the engineering of the inner lock is underway.

The schedule -- I'll only talk about these schedules once and then you can just read them off your copy.

The schedule for the preliminary engineering is to be completed 5/15 of this year, begin procurement September of this year and have the change complete in September of next year.

The third item was to improve the control response of ICS following sensor fairlure. And the first step of that we're working on right now to define the BEPDR phase criteria and I've indicated the schedule there.

The third category in our response to the show cause letter was changes to improve the response of the NSSS. We had actually four in this category.

The first was to provide rapid main feed water flow reduction power in the trip. I've indicated the schedule there.

The second was to add a one E loss of all feed water trip. The preliminary of the BOP pressure is underway. I've indicated the schedule.

The third item was to add main feed water overfill protection. That preliminary design of that is underway.

The fourth item was to provide auxiliary feed water overfill protection and rate control. I've indicated the schedule there.

I realized this morning in looking over my view graphs I made a mistake. I should have deleted my item five because I've incorporated it into item four. They are now one item. If you look back at the old view graphs you will find them listed as two.

MR. EBERSOLE: Pardon me. Does that rate control mean now that you're actually going to control the flow rate of off street water rather than just have pull off or pull on?

MR. HOSLER: Correct.

MR. EBERSOLE: So that will approximate the normal operational mode of the boiler won't it? Which is really not with a sensible level of any kind but rather with a boiler --

MR. HOSLER: There would be some level and then you would control the level -- you will taper off as you approach your set point rather than run full flow and then shut it off right there.

MR. EBERSOLE: Will that -- will that really sort of provide you with a more nearly -- with a mode a control similar to that which exists full power.

Do I gather that you are spraying the feed water with vertical flow?

MR. HOSLER: No, well it's not spray in these particular design in the 205 but you are correct, it is varible flow and will start at full flow and as you approach the set point the flow will then be tapered off so that you don't overshoot.

MR. EBERSOLE: Well, then it -- it's quite similar then to the main feed water full control except that it's shut on heat remover rays.

MR. HOSLER: Yeah, right.

MR. EBERSOLE: It's not a bang, bang type control.

MR. HOSLER: Yes, sir, that's what it is right now.

MR. EBERSOLE: Okay.

MR. HOSLER: The fourth category for consideration with changes to improve the capability and medigate transients. First, was to provide one E low level cutoff and heaters. We have drafted United Engineers to start procurement of safety grade breakers for those heaters. Heater cutoffs will be by the ECI system. For all heaters the one E added on one E heaters. The preliminary engineering for the ECI is underway.

The second item was to improve auxiliary feed water control following aspects acuation. That has been incorporated now in one and four.

Number three, strip the reactor coolant pump on low reactor coolant system pressure, avoid detection. All I can say on that it's a difficult one and evaluation of what might be used as a trip parameter is underway by B&W. That's work bonded by the owners group as most of this is.

And the fourth one is to go back and look at our feed only good generator logic and decide what change is made -- may be made.

The first item there is to come up with the criteria for that system and then evaluate the system that we have against any new criteria.

MR. EBERSOLE: Under item D1, how many heater groups do you have? You're depending on diversity in case you burn some out. You will retain some of the others, right?

MR. HOSLER: That's right. We have -- in those heaters that we define as needing to be one E in order to repressurize it will be redone in that.

MR. EBERSOLE: All right.

MR. HOSLER: In our response we had a separate listing of additional studies that we thought should be done which may result in changes or may not.

One was a secondary system reliability study. That will be a very big study. All I can say on that right now is that we're finalizing the identification of transients in the secondary system. That's being done by both B&W and United.

Control air supply system. That study is underway. We have identified some valves with failure due to loss of air could cause transients and there are several fixes to that. One can possibly change their fail position or provide accumulators or possibly do both.

Minimum final feedwater response study. We have looked at that once. We're going back to look at it again to make sure that our assumptions there are still right. That one may end up with no required changes.

Auxiliary feedwater turbine reliability. That study is underway. We are looking at the steam routing to determine if there are places where water could become trapped. We are also looking at operating data for the particular governors that we have purchased.

The fifth one is the NNI and ICS reliability study, power supply reliability. That will be a big effort. I'd have to say that right now it's just getting started and of course, as a result of Crystal River 3 we have new things to look at in addition to what came up from PMI and bulletin 79-27.

The last item I have listed is the heater drain pump reliability study. And that study is underway. We have some preliminary recommendations from RAE in terms of continued cold water injections from that pump to help any concern for MPSH available.

Our submittal on December 3rd included these items. It stated that it could characterize these items as being changes to ISE systems. Some values and we're not talking about heat exchanges, big pumps and things like that and we've reached a conclusion at that time that construction should be allowed to be continued.

As a result of the work that we have done to date, we don't reach any other conclusion and of course, that conclusion was also reached by Mr. Denton in his memo to the Commission as of the 22nd.

Are there any questions?

CHAIRMAN ETHERINGTON: It looks to me as though on your dates here as though if the decision had been made to place a temporary hold on installation it wouldn't really have affected you very much. Is that right?

MR. HOSLER: No, that is not correct. It was a little on -- it's -- probably wasn't that certain as to what type of a halt you were thinking about but certainly in the spectrum of things it could have been a complete halt on everything and that would not have mattered as to what the changes were if the CP was just taken away that's -- would cost us about a million dollars a day.

CHAIRMAN ETHERINGTON: Would you elaborate a little, I don't quite --

MR. HOSLER: Well, the halt on construction as it was given to us was that. A halt on construction of the plant period.

CHAIRMAN ETHERINGTON: Oh, on the plant, not --

MR. HOSLER: Yes.

CHAIRMAN ETHERINGTON: -- just on installation of of these items which were disadhered.

MR. HOSLER: No, but as I say, what the halt meant could have been a spectrum of things from halting on particular things like installation of the major component or total halt in the plant or don't pull any cable or something like that.

However, we took it to be in the most conservative way in stay and we let's say came up with our scheme of how to attack the thing on the assumption that it would be a complete halt. We took it that serious.

MR. EBERSOLE: One little minor question. You got into a number of engineering details here. Could you comment on what you consider to be the reliability or quality level of the main feedwater cutoff on high level in your -- it's done by -- you have turbine driven pumps I believe.

MR. HOSLER: That's correct.

MR. EBERSOLE: And you do -- you do pump trip and valve closure?

MR. HOSLER: On high level in the steam generator?

MR. EBERSOLE: Yes.

MR. HOSLER: No, that was -- that is an item up here that I've listed for study.

MR. EBERSOLE: Say again.

MR. HOSLER: That is an item up here that I have listed. These items here were things that we are studying now. They are not things that were in the plant let's say before we --

MR. EBERSOLE: Oh, you're studying that now?

MR. HOSLER: Yeah, they're not something that we had before we got the show cause letter.

MR. EBERSOLE: All right.

Thank you.

CHAIRMAN ETHERINGTON: Any further questions?

Thank you, Mr. Hosler.

MR. SALERNO: Good afternoon. My name is Mike Salerno of Consumers Power Company.

Like Mr. Hosler I was told that what the ACRS was interested in was new development since the last time we talked to you which was in January and that's basically what my presentation will be.

I'd like to go over a quick history of how this issue has impacted Consumers Power Company and then get you up to date on some recent information that we have submitted just recently and go -- finish with basically Consumers Power's philosophy on this issue as of right now.

We received as the other two utilities the request on October 25th, the 5054F for information concerning possible construction stoppage and we replied to that on December 4th.

Our reply included three major categories. First of all, the status of construction of the Midland unit which we gave in detail. Some over cooling transient accident analyses which were incomplete at that time which we have subsequently made complete in a recent submittal. Some committed changes -- some design changes that we have and they fell into three categories.

State of the art improvements that we have that we feel are above that of the operating plants at this time. Some committed changes we have already made both in light of over cooling and before over cooling became the issue that it is. And some areas that we are conducting further studies that we feel impacts the over cooling issue.

We presented the details of these type of changes we have under consideration and committed to to the ACRS on January 8th and I will now go through that again in light of the instructions I've received.

January 22nd, of course, Mr. Denton's letter came out basically in support of continued construction. Of course, we endorsed that. Since then, March 14th, we received a supplemental information request from the NRC which was basically 27 questions they asked.

Primarily based on our submittal of December most of them were keyed to our Appendix F which were basically the design modifications we have committed to, the state of the art changes we already had and the design studies we had ongoing.

We responded to these questions within the last week. Upon reviewing these questions, the one thing that we did ascertain is by and large we felt the questions were not pertinent to the 5054F issue of construction stoppage but they were pertinent to the issue of over cooling and we responded along those lines.

The supplemental information response went in on April 3rd and this is the extent of the response to 27 questions. Along with that we provided some information to supplement what we had already told you about the changes that were ongoing and I'd like to just run down a few of these additional information that is found in this submittal.

We gave additional details on the areas that we're going to look at under NNI and ICS review. That was -- before that was a little bit general in nature. We commented on some changes that other organizations, other utilities said they were looking at as far as their plants and tried to draw a line of why we thought either they were applicable or not applicable to the Midland unit.

We specified some design criteria of the AFW level control system which we'll implement on Midland. We gave some design details of the AFW piping modifications we're conducting both in the suction side and the discharge side.

We gave some details of the pressurized level indication system on Midland and specifically the expansion we're doing from 324 hundred inches.

We also provided some additional information on some instrumentation concerns such as incore thermal couples pesat tesat meters and automatic reactor coolant pump trip, et cetera.

Along with this submittal of April 3rd we modified our original submittal of December and this is the modification that went in on April 3rd of this year.

Basically this modification included complete modification of Appendices A and B which was the over cooling analysis that was previously submitted and as I said before, somewhat incomplete.

This revision provided a new analysis -- an analysis that hadn't been provided before but pressure -- pressure regulator malfunction, various analyses of small steam line break, a half .5 square foot break, various sensitivity studies to them, additional sensitivity studies to the main feedwater overfeed case which were not included in the previous submittal and also provide an additional main -- large main steam line break analysis taking credit for the Midland safety grade AFW level control system which hadn't been taking credit for in the initial submittal.

So this new information has just come to the staff as of April 3rd, Thursday of last week.

Finally, to summarize the present CPCO position is on over cooling and sensitivity. We feel right now that the staff has been supplied sufficient information to make a decision with regard to construction stoppage.

The additional studies we did as far as revising this response and supplying the response to the 27 questions has not changed our opinion of that. Our design changes and studies that we have identified are compatible with our present construction schedule and we feel we can accommodate them within that.

Although we don't feel that the sensitivity issue is closed, we feel that it should be pursued during the normal licensing process and we would encourage the staff to put that back in the licensing process and get on with the licensing review of Midland and tie your over cooling events into that.

That's our position. I'll entertain any questions you might have.

Thank you.

CHAIRMAN ETHERINGTON: Would you remind us briefly the status of construction of your plant at the moment.

MR. SALERNO: Somewhere around the area of 60 percent.

CHAIRMAN ETHERINGTON: Are all major components pretty much installed?

MR. SALERNO: What you're looking at basically the finish of 60 percent is in the area of small pipe, cable, instrumentation and those type of things. Large pipe and major components are essentially 100 percent.

CHAIRMAN ETHERINGTON: Any questions?

Thank you very much.

From being behind schedule, we're way ahead of schedule now.

The remaining item is the Executive Session which will not be recorded. I think we have to decide what we want -- what we recommend for presentation to the committee on --