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In the Matter of:

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REACTOR PLANTS)

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UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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UNITED STATES NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In the Matter of:

SUBCOMMITTEE ON B&W REACTOR PLANTS

Tuesday,
May 3, 1988

Room 1046
1717 H Street, N.W.
Washington, D.C. 20555

The above-entitled matter came on for hearing, pursuant to notice, at 8:30 a.m.

BEFORE: MR. CHARLES J. WYLIE
Retired Chief Engineer
Electrical Division
Duke Power Company
Charlotte, North Carolina

ACRS MEMBERS PRESENT:

DR. WILLIAM KERR
Professor of Nuclear Engineering
and Director of the office of Energy Research
University of Michigan
Ann Arbor, Michigan

MR. CARLYLE MICHELSON
Retired Principal Nuclear Engineer
Tennessee Valley Authority
Knoxville, Tennessee
and Retired Director, Office for Analysis
and Evaluation of Operational Data
U.S. Nuclear Regulatory Commission
Washington, D.C.

MR. DAVID A. WARD
Research Manager on Special Assignment
E.I. du Pont de Nemours & Company
Savannah River Laboratory
Aiken, South Carolina

ACRS COGNIZANT STAFF MEMBER:

Richard Major

NRC STAFF PRESENTERS:

B. Jones
B. Siegel
J. Calvo
R. Kendall

Consultants:

G. Reed
I. Catton
P. Davis
H. Etherington

P R O C E E D I N G S.

CHAIRMAN WYLIE: The meeting will come to order. This is a meeting of the ACRS Subcommittee on Babcock and Wilcox reactor plants. I am Charlie Wylie, Chairman of the ACRS Subcommittee on the B&W reactor plants. The other ACRS members in attendance are Dave Ward, Carlyle Michelson, and we are expecting Dr. Lewis and Dr. Kerr later today. Consultants present are Harold Etherington, Peter Davis, Ivan Catton and Glenn Read. Richard Major is the cognizant ACRS staff member for today's meeting.

The rules for participation in today's meeting have been announced as part of the notice of this meeting that was published in the Federal Register on April 22nd, 1988. This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act and the government in the Sunshine Act.

We have received no written or oral statements from members of the public.

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 heard.

The purpose, as I mentioned, the purpose is to review and discuss the B&W owners group plant reassessment program and the staff's evaluation.

The ACRS has been requested by the Commission to give advice on this activity as well as to consider specific concerns by Mr. Demetrius Basdekas of the NRC staff regarding the consideration of specific technical safety issues as pertaining to the reassessment.

The ACRS reviewed in 1986 the initial activity in this reassessment and wrote a letter in which the ACRS expressed concerns and made recommendations. The time has been identified on our agenda to address the disposition of those concerns.

I will ask the Subcommittee members and the consultants to keep in mind that as to what we should as the meeting progresses, what we should bring to the Full Committee on Friday morning. There is three hours allotted on the agenda on Friday morning for the full ACRS.

Also any recommendations and comments that the Subcommittee or the consultants would suggest the ACRS put in a letter to the Commission in regard to this reassessment program; we will discuss those later at the conclusion of our meeting.

I will ask the Subcommittee members and consultants if they have any comments at this time?

Hearing none, we will proceed with the meeting, and I believe Neil Rutherford, are you going to be the spokesman?

MR. RUTHERFORD: Is the staff going to have any presentation, Charles?

CHAIRMAN WYLIE: Okay.

MR. SIEGEL: We are just going to follow up.

MR. C VO: My name is Jose Calvo. I am the designated manager for the review of, the staff review of the B&W owners group reassessment effort, and what I would like to do, I would like to start the presentations by introducing the topics that we are going to discuss as well as the staff is going to present them.

I would like to give you a little background. Byron Siegel, who is the project manager for this effort, is the next one in line, and Bob Jones, who in addition to his work, he was the overall technical coordinator for the review. We have got Rick Kendall, who is representing the instrumentation and control systems; Bill LeFave, the mechanical, from the Plant Systems Branch who will be introducing those systems on a particular area. You have got Gary Hammer, who will be--the Mechanical Branch, who will be talking about the task force, and from the area of human factors, we are going to have a consultant, Joseph DeBor, who is from the Science Application International, and he will be supported by the staff of, the the staff representative for that particular topic will be Ann Smith representing the Human Factors Assessment Branch.

Finally, we have got Mark Rubin, who is from the Division of System Engineering and Systems Technology, who will be representing the risk assessment with the assistance of the Brookhaven National Laboratory.

That presents the staff. That's all I am supposed to say, and if you have any questions, I would like to bring it back to Byron Siegel, who is going to give you an overview of the B&W program.

MR. SIEGEL: As Jose mentioned, my name is Byron Siegel, and I was responsible for the, I was the lead emergency manager as far as coordinating the whole efforts on the B&W program. I started last August or July about the time that the owners group sent this, their final revision to their report, the B&W 1919, which is the safety performance and improvement program for B&W plants.

I didn't realize, I guess I thought that the owners group was going to start off which something else so there is a slide that sort of is a back-up slide that I have that I am going to use that isn't on the handout that I have up there.

Just so that this doesn't get you cold, originally--this is just a little history--originally Mr. Stello, who is Chairman of the EDO, sent a letter to Tucker who was chairman of the owners group, in January of 1986, and essentially he identified some concerns related to the sensitivity of the B&W design plants to operational transients of the Davis-Besse and Rancho Seco events that happened in 1985, and he also said that the staff was going to reassess the overall safety of the B&W plants to determine that the present requirements were appropriate for long-term and lead to level of safety comparative to other PWRs. I'm sorry.

MR. REED: I seem to recall more in the challenge to B&W and the owners group with respect to what they were to look into, and let me remind you that the public announcement No. 86-88 had words in that that went something like this--the reassessment will include thermal hydraulic design aspects. Also talked about basic design requirements, and basic design. That seems to be more operationally requirements from the challenge that was issued, what you have there.

MR. SIEGEL: Well, these were exactly out of the, those are words almost out of the letter per se. There were other things that were included.

MR. REED: So are my words exactly out of the public announcement.

MR. SIEGEL: I think most of the areas were primarily operational that were looked at.

MR. REED: That's the thinking that bothers me because it seems to me that the real issue here is design of the B&W plants, and say the two B&W plants--

MR. SIEGEL: We looked at--I think the owners group and the staff will address those aspects as we go along in the program. This is really just a basic overview.

MR. REED: I wanted to point out it seems to me some words got dropped.

MR. SIEGEL: What I just tried to glean out is what I thought were the key aspects that he had, that he had, that Mr. Stello keyed on.

In a letter from Tucker to Stello in February 1986, the owners group committed to take the lead in this effort. During the time that we, that the owners group took the lead, the staff interacted with the owners group to determine--during the development of the program and after the original program was outlined, the staff then maintained its normal role of assessing transmittals and limited independent analysis. As a result of this effort, the owners group developed their report called safety and performance improvement program. B&W 1919, there were five revisions to it, the last one was in July of 1987.

In that report, basically there are, the report has recommendations to improve the performance of B&W plants to reduce the number of complex transients and the number of trips that occurs at B&W plants, and there are approximately when all is said and done, about 275 recommendations that came out of that program.

The staff in its review reviewed all those recommendations. The reports themselves may not specifically identify each and every one, but there are, we looked at each and every one of them, and some of the statements in the report combine, more than their general statements that combine more than one of the recommendations.

We had a meeting with the Commission in August of 1987. I believe was August 5th, and in addition to what, in addition to what was already in the report, the Commission through a letter from, memo from Chilik asked you to verify the safety of the B&W plants, comment on the adequacy of the once through steam generators, the U tube steam generators, comment on the acceptability of the emergency feedwater initiation and control systems for B&W plants.

The staff completed its review just in March 1988. There has been a report that was issued in November of 1987 which you all have I believe, and a supplement report in March of 1988.

(Slide)

MR. SIEGEL: Basically like I mentioned on previous slides, this was a continuous interaction on the scope of the program. We reviewed, evaluated the results and then we did some independent work in certain areas, and a risk evaluation, we had a contract with a consultant, Brookhaven, consulting in human factors, SAI. There was a limited thermalhydraulic analysis which addresses part of your concern and limited operating experience review.

Basically now that the, now that the, we have evaluated the report, we see our role as that of oversight role. We are, we have evaluated the recommendation approval process and I will go into this, on the implementation part, I will go into more detail on these. We are going to evaluate the implementation programs at the utilities, what programs they have in place, evaluate the implementation process, verify that they have implemented the recommendation, and track the implementation process, and again, this is just an overview. The owner groups and the staff will go into more detail those aspects as we get into the program today.

MR. MICHELSON: In an overview sense, I noted the fairly careful consideration of the human factor input to the problem, but I also noted that practically no mention of the external events aspects of these plants and whether or not they are much more susceptible to possible core melt from external events, for example, which may be by far the overriding consideration.

MR. SIEGEL: When you say external events like loss of off-site power?

MR. MICHELSON: No. External events like fire, like pipe breaks outside of containment, things of this sort; these are not, the pipe break aspect is almost treated in the PRAs, treated rather superficially. The real flooding aspects are not treated in the PRA. The fire is not treated in the PRA, and this plant may be very susceptible to relatively modest fires in certain part of the plant. I don't know. And you really haven't looked into it.

MR. SIEGEL: I, I think maybe the owners group can answer a little better, but you know for the best, just speaking for myself, and I will hand it over to the Dick to address and Bob perhaps--

MR. MICHELSON: The PRA experts tell me that external events may be the true out outliers, not the internal events.

MR. JONES: Right up front, we have made a decision not to look at external events. We did concentrate on the basic design of the system and whether there were problems with the basic designs, and the operational problems that we have seen at the plant. We did not expand the scope beyond those types of operational problems such as external events. Those are to a large extent being looked at on the seismic programs. I forget the number of it, but USI on seismic, et cetera. We would feel those would be the appropriate place to take care of it as opposed to this, this reassessment effort.

MR. MICHELSON: That should have been made clear in the SER, that you are assuming that test will be taken care of.

MR. SIEGEL: It was not identified.

MR. MICHELSON: May not be there. I didn't find it.

MR. SIEGEL: Appendix R would cover the concerns that you had on fire protection.

MR. MICHELSON: That's a very simple answer to give which is I think basically not correct. It's, if you are going to dig into and make great claims with the low probabilities or show how you have corrected it, where the probabilities are higher and then totally ignore which many PRA analysts claim to be the major contributors to risk, we haven't got the picture then. You know it is just not there.

MR. JONES: If I could just again in one sense comment on it, when we did the risk assessment, what we were trying to answer to a large extent was number one, does the operating experience demonstrate that the B&W plants have much greater risks than other PWRs? That was the question, first question we try to look at.

The second question then was does the PRAs that have been done which seem to indicate that B&W plant risks are not out of line with the other PWRs, did they appropriately account for the operating experience? I mean were the assumptions valid in light of the operating experience that we had seen over last few years?

And it was from that perspective we looked at the risk of these plants. We did not again open them up to the external events. We are really looking at operational history and whether they were challenging our perception of the B&W plant risk.

MR. MICHELSON: The key question in my mind at least is whether or not these plants are any more susceptible to external events than are other plants. I won't find that answer in any of this material?

MR. JONES: No, you won't.

MR. MICHELSON: Although I find hints it might be, because air systems and so forth of these plants were easily susceptible to damage of the air system and that's the easily damaged system in case of fire because it is non-safety, not protected. The same in case of earthquake, not protected; the same and so forth. So I don't want to spend any more time on it, but I really would like to make the point that I'm not sure whether these plants are less safe or equally safe to the others, or perhaps more safe.

MR. RUTHERFORD: Let me add a comment to what Mr. Jones said.

We have not seen any evidence, although we have not done any systematic review, but we certainly haven't seen any evidence that the B&W plants are any more susceptible to external events consequences than any other vender type.

MR. MICHELSON: You don't see it if you don't look for it in the PRAs.

MR. RUTHERFORD: We have done PRAs on some of the plants.

MR. MICHELSON: External event PRAs?

MR. RUTHERFORD: They have included external events and certainly external events can drive the results, but where we have seen problems with external events, it has been a plant-specific issue, not a vender type issue.

MR. MICHELSON: Did Oconee do a fire PRA?

MR. DAVIS: They did do a full scope PRA.

MR. MICHELSON: Including fire?

MR. DAVIS: Including fires; they did find vulnerability to flooding at that plant which was a plant-specific design situation that was subsequently corrected.

MR. RUTHERFORD: That is correct.

MR. DAVIS: I think we do have some evidence that PRA plant capability for external events.

MR. CATTON: Just out of curiosity,could you put that last slide up? I found no reference to the MIST program anywhere. And your limited thermalhydraulic analysis was done by INEL using RELAP 5. It is my understanding that research is using TRAC to do the analysis of MIST. Isn't that a little strange, or don't you use the results of the research, or they are not applicable or something?

MR. JONES: Let me try to duck that last part of the question, because that's not a characterization I would use anyway.

No, we did not use MIST, not really in assessing the overall program.

MR. CATTON: It shows I believe there are transients that have been found.

MR. JONES: That is correct. I can't remember specifics. I think at least two of them certainly were on MIST. When we did the evaluations which was with--the area you are talking about is thermalhydraulic analyses, and the sensitivity analysis stuff, that was done by NPR and your on-site role, of those results. We were primarily trying to ascertain one, the reasonableness of the results that NPR came up with and their conclusions and also to look for any inherent sensitivity which should be addressed via some of the other programs in step such as the system reviews and to tell us something, that we have to concentrate a lot of effort in a specific system review activity to better control the steam generator or something like that. That's what we primarily were looking for--Were there any sense sensitivity insights that we needed to deal with?

And from that extent, we really didn't use MIST directly in the computer calculations to come up with and say this given time is exactly right or you know off by 20 percent or whatever, wasn't the overall thermalhydraulic response indicative of the problem?

There is a Basian reference to MIST and the issue of interpretation of natural circulation where we do mention the MIST results as recognizing that interruption of natural circulation does not lead to unsafe condition.

MR. DAVIS: You did not use the code? You tuned against the facility? The only reason I brought this up is when I read the recommendations at the end of the INEL report, I believe there were ten, of the ten odd recommendations, at least eight had the word simulator in them. To me that means some sort of a reproduction of something with fidelity, and here you have one of the major programs within NRC that is, supposedly is achieving that for you.

Anyway, I just raise, wanted to bring that out for some of the people who were here.

MR. JONES: Why don't we hit it again when we go through the sensitivity discussion? But I know where you are coming from on it.

MR. SIEGEL: Basically this is a summary of what we have done in the SER and SER supplement, neither one of them, either one which conveys any new positions and none of them contain any new requirements--only recommendation offered for consideration.

The reason for that is that most of the areas that we reviewed in this program were balance of plant type systems where the staff does not have any requirements on it, and as a result, any of the recommendations that we have in their numerous recommendations throughout the report are couched in the terms of offered for consideration. We encouraged the owners group to, or we would desire I should say the owners group to take our recommendations into consideration, and we would like them to go back and look at what they have done in the past to see if they are applicable, but as of, but in addition to that, anything that they do in the future we were hoping that they would, our intent is for them to use those recommendations when they are looking in the future for any events or transients that occur or any evaluations when. They do their plant-specific, the utilities do their own plant-specific implementation, the intent is that they will look at this report and incorporate the recommendations we have into their evaluation when they implement the recommendation.

The SER there were, I think the owners group is going to go through the eleven major projects, and I have said that the SERaddressed nine of the eleven major projects. It really only addressed eight. There is one item which is called review of emergency procedures that wasn't addressed and it isn't addressed in this report because the owners group hasn't completed their evaluation yet.

We addressed the owners group programmatic and management actions implementation. We addressed additional staff recommendations, recommendations and concerns identified by staff member. The supplement addressed the integrated control system, non-nuclear instrumentation, reactor trip initiating events review, acceptability of the emergency feedwater initiation control type systems. That was one of the items that the Commission asked us to address.

We in addition went through, and again the owners group has in their report of recommendation, they have identified what they call high priority recommendations, or key recommendations, and we will get into that later. In addition to the ones they have identified as key recommendations, the staff looked over the list and determined some additional recommendations that we thought were high priority.

We also discussed the staff impact assessment proposed owners group recommendations. There were some open items in the SER that we closed out in the supplement and again we had additional staff recommendations results from our review of the issues in the supplement.

We did not add' ' all these concerns identified by the staff member in the SER so we completed those in the supplement, and there were two other Commission items identified. I am trying to remember what they were. Oh, the ones through, this is the U tube steam generator was an item they asked us to address to verify the safety of the B&W plants.

That was all I was going to say as far as introductory remarks, and I believe--I don't know if it is Neil or Dick that is going to do it first. Is there any comments before?

MR. WARD: Yes. Byron, what is the, just in summary, what is the owners group reaction to the recommendations?

MR. SIEGEL: Well, the biggest area that I guess that the only comments we have gotten back were on the SER, and the biggest issue in the SER was the human factors area. We felt they ought to go back and look at, use human factors expertise to look at that.

The owners group sent us a letter in December of 1987 saying that they didn't feel that that was necessary in the future and in transients they would look at human factors aspects for any event that is, occured in the future in more detail, but they didn't commit to or their opinion was it wasn't necessary to go back and incorporate the recommendations we had in the human factors area.

I am not sure this is the right time to discuss the details of that. It would be better off later on in the, after they go through their whole program and we do, and in closing remarks to probably address--

MR. WARD: I wanted a summary.

MR. SIEGEL: That was basically the main issue in the SER. There were some additional recommendations. If you look at the SER, and the summary conclusions, we specifically didn't identify with the exception of human factors--there may be a few other areas--any of the recommendations that we addressed throughout the report, primarily because taken by themselves, we didn't think they were important enough to warrant being addressed on a line-by-line item in the summary and conclusions.

They were things we said it would be nice for them to do, but we didn't feel strongly enough that they necessarily, the program was, that the program was--we were concerned about the program because they hadn't done this, so the intent was, the hope was that they would take them at face value, and use them in future programs and also perhaps go back like I mentioned before and look at what they have done in the past and incorporate those, but we didn't feel that strongly that we felt that it was necessary to make an issue of it because you know, you are talking about many recommendations. Okay.

MR. RUTHERFORD: Good morning. My name is Neil Rutherford. I'm from Duke Power, and I'm currently Chairman of the B&W owners group Steering Committee. We certainly welcome the opportunity this morning to meet with you and discuss the results of our safety and performance improvement program. I think we are rightfully proud of this effort and we feel like it will contribute to make the B&W plants top performers in the industry.

Before we get into the main part of the agenda, I would like to introduce the presenters that you will be seeing today.

In addition to myself, we have Dick Skillmanfrom VPU who was chairman of our SPIP management team. Dick is over here.

We have Stuart Rose from Duke Power who served as the project manager for the sensitivity study. Stuart is sitting back there.

And Larry Stalter from Toledo Edison who is Chairman of our INC Committee, and led the review effort for the ICS and NNI system.

I would like to offer apologize for our Executive Committee Chairman and Vice Chairman Wally Wilcus who is Chairman of the Executive Committee, is entertaining Commissioner Zech at Florida Power today and he could not be here, and Dick Wilson also had a conflict that prohibited his presence.

I would like to briefly go over an outline of the presentation that you will be seeing today. First of all, we are going to have a general overview of the program which will include the definition of the issue, the information gathering process that we went through during the program, and a summary of our primary findings, and also we will mention the open items that still remain to complete the program.

When we met with the ACRS back in '86 originally, the chairman of the subcommittee wrote Vic Stello a letter in which he expressed some concerns about the program, and we would like to respond to those items and make sure that those are appropriately covered also.

Then we will get into a more detailed review of the findings in the various systems reviews, the sensitivity study, and the ICS/NNI and the risk review, and at that point in time, we will also get into a discussion on the findings in the SER related to ICS/NNI and the human factors area.

Once we go through the program itself, then we will address recommendation follow-through and implementation.

(Slide)

MR. RUTHERFORD: As you are all aware, this is certainly not the first time that we have been here to talk about the SPIP program in the last two years. We have had numerous interactions with the ACRS and the commissioners over the past two years concerning the program. I am not going to go through each one of those, but suffice it to say there have been a number of interactions, the most recent of which was the presentation that we made to the commissioners back in August of '87.

(Slide)

MR. RUTHERFORD: The objective of today's meeting is to make sure we provide you all the necessary information so that the ACRS can conclude that the owners have been responsive to the issues raised in Vic Stello's letter and that we have adequately addressed the complex transient and trip related safety concerns on the B&W plants.

MR. REED: Did you in the owners group interpret the public notice and early papers that passed as asking for thermalhydraulic evaluation and reassessment?

MR. RUTHERFORD: That was part of it. The responsiveness of the B&W machine if you will was a part of the concerns that we wanted to address.

MR. REED: Well, the words up there--

MR. RUTHERFORD: Certainly.

MR. REED: Of the objective don't seem to reflect that, either.

MR. RUTHERFORD: Well, that all has to do with the complex transients I think. A part of the complex transient transient question is the design of the machine itself.

MR. REED: The trouble that I have is when I think of basic design requirements, basic design, I think about such things as the placement of the steam generators, high or low, whether the primary system has natural circulation potential or does it tend to defeat it, in fact I would have looked at why are there two B&W basic design differences? Why does Davis-Besse have high set steam generators, and why does the other seven have low set steam generators? What are the impacts on containment height and these, kind of those are what I think of as basic design, not what was evaluated in the documents that I have.

MR. RUTHERFORD: Well, we didn't look at that particular aspect of it because I don't think there has been any questions or concerns raised about whether the B&W plants have natural circulation capability, et cetera. That's been proved out. The concerns were--

MR. REED: There haven't been any questions raised? Not even from MIST?

MR. RUTHERFORD: No. I think MIST proved that indeed natural circulation capability exists just like we have--

MR. REED: You realize with the low set steam generator you have a 30-foot plus riser that rises up to the cold leg entry into the vessel? You realize that if you slug that with dense water, you can block natural circulation?

MR. SKILLMAN: Can I make a comment, please? I am Dick Skillman. Is this on? We proved, Glenn, we proved natural circulation at TMI-2. It worked and it worked perfectly. It is not a matter whether it will or won't. TMI, we removed decay heat at TMI-2 for a year in natural circulation even with the difficulties we had in the instrumentation after TMI-2. In Toledo, the raised loop design will enhance that, but the lower loop 177--

MR. REED: I would agree. I would like to see this kind of comparison in the work that you did, that the raised loop won't have natural circulation problems and that the lowered loop can get into natural circulation blockage, and I think that this kind of thing, this basic design issue, has not been put to the forefront forthrightly, and I might remind you that the first pressurized water reactor that was ever built had blockage of natural circulation from a riser, a vertical riser in the cold leg.

MR. SKILLMAN: TMI had quite a bit of blockage.

MR. REED: I look at data we got down when it was down at 90 degrees Farenheit. You were in a period of blockage in TMI-2. Yes.

MR. SKILLMAN: From the stoppage of the reactor coolant pumps until we ceased to have enough thermal driving head.

MR. REED: You melted the core, and there was a period when it was 190 degrees Farenheit in the cold leg riser, and the rest of the inside the vessel you are up at 104 degrees.

MR. SKILLMAN: Let me try to answer for Neil.

MR. RUTHERFORD: Let me respond here. I think those types of issues were beyond the scope of this program, and that we had not seen any evidence that we have any weaknesses in these areas versus any other plant type. We were driven by the issues coming out of the complex transients that had occurred on the B&W plants, and the design issues raised by those complex transients.

Natural circulation, while important phenomenon, I think was adequately proved out by MIST, the plant tests that we have done, the TMI experience, and it was beyond the scope of this program.

MR. REED: The sacred challenge in this business is to always and forever assure the removal of heat from the core, be it power heat or decay heat.

Natural circulation because of loss of outside AC incidents, is a very, very important part of that as long as you depend on the secondary system or the steam generators as the path for that heat removal.

Now I quite frankly think there are some thermalhydraulics aspects with respect to the low set steam generators that say that the path through the steam generators for decay heat removal is not well enough assured, and therefore, the path and ultimate path must be, must be in back-up reliable state. We will get to that later.

MR. RUTHERFORD: Well, I guess we have seen no evidence to support that, and that's--

MR. REED: I guess that's where we disagree. I say the evident was with Three Mile Island 2 and the, and the evidence was at MIST. All right.

MR. RUTHERFORD: Suffice it to say our program did not address that and it was a re-review of the B&W plants for specific areas, not a general complete re-review of the total design. I don't disagree with your comments about the importance of the natural circulation capability, but that was beyond this program.

MR. CATTON: Natural circulation was beyond this program did you say?

MR. RUTHERFORD: Looking at natural circulation capability, other than in what I would say a very high-level, was beyond the scope of this program.

MR. JONES: If I could comment from the staff--

MR. CATTON: Could you tell me where the cut is when you say high-level?

MR. JONES: The owners group set forth a program in B&W 1919 which had a very specific objective to it. They didn't, their program in and of itself was not sufficient for the staff. We did additional looking. We looked deeper in the reactor. We looked ourselves at previous NUREGs to assure that previous staff concerns were being addressed. We looked a little further than they looked.

They looked at their specific problems, systems, and went into it, and as you will note, well, in general, we think that the job they did was favorable. We went beyond that. The specific issue of natural circulation raised by Mr. Reed, you will not find a mention of it in the report. That's clear. I mean it is not there. Not that it was excluded; it wasn't given a comment in the report itself.

The reason it is not there is we don't see the problem that Mr. Reed sees. We had, we discussed this issue with the Subcommittee, the Decay Heat Removal Subcommittee two, three months ago I believe. It was related to natural circulation and thermal block in the B&W designs. I thought we satisfied the Subcommittee at the time that there was no decay heat removal problem related to natural circulation from the specific lower loop design of the thermal block, and you know, it is just not in this program directly because previous staff concerns, yes, it was raised, the issue about natural circulation and how you got MIST in two phase natural circulation, concerns and questions. They were felt to be adequately addressed already or in the process of MIST and we haven't seen anything that raised a safety concern such that it needed to be directly considered within this overall effort. Not that it was excluded per se--we didn't see a safety problem that we fell that we had to address it in this report.

MR. CATTON: But every one of your reports is initiated by discussing Three Mile Island and following Three Mile Island, that was a major concern. It seems to me that you ought to put it to rest if that's your, what should have to happen to it right at the outset within your report; also you are not addressing the so-called lessons learned in Three Mile Island.

MR. JONES: It was put to bed I thought.

MR. CATTON: Not in your report.

MR. JONES: Not in the report;

MR. CATTON: It should be in this report because you start your report by talking about Three Mile Island, and that brings all of these things back to mind. They should be put to rest there by reference or by something.

MR. JONES: Recognize this report to a large extent is an evaluation of the owners group program with transients as the staff felt necessary to assure that there were no safety problems.

MR. CATTON: I hear you, but if I took--

MR. JONES: The issue of natural circulation, you are correct, there is no mention of it in the report. It was done in one of the earlier NUREGs which came out after TMI and we did not repeat it.

MR. CATTON: If you take the lessons learned document adjacent to your SER, people are going to be very unsettled about what is left out.

MR. JONES: We are willing to discuss any specific issue you have and try to address it here, if necessary. Maybe in this report it is not as complete as you would have liked to have seen it, and there is nothing I can do about that now, but all I, what I can say, to the best of my knowledge, we have picked up things like natural circulation issue, and made sure there was no problem and then went on. If there are specific issues, we will be glad to discuss them with the appropriate people on the given section of the report or whatever and we will try to address it at that time to the best of our ability.

MR. MICHELSON: The thing I found lacking in your safety evaluation, though, was not just the question of natural circulation. I realize that's being put to bed in a different program. That part didn't bother me.

What did bother me was a discussion of natural circulation in terms of the uniqueness or additional complexity that might be involved in properly addressing that circulation for the B&W plant versus say a Westinghouse plant.

I didn't find a feeling in here as to whether natural circulation was so natural that it didn't require any operator intervention or operator intervening inappropriately, it would not necessarily disrupt it. It was no different than any other PWR, and I didn't find a discussion whether there is any difference in maintaining the natural circulation for this plant versus other plants. If there is, it ought to be considered as a human factor.

MR. JONES: Actually it is discussed at least with reference to the small break LOCA transient within Section 5 on the sensitivity evaluation. We note very specifically that the B&W plants, on line, the U tube plants, will not, can interrupt natural circulation long term and it may be more difficult to accomplish orderly shutdown of the plant and we looked at procedural aspects say that there is guidance provided to the operator, there wasn't specific safety concern with respect to core cooling, and so we recognized the uniqueness and noted that uniqueness, but said there wasn't a specific problem that we could tell associated with it.

MR. MICHELSON: What I found lacking was a discussion that first of all referenced me back into whatever was coming out of MIST or wherever, where the requirements for natural circulation were established, including the operational steps, if any, so that I could go back to see how that worked. I realize the statement was in there but no connection back to the MIST work or some other work that established that connection.

MR. JONES: As I said, I am willing on any given item and the other staff members in their specific area I'm sure can address the types of concerns you are addressing--maybe not to your satisfaction, but to the best of our ability.

MR. MICHELSON: As a generalized statement, is it more difficult then to obtain, are there more, does operator training level have to be higher, and understanding have to be higher and so forth for a B&W versus say a Westinghouse?

MR. JONES: Not normally initiate natural circulation.

MR. REED: I would like to take exception to that and disagree with what you said, Carlyle. The documents that I received that I think covered the waterfront, don't clearly--they point out all kinds of comparisons between B&W and Oconee and Calvert Cliffs and Robertson but they avoid the very basic design issue of decay heat removal and natural circulation of each systems on loss of AC. They don't clarify it.

Now what ought to have been in there is the fact that the U tube steam generator plants get their driving head from the core delta P, from water heating rising up through the core, and that the B&W system gets no, in both their designs, gets no driving head from the core. Delta P and temperature rise.

They all ought to point out that the B&W very clearly hits its only driving head for natural circulation from the external component known as the steam generator. These are basic design issues rather than a lot of little nuts and bolts. I would like to see diagrams in a clear discussion of these differences. I don't think the operators in these plants understand it, that where the driving head comes from, why they must safeguard the actual level of the water in the

B&W system in the steam generator, very, very carefully, and in fact, I am not so sure they can always safeguard that level at that point.

MR. RUTHERFORD: I would like to take exception to that. I think the operators do understand that. We have enhanced our training over the last few years to point out some of the items that Mr. Jones has alluded to as far as interruption, and what the operator might see on these machines.

I have got just to take exception to those comments. I don't believe that is a correct presentation of the present state of operator understanding on the B&W plants.

One other comment, too, as far as decay heat removal and in the largest sense, and we can touch on it later, too, but it is true there are differences between a Westinghouse plant with a U tube generators and a B&W plant with once throughs, different characteristics. It is going react differently, but there are positives and negatives in that reaction.

If you look at decay heat removal in total, certainly the B&W plants have better capabilities in terms of feed and bleed. That is obviously one of the ways to remove decay heat if natural circulation fails. As we said, we don't think we have any problem whatsoever with natural circulation, but that is in the total risk.

MR. REED: We will get to that feed and bleed capability later with your single internal pilot operated relief valve which probably won't operate, but I don't think you are here for that purpose. You are here for sort of an overview and we will get that feed and bleed capability that you claim.

MR. RUTHERFORD: It was specific to Davis-Besse as far as feed and bleed capability.

MR. REED: What I read is there is a single PORV in each plant.

MR. RUTHERFORD: The high pressure injection pumps are capable of pumping against--

MR. REED: They run the pressure up and up at a time you ought to be running it down a little bit.

MR. RUTHERFORD: Well, let's move on with the presentation.

(Slide)

MR. RUTHERFORD: Before I turn the program over to Dick Skillman, I would like to just say a few words about the SPIP program itself.

When the Stello letter was issued back in early 1986, the first thing we wrestled with was somehow quantitatively defining the issues. There were a number of qualitative issues in the letter, but we wanted to get to something that we could measure, something that we could set improvement goals on and measure our improvement over the years.

Also throughout this process, there has been a strong executive level review commitment to the program and to the goals that we initially set. This is not only in terms of monetary support, but also in the support of our, each of our organizations to making sure the program was manned adequately, and supported by the technical people in each of our organizations.

The bottom line here is we wanted a program that had some tangible results for us in terms of improving the plant safety and performance.

In addition, we wanted to make sure that not only we were satisfied by the scope of the program, but the scope also adequately addressed the issues that had been raised by the staff.

While the program certainly does have some economic benefits to the owners, safety was the primary orientation throughout execution of this program, and I think you can see as we go through the systems reviews that we have done, and the other type reviews that we have done, that that indeed was our primary goal.

To execute the program, we not only looked at our historical data base, but we also looked at potential plant performance that heretofore had not been exhibited in natural events. We were fortunate in this area that we have got a very good data base for historical purposes from our TAP program where we have been systematically collecting data over the last few years, and that did provide a sound basis for proceeding with the program.

The next point I would like to touch on is our use of independent support and technical overview in the program. Certainly the owners individually and collectively provided a lot of manpower and support to the program. B&W did a lot of the technical work and support, but we also felt the need to have some independent review and oversight in the program, and we will cover exactly the mechanics of how we did that later, but not only the outside support from the contractors that we used, but the NRC staff, ACRS comments, et cetera, were also helpful in sharpening our focus as we went through the program.

As I mentioned, we are very proud of the results of the program, and we already see instances where plant improvement has resulted from implementing recommendations, and we are confident that as we continue implementation of the recommendations, that we will see continued improvement in safety and performance.

And certainly in closing, SPIP, the SPIP program complements and reinforces other industry safety and performance improvement, improvement initiatives that are ongoing in the industry today. I think as you look across the industry, we are seeing improvements in terms of trip reduction, et cetera, but we think this program is going to enable the owners to be in the forefront of that improvement.

Okay. At this point in time I would like to turn the program over to Dick Skillman, who is going to offer a summary of the program, and a summary of the results.

Any additional questions at this time?

MR. SKILLMAN: Good morning. I am Dick Skillman from GPP Nuclear Corporation, and I was the SPIP chairman. I was head of the management team comprised of the B&W owners personnel who did the review of the Babcock reactors.

(Slide)

MR. SKILLMAN: I would add to one comment that Neil made regarding the program. It was a large program. It was comprehensive. It is continuing today, as we are here today, there are people at each of the plant sites working on recommendations that now number well over 200. The owners have invested in the neighborhood of $10 million in this program. We have spent over a hundred man-years, so by any measuring stick, this program was substantial. It is a one-of-a-kind program and we believe that we have interrogated these plants to a level that other plants have never been interrogated.

What was the issue which we were dealing with?

Several issues have been spoken at the table here. We were not trying to determine whether or not a Babcock plant is better than or worse than Combustion plant or Westinghouse plant. We weren't trying to do a basic performance comparison between the plants, and this was not a commercial review.

Two events preceded the Vic Stello letter of January 24 of 1986. Those two events were the June 9 Davis-Besse incident, and the December 26 Rancho Seco. In both of those cases, the appearance was the plant was too hard to handle. There was too much operator energy involved in recovering from those transients, and as you think now Rancho Seco is just coming back. Davis-Besse has been on line for sometime, but those two incidents coupled with the perception of TMI-2, lessons learned, operator action, core melt, caused Mr. Stello to say something should be done about these plants, we want these plants reassessed, and that's the backdrop for SPIP, two mid-late '85 incidents involving a lot of operator energy, extreme plant conditions, and the perception that the Babcock plants behaved inadequately, so the issue that we tried to get our arms around is the issue of transient complexity.

Not only were the post-trip behaviors of the plants complex, but it appeared as if the plants were tripping too often. Consequently we said we wanted to define these complex transients, using some parameters or some measuring sticks that would let us understand the transients in detail. We used six parameters. Those are basically the ATOGI parameters. This let us quantify the issue so that we could determine where we should concentrate our review efforts, and in passing we would comment that interactions with the NRC staff, with the ACRS, with the commissioners, with other people really let us focus in on where we wanted to go with the safety and performance improvement program.

Some definitions--trips, a trip is a situation where you have an unplanned de-energization of the control rod drive control system power breakers, thus resulting in dropping the rods into the core. The salient word is unplanned, and power and transients, the aggregate dynamic plant behavior following a trip. What we are trying to focus on there is the entire range and spectrum of activities that the operators are obligated to attend to after the plant is tripped. It is combination of energizing systems, making post-trip systems function, and getting the plant back to where the plant is supposed to be in a near and far-term timeframes.

MR. MICHELSON: Before you leave that slide, it appears that the emphasis of this study is on transients, not necessarily on accident responses.

So that part is fine. I understand. Now when you are dealing with transients, though, you have to be quite concerned about the state of the plant at the time of the transient because the transient may be initiated by a number of different kinds of events outside of the, or inside the primary containment which are not of themselves what we classify as accidents, but if the transient is not adequately responded to, it results in a core melt anyway, so I get quite interested in how you can initiate plant transient outside of containment, and then I get back to the question of for instance, have you considered pipe break outside of containment as a transient initiator? It is a, some people call it internal event, some people call it external. I can't get uniformity of opinion.

Are you including pipe break as an internal event, outside of containment, included as a transient initiator?

MR. SKILLMAN: We included anything that would trip the plant as a plant trip initiator.

MR. MICHELSON: Pipe break will trip plants, a lot of external events which you have already I think told me you didn't include. I think I already got the answer to that. I am just asking, though, is pipe break an internal event or external event for the purposes of this study?

MR. SKILLMAN: Regardless of whether it is internal or external, Carl, the issue is what does the plant do after the plant trips?

MR. MICHELSON: In view of that initiator existing as well.

MR. SKILLMAN: We did not specifically address initiator of Class A versus initiator of Class B versus initiator of Class C.

MR. MICHELSON: Effects of the pipe break, if indeed it is transient initiator all right, but you didn't chase down what else the pipe break was causing while you were trying to mitigate this transient?

MR. SKILLMAN: We did not for the reasons that Bob pointed out.

MR. MICHELSON: Pipe break is not in your study really either in that respect?

MR. SKILLMAN: That is correct.

MR. MICHELSON: I want to make sure because some people don't consider those external events. They call them internal events--clarifying the scope.

MR. DAVIS: Help me out a little built with your definitions. On transients, there is three categories listed in your report 1919--A, B and C. Which of those are you calling complex transients?

MR. SKILLMAN: The Cs and the B and the significant Bs, and I will get to that if you would like in a few minutes. I can explain that in detail.

The reason I put this up here is we had a youngster in one of these sessions where the definition of transient was thought to be a vagrant who slept beyond the cooling tower.

What we talk about when we talk about transients is the aggregate dynamic behavior, the interaction of ICS, emergency feed secondary plant relief, all of the systems that are called upon to behave properly to make the plant settle. We are trying to unravel whether or not the post-trip behavior, that is, the complex transient that was experienced at Davis-Besse, the complex transient that was experienced at Rancho Seco, have common elements, if all Babcock plants have problems like we are, those that were experienced in those particular incidences, and what do we need to do about them?

MR. CATTON: A question about the transients--it seems to me that if you are going to look at transient behavior in your plants, you have to understand them.

MR. SKILLMAN: Yes, sir.

MR. CATTON: Yet B&W designed the MIST facility, and it is my understanding that they can't reproduce some of those transients in the plants on the MIST facility. That leads me to the conclusion that gee, you don't know how to, you don't understand these transients well enough to reproduce them.

MR. SKILLMAN: I don't think that reproducing the transient is a necessity.

MR. CATTON: Hold it. You mentioned a number of things that are supposedly built into this facility.

MR. SKILLMAN: Into which facility?

MR. CATTON: The MIST facility; it was built for a purpose, was built to reproduce these kinds of things that you want to study. If that effort is somewhat unsuccessful, that leads me to believe that you really don't understand your plant that well.

Could you maybe help me with this? Where am I running wrong in my thinking?

MR. SKILLMAN: Neil, would you like to make a comment?

MR. RUTHERFORD: One comment, certainly, that the MIST facility was not, the design of the MIST facility was not intended to exactly duplicate what actual plant performance might be. It was meant to examine certain phenomenon that might occur in the B&W plants, and to verify that we can adequately benchmark and model those phenomenon in a real plant, so we have never I guess characterized the MIST facility as being a simulator as such.

MR. CATTON: Certainly not a simulator, but I, it is my understanding that the counterpart tests within MIST weren't all that people expected them to be. Can you explain this? If you can, then that puts it together as you suggest.

MR. SKILLMAN: I cannot explain it, but I would like to try to take a different tack in answering your question. Clearly you have some concerns regarding the thermalhydraulic comparisons between MIST and the other activities regarding Babcock plants.

MR. CATTON: Somehow the whole thing is brought together with the code somewhere. You guys are developing RELAP 5. The NRC is tuning TRAC against the MIST facility, and then the staff is using RELAP 5 to look, look at the thermalhydraulics and how it interacts with other things. You either understand it or you don't. If you don't, I am not sure what good all this code study does you, which is the basis of tracking the transient.

MR. SKILLMAN: Let me say this.

MR. RUTHERFORD: One of the big purposes of MIST was to benchmark our codes so that we could understand, make sure that we did understand what might actually occur in a real plant.

MR. CATTON: But benchmarking codes in modern jargon is tuning codes. You still have to make that big step from the facility to the plant, and if you can't explain why the counterpart test didn't turn out as expected, somewhere you are lost. Your tool is flawed. I'm sure we are going to get into this more later. Why don't you--

MR. SKILLMAN: I would like to make this comment. The Stello letter of January 24 made some assertions regarding the sensitivity of the B&W owners group plants and made some comments regarding the behavior of the plants.

Stuart Rose will talk later about the sensitivity study which was the portion of the program performed for us by NPR, steered by Stuart as a project manager, to address the thermalhydraulic sensitivity issues, a number of them.

MR. CATTON: That's the place for me to raise these questions.

MR. SKILLMAN: The issues pertaining to plant behavior, and we went to some ordinary, ordinate detail to understand the behavior, is the subject of a large portion of this presentation today. What we found is what, what most people perceive may not really be the case in terms of Babcock plant behavior and in so far as decay heat removal, ability of the operator to get a hold of the plant, the way in which the plant maneuvers, ramps and so on.

Transient, the aggregate dynamic plant behavior following a trip, that's an important point because we do classify those transients so as to come to some understanding of the sensitivity of the Babcock plants.

(Slide)

MR. SKILLMAN: The objective of this program was to improve the safety of the B&W owners group plants, to reduce the number of trips and complex transients which occur, and ensure appropriate response for those trips and transients that do occur, and our goal at the beginning of the program was to get the average per plant trip frequency to less than two per year. We are currently at about 1.7 per year, and the new goal as of last September is 1.4 per year.

Those numbers might not seem like great changes, but when the program was started, we were tripping at a frequency of about four trips per plant per year, so this goal was a result of having of the then existing trip frequency and we are doing much better today and we expect to do better still. We are about 1.7 today.

MR. DAVIS: When you compute those trip frequencies, do you use only operating units or do you use all B&W units regardless of the--

MR. SKILLMAN: Operating units, and we subtract out, out of that the units that are not operating.

MR. DAVIS: Thank you.

MR. SKILLMAN: Am I correct? By the end of 1990, the number of complex transients classified as parameters category C will be less than .1 per plant per year or one in ten plants per year.

When the goals were established, we were running at a complex transient frequency of .3 per year, so it is a three-fold reduction in that complex transient frequency rate. We are approximately .24 per plant per year at the current time. Our goal is still .1.

MR. ETHERINGTON: Is frequency of complex transients faster than the frequency of the decreasing frequency of trip?

MR. SKILLMAN: Say again, please?

MR. ETHERINGTON: You have the increasing in the trip frequency, and you have the decrease in the complex transients.

Are they the same ratio on a--

MR. SKILLMAN: No, sir. The trip frequency has dropped much more significantly in the same time period than the complex transient frequency.

MR. ETHERINGTON: So you could say that you haven't really improved on the complex transient situation?

MR. SKILLMAN: We have improved except for a single category C transient experienced at about Christmastime. We have had ten C transients. We had ten C transients go through Thanksgiving of last year beginning January 1 of 1980, and we had the 11th category C at about Christmastime. When you factor that 11th complex transient based on a three-year average to the number of plants then operating, the complex transient frequency is at about .22 to .24 whereas the trip frequency has dropped from 4 to 1.7.

The real issue is a single complex transient gets magnified because it stays in our data base for three years, so we are running at about .24 now waiting for some of the previous complex transients to fall off.

(Slide)

MR. SKILLMAN: This is the SPIP program. We have an information gathering phase well behind us now; integration phase, also well behind us now; and the implementation phase, which we are deeply involved in. What I would like to do is to talk about the information gathering phase. I will keep the slide out so you can see our program through this presentation.

(Slide)

MR. SKILLMAN: What we were trying to do in the information gathering phase is to determine the areas in the B&W owners plants that were appropriate for improvement. This related to systems. It related to thermalhydraulic sensitivities. It related to relative core risk, and in some questions of design for the sensitivity study, and so what we did is we performed a broad and comprehensive search for problems both in the NSS and the BOP. That's important because what we found as we dug more and more deeply into our data is that the balance of plant, its relationship to the core, to the reactor coolant system, particularly in the near term timeframe post-trip, was a portion of the plant that we really hadn't spent as much time looking at, making sure that it was integrated with the other portions of the plant as we should have. And you will see that as we go on.

What we did is we reviewed our transient assessment program data. This is a program that the B&W owners have whereby we monitor every trip and every transient, each one that has occurred since January 1 of 1980, so that we understand how these plants are behaving and why they are behaving the way they are behaving.

We reviewed our systems and some components within the systems. We interviewed our operation and maintenance personnel, and we reviewed other pertinent data related to the B&W plant performance history.

We employed an outside consultant to perform the sensitivity study which is a relative sensitivity assessment, b&W type plants, 177 lower loop, versus Combustion plants, Westinghouse plants, Westinghouse plant, singular, and we performed a review of the PRAs germane to the Babcock plants. We didn't do a PRA per se. We reviewed existing PRAs as Bob Jones said earlier to determine whether or not the category C transients that we had had were properly reflected in those fault trees.

MR. REED: Why don't we go back to the complex transients a minutes, And the reply you made to Harold Etherington, and go back in history a little bit to the first program that the B&W owners group brought in which was called I believe the stop trip program, which the ACRS rejected, and other people did as that wasn't what was intended and what we needed to know about the B&W systems.

Now to me as I looked at the stop trip program, that didn't mean anything, because the B&W reactors had I believe at the time like 1986 or '85, prior to that, had less trips than the other reactors, so that that's easy to say we have less trips.

But now we get to complex trips. To me, complex trips are either undercooling or overcooling events, correct?

MR. SKILLMAN: Yes, sir.

MR. REED: Those are certainly the biggies. Undercool, overfill, overfeed which can be unusual in themselves through those basic three categories.

Now let me try to bring this around that circle. I am going to read from a report by B&W owners group of May 1987 called final report, page 3, 3-6. It says here following the loss of all main feedwater flow, either with or without forced circulation in the reactor coolant system, that is loss of AC, the steam generator level should be controlled to the desired heights before the lower tube sheet to provide an adequate heat transfer surface for water-to-water heat removal and to promote adequate natural circulation flow rates."

Now those words to me say there is some problem in promoting adequate natural circulation flow rates, and there has got to be something done in that single driving head location of the steam generator. There has got to be something very touchy done to make, start and to cause to endure natural circulation on loss of AC. Now that to me is certainly a complex transient to think about.

MR. SKILLMAN: You interpret that as being, identifying a problem. We identified that as being words that, that communicated requirement for the emergency feedwater system.

MR. REED: In other words, if that emergency feedwater system control thing which is very sensitive and gets into problems--

MR. SKILLMAN: It is safety grade.

MR. REED: But look at history. Look at history of your, of your feed system and its control and all the problems, and the oysters and other things that can happen down the line and the check valves that can happen and all the complexities of providing feedwater to a desired level from the steam generator side, and there are two levels, depending on which accident is there. It sounds to me to be a very complex situation which I think should have been reviewed in great depth.

MR. SKILLMAN: It was. It was reviewed in our emergency feedwater review, and we will talk about that in a few minutes.

Information gathering, a major piece of the program to get if I can say it this way navitation points so that we knew where to go in terms of the rest of the program.

(Slide)

MR. SKILLMAN: Let me give you some detail on information gathering. We assessed the, we reviewed the TAP data. Sir, this is the question that you asked, what about these complex transients?

We reviewed and sorted the TAP data transient assessment performance data to better focus on the areas where improvement is needed. As I said, every time a Babcock plant has tripped since January of 1980, our teams or the utility teams or the Babcock teams have gone in to describe what happened, to find out what happened prior to the trip and what happened after the trip, and with that data base, there have been 258 trips since then. We have a tremendous amount of information that says when this happens, and this happens, this result occurs, and by weaving our way through that data, we were able to understand the areas that needed improvement.

We took the TAP data then, 220 trips when we did this in early '86, and we defined specific measurable parameters to grade the complexity of transients. You will see which ones. I will tell you in a minute, and then we--

MR. CATTON: I was going to say something else. Have you ensured that your calculational tools will reproduce these transients and that they are properly put on to the simulator for training?

MR. SKILLMAN: Yes, sir, and Stuart Rose can talk about that in terms of the sensitivity study, in terms of analysis, and the computer, the simulators throughout the Babcock units do in fact fairly reflect this.

MR. CATTON: You have demonstrated your simulators indeed have the proper fidelity?

MR. SKILLMAN: The short answer is yes, sir. Yes, sir.

MR. CATTON: I will pursue that a little more whenever you have, what you pointed to is up here.

MR. SKILLMAN: Using the graded transient TAP reports, then we were able to identify the specific areas to go to further work on.

MR. MICHELSON: Of the over 200 events that you analyzed, did you sit down and make out a table of what was the, shall we say the root cause of initiator of that particular transient, be it human error, external considerations or internal failure? Those kind of categories? Going to show us that later?

MR. SKILLMAN: I would like to amplify this question, Carl, that did we sit down and really go through the root cause to determine whether it was a piece of equipment or an operator, and the answer is yes, sir, we did, in detail.

MR. MICHELSON: Are you going to show us a little simplified graph showing the distribution of those initiators?

MR. SKILLMAN: I can. I hadn't planned to, but I will.

MR. MICHELSON: Either that or tell us in words. It is probably buried in the report, although I had trouble finding from time to time exactly where, but it is fairly important consideration to see what is initiating these transients.

MR. SKILLMAN: Which categorization parameters did we use to determine which transients are more significant? We used six parameters--reactivity, reactor coolant system pressure, temperature and inventory, those three, and secondary side, pressure and inventory; those six. reactivity, three. And primary, two on secondary.

You might say, well, okay, what is an A? An A response, everything does what it is supposed to, kind of no never mind. Plant behaves properly after the plant trips. No passion; nobody running around; everything cool in the control room.

B, the plant response slightly exceed the expected range in one or more parameters, but it doesn't overshoot. In other words, it is a more energetic response, but it isn't one where there is a quandry in the control room.

And the C is where you reach limits which require safety system and extensive operator action to mitigate the transient.

Does anybody need to understand what the parameters are? Let's go on.

MR. DAVIS: Is it true all trips are in fact transients?

MR. SKILLMAN: Generally, yes. The post-transient response, the behavior, of an, in an A category, is the plant just cools down without perturbationi. All the parameters stay where they should, so yes, a transient always follows a trip.

How many have we had? Through May of 1976, had 258 transients, trips and transients. No more response; 247 abnormal; with the C level. 11.

(Slide)

MR. SKILLMAN: Carl, you asked did we do a root cause? We did. this is back-up it is not in your package. As Glenn pointed out, transients fall in three categories--overcooling, undercooling, and overfill, overfeed. We broke them down further into category C, quasi-C, which is a single or a, maybe a second parameter exceeds the C range, the plant does not trip, and a significant B. Significant B is a B transient. We haven't gotten into the C category, but where there is a fairly more strenuous response than an A.

At the time of this writing, we had 237 trips. Those that--this is pre-trip behavior. And what we did is we said all right, what system or systems were involved in the pre-trip plant character? And we are saying the emergency feedwater was the tripper in two out of 237. Main feedwater was the main tripper in 56 out of the 237, so if one were to take a look across the bottom part of the chart, you would see a signature for a fingerprint of the Babcock pre-trip history or the Babcock tripper history, and what it says is we want to knock out trip, do something about your turbo generator.

MR. MICHELSON: The thing that I asked was not this, although this is important, too. What I asked is how many of those trips are caused by somebody jarring an instrument, for instance? And you will identify the system in which the instrument was jarred out. I would like to know whether or not that was a physical jarring of the instrument or inadvertent actuation of fire protection, or it just a failure of component within the control system itself?

MR. SKILLMAN: It is something like 11 out of 127. These are bona fide system trips.

MR. MICHELSON: You mean it was nothing external to the system that caused it?

MR. SKILLMAN: To the best of our ability to unravel it.

MR. MICHELSON: Not less the air--total failure? That is a separate?

MR. SKILLMAN: This is probably a person. The answer is--

MR. MICHELSON: All the others are strictly internal equipment failures, not prompted by external influences, be it human or otherwise?

MR. SKILLMAN: As you broaden the question, I want to say yes, but in general.

MR. MICHELSON: That is just what I call external events and human factors combined. I am broadening the question, trying to find out which one of these are external initiated and which ones are human factor initiated and which ones are internal.

MR. SKILLMAN: Generally speaking, the eleven are the ones that you are concerned about. The more important piece of this, the more important piece of this slide I think is out of 237, there were 76 misbehaviors, and this is where I think that the real value of SPIP begins to come forward, and it begins to lean on some of the issues that you have raised, Glenn.

MR. JONES: Mr. Michelson, if I could also refer you to page 4-13 in the original SER, there is a table that talks about transients versus reactor trip signals, and you will see there is three columns dealing with human errors, operation, maintenance, surveillance and testing type errors which have initiated transients in that, and that is a summary as I remember from one of the specific B&W reports.

MR. MICHELSON: Was it a summary of those 237 or whatever?

MR. JONES: I think this is from the earlier report which is 204, but it is from one of the first, this came from what, the owners group so-called quick sort of the TAP data.

MR. MICHELSON: That this, for instance, says it was never caused by inadvertent actuation of fire protection in any B&W plant because that doesn't show up as any of these items as a for instance. Is that what it says?

MR. JONES: That possibly would be covered under surveillance and testing or operation, but that was not clear. I can't say there was and there wasn't.

MR. MICHELSON: Yes.

MR. JONES: But it would have been a small number.

MR. SKILLMAN: Please let me make my point before I stop. Out of 237 trips, 76 misbehaviors, keep that, that title in mind, because what we are saying is out of 76 misbehaviors, for the overcooling, the undercooling and the overfill, overfeed transients, of which there are about 50 significant transients, the emergency feedwater and the secondary system pressure control, that the main steam safety valves, atmospheric dump valves and turbine bypass valves, compose the majority of the MIST misbehaviors, followed by ICS/NNI followed by main feed, with electrical, PORV, and instrument error showing up as also rans.

The real message for most of us in the B&W owners group is when you back away from it, the trip history, and say what is the misbehavior pattern, you do not find the reactor coolant pumps or the pressurizer or the steam generators or the hardy components of reactor coolant system misbehaving. What you do find is after the trip breakers have opened, the post-trip, that there is a dominance of misbehavior in secondary plant relief and in emergency feedwater, and I would propose the question what, do these two systems really control post-trip?

Decay heat; it is the balance of decay heat post-trip that has been giving the Babcock plants the complex transient misbehavior title. This is where the problems are coming from in a dominant fashion

MR. MICHELSON: Does your chart include the manual trips, in addition to the automatic trips?

MR. SKILLMAN: Yes, sir.

MR. MICHELSON: You treated those the same? Either one was considered--

MR. SKILLMAN: There is a--

MR. MICHELSON: Sometimes you have the trip before the automatic would have tripped.

MR. SKILLMAN: I think what we get back to very quickly is the root of your question, sir, regarding decay heat, but it is, it isn't as if there is an inadequacy of capability to remove decay heat, but clearly there is a mismatch between these two, and we will get into that a little later.

We have ICS/NNI also becoming a part of the misbehavior pattern, and Larry Stalter from Toledo Edison will talk about that a little later, but when you look down this list you find what is missing from the list. There are a lot of things that are missing, but the things that are on that list are balance of plant,and they are significant. And that's where we really zeroed in because when we get into the undercooling, we are concerned about the PORV. The overcooling are the dominant types of behaviors that we have and we find the emergency feedwater and secondary plant relief really leading the pack in terms of overcooling, and while overcooling certainly removes heat, they set the plant up for a lot of, for a lot of hustle in the control room, and we see ourselves clearly at risk because of the frequency of those overcooling transients.

MR. REED: I am very interested in the chart, and it says to me beyond what you are saying, it says well, the emergency feedwater system isn't very predictable, reliable or dependable, and it says that the main steam safety valves, I think it was what SSPC is, aren't very predictable, dependable or reliable, and yet the issue that we are trying to make sure we take care of here, the key issue, the sacred issue is decay heat removal. Right?

MR. SKILLMAN: Yes, sir, post-trip.

MR. REED: Okay. We will reflect on that throughout the meeting.

MR. SKILLMAN: What I would offer in response is yes, sir, that is true, and that's why so much of our energy has gone to attending to these in our recommendations, and we believe that we have zeroed in on the areas that have given us this misbehavior pattern. We know what this is now, and we have gone to work on it.

MR. REED: Just one little point I would like to make is that emergency feedwater really means steam generator secondary side level. That's water level. That's what it really means, and you could put that in brackets under emergency feedwater. We will reflect on that throughout the meeting.

MR. SKILLMAN: Okay. Thank you.

MR. RUTHERFORD: Most of the problems we have encountered have been from removing too much decay heat, not too little.

MR. REED: Okay. Matter of control of the level in the secondary side of the steam generator.

MR. RUTHERFORD: Not so much level control.

MR. REED: Well then, flow.

MR. RUTHERFORD: Pressure; pressure goal has been --

MR. SKILLMAN: Which is sonic to primary, different way to look at it, but it was what it is.

MR. ETHERINGTON: To pump natural circulation, you want to raise the water level. Then you imply overcooling is, this a tricky adjustment between the two.

MR. SKILLMAN: Again, sir--

MR. ETHERINGTON: To promote natural recirculation, you wanted to raise the level of the water in the steam generator, is that right?

MR. SKILLMAN: Yes, sir.

MR. ETHERINGTON: In doing so, if you overcool it, then you invite an overcooling, is that right also?

MR. SKILLMAN: You can, yes, sir, you can.

MR. ETHERINGTON: Is this, has it been the cause of overcooling?

MR. SKILLMAN: Yes, sir, it has been.

MR. ETHERINGTON: That is not really a critical adjustment? Is that what you are telling me?

MR. SKILLMAN: It has been a, an issue of complexity for the operators in the past, and we have, we have looked at that in detail and offered recommendations to reduce the complexity of balancing emergency feedwater flow rate against the then existing decay heat removal requirement, and here is the real, the real goal on that. In the Babcock designs, the emergency feedwater is injected very high in the generator. It has a long length of heat transfer. For every pound of water that goes in there, thousand BTUs are removed.

The real trick is we have designed the emergency feedwater flow rates for extreme conditions when in reality a fraction of that water is truly needed to remove the decay heat that exists at that point in time, so getting that balance control has previously been a, a challenge for the operators, and through SPIP we have identified limitation of emergency feedwater flow rate, settling, increasing the time for run-up for the turbines that produce emergency feedwater is key, recommendations to get the balance between the emergency feedwater injection flow rate, and decay heat removal requirements back in balance, but you are reading it right. That level, and the over injection of emergency feed, has been part of overcooling signature that we have had.

MR. ETHERINGTON: So apparently you have fairly wide latitude, is that right?

MR. SKILLMAN: Say again.

MR. ETHERINGTON: You have a wide latitude? It is not a physical problem?

MR. SKILLMAN: We do have a wide latitude because of ability to remove copious decay heat with a little bit of emergency feedwater, yes, sir.

MR. REED: Harold--

MR. MICHELSON: The thrust of his question--maybe I should let him interpret it himself.

MR. REED: I would like to clarify something for Harold because he perhaps took something I said at face value and there was more to it.

The level in the steam generator secondary side is very important, and also the fact that water is sprayed at a certain flow rate up at the top of the steam generators.

Now way back in ancient history, when B&W created this system, they injected the emergency or auxiliary feedwater at the bottom of the steam generators. After they had delivered the steam generators to Oconee, somebody figured out hey, that wasn't going to work for natural circulation because they could get the thermal block, so they put a spray ring, they added the spray ring up at the top of the steam generator in order to get that dense water up higher so they would have enough driving head to push up the hill, the 30-foot hill on the big cold leg pipe. Very complex; that's why I wonder if it isn't too complex to not have a very reliable ultimate system for decay heat removal.

MR. SKILLMAN: What we have found through the sensitivity study is that the pressure, the pressure in the secondary side is really the tattletale that you are looking for for post-trip decay heat removal using secondary side.

The first reaction is to say you need a lot of water level in order to have the differential temperature to drive the decay heat across the tubes in the generator, but what the sensitivity study has shown us is that the lower inventory of the Babcock design compared with RSG designs is not a disadvantage, but thermalhydraulically it is a secondary side pressure that lets the decay heat be removed, and so if we focus in on that aspect of it, ensuring that emergency feed is delivered at the right flow rate against secondary pressure, we can have smooth control of post-trip secondary pressure and decay heat removal.

MR. REED: Will somebody speak--I don't understand how pressure is a reliable indicator, to my knowledge. What about the fact that tubes can fail and main steam lines can fail and some B&W plants do not have intercept or stop, main steam stop valves?

MR. SKILLMAN: The systems that are TAP data review, that is the review of all of the transients, told us we should be looking in more detail at the integrated control system, ICSNNI system, main feedwater system, the emergency feedwater system, also known as auxiliary feedwater system, the secondary plant relief system, and the instrument air systems.

MR. MICHELSON: Would you clear up one little point for me because I think I hear it both ways? I'm not sure. If I had no water level on the secondary side, but had my spray fully functional, would I have to have any water level to remove the decay heat?

MR. SKILLMAN: Emergency feedwater spray, yes, sir.

MR. MICHELSON: Level has got nothing to do with the base requirement? It only has to do with some of the analytical processes to go through, but you don't need level to remove heat? You just need spray?

MR. SKILLMAN: You need emergency feedwater delivered at several hundred gallons a minute.

MR. MICHELSON: You keep telling me about controlling levels and I think that is--

MR. SKILLMAN: I don't believe I said that. I believe Glenn said that.

MR. MICHELSON: Spray is--I think I heard it both ways.

MR. SKILLMAN: I believe it was Glenn that said that. I said the pressure.

MR. MICHELSON: Your intention was to talk about controlling the spray rate, and you do that through pressure.

(Slide)

MR. SKILLMAN: Very important piece of our information gathering was the interview of the operations and maintenance personnel. We used INPO developed interview process. We did focused interviews with operations and maintenance personnel at each of the plant sites. We looked for transients which may not have resulted in reactor trips, but were considered to be significant by those people.

We looked for areas of improvement where we can reduce the need for post-trip operator action, and we tracked down and defined concerns with procedures, with issues of maintenance, and issues of operator burden.

There was other information available in the industry that would help us focus on our problem areas. We looked at, for instance, INPO information, NRC type information, our own internal event reports, other operational histories such as that was available from INPO, from the NRC, and we conducted these reviews. This was a thoroughness activity.

To be covered independently from my presentation this morning and this afternoon will be a presentation on the sensitivity study by Stuart Rose from Duke Power, and I will be talking later about the risk assessment that we did.

(Slide)

MR. CATTON: At some point later will somebody get at these questions that Glenn was raising?

MR. SKILLMAN: About the design of decay heat?

MR. CATTON: Well, the emergency feedwater, and why you feel that controlling the pressures is the key variable?

MR. WARD: I think they just did. Did you hear Carl's discussion?

MR. CATTON: Yes.

MR. SKILLMAN: What Carl said is do you really need level, yes or no? I am quoting Carl. From memory he said, I'm getting the sense that what you really need is spray, high in the generator, as opposed to level, and my response is yes, sir, that's exactly right. What we need is the emergency feedwater flow rate whose removal, heat removal rate matches the then existing decay heat generation rate and the secondary plant system removal rate so that you end up with an energy balance to hold the generator at pressure.

MR. CATTON: I understand that. I am just wondering how do you get it? How do you get this relationship?

MR. SKILLMAN: By maintaining secondary pressure and by ensuring that the emergency feedwater pumps are delivering the appropriate amount for that pressure. Let me--

MR. CATTON: You have a little feedback loop.

MR. SKILLMAN: Oh, we do. For instance, at all of the 820 plants we had emergency feedwater injection and control, for all plants except Davis-Besse. Davis-Besse has its own steam and feed rupture control system. Oconee 1, 2 and 3 each have emergency feedwater with their own control system by Duke Power, and TMI-1 has the HSPS, the heat sink protection system, but Duke's emergency feedwater control system, TMI-1's HSPS, the other eight Babcock plants with EFIC and Davis-Besse with SFRCS each have that control system as a safety grade system in the plant.

MR. CATTON: As the pressure in steam generator rises and falls you raise or lower the emergency feedwater flow rate?

MR. SKILLMAN: Alter emergency feedwater flow rate, yes, sir.

MR. CATTON: Where did that relationship come from? Is it just calculated?

MR. SKILLMAN: Yes, sir, through the EFIC activities, through the emergency feedwater design and analysis activities by each of the utilities.

MR. MICHELSON: This is based on the principle that you can't spray but a small portion of the tubes because it is a bundle, spraying from the outside by the separators I guess are spreading the water around, wet all the tubes out.

Are you accounting for the fact that some tubes never get cool? MIST I don't think simulated that aspect of the configuration at all? That's why I asked you the question because I'm not sure you gave the right answer, but I think it is the answer that we can accept right now, but I am not sure your test facilities have really demonstrated if I had no water in the steam generator, and only sprayed it, that you know, there is, part of the tubing isn't going to get sprayed in the real generator. A large portion will not get sprayed, may not even get wet, depending on how good the separator plates are spreading the water around, and I don't know that we have ever really tested that. I am accepted it. I don't think we will be in a no water situation in the generator anyway but it is not an entirely frivolous question.

MR. CATTON: I believe your question is one of the items in the research program to look at the--

MR. MICHELSON: It should be.

MR. CATTON: As near as I can tell, you don't have any kind of demonstration that you can do those calculations properly at this point in time? MIST certainly did not give it.

MR. MICHELSON: MIST couldn't do it.

MR. CATTON: Your earlier steam generator tests, near as I can recollect, were inconclusive. The data had too much scatter. There were too many problems with it to really be able to use it in any meaningful way.

How important is it that you are able to calculate the thermalhydraulics of the process? Who is monitoring the pressure enough?

MR. RUTERFORD: It is true we are looking at these kinds of questions in potential research program, and I think what we are trying to do in pursuing some additional tests that we might run is characterize the importance of being able to precisely calculate what is going on. It might be, it might be from a scientific standpoint interesting, but the control of the plant standpoint, not very important. As long as you maintain flow into the generator, maintain the level, then the penetration and the flow of what kind of spread you get in the tube bundle is a bit more of an academic question.

MR. MICHELSON: What do you do as the level is dropping and the pressure is where you want it? For control purposes you ignore the level or do you have a rule that says you must maintain both level and pressure?

MR. RUTHERFORD: Your control system is going to respond to that dropping level, but if your level is dropping--

MR. MICHELSON: Maybe I misunderstood. I thought the control system was monitoring pressure.

MR. CATTON: It is the pressure low.

MR. MICHELSON: And level in some magic way.

MR. CATTON: Separate system that is monitoring level? You said that the emergency feedwater is controlled by pressure.

MR. SKILLMAN: The key parameter, the, this discussion started with Glenn saying you must have water level.

MR. CATTON: Must have heat transfer; that's the translation, what I understood Glenn to say.

MR. REED: Let's say you have got to have the level at certain levels not to stop certain events or to cause certain events to happen. In a small break, for instance, you must have the water level as high as you can get it in the steam generator and in a normal transient, a normal loss of AC, you must have the water level as low and get your spray as high as you can get it. There are all kinds of things that interact. Right?

MR. SKILLMAN: Each plant has its own emergency feedwater control system. Each emergency feedwater control system goes by a different name at each of the sites. Some look at water level. Some look at pressure. One has cavitating venturis on emergency feedwater injection at the generator, so they are all a custom--for each of the different plants, they have different types of equipment. They have different failure modes.

MR. CATTON: Let's be very simple. All I need to know is flow rate, and a surface area of the tubes that are covered, and the steam generator pressure and I can do a pretty good calculation of the heat transfer.

What I can't do now is relate those variables that I need to--what you are telling me, because on the one hand I hear level, level is not very important to those three parameters if it is way down on the bottom somewhere, so if you control based on pressure, you have a different control system that is doing something with level that may interfere, I really think that I would like to see some sort of a written description of the process, what kind of calculations you have done and how do you get to opening or closing the valve?

MR. REED: I don't get a lot of comfort, either, from having you say that each plant has its own emergency feedwater control system. It seems to me that part of the industry's success will come from some kind of standardization, and its success in safety, and to think that each owner is doing some kind of of thing, calculation, calibration, and set up of its own system bothers me.

MR. JONES: If I could at the risk of just confusing the discussion further, we have discussed this matter as I mentioned previously, about two, three months ago, decay heat removal, some Committee meeting, and I made that presentation. Let me try to summarize it again.

There are indeed three control levels for the lower, the B&W plants, for the emergency feedwater system. You do need level in the steam generator because you do not maintain a continuous emergency feedwater flow. Once you fill up the control level, the emergency feedwater is shut off so the question becomes why do I need two, three levels? What is your sensitivity to those levels is I think what the question is.

Now the three levels you have there is approximately a 30-inch level, which can be maintained by either main feedwater or emergency feedwater depending on the plant design, which is used when the reactor coolant pumps are running that gives you an adequate heat transfer surface for heat removal to remove decay heat loads.

If you lose the reactor coolant pumps, and partly in response to this issue of the long cold leg on the B&W plants, you do indeed shift to a higher level which is referenced again on the lowered loop plants as 50 percent of the operate range, which is about a little less than half full in the generator. It is about 20 feet.

Now you go up with the aux spray or in the case of Oconee they can do it by redirecting the main feedwater system through the emergency feedwater nozzles. They will raise that level with some continuous flow rate, to approximately this 20-foot level in the steam generators. At 20 feet, that stable level by calculation, and by test, actual plant experience has been shown to provide adequate natural circulation for transients.

Now the actual sensitivity of that level I can't tell you exactly other than my memory says at TMI, that TMI did some tests where they looked at how low can that level be without the reactor coolant pumps, in order to keep natural circulation going? These were some start-up tests following the long, following the accident, and my memory as I remember it is about 35 percent in the operate range is what is the minimum level they must achieve to maintain stable flow. This is without the continuous aux feed for heat removal.

For the small break LOCA, the issue came down to how do I maintain the condensing surface in the steam generator? This arose out of TMI experience where it was recognized that 20 feet in the steam generator would not ensure a surface area above the lip of the reactor coolant pumps, so I have, could get guaranteed condensation heat removal in the long-term in the boiler condenser mode in boiling in the core, and condensing the steam generator.

The operating procedures were constructed such that if they lose natural circulation, even if they are at the 20 foot level or whatever level it is, should they not be getting the natural circulation they are supposed to be getting, that there are indications they are not getting adequate heat removal from the core, the temperature is, hot and cold leg temperatures are continuously diverging, then the operator is instructed to raise the level to 95 percent of the operate range. That is a manual action. It is also done, saturated the primary system because the small break LOCA concern.

The sensitivity on that number is about 80 percent on the operate range. A sure 75, 80 percent assures that you have the condensing surface above the loop seal, above the lip of the reactor coolant pumps so I could get a continuous natural circulation flow in a boiler condenser mode if the primary system levels should drain down.

And that's the basis for the numbers that are in there and that's the relative sensitivity. The staff has looked at it. They have looked at it following TMI, said TMI-1 did its test. Looking at the lower levels, the MIST is confirming the adequacy of the 95 percent level, the MIST test. And at this point, looking at the procedures, the levels that are there, we don't see a problem with natural circulation, but that gives you a range of the numbers you are dealing with.

Obviously the raised loop design has different numbers because you do not need to overcome this loop seal. They also have a very low-level in reactor coolant pumps operating. In the emergency situation, where they are not getting adequate natural circulation flow, I believe they raise to about a ten-foot condenser level in the steam generator.

MR. ETHERINGTON: Level would have to be higher?

MR. JONES: Yes, sir. It is about, as I said, it is about I think the 95 percent level is about 30 foot of level above the lower tube sheet in the lower loop plant. I am not sure of the exact numbers because the way they run the TAPs, but I believe it is about 30 feet, 30, 35 feet, that the lower looped plants it raised--they do not have this warm loop seal in the inlet to the coolant pump to overcome, to guarantee condensing surface, so they only have to raise it about ten feet.

MR. ETHERINGTON: The same distance between--

MR. JONES: That is correct.

MR. MICHELSON: I think the reason for the discussion is this introduction of the idea of controlling on pressure which they didn't mention at all as a part of the process. It was kind of news to me. I didn't go to the last meeting in whatever.

MR. JONES: There is--you try to control the steam generator pressure. There are operator guidelines how you control steam generator pressure. There has been, as was previously mentioned, there has been operating history which indicates too much feedwater will depressure the steam generator, causing overcooling, which is not desirable. There is a specific SPIP recommendation to put in automatic means to limit the flow rates to the steam generators so they don't overcool while still achieving an adequate fill rate of the steam generator, and inadequate heat transfer surface to continue the process.

MR. MICHELSON: The control system is monitoring level as I understand correctly what you were telling me?

MR. JONES: The control systems are, there are diversity in the control system. There are, there is in the EFIC system I believe you will cut back flow in the start to depressurize the steam generator because that is an indication you are putting the more, for the reason you need to accomplish the heat removal.

MR. MICHELSON: I guess we have gone--I understood your other explanation real well. Let's not get into this. I assume that.

MR. JONES: I hope that was helpful.

MR. MICHELSON: We covered this, which this would be a good time for a break I think.

MR. SKILLMAN: Yes, sir.

CHAIRMAN WYLIE: We will take a break, come back at a quarter until eleven.

(A brief recess was taken.)

CHAIRMAN WYLIE:

MR. REED: Can we hit that pressure just one more second? I am hearing something new and I am a bit confused.

CHAIRMAN WYLIE: Go ahead and ask your questions.

MR. REED: All right. I won't read, entirely, reread entirely this statement on page 3-6 of your final report, but it says here that the steam generator level should be controlled to the desired heights above the lower tube sheet to provide adequate natural circulation.

Now you are telling me you control on a pressure. Now what I think you are doing is maybe you are using some form of three element control. Pressure ma be is the key control in fact, but level is still in there I would hope, and flow is in there from the spray.

Now the things that bother me about pressure being so important in this dry element control, if I am reading this correctly, is that main steam, in every B&W trip, I read in your report, now days, main steam safety valves off, okay. Main steam safety valving, and your chart said this are involved in a lot of these complex transients, and they are highly unreliable on receipt, and if a main steam safety valve opens, what does this do to trying to use pressure control as the key parameter?

MR. SKILLMAN: I have made an error in overplaying the importance of pressure. Level is the key element in emergency feedwater initiation and control systems HSPS and emergency feedwater. The relationship between pressure and the heat removal is, what we have found through the sensitivity study is that what is really providing the heat removal is the relationship between TSAT and the generator, and T subcooled primary.

The point I was making in response to your question earlier is the level isn't the most important parameter is what we have found through the sensitivity study, is it is that, it is the differential temperature is telegraphed by the secondary side pressure which is affected in turn by secondary plant relief as well, point out the condition of the main steam safety valves and the emergency feedwater injection flow rate.

I made an error in leaving unchallenged the thought that level is not an important parameter. It is the key parameter in controlling decay heat removal via--

MR. REED: I can't keep from thrusting this dagger into you. I'm sorry about it, but I go back a long way, and PWRs.

Now if you made an erro[illegible] explaining to us, and you had to go back and check it [illegible] other type person, I wonder if the operators really today understand all this and if the simulator is correct, and if this complex control is still, is possibly in error today?

MR. SKILLMAN: I didn't say I made an error technically. I said I made an error in leaving unchallenged the thought that the level is the key parameter. Level is the key parameter, but what we found, I will say it again, through the sensitivity study, is that it is really the secondary side pressure that is, since it is a saturated system, it telegraphs secondary side temperature, which then is the driving head to primary side compressed temperature. That's the point I am making. I would like to go on from there.

MR. REED: It is three element control? Is that what you are saying, three element control?

MR. SKILLMAN: I am not making any statement regarding the design of the emergency feedwater control systems.

Having talked through generally what we were doing on information gathering, I wanted to say to you here is what is in the safety and performance improvement program. We have the system reviews I&C, main feed and feed emergency feed and instrument operating experience of that is the TAP data review, the review of the other transient information, the operations and maintenance personnel interviews sensitivity study, risk assessment. We carry as a major task the duty of interacting with the NRC staff to get a trip initiator review. We are doing operator burden, completed operator burden review. Bob pointed out the emergency procedures review is ongoing. We had as our advisors an independent advisory Board, and we convened from within the B&W owners a safety and performance recommendation integration group that was a team of very experienced operations and design people to look at recommendation package 200 plus recommendations, with the intent of identifying those that were most beneficial and increasing the level of safety of the Babcock plants.

I would like to speak for a minute about our independent advisory board. We wanted the oversight by people who were not commercially related, by people who were not commercially related to the B&W owners or to B&W, and we retained for about a year and a half Bill Lehman from EPRI, Saul Levy from Saul Levy Associates, Neil Toderay from MIT AND Bob Brodsky with Beta. Their involvement was an every two month review of the program in detail. Their mission was to evaluate the comprehensiveness and the safety emphasis of the safety performance improvement program, and basically evaluate the ability of the program to achieve its objectives. And I will talk later about their conclusions.

(Slide)

MR. SKILLMAN: From within our own ranks, that is from within the B&W owners, we convened the safety and performance recommendation integration group, these folks representing each utility in some significant depth. Had a formal charter, multi-discipline, that is, they were operations, design, maintenance, and so on, and they, they provided a concentrated effort of review after essentially all of the data became available for the recommendations were available.

What they were really doing is trying to identify those recommendations the most important and beneficial to safety performance improvement, and they were reviewing the recommendations from the perspectives of operation, safety design and maintenance.

So our position is that we did a multi-system review. We had an independent consultant perform a thorough and exhaustive sensitivity study. We re-reviewed six years of operating data. We went into detail on the issues of operator burden of our operations and maintenance people. We performed a relative risk assessment looking at the category transient C transients against the PRAs that were available. We went to extend those PRAs to plants that did not have PRA. We have used a great deal of input from the staff in terms of sharpening the focus of the program, and we had our IAB and SPRIG input significantly to the program to spread them to its conclusions.

(Slide)

MR. SKILLMAN: I would like to move over into findings and conclusions. Our conclusions are in four basic areas. They have to do with plant safety and design, have to do with the finding on complex transients, and trip initiators. Please keep those separate in your mind. And we have some conclusions regarding the value of SPIP that we think are germane to this discussion.

(Slide)

MR. SKILLMAN: Based on our risk assessment, the work that we did with SAIC regarding relative risk, the risk of core damage is comparable to other PWR designs. We believe it was a very important conclusion because the real thesis of the Stello letter in January 1986 was determine whether or not these plants needing special design requirements are in fact less safe than other plants.

The answer is, in our judgment, is no. They are comparable in terms of core damage.

CHAIRMAN WYLIE: How many of the B&W units have PRAs?

MR. SKILLMAN: Started with two I believe. Now three, Oconee, and Florida each--now TMI-1 has submitted its PRA so that there are three now, and I don't know the status of the other, the other five plants.

CHAIRMAN WYLIE: Are they--you don't know the status?

MR. SKILLMAN: I do not, no, sir.

CHAIRMAN WYLIE: All right.

MR. SKILLMAN: The areas of sensitivity, thermalhydraulic sensitivities of the Babcock plants are different than the areas of sensitivity for non-Babcock PWRs.

A key concern oft repeated situation is the pressurizers on Babcock plants are too small. That is unfounded. Our pressurizers are adequate in size based on whichever parameters you choose, whether it is outsurge following the trip, or any other parameter you might use.

MR. CATTON: I recollect following TMI statements made by PWR operators that they often lost the level following a turbine trip. This is no longer the case?

MR. SKILLMAN: There is still plenty of water in the pressurizer. The problem is the location of the lower TAP.

MR. CATTON: I assume that that way the sense of it is you essentially make your operator blind?

MR. SKILLMAN: It can be. Yes, sir.

MR. CATTON: He has to run the plant and he doesn't know what is going on, so I don't think that is--

MR. SKILLMAN: We will get into this.

MR. CATTON: It is adequate from the thermalhydraulic point of view, but it certainly doesn't seem to me it is adequate from an operation point of view.

MR. SKILLMAN: Okay.

MR. REED: Is it true, and I think it was true back before some modifications that may have been made, that if you trip B&W unit above 30 percent power level the water level in the pressurizers in the first few seconds or milliseconds would go up to a point where it would lift the power operator relief, and then in the next, as spray hit the steam generator tubes, the water level in the pressurizer would go down out of site? Are those reliable statements from two years ago? You go up, lift up the PORV in the first few seconds or milliseconds then the water level shrinks in the pressurizer to out of sight?

MR. SKILLMAN: I would like to suggest that that question come up when Stuart is talking sensitivity because that is probably the more appropriate place to address the way in which the plant responds. Stuart? Is that, can I defer that one to you?

MR. ROSE: To some extent.

MR. SKILLMAN: Operator burden, another item that is pointed to as being extremely important, at the Babcock plant we believe the operator burden is acceptable. Integrated functions of the integrated control system are a benefit. We also understand that when the integrated system, when the integrated control system is the system that has failed, that the operator burden is too great and consequently we are putting a great deal of resources in modifying, considering modifications to the integrated control system to reduce that burden for incidences when power is lost to ICS/NNI or input failures occur.

We retain the basic note that the integration of control functions in the ICS is appropriate. We acknowledge that the plant is more responsive to secondary side changes, and we believe that the recommendation which covers each of these will further improve the safety level of the Babcock plants.

MR. DAVIS: I have a question. Maybe you would want to defer this. I am not challenging your fourth conclusion, the steam generator inventory, but I was concerned about the statements made in B&W 1919 giving the implication that the inventory is, in terms of accident response, is similar to other PWRs, and I recall reviewing calculations on Station Blackout, for example, where as I recall the numbers, there is about an hour available in a B&W plant before core uncovery starts versus three hours for a Westinghouse plant, for example, and as I recall that difference was attributed to the inventory difference between the two plants.

And I am wondering now if you have some other calculations indicating that these times are comparable, or whether the statements in the report maybe are not valid?

MR. SKILLMAN: I am going to defer that to Stuart because that's a, very clearly a topic of the sensitivity study.

MR. DAVIS: Thank you.

MR. REED: Of course, I don't agree with a number of those, and just to hit briefly the top one, just to make a statement, the top one, of course, refers probably to the root issue decay heat removal.

So what you are saying, the risk, the decay heat removal in the B&Ws is as good as the other PWRs? And I have a great deal of problem with that because decay heat removal is for the most part coming from your steam generator complexity.

Now you could have put in your comparison comparing your high set steam generator with the low set, and whether the risk of core damage is better with the high set or the low set. I always wonder why did B&W change to a high set steam generator on the last one or two plants they were going to build or built? Like Davis-Besse and the one out in this, the West there, WPPSS? Why did they change to the high set steam generator? It costs a hell of a lot more to build it that way so why did you do it?

MR. SKILLMAN: The question that you have asked I won't attempt to answer, but I am going to make my comment.

The fact, this fact rests on non-secondary plant considerations, so your thesis that the secondary plant level is somehow inappropriate and therefore this sentence is flawed in this my judgment doesn't wash. The reason that that statement is true is because the PRA, the thing that saves the PRA on a Babcock plant is an operating makeup pump that does not have to answer a start command. Say it began, the things that saves the Babcock plants is the fact that a makeup pump does not have to answer a start command.

At TMI-2, the pump that was secured is the pump that should have been left operating. It was an operating error to shut down the makeup pump, but that's what melted the core. All plants, that makeup pump not answering the start command makes these PRAs, makes these Babcock plants particularly resisttant to core damage. If you trace through the PRA fault trees you will find that this is the truth.

MR. REED: Dave Okrent had a lot of faith in a PRA. He was an operating type person. I have never had any faith in them.

What you are telling me is if the primary makeup pumps are centrifugals and one is always running, and now you get into the situation of whether it is better to have a running component to provide safety, for safety systems, or a stopped component--

MR. SKILLMAN: Operating component does not have to obey.

MR. REED: Path of decay heat removal has the pressurizer loop sealed and low set in the containment and I am not so sure that is a good path decay heat removal.

MR. SKILLMAN: Regarding the complex review of the transients, if you recall when I showed the table, the trip complexity pattern versus the plant trip pattern, we have conclusions in those two categories regarding the complexity of transients. Complex transients are principally the result of mismatched heat balance between primary and secondary.

Again back to the overheating, underheating, overfill, overfeed, the three different categories of significant transients, the overheating events are of greater safety significance, but they are indeed infrequent. The overcooling events may be precursors to overheating because of the way in which the operators interact with the plant. The overcooling events are dominated by misbehavior of the emergency feedwater and the secondary plant relief systems, and we offer that other system misbehaviors is important and therefore must be acted upon, the behavior the integrated control system and the behavior of the main feedwater system.

(Slide)

MR. SKILLMAN: If you ask what is the pattern of post-trip misbehavior, what you find is that the bulk of misbehavior comes from the secondary plant relief. That's not just main steam safety valves. That's main steam safety valves, atmospheric dump valves, and then turbine bypass valves, and when you dig more deeply into that area you find that the bulk of the problems here are maintenance, BOP type care and feeding of those systems type problems as opposed to fundamental design. In the Glenn's thesis, main steam safety valves are unreliable. We find that their failure rate is about one in a thousand.

Emergency feedwater, approximately the same in terms of misbehavior, leading up to the conclusion that these two systems normally act hand in hand post-trip. The ICS, main feed, electrical also contributing to our post-trip complexity of behavior.

(Slide)

MR. SKILLMAN: Regarding frequency of overcooling events versus overheating events, of course these are the ones that is we sense are bona fide safety significant. About 90 percent of our complex transients are overcooling, about 8 percent are overheating, and several percent of the overfill, overfeed. Clearly these, these attract our attention. These are the ones that we are very concerned about.

MR. CATTON: Overfill doesn't lead to problems?

MR. SKILLMAN: Yes, sir, it can. The Rancho Seco event was an overfill event, and that is what we ascribed to them. The importance, that the ones that have our attention are the ones that are, the overheating event as it turns out, the fixes that go with overoverheating type scenarios will fix the overfill, overfed events as well.

Regarding trip initiation, this is the second pattern I have shown as the trip complexity pattern. Now the trip frequency pattern, the majority of trips by BOP systems or BOP components are people, and turbine generator was the dominant trip initiator before 1985. Fixes are in place to address the turbine generator type problems that we have had. The current trip initiator, the dominant trip initiator is the main feedwater system, with ICS/NNI and electrical also important.

DR. KERR: In the listing you did not distinguish between trips that might be caused by testing while the plant is in operation? Have you separated those out?

MR. SKILLMAN: Yes, sir. These are run planned trips. The de-energization of the control rod drive, control rod breakers, these, at power these are bona fide trip as opposed to testing scenarios or start-up and test type functions. These are at power, unplanned trips.

DR. KERR: Well, isn't a trip that is caused by testing or surveillance during full power also an unplanned trip?

MEMBER OF THE AUDIENCE: They are included.

MR. RUTHERFORD: The technician--

DR. KERR: I am just curious about what fraction of the trip may be caused by testing and surveillance as carried on during full power operation, so I asked if you separated those out.

MR. SKILLMAN: These are included in our trip pattern. That would be, we would classify that as a human error.

DR. KERR: Do you have an estimate of what fraction of these are caused by testing and surveillance during full power?

MR. SKILLMAN: Yes, sir. The number is between 2 and 3 percent. Eleven out of 235 is the number that I would offer right offhand.

DR. KERR: Thank you.

(Slide)

MR. SKILLMAN: Conclusions regarding SPIP value, we found the attention that this program forced us to concentrate in the BOP areas to be extremely valuable because we, we found ourselves instead of looking at classical reactor coolant system type problems, looking rather at plant performance and behavior problems which led us further and further and further into the BOP functions, and the BOP design. A great deal of attention on BOP; we thought SPIP was valuable because it reinforced the value of having this TAP data base, but we have found this data base to be, to be tremendously helpful in being able to go back later, contruct patterns of events that can happen in other plant sites in addition to the one where the incident just occurred.

We found value from the point of view of focusing our own people on a common problem. We are implementing the safety and performance improvement program recommendations. Consequently the safety performance of these plants will continue to improve. We have had diverse input, external to the operators group that was valuable. We have been able to gather points of view from our consultants, from our IAB, from contractors that work for us and we have had a very strong involvement by our executives in the ordering of the program, and the running of the program.

I would have anticipated a question what did your advisors tell you? Our advisors started with a basis, with the concern that the program not reduce itself to the lowest common denominator, that in any case where we were developing recommendations or trying to determine where the program ought to go, we had not to do the easy thing. Rather we ought to do the right thing and the hard thing if that was what was needed to get the job done properly.

Following their advice, we ended up with a program which they have reviewed in detail, which they have communicated by letter to our executives, and these are points from that letter; identifying areas for improvement. It examined all factors involved in past complex transients. As of this writing, there were 13 complex transients, 10 from January of '80 to mid-'86 and in addition, the Rancho Seco event in 1978--excuse me--the Davis-Besse event in '78, Rancho Seco in the year before, the year later, and TMI-2, so they were involved, when they say past complex transients, they were involved in unraveling the 13 complex transients, not just the 10.

They found also that the TAP data base had been valuable. They let them understand what the problems had been. Their belief is the action that the operators proposed taking would reduce transient frequency and improve plant safety.

The IAB concurred with our process for prioritizing the recommendations. They accepted that the SPIP goals are achievable. They felt that the schedule as we had proposed was ambitious, and they reinforced the need for persistent management attention by the B&W owners group, executives. They had a concern regarding the specificity of some of the recommendations, that is, the recommendations were cast too generally, and they thought those recommendations should have been cast more specifically.

DR. KERR: Speaking of recommendations that lacked specificity, what is meant by management attention required?

MR. SKILLMAN: The tone of that comment was hey, execs, if you really want to achieve an increase in the level of safety of your plant, you cannot simply take the recommendation package, throw it into your site or throw it into your engineering organization, and say here, do something with this. Your execs need to get involved, your people that you specifically designate to shepherd the recommendations through and cut through all of the fog at the plant sites to make sure that you really do achieve the behavior changes in the plant that you desire with the recommendations. This can't be defaulted to others. You have got to get involved yourself.

IAB told the owners you need to assure that there is a level of quality in the action regarding these recommendations that ensures that the recommendations get done properly, and the issues of the integrated control system and feedwater reliability deserve special attention by the execs. The recommendations pertaining to those two systems need to be earnestly considered. Again, if you were to have asked what did your advisors tell you, what did your advisors tell the executives, this is a synopsis of what the four advisors Brodsky, Bradley, Lehman and Levy, told us.

DR. KERR: Are you going to get to a more specific comment on the feedwater reliability? For example, did you get comments that indicated that one had to make drastic changes in the existing system, or was it simply a matter of more attention or finetuning or these kinds of things? Perhaps you were going to get to that later.

MR. SKILLMAN: I am going to talk about specific recommendations for main feed later, yes, sir.

DR. KERR: Thank you.

MR. SKILLMAN: All right. Finally, SPIP open areas-- need to talk for a few minutes here about open areas per the agenda.

Let me start first by saying where we are in substantial agreement with the staff. In specific, in specific, with regard to the project, we are in agreement on main feed, emergency feed secondary plant relief, instrumentation, operating experience review, other transient information, the operation and maintenance personnel interviews. The sensitivity study risk assessment, we feel we are together with the NRC on interacting with them.

MR. REED: Where were the operations and maintenance interviewed conducted at Oconee?

MR. SKILLMAN: They would be conducted at each plant site, the level of experience by operations and maintenance, both types of people, at each plant site.

MR. REED: I notice you are doing some comparison at Robertson and I wondered if operation and maintenance reviews were done at Three Mile Island, Crystal River, SMUD?

MR. SKILLMAN: Yes. The operations and maintenance personnel interviewe task is different from the sensitivity study task. This is comparative evaluation of thermalhydraulics, babcock versus CE versus Westinghouse.

This is a different task. This is where a team of engineering people went to each plant site, spent several days with operations and maintenance personnel at that site, and with a--real goal was, was to find whether or not there were some transients that were significant that did not result in plant trip.

The real heartbeat of this task was hey, people, we are here to find out if there are things that have happened at this site that aren't somehow communicated elsewhere in the data base, or are there other items here that influence where we are going in terms of the safety and performance improvement program?

MR. REED: And the people that were interviewed were objectively picked out, selected, in that did the management of the plant say we will interview this guy, this guy and that guy? Or did you take all the names in a hat and take the name out?

MR. SKILLMAN: I don't know. Let me ask if there is someone from the owners who can answer that question? The randomness with which the interviewees were selected for the operations of maintenance personnel interviews?

MR. GANTHER: I think in general they were designated by the plant side, but they were like all the operators at this shift, all the maintenance people on that shift the convenience of the interview times, but they would do all the experienced operators on a particular shift. There is some randomness there.

MR. SKILLMAN: Again we are in agreement with the staff regarding our findings, and the recommendations coming from the operations and maintenance personnel interviews. We are together in our finding on the trip initiator review, the operator burden review, and the integration activities. Probably we are together with the staff. We are in substantial agreement with the staff on the overall program scope and breadth, on the process that we used in the program, on the content of the recommendations, on the program management and the administration, and on the findings regarding plant safety.

MR. CATTON: Where did you combine the sensitivity study which was basically thermalhydraulics and operation? Because it seems to me your arguments--put the, put the other one back on for a moment. When you, from what I gather from what you have said, when you say sensitivity study, this was strictly thermalhydraulic. Was there enough water? Aren't there sensitivities that are a result of the thermalhydraulics that enter into operation like shortened up times and having to do things quicker and so forth?

MR. SKILLMAN: Yes, sir.

MR. CATTON: Where do they come together?

MR. SKILLMAN: Right here on operator burden review.

MR. CATTON: Did you do a comparative study there between the three plants?

MR. SKILLMAN: We did not.

MR. CATTON: Seems to me you missed a key issue then.

MR. SKILLMAN: I don't think so. We considered, we considered doing a relative burden review, babcock versus Combustion versus Westinghouse, and we started down that path in early '86, and we stopped and we stopped on purpose because what we said is that what we are going to do is we are going to get into an arm wrestling contest on who has to do how many actions more quickly for what type of transient on which type of plant, and we said to ourselves that's the wrong question.

The right question is do the Babcock and Wilcox design PWR operators have what they need to do the job that they need to do, regardless of what somebody else does in some other plant? And having unraveled that with the structured process using the human factors professional in our own people, we believe we came to answers that make sense. We did find some things that need to be corrected.

MR. CATTON: I guess I just don't understand this human factor business. To me four minutes is a hell of a lot different than having 20 minutes or 60 minutes to do something.

MR. SKILLMAN: Let's get to that on the sensitivity study. Let's don't--

MR. CATTON: The sensitivity study is clear--four minutes, 20 minimums, 60 minutes. It states to dry out, it states it clearly. If you consider that not very sensitive, or not very different, then I just disagree with you.

MR. SKILLMAN: Isn't the real issue what the operator thinks about that?

MR. CATTON: That's right. But you have taken those things apart, and have not addressed that question.

MR. SKILLMAN: In the operator burden review, is we went into each control room with a select number of scenarios and walked each of the teams through those scenarios.

MR. CATTON: But did you ask the operator gee, would you rather have 60 minutes to decide what to do than four minutes?

MR. SKILLMAN: No.

MR. CATTON: Did you ask him that question?

MR. SKILLMAN: No, sir.

MR. CATTON: You didn't do a sensitivity study.

MR. SKILLMAN: Not that way; the sensitivity study was for a different purpose. We had to do this that way was our thesis.

MR. CATTON: The question early on in all of this was or at least the statement that used to be made was that gee, a B&W reactor is sort of like owning a Ferrare. It is a fine piece of machinery but it is damned tough to run and keep running. One of the reasons was, is this difference in times that you have available to do things. I mean I can spend all day keeping my Ford running and it doesn't matter. You didn't address that.

MR. SKILLMAN: We did.

MR. CATTON: You just told me you didn't.

MR. SKILLMAN: I told you we did.

MR. RUTHERFORD: Let me make comment we did address that in the sensitivity study, and one point to make here, and I don't want to dwell on it extensively, is that dry up time in and of itself is not the critical parameter you are interested in.

MR. CATTON: That's true. It is whether or not you have to, have to do something within that time.

MR. RUTHERFORD: You don't have to. We will get into that more in the sensitivity study. That is not the critical point in time where you have got to take action. Okay, and the times you do have to take action are comparable among the venders.

MR. SKILLMAN: Okay. In the past two slides, I have tried to define where we are in substantial agreement with the staff, where are we in disagreement with the staff.

We are in disagreement with the staff in terms of content in the review of the ICS/NNI system review, and we are in disagreement with the staff regarding the use of human factors expertise in the process of going through SPIP. Those are the two areas of all the areas where we have disagreement.

(Slide)

MR. SKILLMAN: And we will talk about those later. Regarding open areas, areas that need to be attended to, we have an open area of implementation of plans and schedules. Each site scheduled for implementation of the recommendations, those are due this summer.

Both Bob and I touched on the issue of emergency operating procedures review. This is where we wanted to go through each of the emergency operating procedures and make sure that they tie in appropriately to the other procedures that are necessary for post-trip response, particularly in the emergency situations. That's due a year from this summer.

NRC staff has requested the TAP annual report. We are going to make that available. It will be available this summer. The valve task force report will be due late this summer. We will make that available when it is completed. And the staff would like the applicable portions of the recommendation tracking system that pertained to the trip reduction recommendation to the SPIP recommendation. We will make those updates available to the staff as they become available.

MR. REED: On item 4, valve task force report, for some time when I was a member of ACRS I tried to get an industry-wide action going to investigate valves and valves that should not be applied to certain duties on PWRs and BWRs and so on and so forth, and I don't know whether that ever got going or will ever get going.

Is there going to be an industry-wide valve task force? The answer is no?

CHAIRMAN WYLIE: Don't know.

MR. REED: I am just wondering, this task force report may become very important because one of the things I would like to see is a resolution of whether or not internal pilot operator relief valves on PWRs with boron and hydrogen are acceptable. You can look forward to questions like that.

MR. SKILLMAN: With that, I am prepared to turn the podium back to Neil Rutherford, or back to the staff. I'm sorry.

MR. JONES: I am Bob Jones from the Reactor Systems Branch, and I had the overall technical coordination of the reassessment review. I am going to go through two items since the owners group has been through both, kind of the overview or summary and conclusions from their perspective, and the information gathering efforts that they went through, so I am going to hit both of those activities one right after the other. First I want to start with the summary and conclusions.

(Slide)

MR. JONES: And something that has been a matter of discussion over the last few hours has been the overall scope of the program. This slide addresses how the staff sees the scope of the program from what was done, but I think a lot of the questions that were raised earlier had to do with the breadth or the depth of the overall programs, so let me first start out dealing with that activity.

Back in January of '86 when Stello wrote his letter, said we were going to go reassess these plants, and there are phrases that have been quoted about the thermalhydraulic designs, basic design requirements, the fact that we have made modifications since TMI and yet we still have these complex transients at these plants, and staff was a bit unhappy about it, but we struggled for a couple of months in trying to define a scope for this reassessment effort somewhat independently from the operators group which we, when the owners group volunteered to take the lead of the program, we provided our program plan so to speak to the owners group for incorporation into their overall program, but to give an impression of how we were going about this, there really are three, I don't want to call them phases--parts, parts to the scope of the program.

First off, why were we concerned? We were concerned not because we had anything we can put our finger on that says gee, these plants are unsafe. We were concerned because we were seeing a lot of transients that we were not very happy with. So right there we made a decision that one of the major factors in doing this review had to be the operating experience of these plants. What was going on? What are the systems involved? And then to take a good hard look at those systems.

Part of that included looking back at some of our concerns raised after TMI and all the related NUREGs that came out at that point in time, and to try to define what issues still appeared to be around. Thus we did not relook at natural circulation because we felt those were adequately being addressed or had been addressed.

We also said that's still somewhat narrow given the directive which we were given by Mr. Stello, so we ought to take a look at or revisit the issue of the sensitivity of the B&W design, and that essentially also came from the operating experience from TMI, so we said we ought to have some comparative analysis, look at, try to understand what actions were required by the operator, what kind of operator burden exists, and whether anything needed to be done in that area. Were there basic design characteristics that need to be dealt with in some manner, shape or form?

Thirdly, risk--as I mentioned earlier, there was a risk assessment done by the owners group. We did our own independent risk work. The risk expert will be here tomorrow, I believe it is along with his consultant, so I may undersell or oversell in his words what was done, but in essence we wanted to make sure that what we had previously concluded so to speak was that the plant, B&W plants do not appear to have as much, have about the same level of risk as the other PWRs, that indeed that was still true in light of the operating experience and that was a major focus of the risk assessment effort, along with trying to look at what is the risk assessment telling us is where the program ought to be focusing? What systems should be fixed? What are the issues? Where could they get the most bang for the buck so to speak?

DR. KERR: Excuse me. I thought I understood you to say that you looked for plant risk primarily using PRAs, and you concluded that the risk of B&W plants was about the same as that of other plants. Is that--

MR. JONES: That was talking to the risk guy at the time, looking at the risk assessments that were available in say 1986 timeframe. That's what they appeared to indicate--ten to the minus 5, 6,

DR. KERR: I just want to make sure I understood it. Then you said something which I thought I understood you to say this was true in spite of the operating experience?

MR. JONES: What we wanted to do was make sure that what we were seeing from the operating experience, that was being properly reflected in the PRAs, that the PRAs had an appropriate basis, that the operating experience didn't say that the PRAs were invalid.

DR. KERR: How would you tell whether operating experience was reflected in the PRA or not?

MR. JONES: At that point in time I have got to step back. I would need the risk expert to standard up here and tell you what was done and why and how.

MR. WARD: Are we going hear that tomorrow?

MR. JONES: You should be hearing that tomorrow. Somebody will be on the phone to tell him that for sure, I hope. You should be hearing that tomorrow.

MR. CATTON: That is an important connection.

MR. JONES: Yes. That was one of the focuses of our effort along with evaluate what the owners group did, which we, we had disagreements with how they did things, ended up doing our own independent assessment as a result of that.

MR. CATTON: Did you try to track through some of the various events that took place using PRA to look at the situation?

MR. JONES: In fact that is exactly what we did was we took the category C events, developed a humongous event tree of I think it was over 200 events. There is, the risk consultant is in now--about 200 events in the event tree, to make sure we could follow those and track them and try to bid all these things and get a relative probability for these things. What it means from a percent.

MR. CATTON: If the risk is the same, does that mean most of those events were uneventful?

MR. JONES: Let me hold off on drawing a conclusion, a specific conclusion on that, and let the risks people do that. Okay, but that is one of the subjects or main thrusts of the evaluation that they did.

MR. REED: I still have a problem as I started out the meeting with this program scope shift. It seemed to me what has happened has been a good job of, as represented by that chart, of finding out what caused the trips, what caused the complex transients and so on and so forth, and you narrow it down then to a system or the main steam safety valves.

Now it seems to me that you dropped from this program scope, this issue of basic, the words basic design requirements, and thermalhydraulic details, comparison and details.

MR. JONES: The thermalhydraulics came from the sensitivity work.

MR. REED: Well, to me it isn't, it doesn't go far enough. The program scope has got to be more operational than statistical and they have got to be design basics.

MR. JONES: This is how we interpreted the Stello letter within roughly two months after it was done, and with the blessing of management that was an appropriate scope for the program.

MR. REED: So there was a change somehow.

MR. CATTON: Are you going to--maybe I should ask you, I asked earlier about the MIST counterpart tests, counterpart to Davis-Besse and Rancho Seco. In fact they really couldn't reproduce them. How much confidence should I place in the sensitivity study, if I don't know enough to run the test on MIST or even get close?

MR. JONES: First off, MIST was never constructed to examine those transients. Okay. I want to make that clear. It was not constructed for that purpose. It was constructed to examine natural circulation, small break LOCA type behavior. That was the basic premise upon which MIST was founded.

Now when we looked at putting together this Phase 2 or Phase 4, depending on what numerical scheme you want to use in dividing up the work, but to follow on this program that's essentially completed now, we asked what tests could we do? And we decided we would try to look at some of these counterpart tests and see how well MIST could produce that behavior.

We recognized that there are scaling compromises made in MIST, and part of the problem I think had to do with those scaling compromises which had to be made. It was not constructed to be a very detailed steam generator simulation.

As far as what I think would be the significant issues you saw from the SMUD test and the Crystal River test, and that's why we have ongoing a discussion with the B&W owners group about the ability of the computer codes, to, to look at steam generator behavior, and we are discussing the need for follow-on testing related to the steam generators, and that's the so-called TAG 2 process, which is currently underway and should be wrapped up sometime this summer or early fall. That program is underway.

MR. CATTON: Why did Idaho use RELAP 5 rather than TRAC which is tuned to B&W?

MR. JONES: If I could hit that when we do the sensitivity, I would appreciate it.

MR. CATTON: That's fine.

MR. JONES: Okay. I would like to make another comment on the response to some, some of the things that Mr. Skillman talked about.

The owners group set a set of goals for reactor trips, complex transients. They also came up with a categorization scheme for the transients.

The staff has never bought that. We have not bought those goals as being appropriate. In fact, what we said was we thought that to some extent, they were not ambitious enough, certainly the goals, and that it is stated in the SER clearly.

The owners group is using that as a measure upon, a means upon which to measure whether they are achieving progress by implementing these recommendations and whether they are indeed fixing the problems they have seen in this plant, and they are probably fine and appropriate for that, but as goals, specifically safety type goals, we haven't bought that. I want to make that clear.

CHAIRMAN KERR: What would you buy?

MR. JONES: We never wrestled with it. We didn't try.

DR. KERR: How did you know it was not a good goal if you don't know what goal you would accept?

MR. JONES: I will give you the area that we basically had our biggest problem with was the category C transients.

DR. KERR: I'm sorry. I am asking a question, and--

MR. JONES: I am going to try to address it. The one we had the most difficulty with--you know, you can't prevent all reactor trips, and a goal of two per year is probably not an unreasonable goal, but the complex transients we scratched our head about.

First off, we had trouble with their categorizations, and in all honesty if I put ten people in the room, I would get ten different categorization schemes.

DR. KERR: I am not pretending it is an easy thing to do. I am simply saying you said that you did not accept their goals. When I asked you what you would accept, you said you didn't know.

MR. JONES: That's right. And then you asked me why.

DR. KERR: No, I didn't ask you. I said how could you decide you wouldn't accept their goals when you didn't know what you would accept?

MR. JONES: Let me give you the--category, the categorization or the, the goals they set for the category C transients in our opinion were not very aggressive, and the reason we came up with that conclusion is what we did was we said--

DR. KERR: What does aggressive mean?

MR. JONES: Let me keep explaining and then if I haven't answered your question, I will try again.

If you took, at the time this program came up and the time they put the categories together, if you took the ratio of number of category C events which had occurred, and you took the reactor trip frequency that had occurred, you would come up with a number that is very much like the .1 of category C events per reactor trip per year, so that effectively if they would achieve their two reactor trips per year, and do nothing else to the plant, you would get the .1

almost by default.

DR. KERR: What does by default mean?

MR. JONES: The ratic would come down to .1. What happened was the ratio of .1 to the two reactor trips comes out to whatever number, .005. If you go back and look at what things were experienced, that's exactly what you had, so if you just reduced the number of reactor trips with the numbers of transients, you are still getting the same percentage of complex transients.

And we said gee, that doesn't seem like a very, that doesn't seem like you are trying to attack your complex transients other than trying to reduce the number of risk trips you are getting. If you wanted to make sure, we thought there ought to be a low goal for complex transients to assure they were aggressively seeking fixes to the causes of these complex transients. Let me also--

DR. KERR: Suppose you didn't have any trips and therefore had no complex transients? Would you still insist on the same ratio?

MR. JONES: That's an undefined, but--

DR. KERR: To me, it seems to me the important thing is how many complex transients you want to, events or how many trips, and this seems to me to be relevant. It seems to me the ratio is relevant.

MR. JONES: What we were concerned about when these goals were constructed was that if your reference were placed only on reducing the number of reactor trips, you still haven't really taken care of maybe some of the fundamental design characteristics that are leading to these complex transients.

Now I would also want to back up and say while that is their goal, okay, the way they went about the program is they did look at what caused these complex trips so had the goals almost to a large extent become irrelevant, but I did not want to leave the impression that we bought the goals as appropriate levels of safety. We never tried to tackle the issue. We didn't try to tackle the issue.

What we tried to do was look at are they looking at the right systems? Are they looking at the behavior problems in these plants? Are they fixing the right things and are they doing a, a fairly broad scope effort in looking at those systems? That's what we concentrated on, not whether these goals made sense, or whether they would achieve the goals.

DR. KERR: You didn't care about how many trips or how many complex transients you had, as long as they went about it in the right way?

MR. JONES: That's right. That's right. Rather than knock your number, let's go look--

DR. KERR: We are more interested in procedure than results? Is that a fair statement?

MR. JONES: No. No. We are interested that they get what--we are not looking at a number which says this is what is acceptable, but rather what we were looking at is are you fixing the things that are causing you problems?

Now that will give you some number, and the owners group has stated that they will continue to try to improve these plant performance, and that their real goal is to get them down to zero ultimately, but under that base, we said okay, let's not argue numbers, let's argue what you are doing in the program.

DR. KERR: But if you don't look at numbers, how will you judge that the program is accomplishing anything?

MR. JONES: That's what we set the goals, as a way of seeing whether you are making progress and whether you are, whether you are really making improvements in the plant.

This type of approach makes sense. What we did not want to do was argue specific numbers. That's the point. The goals are fine as having something to kind of look at, make sure you are going in the right direction, have some way of measuring you are going in the right direction. We think that is a good thing to do.

MR. WARD: That's what goals are usually for, isn't it?

MR. JONES: What we didn't want to do is start arguing is that the right number? Because you know, it is is

.1 complex transients up front the right number to shoot for? We hadn't done the risk assessment work to say that is the right number to shoot for. We hadn't figured out from a risk assessment up front whether the complex transients as defined made any sense from a plant safety standpoint.

DR. KERR: Let me hypothesize something. You said that zero was not an appropriate goal. You said--

MR. JONES: It is a good goal. You are never going to achieve it.

DR. KERR: You said two was not an appropriate goal because it is too big.

MR. JONES: I said two is probably a reasonable goal for trips.

DP. KERR: That leaves only one number it seems to me.

MR. JONES: We said two is reasonable probably for trips, and it is consistent with the industry kind of goal standard so to speak. We thought that was okay, was a complex transient that we didn't want to really argue that much about, partly because then we had to get into the definition scheme. That was the other thing I wanted to get into, how they categorized these things, A, B, C.

There were tons of comments as to whether those were the appropriate ways to break it off. We did not try to resolve whether A, B, C was appropriate, because the owners group, we asked the owners group does that measure it? They have said no. We said fine. You are not going to use as measure of safety ARTS. That's fine. And what we were concerned about was gee, are you looking at all these transients which indicate off normal behavior? Don't restrict your efforts to just the category Cs, and they didn't.

When they did look at the, where the problems were happening, they looked at the Bs and the Cs. We said given they are looking at all events that progress beyond what would be a normal expected transient, let's not argue with it. They are looking at everything that we want them to look at, so let's not quibble over the details. And that's what we did, but I didn't want to leave the impression we bought that.

Now just going back to how this slide is put together, it has kind of already been covered. We did--as noted already, there was a lot of emphasis placed on balance of plant systems within the program. We did interact with the owners group continuously throughout the entire program. These were in working level meetings and formal communications, letters, questions, back and forth. We believe given the scope of this, the interaction, with the staff, that the overall program was comprehensive.

Looked at thermalhydraulics, tried to l[illegible] at the other, it tried to look at the systems that were [illegible]blematical at the plants. From that standpoint we thought the program was comprehensive and we think the recommendations that came out of it will improve the safety of B&W plants. We will get into a few specifics in a few minutes.

MR. CATTON: When you did this, you didn't find that it was a little disconcerting that the pace was much quicker with the B&W reactor?

MR. JONES: We will talk about that in the sensitivity.

MR. CATTON: I am just asking for a yes or no.

DR. KERR: What was your question?

MR. JONES: The answer to that is to a large extent, no.

MR. CATTON: We have been discussing the sensitivity issue off and on. It is focused very tightly on thermalhydraulics, and that's all it looked at, and the fact when it dries out in four minutes rather than 20 or 60 minutes, doesn't seem to ring any bells with anybody, so I just keep trying to get them to focus and tell me the fact the operators can do things quicker doesn't matter. It does matter, and I have not been able to get an answer.

MR. JONES: The answer is it does matter, to some extent, and it was reflected in the PRAs, and from that standpoint, although they did have some things they have to do quicker, it is not a problem, a large problem. I mean you will find from the PRAs that one of the things is, improvement of the operator performance is one of the areas that would improve the risk of these plants.

MR. CATTON: I have found in the Idaho report--I am not sure which volume it was where they discussed the fact that there was, that one had to incorporate a factor of ten to 40 on the operator error rate.

It seems to me a factor of ten to 40 on operator error rate would make a big difference between plants and somehow this quicker pace certainly should impact on that and that ought to be a, a number that you could track right out the end on the PRA.

MR. JONES: Yes. I think the PRA did that, and he will address it. Okay.

Now one of the things, while we were in a lot of agreement with the owners group as their chart indicates, what their chart does not indicate, however, is we had a lot of comments that they did not incorporate.

DR. KERR: Wouldn't you have expected them to incorporate all the comments?

MR. JONES: No, not all of them, but we had them looking in the ICS--

DR. KERR: They were comments that should be, have been incorporated, or throw-away type comments?

MR. JONES: There were some comments which arguably they should have incorporated.

DR. KERR: The fact they didn't incorporate all of them is not the issue. The issue is that they didn't incorporate some that you felt they should have?

MR. JONES: That's right.

MR. WARD: Did they know which were which? Did they have a way of knowing which were which?

MR. JONES: Well, I think, I think in the area of the ICS, in all honesty, I think almost every single one of those comments in our opinion were very valid comments that should have been incorporated.

I think there were some of the earlier comments, the very early comments associated with the negotiation of the scope of the program, which where they told us we are not going to do something, it didn't bother us a hell of a lot, okay, at that, you know, recognizing we are in the negotiation phase almost at that point in time, so we were pushing the boundaries of their program as far as we could push it to try to look at as much as we can, and get as comprehensive a review as we could.

So either that was kind of, you know, almost negotiating room. The more detailed comments that came through the meetings, through the interactions, the letters, those were comments we believe should have been incorporated, all of them.

They, we think because of that, we are going to see some problems in these same systems that are causing problems today that we have known about, and seen.

CHAIRMAN KERR: You are convinced all of these comments would have improved the system had they been incorporated?

MR. JONES: We think if they were incorporated into the original program scope--these were more scope questions to a large extent. It would have improved the system.

DR. KERR: I thought you were talking about changing or something that would be made to the reactor?

MR. JONES: No. Most of our comments were not of the changed nature. Most of them were of the nature of in your ICS review, ensure that you relook at your responses to INE bulletin 79-27 and assure that you have proper fixes for that. And we will get into that that's one of the so-called significant issues. We think because of that some of these concerns may pop up again which we have known about which we have expressed.

DR. KERR: It isn't what is finally done to the reactor, to the operation of the reactor, that you have concerns about? It is the description of the program that you are concerned about?

MR. JONES: No. If you don't define your program, you can't--if it is not included in your program, you can't fix the issue necessarily. Okay.

You will see that when we talk ICS. You are going to see a series of concerns that we have expressed to try to see whether they were resolved, and you are going to see the answer is a mixed bag. All the old concerns we have identified in the ICS/NNI, not all of them are going to be addressed.

DR. KERR: See--

MR. JONES: And therefore, those concerns are not going to be resolved, and you are going to see or it is likely, there is some additional likelihood because the program didn't look at it, that the fixes you have come up with aren't going to fix some of those issues and you are going to see those very same types of transients that you have seen before.

DR. KERR: It is entirely possible it seems to me in my own experience in reading various generic letters and issues, that over the course of a few years, perspectives change, perspectives change and the perspectives of the staff, and to ask that one take into account everything that has been written over a period of four or five years may involve taking into account even contradictions, and I am trying to find out whether--

MR. JONES: I don't think that was the case.

DR. KERR: Trying to make certain they satisfied a number of publications or whether they attacked the problem appropriately, and it seems to me the two are not necessarily parallel.

MR. JONES: When you hear the ICS/NNI discussion, I will know--I haven't looked through the owners slide, but I know the approach we use, and I know the approach they generally use. Their first things that they did was to come up with a set of design requirements for that system. We have a set of concerns that have, we have seen with experience of problems with the ICS. We would think that those concerns should, resolution of some of those concerns should be embodied in this design requirement.

The design requirements document is then where they took the plant designs and compared to, said this is what we are missing at this given plant. Therefore, these are the types of things we have got to fix.

Now if you haven't assured up front these concerns were at least examined in the process, then your design requirements are somewhat inadequate, and then we are saying that you have not done as comprehensive a job of looking at the ICS, for example, as you should have done.

DR. KERR: You feel that either the staff understands the system better than the owners group, and therefore the owners group is not capable of defining requirements, or else they have deliberately left out something?

MR. JONES: I will leave that to both sets of experts.

MR. MICHELSON: Don't leave the slide yet.

MR. JONES: I think the very specific issues I am going to back down, but I think yes to some extent, that's where we have some disagreement. As noted on the content of the ICS/NNI review, there are substantial issues--I don't want to say substantial--there are issues on content.

MR. MICHELSON: I have a real problem with program scope. I read the Stello letter that talked about a need for a broad evaluation of the B&W design. It addressed the staff by saying the staff will reassess overall safety of B&W plants, so overall safety to me maybe means a little differently than it does to you. I read it as being transients and accidents including external and internal initiators.

If I really want to talk overall safety, that's beside the point a little bit, and then I go to page 9-86, your staff evaluation. You indeed point out some shortcomings of the, this whole business. When you read the analysis, where I am addressing only sequences similar to category C events, that have already occurred at B&W plants. "Results therefore do not reflect the contradictions of other important initiators such as the loss of off-site power, loss of service water, or external events."

Then I go on to page 9-9, and it points out a general finding. It says, "Of significance is the finding the B&W event trees are not fully representative of the observed category C events." Let me finish. That is, there does not exist on the event trees a clearly identifiable sequence which adequately represents the observed scenario for each of the category C events.

Now these are bits of information which lead me to believe that you really haven't assessed the overall safety. It is extremely important areas that you have not addressed even to the extent of saying why you didn't address them. You just put it in as one place, buried and forgotten.

You know, what, what happens? Am I to believe that you are really assessing overall safety or am I to believe you have only looked at certain transients that to determine what their safety contribution might be? And besides that, on the previous page you say these weren't all that important anyway, because it says category C events are not likely to be significant contributors to core damage frequencies for Oconee, Crystal River, ENO, Rancho Seco, particularly when compared with other potential contributors such as Station Blackout, loss of service water, or external events. You have looked at a minor part. You admit you have looked at the minor part, and you haven't really addressed what you think is the major part of this problem, and that's assessing overall safety, and I say no, I just can't, can't buy it.

MR. JONES: I gave you the scope. We used six and--

MR. MICHELSON: You didn't justify why you didn't do what Stello told to you do.

MR. JONES: As I said, we put that program together in 1986. His assistant was involved in it, and we never got any comments as to the scope of that program was wrong.

And in fact, one time we got told that some places we were going to look we shouldn't look, so I think to some extent it was looked at, and felt that the scope was appropriate, and I would have to assume after the Stello letter, or close to the Stello letter, it was deemed appropriate scope.

With respect to your very specific comments, I would like you to if you want address those to the risk assessment person tomorrow. He will be there, but I do want to note that a lot of the deficiency you are noting which were with respect to what the owners group did, we have at least partially compensated for by doing our own detailed independent risk assessment. That's one of the reasons we did it.

MR. MICHELSON: I don't dispute that. I don't find in here you went back and looked at yours, for example, as external events. I think you said earlier you didn't, you didn't cover that one.

MR. JONES: No.

MR. MICHELSON: How about the case of pipe breaks outside of containment? Did you do an analysis of those?

MR. JONES: No.

MR. MICHELSON: This to me is what overall safety is about. It isn't just about transients being the only contributors to risk. It is one of the contributors maybe, only a minor one. You kind of admit on page 9-7, you said really these are the minor ones.

MR. JONES: We looked at why are we in this program in the first place? We are in here because of the operating experience. Therefore, our primary thrust was the operating experience.

MR. MICHELSON: Then I think Stello ought to, well, when we write a note, I think the Committee ought to point out whether or not they think you reassessed the overall safety or not. Overall safety to me means a lot more than transients.

MR. JONES: That's fine. I just wanted to give where we came from and make sure it was clear that is the scope of our review, and that's what it was limited to.

MR. DAVIS: Isn't it true, though, that you do have as part of this exercise, some PRAs for B&W plants which have looked at all of the initiators, and those PRAs are not showing significant safety problems?

MR. MICHELSON: You better go back and look carefully at how well they model external events before you say they looked at external events.

MR. DAVIS: The Oconee PRA is considered a state of the art PRA and did look at external events, and did in fact find initiator that was important and fixed.

MR. JONES: We did look at the existing PRAs. Okay. Now as to the extent of those, and the details of those PRAs, hold your question for the risk expert, please. Okay.

MR. SIEGEL: Can I make a suggestion? I understand the frustration apparently of the Subcommittee on these issues because since we have started this today, Mr. Reed and Mr. Catton, and Dr. Michelson have expressed a concern in their particular areas.

But it would, I think a major point we understand, I think you ought to make it your letter. I think you really ought to try to assess the program on the merits that it has and not try to make it what it isn't, and you should make that point when you send your letter to Stello.

MR. JONES: Now just to give you a flavor of the review, and that's the only purpose of this chart, these are the systems that were looked at, as part of the overall program--turbine, main feed, ICS, electrical valve, et cetera. These are the approved, number of approved recommendations in the B&W recommendation tracking system.

These are the number of key recommendations which were identified by the owners group. The high priority recommendations are additional recommendations and the staff looked at them, that we thought ought to be given a high priority attention in their implementation phase, and those were outlineed in the report.

We had some disagreement with some of the recommendations which are noted in, in the SER, and we have provided some additional guidance, comments, on the number of recommendations, roughly along here, and again you can see the one that is the, well, we have had the most difficulty with was the ICS/NNI. The next five slides kind of go through some examples of what are key recommendations, what are high priority types of disagreements and guidance we have.

I am not going to throw those up. They are simply there to provide you an overview to the flavor of the evaluation and the recommendations that came out, and you will hear more about that I am sure as you go through the detail, specific comments of the review and can use that as a hit list if you wish.

(Slide)

MR. JONES: For any you wish to understand further; I would like to drop, however, to put a perspective on the program, and where we come out with this thing.

This is somewhat different perspective than is provided in the summary inclusion section of the SER, but it is not inconsistent with it by no means.

What were the significant improvements that came out of this program? We saw a couple of things. Number one, a lot of the most difficult transients that have been encountered on the B&W plants have generally been in response to ICS/NNI failures, difficult from the operational sense, and causes a lot of plant and equipment to go to some strange states.

There have been, there are two recommendations.

CHAIRMAN WYLIE: I think they are very key, associated with improving the response to ICS/NNI failures. One of them is the concept of known safe state. This is if the ICS loses power, you will specify failure states of equipment, so that the transient is basically benign, so you should not have things like the Rancho Seco event of 1985.

Recovery of ICS/NNI power also can cause equipment to move to some strange states, require some manual actions, rapid manual action by the operator to put it back in manual, and take control of the plant. It involves, said that the plant will stay in known safe state when you put the ICS back if you lost power and start to put back components. We think those are significant.

MR. MICHELSON: On the known safe state, one of the problems we have observed in LERs is the equipment doesn't necessarily see a total loss of air pressure, for instance, or total loss, but rather sees a degradation of the air supply or the holding supply or whatever, and those lead to yet other states which are not necessarily safe and are not necessarily included in the analysis.

MR. JONES: I understand that, and we have some comments on known safe state. We think the concept, we think the concept is very good where there are a lot of things embodied in that concept such as the operator shouldn't have to take actions that are abnormal from what he normally takes. The response for reactor trip; we are not sure all plants can achieve this right now, and we would like them to pursue that and make sure that that is what happens.

Again, if you want to get at level detail on the concept of what it covers and doesn't cover, I think the ICS/NNI expert is here, but we have had comments on known safe state. We think the concept and what has been done are vast improvements. SMUD implemented this, and we think, I think we are generally happy with it.

MR. MICHELSON: As I recall, that the Crystal River event, loss of voltage, kind of caused serious control instruments to fail. Some fail upscale. Some fail downscale.

MR. JONES: That's the question that's embodied in this known safe state.

MR. MICHELSON: I think what you are saying is that they have gone through and reanalyzed all of these situations so that they know better just what their state is on this kind of condition if it develops?

MR. JONES: I would rather have the ICS/NNI expert answer that.

I am not sure that is totally a true statement. I think it is, this is the recommendation is to make the modifications necessary to achieve the known safe state. They haven't defined it, or what those specifics are, and there are plant to plant variations that would have to be considered anyway.

MR. ETHERINGTON: These are necessary recommendations at the time. Do you think some of them should become requirements?

MR. JONES: These the owners group recommendations.

MR. ETHERINGTON: Yes, but do you think any of them should be requirements?

MR. JONES: This program was, was initiated as a cooperative program. We did not and have not decided to make any of these requirements at this point in time.

However, we have full intention of following up, monitoring their program and assuring that these are implemented as Mr. Siegel will talk about, including going out to the plants to audit the fixes that are out there, and if we find that they are not doing an appropriate job, we will take whatever necessary regulatory action is required at that time.

MR. SIEGEL: In answer to your question, the operators group or the utilities through the owners group has committed to implement all the applicable recommendations for their plants.

MR. ETHERINGTON: The individual--

MR. SIEGEL: Yes, through the owners group; the owners group is monitoring their, them and how they are implementing these recommendations. They will probably, we will get it in more detail later, but they have that commitment. We don't have any requirements, but so far, from what we have seen, they are following through on those commitments. We may disagree on the times, but that is another issue.

MR. JONES: Another area we think they have made progress, this integrates several of the actions they are taking, is in the area of the heat sink reliability. There has been a lot of discussion this morning about the heat sink.

In the B&W machine, there are basically three means of decay heat removal available. Initially it is the main feedwater system. If that reactor trips, they will run back main feedwater, attempt to use the main feedwater system. If the main feedwater system is unavailable, then they would go on to the emergency feedwater. If the emergency feedwater system is unavailable, then you would end up in the feed and bleed type mode.

Now they have, there are numerous recommendations.

None of them are listed here as far as the detail, but there are numerous recommendations to try to keep the main feedwater system on line, and that includes the control aspects from the ICS controller valves in the main feedwater system, to ensure proper runback of one feed pump trips the other, handle the load without the plant tripping, for example.

There are EFW reliability improvements. There are several issues associated with the ensuring that the secondary pressure control is maintained where you would like it to be. And then there is, there are, have been problems with motor operated valves, which there is an INE bulletin on. I can't remember the number, but there are actions being taken by the owners group with respect to valves which will have impact on the HPIS system, makeup system, et cetera. These will enhance the heat sink availability.

MR. REED: But I believe in that chart of equivalency with other PWRs that Mr. Skillman showed with about six or eight bullets, and the bullet number one was, said that the B&W system was more adequate on, was, had less risk on core damage than the other PRAs, or implied that.

Now I would like to find out if the staff agrees because it is a very important statement made by Mr. Skillman. I challenged his statement us because of the complexity of emergency feedwater on the secondary side. He said we didn't use that. What we based this adequacy on was the primary plant bleed and feed system, and then he said the primary plant bleed and feed system gets its water from the makeup pumps, the primary makeup pumps, charging pumps which run all the time. Only one is used and therefore, this always running system, pumping system, is more reliable than the other PWRs who have them shut down and swing them into service.

Now that was a very, very key statement, and I think the industry from my some 35 years in it has struggled with whether or not a system at rest is more reliable than a system operating or pumps and equipment operating.

Do you agree with Mr. Skillman that a system operating is a more reliable safety system than one at rest?

MR. JONES: If you would hold that to the risk assessment expert, but I will say I don't think the staff is saying that we think the B&W plants have less risk than the other types. I think what we are really saying is they are comparable at best.

MR. SKILLMAN: That's what the slide said, too.

MR. JONES: Okay. That's where we are at.

MR. DAVIS: May I ask a question about a specific transient?

MR. JONES: Sure.

MR. DAVIS: Under Station Blackout conditions which are generally found to be fairly significant in terms of risk, you're left with really only one way, one means of removing heat, and that's the emergency feedwater, is that correct? You can't operate high pressure injection under loss of all AC?

MR. JONES: That's right.

MR. DAVIS: Now do you know if the B&W plants go into a cooldown procedure upon Station Blackout conditions?

MR. JONES: We did not examine Station Blackout in this thing, in this program, and that was by choice. The reason for it is it is an ongoing generic issue, and therefore, we didn't see the need to incorporate--we would have to accelerate to make a decision on this plant as opposed to anybody else's plant. We did not see any particular reason to accelerate it for the B&W plants. Therefore, we let it go as part of normal resolution in the, on the Station Blackout issue.

MR. DAVIS: You don't know what the procedures are for Station Blackout?

MR. JONES: No.

MR. REED: I have got to get something straight. Did you say that the high pressure safety injection pumps would not have power on loss of AC and does that mean that these charging pumps on the B&W system, these primary makeup pumps would not have AC power on loss of outside AC?

MR. JONES: No, no. He was talking about Station Blackout outside, all AC. That's what I was answering. Okay.

The last one was they are making, there have been numerous recommendations associated with the instrument air system which we think are significant improvements to the, improvements in the plant, but there are other improvements which we think are important, but we don't want to, we didn't put them in a significant improvements category based on judgment.

There are, again there are numerous actions defined in the program to reduce reactor trips, to input signal failures in the ICS by hardening signals, improving maintenance, and tuning of the ICS. Run through some of the more benign transients, main feedwater system improvements so they can run back and handle loss of single main feed pump and turbine system which has been a cause in the past of numerous reactor trips.

We think that we are going to reduce challenges to the safety systems by improving the main steam pressure control. You won't depressurize the steam generator, less likelihood of challenging. HPI system, again reducing overcooling, associated with main feedwater in EFW; again it is to keep you down off the, off the high pressure injection system and in fact, part of these, in reducing reactor trips, will keep on the main feedwater system; also reduce challenges to the emergency feedwater system.

Improvement in response to ICCS are going to start challenging the safety systems in the plant. There are again operator burden issues and operator performance issues where there have been a bunch of recommendations made which we also think will improve, will decrease reliance on the operator by decreasing the number of events.

Finally, we think that it is also going to reduce PTS risk. The largest problem with these B&W machines is they are really prone to overcooling. A lot of these actions will help mitigate that or keep it under control.

(Slide)

MR. JONES: That's the good news. What is the bad news so to speak? What do we see as the significant issues remaining from this program? Implementation--progress may be fine and it may have all the right stuff in it, but if it doesn't make the hardware changes and sortware changes, you haven't got anything except a pile of paper. That's the key--Implementation.

And what we intend to do is to monitor the plans and progress, monitor the recommendations, track system reports that will be provided by the owners group, and we are going to go out and do some plant-specific audits, do some inspection.

Human factors issues, there has been some discussion on that earlier. In the area of human factors, there have been some significant human factors improvements. Okay. We are not saying that what they have done isn't good. We are just not sure it is far enough. They didn't have a human factors expert involved in their program, and as a result, we are not sure how deep they could have gotten into the overall issue of the operator. We think they could have done more, and we have suggested they go back and look at what they have done with the human factors expert and the data they have gathered as part of their various tasks under that issue, we have rejected it at this point.

(Slide)

MR. JONES: Finally, the one I mentioned earlier, INE BULLETIN 79-27; this bulletin came out after the Oconee event. As I understand it, there was supplement that came out after the Crystal River event in 1980. This issue is basically the assuring that the plant responds reasonably and you have adequate instrumentation and such to respond to a loss of non-class 1A instrumentation and power system buses during operation. The Rancho Seco event clearly indicated that modifications that have been made at the plant may not be adequate.

Now how widespread that is, we weren't sure. We have looked at INE Bulletin 79-27, wrote it off back in 1981, '82, in that timeframe, but given Rancho Seco which was also written off, we said, gee where do the other guys stand with relation to this bulletin? So we requested them to incorporate that as part of their overall ICS/NNI system review.

They didn't do it. Their claim, and to some extent it is a correct claim, it is plant-specific, and the modifications were plant-specific, but we wanted to have some assurance that this issue has been resolved. We think that if you resolve 79-27, and fully incorporate this issue of known safe state, the recommendation known safe state, you have essentially resolved your ICS/NNI problems, the major ones.

Given that the owners are saying essentially that 79-27 is resolved, from their perspective, what we are going to do is we are going to allow, as part of the audit process, we are going to look at how they resolved 79-27 and take whatever action is appropriate to assure that it has been implemented properly.

We think that will go a long way to assure that the ICS/NNI will be resolved. That summary conclusions--information gathering--this is real short. The owners have described earlier their activities that they used in gathering information to determine where should you go with this program?

The staff, the staff's activities in this area consisted of two things. Number one, we looked at what they did. They produced some reports. They went through in detail the TAP report and made some recommendations. We looked at that.

In addition, to provide ourselves some assurance that what they were looking at was appropriate, we went in and we audited about 40 of the 200 TAP reports. We also looked at the yearly summaries to get overall perspective of the type of problems that we were seeing at the project. We looked at our previous concerns from NUREG documents that were produced in response to these various events.

We asked the regions what do you think is wrong with these plants? Some of those we incorporated as part of the review effort. Some of those we passed to the owners group as comments, as staff comments. We looked at whether or not there was any specific actions that haven't been done similar to Rancho Seco and not having EFIC installed as of 1985, see whether there was anything outstanding we thought we needed to accelerate, and we looked at the Davis-Besse decay heat reliability improvement program which they did as part of their restart effort, to see whether there was anything in there that we ought, that ought to be generically considered by the owners group, and we found there were some and there were--and some of the other were very plant-specific modifications, but a number of them were indeed already beingg developed on the part of the owners group program.

DR. KERR: So far you have described this activity as if you sort of lumped all the plants in the same basket. Is that a fair assessment? You sort of considered all of these B&W plants as being about the same level of performance?

MR. JONES: I don't want to put the word we thought they were about the same level of performance because that is not what we did.

What I would rather say is there may have been experiences at other B&W plants which may be just as valid on another B&W plant and therefore ought to be looked at for generic implications. That's what we did.

DR. KERR: Well, emphasis seems to be on the plants.

MR. JONES: Yes

DR. KERR: Rather than on the operating organizations.

MR. JONES: That is correct.

DR. KERR: And it occurs to me that both can have significant influence on plant operation and yet the emphasis seems to have been almost entirely on the plant.

MR. JONES: We will be discussing that in I guess a few minutes when we talk about the concerns, the previous staff concerns. That was one of your issues that you raised, but that was not part of SPIP, not part of SPIP or the, our overall evaluation. The owners group did not do that, nor did we. I tell you that we didn't do it. We will talk about it in a minute.

MR. ETHERINGTON: I think this didn't apply to--

MR. JONES: Excuse me?

MR. WARD: How did we meet that?

MR. ETHERINGTON: I can understand that the owners group working together would not want to be critical of each other, and taking into account the plant operation, I think the staff should--

MR. JONES: We will talk about that in a few minutes, but we did not. I am not hiding anything. We didn't do it.

DR. KERR: The fact you did not must imply that you don't consider that important in plant safety?

MR. JONES: Boy, I wouldn't want to touch that statement with a ten-foot pole.

DR. KERR: You have got to touch it--

MR. JONES: I don't want to agree with that statement is what I am saying, but it was beyond the scope of this program I will tell you, but I agree. I would totally agree that the operating organization does have bearing on the safety of a plant, but we did not look at it as part of this program. We did look at plant, the design characteristics of the plant, and that was the decision made up front. We thought that we already had ongoing mechanisms, SALPs, et cetera, which we could monitor the plants and the operating organization. This effort was focused on the system.

MR. ETHERINGTON: Maybe the question is whether there should be an extension.

MR. RUTHERFORD: If you look at experience with SMUD and Davis-Besse, the staff has been heavily involved in the revamping of the operating organizations for those two particular plants, and I think that's the appropriate way to handle it. It is a plant-specific issue if you will versus an owners group issue. We do some things in the owners group as far as looking at each other, and I will talk about that later, but I think it was handled appropriately by the staff in those two instances.

MR. JONES: Now in light of what we looked at from the information gathering, what did we come up with? It really is fairly simple. Given all the words that are up there, what the bottom line is, is the operating experience was, did provide, or the looking at all this information, did provide us the assurance that the overall direction of the program, the systems being chosen, the type of things that were being looked at, were the appropriate things to look at. That's the bottom line. And that's essentially what we did. We didn't find anything glaring that was missing from the standpoint of the operating experience, and it was a broad-based thing that looked at various things.

MR. REED: But in your comparative studies, you picked out three plants--one CE. one B&W and one Westinghouse, and I think I can say that certainly the B&W plant picked was not, not a Davis-Besse--

DR. KERR: I can't hear you.

MR. REED: Was, the plant that was picked was not a Davis-Besse or a SMUD. You picked Oconee for your comparative PWR. In my opinion, the Oconee plant, the oldest, the most seasoned operating organization, with their best history perhaps isn't the one that should have been picked for the comparative conclusions.

MR. JONES: When you say from the standpoint of sensitivity or the risk, Glenn, because I am not, if you talk about it from the sensitivity, that's not, that doesn't mean anything to us because we weren't looking at the operating organization nor the operating history.

We are trying to find out thermalhydraulically their significant design difference in response, and the, to be honest with you, I don't see tremendous differences between the Oconee or SMUD or Crystal River, and to a large extent, Davis-Besse.

MR. REED: There is even a design difference that Oconee has a dedicated independent afterthought decay heat removal system.

MR. JONES: That was not credited for, in looking at the thermalhydraulic, thermalhydraulic design characteristics.

MR. SKILLMAN: Could I please make a comment? We did not only consider Oconee in the sensitivity study. We included Davis Besse, TMI-1, and Arkansas, in addition to

Oconee, and so we have represented the raised 'oop 177, modified 177, TMI-1, Oconee, and original 177, and Arkansas, classical 820, 177. I think the sensitivity study did a fair job of looking at a spectrum of current design Babcock 177s.

MR. REED: You had design aspects in here, and you did you certain comparisons, and you had people, operating organizations aspects in here, and you did certain comparisons.

Were those separated out clearly in your final conclusions?

MR. JONES: When you said we looked at people, you mean from the operator burden perspective. That was covered under the operator burden st[illegible] and we will be discussing that in more detail later, how those were separated.

We did look at a global operator performance aspect as part of the sensitivity study where we looked at time to do actions, et cetera, and whether it indicated anything with respect to an operator, and that was also translated into part of the overall human factors assessment which will be discussed later.

With respect to risk, we did attempt to come up with some quantification of the differences between the plant, but that is quite difficult given that we did not have full PRAs for the plant, but it does provide some additional insight, so we did try to account for specific plant-to-plant design differences as best we could, and the risk person will talk about the details of that as you deem appropriate, or would like to pursue further.

That's it for me.

CHAIRMAN WYLIE: Okay.

MR. REED: Lunch.

CHAIRMAN WYLIE: We had one item before lunch. I will leave it up to the Subcommittee. Do you want to pick up anything, or want to go to lunch?

MR. WARD: Let's go to lunch.

CHAIRMAN WYLIE: Go to lunch. We will be back at, in an hour.

MR. REED: One-thirty.

(Whereupon, at 12:35 p.m., the meeting was adjourned, to reconvene at 1:30 p.m. the same day.)

A F T E R N O O N S E S S I O N 1:35 p.m.

CHAIRMAN WYLIE: Let's resume the meeting, and we are going to pick up with item 4 on the agenda, disposition of previous ACRS concerns from the July 16, 1986 letter, and I call on Mr. Rutherford.

MR. RUTHERFORD: Okay. After our previous meeting with the ACRS back in 1986, the Subcommittee wrote a letter to Vic Stello, and in that letter they expressed three concerns.

First of all, they expressed a concern about the effects of the operating organization on the system performance, and we touched on this a little bit this morning during the discussion.

Second of all, they expressed concerns about how the unique features of the B&W plants were going to be characterized, and then noted the attention that we ought to be paying to decay heat removal.

(Slide)

MR. RUTHERFORD: First of all, for the question about management, certainly we agree, we agree that management plays a key role in the safe operation of any facility. I think it is, like we said this morning, it is something that, though, that was beyond the scope of our particular program as far as plant performance. We have dealt with that issue at the Executive Committee level in that each executive recognizes the interdependence that we have and the effects that an event at one plant can have on all of us in terms of increased NRC scrutiny, et cetera, and this has certainly prompted us to initiate some of the oversight and audit functions that we have installed in the program and that I will be touching on a little bit later in the presentation.

Thirdly, in response to the letter that was written by the Subcommittee, Carol Denton responded to that by noting that those type concerns should be handled on a plant specific basis, and we basically agree with that. As I mentioned earlier this morning, the handling of the SMUD event and the Davis-Besse event I think were appropriately handled by the staff in that they looked at those individual utilities. It is not really a vender specific problem if you will. Plant-specific or management type concerns can arise at any particular plant in the country.

Here again, the bottom line is that we do look at each other. We do evaluate how we are implementing recommendations, how our plants are operating. The steps that we can take when we see an outlier are somewhat, are somewhat limited, although peer pressure I think has been very effective in spurring each of us on to better performance, and I think we approach that issue more on the positive side of the coin if you will versus the negative side, and that we offer encouragement to other members. We offer assistance in a lot of cases to other members in solving problems, and I think through our group efforts, we ought to elevate us all in terms of our overall management capabilities of the plant.

MR. WARD: Can I comment on that? I'm not sure that, well, perhaps neither you nor Denton understood what we were trying to say in the letter, but this whole issue arose from something that operating experience was saying, that there were too many transients and too many of a certain type of transient in some class of plants. That was called the B&W plants.

However, when you looked at the, at the data, there really seemed to be two different populations. There were the three Oconee plants, and there were all the others. And there just, you know, looking simply at those data, there seemed to be no more reason to single out lets say the three Oconee units for some sort of special attention under a program like this than there were any other three plants in, out of the hundred in the country, and so we are raising the question of whether, you know, the right things were being looked at.

It is--is there something in the operating procedures at Oconee? I mean, when you did, you try to look--we didn't want this to be, we weren't just making a motherhood statement about good management is wonderful. We all know that. It is not particularly useful to say that again, but is there something very specific in the way those three Oconee units are operated that made them a different population? Did you happen to look at that at all?

MR. RUTHERFORD: We didn't really look at that specifically. Obviously that's hard to separate out, what are management related problems versus what are design considerations that may play a role in complex transients. And when you look at management, looking at our particular experience and view, I don't think you can point to any one thing and say there is the key, we can pass this on to the other plants.

It is hundreds and thousands of little things that you do I think in a plant that end up in having a good performer. And I mentioned through our group action we do share a lot of things and a lot of those things are passed on, but we haven't necessarily gone out and systematically looked to define well, what are the good attributes and procedures or preventive maintenance programs, et cetera?

A lot of those things do come out in our, in our committee activities and those kinds of efforts, but I can't say that it is totally systematic.

MR. TAYLOR: I think there is one other point, too. This addresses Dave Ward's question, and that is I think there was a recognition on the part of both the Executive Committee of the B&W owners, as well as on the part of the NRC, that there were a lot of other efforts in that area going on. They were evolving then and they are still evolving today in terms of things like INPO's corporate evaluation process, trying to find out management problems, the NRC SALP evaluations which do get into management problems, so I think there was a recognition that this was an important area, big area, but there were some other very significant things going on that would make it inappropriate to try to make a structure of it.

MR. RUTHERFORD: Certainly that is a more systematic process of trying to find good practices and passing those on to other members in the industry. Okay.

(Slide)

MR. RUTHERFORD: Okay. Moving on to the next point regarding the safety significance of the unique B&W plant characteristics, we spent a great deal of the agenda this morning talking about that, but basically that was the major thrust of our sensitivity evaluation, is to try to offer some perspective on that whole issue, that oh, the B&W plants are different, more responsive, Ferrares versus Fords or whatever, however you choose to characterize the differences, and after this presentation, we will be moving on to the sensitivity study and we can, of course, address that in more detail.

Thirdly, the issue of decay heat removal--we, of course, have already made presentation to the full ACRS on decay heat removal in which we described the three lines of defense being maintenance, main feedwater, auxiliary feedwater, and feed and bleed.

Now we kind of made a leap here over into the feed and bleed issue, and you have got to keep in perspective here that this is really the third line of defense if you will. Once you lose main feedwater, once you lose your safety-related source of emergency feedwater, then you have got the feed and bleed capability as back-up, and we are certainly confident on the B&W plants that that is a very viable back-up source of decay heat removal.

MR. DAVIS: It has been a while since I looked at this bleed and feed procedure, but the last time that I had occasion to look at it, there was some concern expressed that by the time the operator decided that this option was the only one he had left, it would likely be too late for it to be effective if it were implemented, and there was also some concern expressed about the fact that he would, it would be difficult for him to balance feeding and bleeding and maintain adequate core cooling.

Have those problems been resolved and does the staff agree with that conclusion D up there?

MR. RUTHERFORD: I don't think we ever saw it as a problem. There were certainly questions about feed and bleed capability and being able to take credit for that after the TMI accident, and we, of course, have addressed that question in the sensitivity study, but this relates to the comment that I made earlier about steam generator. Really that's not critical time point.

The critical time point is on out in time before the operator has to take actions to restore emergency feedwater or to initiate feed and bleed, and that time is--I forget the exact time, and Stuart will get into that, but it is comparable to the, to the other PWRs, not as long as some, but it is significantly out there to allow the operator time to initiate those type actions.

DR. KERR: Does your answer imply that you have not heard of this problem Mr. Davis mentioned, or is that the problem has been solved?

MR. RUTHERFORD: Here again, we didn't perceive a problem. I think the staff had questions about feed and bleed capability. Some of those questions were resolved via the MIST facility, and I think we are on pretty firm ground, both us and the staff now, saying that feed and bleed is a viable mechanism.

Bob, do you want to address from the staff viewpoint?

MR. JONES: The issue of initiating feed and bleed, it has been a generic issue in-house, being evaluated now, but the operators group program did identify as one of the recommendations looking at drastic action, things such as initiating feed and bleed, ensure appropriate guidance is given. That is one of the recommendations in the program. We have think that is a risk significant recommendation, will mention later about the risks affecting that.

With respect to controlling the feed and bleed process, in the B&W plant, control of the feed and bleed process can be as simple as turn on the HPI and walk away. You don't have to do anymore than that.

Ideally it is done by turning on the PORV and running the HPI, just running it. On Davis-Besse it is a little different because they have got a lowhead HPI pump, did depressurize down, but that's--

MR. ETHERINGTON: Would you include the Crystal River as feed and bleed?

DR. KERR: The question was you would include the Crystal River episode as feed and bleed?

MR. JONES: The Crystal River event kind of exercised so to speak the mechanism, the opening of the PORV, the actuating of the HPI water going out the valve. They really didn't have to rely on it at that point in time. It was only used for very short period of time anyway, as I remember it.

MR. ETHERINGTON: There was feed and bleed--control room, pumping--

MR. JONES: It is in the, a controlled operation. You do not control on level. You do not control on any parameter. About the only thing you may do is in the long term. I don't have a timeframe, exact timeframe for you, but certainly on the order of hours, you could get into a, where you would be throttling the HPI to just maintain the subcooling margin, at a reasonable level to depressurize, continue to depressurize the plant, but that would be after the initial actuation, getting the core returned to the subcooled condition, then a long-term you throttle your HPI on your hundred degree subcooling line, throttle the HPI and you are going to come down to pressure. Your outflow is there.

MR. ETHERINGTON: Thank you.

MR. RUTHERFORD: Okay. And of course, the bottom line is, as we presented earlier today to the ACRS, is we feel like we have abundant capability here as far as decay heat removal, and that we don't see any need for any basic changes in that capability, although we have a number of recommendations in the SPIP program that relate to improving the reliability of that process.

That's all I had on that. Was the staff going to respond?

MR. SIEGEL: Yes. I don't really have a prepared response because I didn't think we were going to discuss this specific unit, but--item, but with regard to management, I would just like to elaborate on what Jim said.

Basically we feel that what we do, first of all, this was an owners group review. The individual plant management--but we feel it is more than adequately addressed by the INPO, but what the staff does on their SALP evaluation, for instance, we have, every project directorate has a meeting with Merley every year, to brief him on the status of the plants. The region is involved in these conference calls. We sit down and one of the areas that is discussed is management both from a corporate level and also from a plant operational level.

And in addition, when we are identifying or discussing which plants we consider a troubled plant, like the staff is going to have a management meeting in June, one of the areas that we are, we review is plant management and corporate management, and specifically I think the management per se not only in this area but in every area we look at plants that the management is good, it reflects in all the areas. If it is bad, it generally reflects in all the areas, too, so we think that that area is more than adequately covered.

With regard to the other two items, the significance of B&W units are more responsive, Bob Jones is going to address this during his sensitivity evaluation, and the ability to trip the reactor and remove decay heat, Bob has already discussed that this morning, so we really don't have any further comments.

DR. KERR: Let me go back to the first comment to see if I understand.

This investigation was initiated because of operating events, perspective on the part of someone that these operating events raised some questions about the safety of the B&W plants.

Now it is my memory most of the operating events did not take place at the Oconee plants.

MR. SIEGEL: That is correct, of the category C type, yes.

DR. KERR: Hence it seems to me one might have wanted to look at what was unique about the Oconee plants. Clearly it is not that they have B&W reactors because the other three have, B&W 4 whatever, have B&W reactors and yet what one is looking at is B&W reactors as if somehow the fact that Oconee 1, 2 and 3 exist has been forgotten in looking at those transients, and it was for this reason that we raised the question. Maybe it isn't something about the reactor. Maybe it is something else. Maybe the reactors are okay.

MR. JONES: If I could add one comment on that, Neil may remember it, but my memory says that there was an ACRS--not ACRS--a Commission briefing in November probably '86 where we looked at the operating history of the plants, and my memory says while indeed Duke didn't have any of the category C events, they did have a lot of the category Bs, and significant Bs. I mean they were not, they are really not that far out of line on an overall operating experience except they haven't seen any Cs. They do have or have experienced some significant Bs, and not an outstandingly low level of them in comparison to the others.

MR. ETHERINGTON: Those include instruments, instrumentation on the bottom of the reactor?

MR. JONES: No, we are not including those. These are the events from the 1980 to '85, '86 timeframe is what it is based on, and they did have several significant category Bs in some of the Oconee plants which you know, tended to indicate that really while there is some diversity in the C transients, there is clearly still some overall design issues that affect across the entire B&W product line.

DR. KERR: But they weren't the thing that called the problem to your attention, were they? It was those severe transients?

MR. JONES: Yes. It was the Cs that essentially have raised, what started this, but some of those Bs don't miss by a heck of a lot.

DR. KERR: And that's, we are getting to--these questions appear to indicate that you don't understand what it is we are talking about, and what I was talking about at least was how one first identified the problem I thought was on the basis of severe transients, and again, I thought that the severe transients didn't happen at these three plants, and yet what has been focused on is the whole population of plants.

Now I will say no more, but--and I say this only because it appears to me that people to whom we are addressing this question don't understand our question or the basis for it.

MR. JONES: Clearly we interpreted your, back in '86 when we wrote the response, that answer was really looking at did we need to consider a management across the board? We weren't looking at it as just narrowly the way I think you are now talking about--is there something in Duke particularly beneficial that they can learn from? And really we judged it that we have, we were looking at it from correcting bad performers as opposed to looking for the good and finding it back, and in that way, what we already were looking at was the fact that we have existing mechanisms in place that we thought would do an adequate job.

DR. KERR: My point was--I absolutely will say no more about it--it is a hypothesis, given these severe transients, one might have concluded hey, there is not anything wrong with these plants. It is the way they are being operated that is the problem. Now you have looked at it, apparently concluded that's not the case, but if one simply took the evidence of severe transients, at least hypothetically, that might have been a conclusion that one would have reached.

MR. SIEGEL: I think directly getting at the problem by, through the recommendations, even though perhaps a lot of these stem from the fact that management perhaps didn't, in some plants didn't identify some of the problems they had, through the recommendations, these, some of these problems are being corrected.

The management per se is a more broader-based one and it is more long-term one that the staff is continually looking at, and I'm not sure, I think we are looking at that area, and when we do see areas that weak management, we have pointed out to the utilities like I mentioned before either through the SALP or the review process that the staff goes through on a yearly basis to evaluate plants, but I think you are probably right. Some of them were due to the fact that perhaps there was a lack of management attention in some areas that there should have been. I think those responses were corrected through some of the recommendations. The owners group might want to comment on that.

DR. KERR: Serendipity is going to save us?

MR. SIEGEL: I think we are--at management where there are weaknesses, we have identified them on numerous plants by the mechanisms I mentioned.

MR. WARD: Can I pursue this a minute? We didn't say anything about management in our comment, although we did say something about operating organization which may have distorted it a little bit, but you seem to be saying that the, you know, it is the balance of plant features that tend to be driving some of these, everybody seems to be saying that some of these incidents. Clearly the three Oconee units have the same balance of plant design.

Are you sure that's not the key? Are there some key difference between the balance of plant at Oconee and the others? I mean I am just, we are just stuck with this sort of simple minded observation that there seem to be two populations, and instead of jumping to the conclusion that you already know of the reason for a problem, why not try look at it more objectively? Maybe you have done that, but tell us if you have.

MR. JONES: I think that's why we have taken the approach, first off, while the two transients, Davis-Besse and Rancho Seco, had a big impetus, a push to go forward, we have had lots of, nagging problems with these plants. Those were kind of the straws that broke the camel's back. If you go and look at the abnormal transients, and you can quibble how many of these were abnormal and normal, the owners group put them up as normal, at one time they were discussed as abnormal, I don't know how to exactly characterize them, but there are at least a subclass of the Bs which are quote, significant category Bs, and as I said, those have shown up across the board; they do not, Duke does not stand out as having none of those. They do have a fair number of those, so I think it is to a large extent a design, you are seeing the design effects across the board, yet there are differences in balance of plant which would be difficult to fix within the existing frameworks of the system.

I mean Duke doesn't have isolation valves, MSIVs. Other plants do. That is going to have certain impacts on some transients which are good, and bad on other transients, so there is a balance across the boar, d and we had to deal with each system and look at them almost collectively to see whether it was experience that applied across the board, and that's how the recommendation came out, but I don't think there is a simple-minded Duke has everything right because they have experienced some significant transients.

MR. RUTHERFORD: Okay. Let me respond a little bit to that. Now I don't basically agree, disagree with what Bob has said. There are a number of reasons I think when you look at Duke that are experiences different from the other utilities in some respects.

First of all, it is true that we have had comparable frequency of category B type transients, but I think if you look at the root cause of those transients, they were fairly self-limiting versus some of the category C events that we got into that were not self-limiting.

And I think the differences there are attributable to a number of factors, management being one of them, and if I had to put a finger on one particular item, it would be finding the root cause of events and learning from industry experience early in the game and making appropriate changes.

I think perhaps we have done a better job of that, blowing our own horn, than perhaps some other plants, and we concentrated on that aspect of things in the SPIP program to make sure that we all have good root cause programs and that we do indeed thoroughly analyze events and go in and take appropriate corrective actions.

Secondly, there are design differences between Oconee and other plants that do influence the fact that we have avoided some category C events, and those relate to the complexity of some of the control systems that are utilized in the plants, but I think that's a, while some degree of contributor, not the overriding contributor to the differences that you see.

MR. WARD: There is a non-complexity in the Oconee design? Is that what you are saying?

MR. RUTHERFORD: I think in some case we have got somewhat simpler control systems.

MR. WARD: But you haven't been able to zero in on that as--

MR. RUTHERFORD: You look at Davis-Besse and the contribution that the SFRCS system made to that event, we don't have that complex control system at Oconee. Of course, control systems can cut both ways. They can help you or they can hurt you, depending on failure modes, et cetera, so in that respect, I think that Oconee design is a bit more forgiving, but overall, I think that it is probably a minor part of this overall puzzle.

Getting back to the main thesis here, I think we have picked out some things that do relate to quote, management of the plant, that we have attempted to pass on to all the owners and ensure that we are all doing a good job in this area of reacting, identifying problems and reacting to those in a timely manner.

Any other questions?

CHAIRMAN WYLIE: Any other questions on this? Let's move on.

MR. RUTHERFORD: If not, I will turn it over to Stuart Rose, and he is going to go into the sensitivity study.

MR. ROSE: As Neil said, with no small amount of fanfare, we get to the sensitivity study this afternoon.

I would like to accomplish two things this afternoon. I would like to review with the Subcommittee the purpose, scope, and methods of the sensitivity study, the work that was done, and take the opportunity to remind you that this material was discussed with you on July of 1986, at which time we went through the analysis matrix in some amount of detail, and talked about what we would be looking at and what we would not be looking at under the umbrella of the sensitivity study.

The other things I want to cover are the results, the conclusions, the recommendation, results from the study, and based upon the work that was performed.

(Slide)

MR. ROSE: As you know, the owners group employed NPR Associates to assess the differences in thermalhydraulic design arising from differences in design characteristics between the three PWR venders.

These analyses were based upon the issues that were on the table at that time, were bounded by the scope of the study that we talked about about a year and a half ago. Our purpose was to try and define what sensitivity was, and then to quantify thought differences in sensitivity.

NPR performed a comparison of the typical B&W units against representative Combustion and Westinghouse reactors, and you can see the list of units in the B&W category that were analyzed--older vintage Combustion plant, a more recent vintage and a recent Westinghouse plant with incorporating the pre-heater, feedwater pre-heating section in the steam generator.

Again, I would like to emphasize that the purpose of the study was to quantify relative differences in thermalhydraulic behavior within the scope of issues that were before us at the time that the study was put together.

These results were submitted to the NRC on April the 4th of last year, 1987.

(Slide)

MR. ROSE: In terms of scope, the sensitivity study included thermodynamic response of the reactor and steam system during normal plant operation. These were characterized as bare plant analyses in that they were run without control system and protection systems in place. They were run using step changes or impulses in reactivity change, feedwater flow, steam pressure, steam flow, and an item to understand the inherent behavior of these units that is based--there was a function of the design differences. The study quantified these differences in the control of key plant variables.

Secondly, the study analyzed the plant thermodynamic response for anticipated operating occurrence, things such as reactor trip, turbine trip, runback, loss of one feedwater pump, those types of events.

MR. CATTON: What did you use to do the analysis?

MR. ROSE: All right. We used, NPR employed some simplified dynamic codes that were simplified by NPR, simplified in the sense they were not the RETRAN, RELAP type codes, but simplified in terms of simpler model of each of the primary steam generator and another components that were then validated against actual plant data, or against other existing validated computer runs like RETRAN and RELAP and others.

MR. CATTON: RELAP doesn't have the differences between the plants well modeled, and that's why we have MIST. What did you do about that?

MR. ROSE: Well, as I said, part of the validation of the NPR model was used on actual plant data. There was--

MR. CATTON: That doesn't get you into some of the more narrow aspect of the transients you are looking at.

MR. ROSE: I think in some cases it does because the transients that they used for validation was a, a turbine trip and TMI back in 1974, with a artifically suppressed reactor trip function; the 1985--

MR. CATTON: What were the transients? You didn't list them. Do you have a list of the design differences?

MR. ROSE: The design differences, no, I don't. I don't have a list of transients. They I think included turbine trip at TMI, 1985 Davis-Besse event, a turbine trip and reactor trip on Westinghouse unit, and also a transient on a Combustion unit.

MR. CATTON: And what were the thermalhydraulic design differences that you were trying to consider?

MR. ROSE: We were looking for differences--I have a slide that will get to that in just a second--looking at key plant variables.

MR. CATTON: Okay.

MR. ROSE: Let's see. I believe in the third bullet, the study also looked at thermodynamic response comparison for selecting transients and accidents, things that are, some of the things that are analyzed in the FSAR such as rod withdrawal, and loss of feedwater events. Some of those analyses were based upon a comparison of the analyses presented in the FSARs. That is, they were not detailed computer codes. Computer analyses run within the scope of this sensitivity study--

MR. CATTON: You are really staying pretty close to normal operation, not getting way far away.

MR. ROSE: I don't think that is true.

MR. CATTON: Are you getting into circumstances where you have two phase in the primary system?

MR. ROSE: No, no two phase, but it is getting away from normal operation in the sense other failures, steam relief failure, that is the sort of thing.

MR. CATTON: Sure.

MR. ROSE: The study looked at the protection and control systems, and assessed the design differences affecting the complexity of hardware, looking at the number of modules and components that have to work properly to achieve the desired control function, comparing those counts with the B&W

integrated control system, the Westinghouse and the Combustion design, and did some assessment of operating experience actuations and off normal occurrences to see if that, that relative level of complexity was reflected in actual experience.

And finally, NPR performed assessment of operator responsibility, the things that the operator must accomplish following a reactor trip in order to properly control the, control the event, and they looked at both normal and off normal conditions in that assessment. They were looking at things like properly controlling makeup and let down, and steam generator level as actions that the operator has to, to assure are carried out.

(Slide)

MR. ROSE: This is an indication of how we defined sensitivity and how we attempted to quantify it. We are looking at sensitivity in terms of margin time and frequency, margin with respect to how close the plant response, the thermalhydraulic response approaches a limit, a safety limit record, more particularly, an operational constraint of some sort such as reactor protection system setting, or flooding of the aspirator ports on once through steam generator.

We also looked at the response in terms of time. How quickly does that transient proceed? Are the rates, the slope of the curve different between the three types, and also in terms of frequency, are there aspects of the plant design that would cause a particular transient to be experienced more frequently than on the other design?

Some of the safety parameters that the study looked at were secondary design pressure, primary design pressure and temperature, saturation margin, minimum, kilowatts per foot limit, PTS limits. More particularly the study focused on these, what we will call operational limits and criteria, as being more pertinent to what the operator sees in controlling the plant, and these are the quantification of the sensitivity that the study looked at.

And analyzing the plant response, NPR looked at how quickly the steam generator would dry out. For example, it looked at how quickly the aspirator ports, the level would fill up above the aspirator port on a once through, or to the moisture separator on a circulating generator, how quickly pressurizer level indication might be lost. This is the method with which sensitivity was quantified.

(Slide)

MR. ROSE: That then is the basis of the sensitivity study, what was looked at, and by omission what was not looked at. Now I want to get into a review or a presentation of the conclusions and results from the sensitivity study.

First of all, a couple of general conclusions that were reached as a result of this study show that in several aspects of the B&W design, which had been perceived as causing greater sensitivity, in fact did not. It was a conclusion of the study that the pressurizers on the B&W units are as large as or larger than those on other units.

MR. CATTON: Why is it that you have a loss of level on the turbine trip and the others do not?

MR. ROSE: We don't have loss of level on a normal turbine trip. If the rest of the plant operates within the, within its limits, we don't.

MR. CATTON: What happened at Three Mile Island?

MR. ROSE: When the--

MR. CATTON: The accident; didn't they lose sight of the level following the turbine trip? My recollection is that that was a common occurrence on B&W plants, that they, following the turbine trip, you get the shrink and then they have to jump in and maybe--

MR. SKILLMAN: The trip, the level remains in the pressurizer. On an extreme cooldown, like when the emergency feedwater system and the secondary plant system get out of kilter, you can experience such extre cooling you have a super shrink and you go below the lower TAP, but that is not a common occurrence, the lower level TAP on the pressurizer. At TMI, what happened is, was steam formation, transfer of level from the reactor vessel to the pressurizer, and with the stuck open PORV, water and pressurizer exhausted to the effluent condensing tank, leaving empty core with a concurrent pressurizer level--completely different scenario.

MR. CATTON: I didn't want to get that far into the scenario. I am referring to right at the front end. It was my understanding that it was common relative to the others.

MR. SKILLMAN: No, sir.

MR. CATTON: Lose sight of the level in the pressurizer.

MR. ROSE: Prior to TMI.

MR. CATTON: It says that in the lessons learned. Is that document incorrect? At least I think it does.

MR. ROSE: I don't recall where it says that, that there have been a couple of changes in the history, spend a minute or two talking about that.

Prior to the TMI accident, on the B&W design, the PORV lift set point, 50 pounds I believe the high pressure trip set point, as currently on a number of Westinghouse designs, so that any time the reactor was experiencing a high pressure transient, the PORV would open. Not a function of the pressurizer being so tightly compressed; it is where the set point was established.

Secondly, once the reactor tripped, again with nominal steam pressure control and steam generator inventory control, pressurizer level would remain on scale.

One or two of the B&W plants with a compressed indication range experienced a loss of level, but they corrected that. These are the two B&W pressurizers, one of which we call the--

MR. RUTHERFORD: Stuart, let me offer some information here on, to document the experience on pressurizer levels.

Since January 1, 1980, we have had no off-site low pressurizer, off scale low pressurizer indications at Crystal River, Davis-Besse, Oconee 1, 2 and 3, and TMI, and ANO. No one, has had no off scale low events since they raised their pressurizer level, their normal operating pressurizer level in mid-1983, and Rancho Seco had one off scale low event in 1985, the overcooling transient.

MR. ROSE: Keep in mind again the difference in level spans the full range. Wide range indication is 400 inches on some of the B&W units. The same pressurizer has 320 inch span. I believe Arkansas is in that category, and they took the step of raising their nominal operating level to give themselves a little more cushion. As Neil said, since 1980, there has been the one at Rancho Seco.

MR. WARD: Could you adjust that or maybe read us off those volume numbers across the--

MR. ROSE: 1520 cubic feet for the two B&W designs, 1517 for this Combustion unit, 1220 for the second unit, 1435 for this Westinghouse unit, and I believe that is 1835 for the--

MR. SKILLMAN: Let's read the cubic feet per megawatt, which is a very important index in terms of--

MR. WARD: Why did it take--these are just facts. You say the study revealed this. I guess I am not so much questioning the--but I mean I have been coming to meetings for years and people have been telling me that the B&W pressurizers are smaller than the other PWR pressurizers. I guess I was too dumb to know where to look for facts, but why has this been such a mystery all these years?

MR. TAYLOR: I think part of it goes back to the perception that Ivan talked about. They go back prior to TMI, losing the pressurizer level was a frequent thing. It happened more often than it should have, and that's when people perceived boy, you know, the pressurizer is small, and really what was happening was that they were talking about the visible range of the pressurizer.

MR. CATTON: We were told it was too small.

MR. TAYLOR: That is what people were saying. It wasn't until this study when they made a close examination of some plants that were supposedly comparable and look, not only is pressurizer level not going off scale low like it used to seven or eight years ago or prior to seven or eight years ago--here are the actual volumes. I think it is partly perception.

MR. DAVIS: It is an important relationship, the sort of pressurizer relative to the volume of the primary system, because you can have shrinkage and expansion during these transients.

How does B&W compare on that base because I don't see that number up there?

MR. ROSE: That was not the method that NPR used in assessing pressurizer volume. They looked at volume over megawatts.

MR. SKILLMAN: I think they also looked at volume over shrink volume. That would take into consideration the changing density for a larger reactor cooling system volume. On that base, the Babcock pressurizers compare about equivalent. There are different things among them, but in general, the allowable, if you will the volume change is a function of shrink mass equated to volume in the pressurizer, compares about the same across the line of pressurizers for Babcock, Combustion and Westinghouse.

MR. REED: Let me add a little bit to what Mr. Davis just said. In my opinion, pressurizer sizing, it is a, size should relate somewhat to not only the primary cooling system volume, but the post-coupled secondary side inventory steam generator volume. That's close coupled. You can't shut it. It is going to act fast in controlling shrink or controlling volume expansion, so they have not addressed this in the documents I have seen here, that the close coupled, secondary volume is a factor, and quite frankly, transients are always interesting, the kind of transients you can get, and in fact pressurizer sizing is very complicated, pressurizer sizing, but I would not ignore the total couple inventory in sizing, and therefore, I always come out with even those though might look big volume-wise, they are not. They have got a much smaller coupled inventory to temper the change.

MR. ROSE: I believe that NPR did a sensitivity study, touched on some of the issues that you just raised. Looking at the time, the response of transients; especially high pressure transient was looked at as part of the study.

MR. REED: I saw the pressurizer ratio thing, and I didn't see that in there.

MR. ETHERINGTON: I think what we are leading into is a little bit superficial. If you take one BTU out of cubic foot and get about the same shrinkage in, you take one BTU out of two off the--should be somewhat independent of the volume.

MR. CATTON: So the steam generators wetted area and volume would be an important--

MR. WARD: He means the primary system volume.

MR. CATTON: That was what I am referring to. You need to know the heat removal rate if you are going to have to calculate the shrinkage for a given volume.

MR. WARD: Yes.

MR. CATTON: Once you know that, you take some kind of ratio to the pressurizer side and see if you can handle it. I don't see that anywhere, either. It seems to me it is relatively simple concept. I am saying the same thing you are.

MR. DAVIS: Since 1980 you have had 270 some transients, and perhaps only one case did the level in the pressurizer go off scale, and I presume in none of them did you overfill the pressurizer.

MR. ROSE: I believe that is correct.

MR. DAVIS: To me that says something about the adequacy of the volume of the pressurizer, something positive.

MR. ROSE: I think it does. Okay.

(Slide)

MR. ROSE: Second general conclusion, B&W units are less sensitive to steam demand upsets than are the other designs. That has to do with a, the variable heat transfer area and the response to a step change in steam pressure and steam flow.

Thirdly, B&W units do not impose greater burdens on the operators following most--that is normal reactor trips. These positive conclusions--the study's recommendations for improvement, we want to make sure that they do clear the air on a couple of different points.

MR. DAVIS: One of the conclusions in your report on the basis of the NPR study is that the steam generator volumes are not small in terms of the time available to initiate feedwater before dryout, and this also goes against what at least I perceived as a difference in the design of the B&W plant.

Can you elaborate a little bit on that?

MR. ROSE: Yes, I can.

MR. WARD: Are you going to get to that?

MR. ROSE: I am coming to that.

MR. REED: Just before, on the slide you just had up, I am still having trouble with the pressurizer size as large as the other recirculating steam generator, PWRs, because you don't have this coupled large secondary side inventory to help cushion the expansion and contraction and these fast transients that trip and up and down.

Now I think the proof of the pudding would be to go to the record there of these plants and ask B&W, Westinghouses and CEs what the fluctuation in level in most of your normal, in your normal transient; what is the fluctuation level? I think you will find if you look at that fluctuation level that B&Ws are, have substantially more, which says something about pressurizer sizing.

MR. WARD: If it doesn't fall out either end, what is the difference?

MR. REED: Fine. I am not bothered by this problem whether the pressurizer is too big or too small. I am bothered about bigger problems.

MR. ROSE: I will do specific conclusions and we can get to the other question then--relative to other PWRs, the sensitivity study concluded that B&W units are not more sensitive to reactivity upsets, concluded that B&W units are not more sensitive to reactor coolant flow upsets. Response to coolant flow upsets are more a function of core designs than differences between the three PWR venders. The study concluded that the B&W units are less likely on average to experience a leak leading to a net loss of coolant. This is tied back to the high-head makeup capacity at most of the B&W units, and the ability to compensate, in large compensate for a larger leak size at operating pressure.

The study concluded that the B&W units are somewhat less sensitive to steam demand upsets such as low rejections and turbine trips. The reactor trip on turbine trip is not required to ensure plant safety in NPR's opinion.

NPR also concluded that the units are not more likely to overcool failure in a reactor trip. This is an outshoot of the the steam pressure control reliability and the observed reliability of code safeties versus atmospheric dump valve and turbine bypass valves.

They concluded that the B&W units are more sensitive in their response to main feedwater upsets, although the frequency of such upsets is not as great as in other PWRs.

MR. WARD: You said not as great. It says not greater than.

MR. ROSE: Is not greater than other PWRs--excuse me.

Again, due to the variable heat transfer areas, and the smaller initial inventory--

MR. REED: I am having trouble with all of these, but suffice it to say that if Westinghouse is doing the study on their reactor, they would come in with identification of things about their reactor as you subjectively have done it about your reactor.

MR. ROSE: I think there is a great deal of objectivity to this.

MR. SKILLMAN: I take real strong exception to that. That was not a subjective bunch of conclusions. These are conclusions that you can read for yourself in the appendices of B&W 1919. The models are there. Differential equations are there. These models have been tested against actual plant response. This information has been given to the Combustion Engineering owners group, Transient Assessment Committee, and they in many cases are saying yes, that's true. Now that we see that presented the way it is being presented, we agree that your plant does that and ours doesn't.

So this is not just a B&W owners group and NPR making unfair conclusions. These are objective conclusions based on hard data which you have access to in your copy of the B&W 1919.

MR. REED: I stand by my statement, and let's take a bullet. Are not more likely to overcool following a reactor trip--and yet we have got all these overcooling events that were there on the chart.

MR. ROSE: This statement is based on a nominal--

MR. REED: Twenty.

MR. ROSE: Response of the steam pressure control system; what you see on the chart are failures of that system.

MR. SKILLMAN: The chart shows the complex transients, not the responses. As I pointed out on that chart, I was trying to break up the difference between trip and complex transient response. What we showed you quite frankly is our dirty laundry and what makes the laundry dirty, and the bulk of those are overcooling transients. In fact, we have had 50 significant transients out of 250 trips, and if you look at the 50 significant transients, about 90 percent of those are overcooling transients, but what I didn't talk about are the 200 trips that are normal in which case there was no overcooling. I talked about the complex transients.

MR. REED: Well, to try to rebut again, you are, well, what we will call throwing off certain information and putting on best case listings which are not let's say too, well, you can call them normal, but they have lots of cases that aren't the normal. And quite frankly, I don't believe Westinghouse or CE are going to rebut to your list because why stir up a hornet's nest?

MR. WARD: I guess I didn't quite understand Mr. Skillman's response. If I look at the fifth bullet there, if these are only the, if you are only talking about situations where the, all the systems respond normally, then there is no likelihood at all for it to overcool, ight? I mean if everything works, it is never, it is not going to overcool? I mean what we are talking about here is the tendency to overcool given something going wrong.

MR. ROSE: The specific point of information that NPR reached this on could include, had to do with the observed failure in code safeties versus observed failures in turbine bypass valves, atmospheric dump valves. The rate of failure to reseat code safety valves is significantly below the others, and the overcooling transients that have been seen in the past by and large have not involved the code safety valves, but have involved the interaction between the ICS and the turbine bypass valves and high emergency feedwater flow rate. Those two things coupled together have led to those overcooling transients.

MR. REED: Atmospheric dump valves are sized to pass a max of about 10 or 15 percent of the heat flow rate, and main steam safety valves are probably going to pass 20, 40 percent of the heat rate.

MR. ROSE: Not individually; at 5 to 20 valves per.

MR. REED: Atmosphere dump valves, some are only sized for 5 percent, 10 percent, and you are talking about opening a big valve versus a little valve, and no one has put a lot of tension on atmosphere dumps on the plants because they don't involve a big safety problem.

Again, I have got to disagree with you.

MR. WARD: If I understand what you just said, the fifth bullet really means are not more likely to overcool following a reactor trip which the code safeties don't reseat? Is that what you held I mean therein?

MR. ROSE: Let me see if I can put it a different way. The B&W units' use of the code safeties for steam pressure control post-trip is not more likely to cause an overcooling transient than on other units. The code safeties are reliable.

MR. ETHERINGTON: What temperature constitutes overcool?

MR. ROSE: What temperature constitutes overcooling? In our definition, below 500 degrees was a significant overcooling.

MR. CATTON: Are there similar qualifiers on all the other bullets?

MR. ROSE: Certainly the details behind all of these bullets are laid out in 1919. This is just a summation.

MR. CATTON: I understand, but that fifth bullet, it turns out that the qualifier was rather significant.

MR. DAVIS: If you are going to say something about the feedwater control, the statement might say that they are more likely to experience overcooling from malfunctions of feedwater.

MR. ROSE: Next slide.

MR. DAVIS: Also No. 3 is a little bit confusing to me. Are you talking about leaks in steam generator tubes and safety valves? I certainly don't think there is much difference in the loss of coolant accident frequency among the plants?

MR. ROSE: We are talking about primary coolant system leaks.

MR. DAVIS: Including pipe ruptures or just--

MR. ROSE: No; below that level. On this side of the chart is makeup capacity, 100 to 800 gallons per minute. On this side is the leak size in square inches, and what this data shows is for 2200 psi operating pressure, two makeup pumps in operation in B&W units span this range of makeup capacity which corresponds to this range of leak size that they can accommodate without a net loss of coolant, reactor coolant.

The CE units span this range, and the Westinghouse units span this range.

MR. DAVIS: It is really not the frequency of the leak? It is the ability to make up leakage?

MR. ROSE: Yes, sir.

MR. DAVIS: Thank you. Incidentally, I don't think we were provided with the appendices to this report.

MR. ROSE: All of these figures are in 1919.

(Slide)

MR. ROSE: The second slide, specific conclusions continued--the B&W units are in some but not all of the plants subject to greater cooldown rates from overfeeding of emergency feedwater--the point you made just a second ago. That fact is acknowledged, is a part of the NPR conclusions, in some but not all plants because some of the plants already have limitations on the emergency feedwater flow rate.

MR. WARD: Those are the plants. What do they have?

MR. ROSE: Cavitating venturies: the B&W units are equivalent to many other PWRs in terms of time available to use alternative means of decay heat removal on complete loss of emergency feedwater or feedwater.

MR. CATTON: When you say equivalent, what do you mean?

MR. ROSE: I will show you. This is also in 1919. This is based on Los Alamos study in NUREG CR 4471, and this is a comparison on a consistent time line of the time available, of the milestones and end points involved in a total loss of feedwater accident, and what it shows for the B&W units is that yes, the steam generator will dry out more quickly than it does on the other units, but that is not the end point. That is only an intermediary milestone.

The more important milestone or end point is the time with which the operator can take action and prevent core heat-up and damage, and what the Los Alamos study shows is that the time available in the B&W units is comparable to that in the CE unit. It is not, this is not the key point that we need to focus on. It is more this point out here.

For the CE units, the study concluded that they must begin feed and bleed cooling before steam generator dryout or else they will be unable to avoid core heat-up in the absence of emergency feedwater in all cases, so what this study did was try to put these things on a consistent time scale and compare not the time to steam generator dryout which is that intermediate point, but the total time available to the operator to take action to avoid the undesirable end point. That's the basis.

MR. MICHELSON: Risk analysis, did you put in there any factor to account for the reflooding of a dried-out generator which would be the B&W case versus in the other case, not having to reflood a dried-out steam generator?

Certainly the risk has got to go up a little bit. Tube rupture, differential stretch, all that sort of thing has got to be greater if you dry out the generator and sit there for 20, 30 minutes before you wet it down again.

MR. ROSE: To my knowledge, that was not a part of the Los Alamos study.

MR. MICHELSON: That would increase the risk.

MR. ROSE: Time and again that is a point that is brought up, the time element.

MR. MICHELSON: It is very undesirable to dry out a generator and then reflood it.

MR. REED: What Carl is saying is very, very true, and I am trying to figure out why you are comparing apples and orangess or what is here, because the real issues are when does core heat-up begin? You notice it is out substantially.

The other another real issue is for all your great injection that you have, you say you have got capable more injection. More injection means higher pressures on the primary side. The dryout of the steam generator means more stress and strain and concern on the secondary side.

Now you have maximized the differential on the tubes, which to me means more opportunity for tube leak, and if you put all these things together, I always come out with the fact that you have got sensitivity here that is of great concern.

Now I don't think it is a good idea necessarily to run pressures up when you are in a transient. A complex transient, and drying out the steam generators, up the pressures up to a max of 2500 plus. It only increases the opportunity for rupture.

MR. RUTHERFORD: I thought an intentional revolution would be I lost the back-up to the backup system. If you lose your safety grade auxiliary feedwater system, obviously you are not going to sit there without putting water in the cooler.

MR. REED: This morning we were told that you are weighing this core damage issue on the bleed and feed and ignoring the fidelity of the secondary feedwater emergency system.

MR. RUTHERFORD: That is an incorrect interpretation.

MR. REED: Well, that's what I heard.

MR. RUTHERFORD: What was said this morning, all PWRs would go through a similar evolution if you will of maintaining the most viable source of feedwater, main feedwater hopefully first, if not that, emergency feedwater, and then ultimately, if you have none of those sources, going to feed and bleed.

MR. REED: I agree that certainly feed and bleed or bleed and feed should be a back-up thing. It is dirty because it squirts in the containment. You don't want to squirt inside containment any more than you have to because you have got to clean it up.

I agree with that, but on the other hand--you use that as the basis of your equivalency, and on another hand, you want to say well, we don't want to use bleed and feed, use the other things which in my opinion don't have equivalency, namely time for dryout, and emergency feed capacity that you have had in the past.

MR. ROSE: The only thing we were getting at in this part of the sensitivity study was time available, and that was largely in response to the Subcommittee's concerns after our last meeting in July of '86. This was in addition to the original scope.

MR. RUTHERFORD: I don't think there are any differences in the global sense between reliability of main feedwater on a B&W plant versus a Westinghouse plant, and likewise for the auxiliary feedwater systems.

MR. REED: Except for the big thing--inventory. Sure, I will agree with you, but you have got to figure that inventory.

MR. RUTHERFORD: Well, the problems that we have had, as we mentioned before, have been excessive inventory versus failure to deliver inventory, which is a different problem if you will.

MR. REED: Am I to understand--I believe it was in the record that Davis-Besse saved themselves strictly by time. If they hadn't gotten something done in so many minutes as they did, that is the bringing in of isolated makeup pump, they would have been in real serious core damage trouble, so time and inventory are very important.

MR. RUTHERFORD: And what Stuart is saying in his presentation is that the time available at different vender plants would be comparable. The Westinghouse plant is better. It would be comparable to the heat plant in terms of total time to take operator action.

MR. DAVIS: I got the impression your main feed might be more reliable because you had or were going to institute main feed runback procedures and would not trip main feed on some transients that for example, the Westinghouse plants would trip.

MR. RUTHERFORD: Well, we have that capability now. I think the recommendation was to wait to improving the reliability in some cases. Yes, we do have that capability at present.

MR. WARD: You don't consider that an advantage?

MR. RUTHERFORD: Oh, certainly; if you look at Westinghouse plants, they are a lot more likely to end up on emergency feedwater than the B&W plants.

MR. WARD: They absolutely depend on it as I understand, given a reactor trip, a turbine trip.

MR. RUTHERFORD: Right.

MR. DAVIS: Your success hasn't been real good in controlling the runback; as I recall, about one out of four or five times that it has not worked. Is that a wrong number or--

MR. RUTHERFORD: I, I can't dispute your numbers there, that in some cases we haven't been able to, but there have been a lot of cases where we have had success.

MR. TAYLOR: Let me make a general response to Pete's question. There were, there have been quite a few efforts in the last three years to improve main feedwater control systems. There have been very significant improvements in the Arkansas plant. There have been very significant improvements in Crystal River, and the frequency of loss of feedwater events has dropped off significantly.

In the last year, there have been three cases where trips were avoided which would have occurred prior to that period of time because of these changes, and there have been very few trips on the B&W plants in the last year, but because of these main feedwater control system improvements, there have been three cases where one feed pump has tripped, plant has not tripped. The plant ran back. If it had happened a year prior to that, it would have gone down.

MR. DAVIS: Is your main feed--

MR. TAYLOR: Steam, all steam.

MR. MICHELSON: Help me out for just a minutes You showed on your previous draft that you dried out much sooner in the B&W case but that--I think it was about 30 minutes before you started to have difficulty, had to respond by that time. And you said that's also the same for I guess the Westinghouse. I can't read it that well from here.

MR. ROSE: For the Combustion unit; westinghouse is on the bottom.

MR. MICHELSON: Okay. Now I am trying to determine whether the, is the unique differences because the secondary side of the Combustion unit certainly has a lot more water than the B&W, doesn't it?

MR. ROSE: Yes.

MR. MICHELSON: And so first of all, I got to boil that water away before I start really heating up severely the primary side, because my heat sink is a reservoir of water. You already said it is going to be much bigger for Combustion ones having to go to the primary side.

Now I have got to start going off, relieving something to take the heat out, but don't I have just as much water on the primary side of the Combustion as I do on the B&W, or at least approximately?

MR. ROSE: The way the study was conducted, what NPR looked at, the Los Alamos study looked at emergency operating procedures that the Combustion units have to go through, and as has been noted, they do not have the high-head charging pumps. First have to open the PORV, allow the primary system to blow down before they can get charging, significant charged water into the RCS. I believe that it is that additional time--

MR. MICHELSON: That's not the criterion I was particularly interested in. You are getting pretty darned excited on a PWR plant long before 30 minutes because you, particularly a plant like Davis-Besse, you are going to have to do blowing down or something to it or it is going to blow itself down through the safety relief valves long before the Combustion unit is going to below itself down, long before. Combustion has got so much secondary side water to take the heat out first, so I don't know quite what we are comparing, apples and bananas or just what.

MR. ROSE: I believe it is a valid comparison because--

MR. MICHELSON: Maybe operating procedures look good, but what is happening to the plant may be quite different than the two cases, and the level of excitement of the operator might be quite different.

MR. ROSE: The point we are trying to make here is that up until this time, you are talking about steam generator dryout. This was considered to be the end point. Steam generator dryout, dryout, dryout, and there was no more comparison.

MR. MICHELSON: B&W, only about 12 minutes or something?

MR. REED: Four minutes.

MR. MICHELSON: Depending on the condition at the time, could be as short as 2 minutes.

MR. ROSE: The point we are trying to make is that that is not the end of the picture. You have to also, when you are trying to assess the time available for the operator on the board to take action tc avoid core heat-up and damage, that's not the end of the analysis.

MR. MICHELSON: And the B&W case is seeing a lot different condition, up to 30 minutes, than it is--the CE case is a lot different. You already have a lot of primary side inventory I think by the end of 30 minutes, unless you keep making up.

MR. WARD: All he is saying, if you look at the time of core heat-up, it is a difference of only a factor of two instead of a factor of four with steam dryout, steam generator dry.

MR. ROSE: What we are saying--

MR. WARD: It shows there is a big difference.

MR. MICHELSON: Four minutes versus 30 minutes I thought was the time.

MR. WARD: Steam generator dryout, but so okay. So that's a factor of seven.

MR. MICHELSON: Not occurring until you get down into the reactor vesse. That just happens a hell of a lot sooner on a B&W plant.

MR. ROSE: Given the high makeup capacity in the B&W units, all of this time is available to begin feed and bleed cooling. If the operator initiates feed and bleed at any point up until this time, they will be successful. For the Combustion unit, it must begin up until this point. If they begin out here, it will not be successful, and so we are trying to put the time scale on a comparable basis.

MR. SKILLMAN: What the arrow on the bottom shows is if I can use the term, the drop dead time by which time those components must be in operation to prevent there from being core damage. The top line shows that on the Babcock plant, using two out of three 'PI and one PORV, on the time scale you have got to make that decision and do it at about 28 minutes. If you are going to go with two, three pumps, no PORV, you have until about 38 minutes and you can stave off core damage. Those pumps deliver so much flow you can cover the core right now. Next line; Combustion Engineering, if you fail to get three of three charging pumps plus the PORV, by about 22 minutes, you have lost it. You will never catch up to it.

R. MICHELSON: Because of the capacity?

MR. SKILLMAN: Other thermalhydraulic conditions in the cooling system at that time. Drop down to the next line.

MR. MICHELSON: Plant is getting a little more excited early on, but you are saying you have got big enough pumps?

MR. SKILLMAN: To recover; you can wait longer and recover sooner on a Babcock plant because of I think the inventory condition and some other, but you get down to the bottom line on the Westinghouse plant, you have about 50 minutes to make the decision using one out 60 HPI pumps, two PORVs also or about 130 or so with both HPIs. They have got a lot of secondary side.

MR. DAVIS: B&W line indicates that is for the Oconee one. Is that, would that curve be identical for all the B&W plants?

MR. ROSE: All but Davis-Besse.

MR. MICHELSON: Large capacity high pressure makeup? Large capacity.

MR. REED: Just so the B&W folks will feel better, we have criticized quite a bit the CE valve 80 design because of its inability to depressurize rapidly, so you know that we criticize other people, and that's what you are talking about.

MR. REED: Handed pumps depressurization through PORVs.

CHAIRMAN WYLIE: On your earlier slide, on your studies regarding the B&W units being less sensitive to steam upset, do I conclude that, do I conclude from that that the B&W units can consistently take full load rejection without tripping the reactor?

MR. ROSE: No, sir.

CHAIRMAN WYLIE: I thought that is what that said.

MR. ROSE: This conclusion--I lost it--is based upon the analysis that shows that given a step decrease in steam flow, or a large increase in steam pressure, leading to a decrease in steam flow, that the nature of the once through generator will tend to try and return naturally to equilibrium. As the steam pressure goes up, steam flow goes down. The feedwater flow rate remains essentially the same. The level starts to rise of the once through generator, and eventually you tend to recover, come back to a lower power level, but come back to an equilibrium. Because the U tube generators don't have that variable heat transfer area, they don't respond that way.

This is a plot of steam flow as a function of time for a step change in turbine control valve position closure.

CHAIRMAN WYLIE: Small step.

MR. ROSE: Approximately 10 percent or so; this is part of the bare plant analysis.

CHAIRMAN WYLIE: What happens when you get full load rejection? They are designed to run back?

MR. ROSE: They are designed to run back, and if everything responds the way it is designed to, they can.

CHAIRMAN WYLIE: Have they?

MR. ROSE: I believe they have.

CHAIRMAN WYLIE: Consistently?

MR. SKILLMAN: Not consistently, but they have done it. It is not normal.

MR. ROSE: And since TMI, of course, the point--

CHAIRMAN WYLIE: What prevents them?

MR. SKILLMAN: The high pressure set points has been set down, and the PORV set point has been changed. Prior to those changes, the plants were designed to be able to take a hundred percent load rejection. With those changes, you are not able to absorb that quick energy lift. Consequently, you get yourself in the HP trip set point about 2300 psig. Prior to those changes in the plant, the plants were able to take, theoretically able to take runback from 100 percent, and the plants were, they were designed to do that.

CHAIRMAN WYLIE: Did they ever do it?

MR. SKILLMAN: Yes, sir. TMI-2 did it.

MR. RUTHERFORD: We weren't able to.

CHAIRMAN WYLIE: I just drew the wrong conclusion from that bullet I guess.

MR. ROSE: Final two bullets on this page, again for most reactor trips, B&W units do not impose greater control burdens on plant operators, but they do impose greater burdens on the operators in diagnosing and respoinding to failures of the automatic control systems. Such failures are more likely to lead to complex transients in B&W units.

MR. MICHELSON: I guess what you are saying is if everything works right, it is no greater burden than other types of plants, but maybe there are more things that have to work right and quickly in order to keep the burden off the operator? I think t at's just a fast response system, and if it works right, then it is no different than others, but if it doesn't work right, the operator really has got to scurry in a hurry.

MR. ROSE: In some respects, it is less of a burden on the operators under the normal case two versus four loops, that they have to keep taps with, and automatic feedwater control on the B&W design versus manual control on other some of the other designs, but again, that's for the nominal case.

MR. MICHELSON: Automatic feedwater control, all of them have automatic feedwater control.

MR. ROSE: Post-reactor trip; some of the other designs, when they isolate or trip main feedwater, go to emergency feedwater, that's manually controlled. The operators have to step in and control it.

MR. MICHELSON: Control the auxiliary feedwater; I thought you said main feedwater control. I misunderstood.

Sorry.

MR. ROSE: Recommendations--which there were five, although some of them had several parts to them.

NPR recommended modifications to the ICS as being essential for a substantial reduction in the frequency of feedwater upset, and to the elimination of complex transients.

Types of things they were recommending be done is a separation of the feedwater pump speed control through the feedwater, regulating feedwater control valve position.

An independence between trains of the main feedwater system, the feedwater pump speed control, and position of its corresponding regulating valves be made independent between the two trains.

MR. MICHELSON: These are all steam-driven main feedwaters, all the plants?

MR. ROSE: Yes. That NPR reflected that control of RCSTs and secondary side pressure, those two key variables, be assigned to separate individual sub-systems, and not integrated into the rest of the control system.

MR. REED: First two bullets, has this separation taken place yet? Has it been done anywhere?

MR. ROSE: No, sir. It is being considered as part of the larger issue of ICS.

MR. REED: I would be bothered having the two things independent because these two independent things then would both be trying to do the same thing, namely, control the flow of feedwater into the steam generators. I would worry about bucking reactions between these two sets of controllers, trying to do the same thing independently, but you haven't done it yet.

MR. ROSE: I think we have similar concern. That is why we are wanting to look at this in a total context.

NPR recommended that we consider use of redundant detector with auctioneering to select output, and we consider use of pneumatic accumulators to reduce the likelihood of losing key positioners, feedwater regulating valves.

They also carefully pointed out that we should retain certain positive features of the integrated control system, that these were very desirable and beneficial in terms of controlling the plant; the coordinated reduction reactor power and steam demand on loss of one feedwater pump, which the ICS provides; limiting feedwater flow to each steam generator based on a number of reactor coolant pumps that are supplying that generator, and over, having overriding control to maintain a minimum water level in the generators--these were positive features that we need to ensure that we retain.

MR. MICHELSON: Is there going to be an attempt now to make dual trains or something of that sort on ICS, in other words, so single failure doesn't put it in such a fancy complex transient?

MR. ROSE: If I could defer that question to Larry Stalter when he comes up to talk about the ICS, I think he will tell you what we are looking at.

MR. DAVIS: I had a question on the main feed. You require AC power to operate main feed?

MR. ROSE: I believe so; yes.

MR. DAVIS: Even though they are steam driven?

MR. ROSE: Main feedwater?

MR. DAVIS: Yes.

MR. RUTKERFORD: You have got booster pumps in some designs and back-up--

MR. DAVIS: Thank you.

(Slide)

MR. ROSE: The second recommendation from NPR was that we should reduce by order of magnitude the frequency with which main feedwater upsets occur.

Thirdly, that we limit the maximum flow rate delivered by the emergency feedwater system or reduce the likelihood of persistent demand for high flow limitation on steam generator fill rate. We are pursuing the first part of that.

Number 4, perform analysis for and obtain licensing approvals to remove the anticipatory trip on turbine trip. This trip increases the plant's susceptibility to overcooling without markedly increasing overall plant safety. We are not pursuing that recommendation.

And No. 5, employ the turbine governor valves to relieve surplus energy following reactor trip in lieu of atmospheric dump valves, turbine bypass valves or main steam safety valves. We are not pursuing that at this time.

The last two recommendations were couched as an option on NPR's part, not related to conclusions of theirs within the context of the sensitivity study.

MR. MICHELSON: What is your thought on item 4 concerning the reliability of turbine trip, the thought that it is very reliable?

MR. ROSE: The anticipatory reactor trip on turbine trip, I think has been very reliable. I am not aware of instances where it has failed.

MR. MICHELSON: I am thinking more of the case you should be getting turbine trip and you aren't. Better have reactor trip on some other signal. I notice lately there have been a lot of LERs on turbines that have failed to trip because of the plants in the turbine control system. That worries me. I thought that was one of the most reliable of the arrangements we had in our entire nuclear plant was the turbine trip, not turbine trip on the lower side, but turbine trip on lead. If the turbine trip is not so reliable as I thought, then it ought to be anticipatory reactor trip on other than this turbine trip.

MR. JONES: Crystal River.

MR. MICHELSON: I guess that was it. That was, really kind of concerned me. I read not too long before that another person discovered that the reactor wouldn't have, the turbine wouldn't have tripped except the heating tripped it, but it is a different circumstance, a second LER, different one. That led me to believe turbine trips aren't as good as I thought they were.

MR. ROSE: I believe those concerns are somewhat different from what NPR was getting at here.

MR. MICHELSON: I guess it must be. Yes. Thank you.

(Slide)

MR. MICHELSON: Why won't you want to trip the reactor, trip the turbine?

MR. ROSE: To retain the capability to ride it out, ride out the transient, as originally designed.

MR. REED: But that's a utility desire that doesn't necessarily relate to safety. I think safety should get precedence, and not a desire to maintain the reactor rods up.

MR. MICHELSON: The idea is you would like to try the bypasses first, that sort of thing, to see if that will carry you through. That's a full power trip.

MR. ROSE: As I said, we are not pursuing this particular recommendation.

The sensitivity study also incorporated a peer review process. The peer review group was established to provide analytical input and review. The group included utility, vender, and NRC thermalhydraulic analysts. These people were experienced in the development of codes and models, and were very valuable. Therefore, input was very beneficial during this phase of the sensitivity study.

The peer review group concluded that the analysis and results are technically sound and appropriate for the study's comparative scope, that the results of the sensitivity in and of themselves are not sufficient to draw conclusions on design changes, and that subsequent evaluation of ICS design changes should carefully consider the total impact on plant response and other transient aspects. I think several of the concerns that you expressed, Mr. Reed, on main feedwater control, you want to look at that in its total context.

And it is up to the owners group to confirm that the proposed reconfiguration can be achieved while preserving the current positive capabilities of the ICS as NPR pointed out. That's all the material I had to cover. If there are no other questions? Bob, are you next?

MR. JONES: I think we are going to get a break.

MR. WARD: Oh, please, Mr. Chairman.

CHAIRMAN WYLIE: Okay. Let's take a break. We will take a 15-minute break.

(A brief recess was taken.)

CHAIRMAN WYLIE: We will resume our meeting.

MR. JONES: The staff's view of the sensitivity evaluation the NUREG document--whatI would like to cover first is what did we do?

The basic activities that the staff performed was we reviewed the specific MPR evaluation, both model adequacy and the conclusions and recommendations. This was done using some contractor assistance for some calculations which were done as part of another research program.

Stuart Rose mentioned that NRC was a member of the peer review group. I want to take a little bit of exception to that. We, we participated in the peer review process in order to audit it, but we were not a formal member of the peer review. We didn't feel that would be an appropriate thing for us to do, so their peer review report was done without us, to clear it up.

We also went and looked at the issue of pressurizer size. Stuart mentioned that the owners group looked at it and NPR. The issue of pressurizer size is an old issue that we, that was raised by the staff following the TMI accident.

One of the questions that we asked ourselves was what, what rules do we have out there where the B&W plant design may have an impact on the response of the plant, whether or not rules that we put out appropriately considered the specific or unique design characteristics of the PRA plant.

We looked at two specific rules, the ATWS and PTS rule, to assure ourselves that any specific design characteristics of the PRA plant were appropriately accounted for, and per the Commission's request, we looked at the adequacy of the OTNG.

(Slide)

MR. JONES: What did we find? In general, you saw a large list from Stuart of the, what NPR concluded with respect to sensitivity, and we generally agreed with what they came up with.

We looked at the responses that were calculated by NPR and some independent stuff done by, by our contractor, and basically what we were finding was the model was indeed reasonable and was coming up with reasonable answers and we had no reason to doubt the conclusions that were being drawn.

We did have some a small caveat on some of them which I will try to outline as I go through it. One of the issues that always seems to come up is the issue of sensitivity of B&W plants to feedwater upsets. Clearly the B&W plants are more sensitive. The NPR study just further confirmed the previous findings.

We did agree that B&W plants are generally not more sensitive to other design upsets, including the upset in steam flow. Now there has been a lot of discussion on that today. Basically what happens is for a steam flow upset, you get a change in the surface area in the steam generator which tends to mitigate the upset, so if you have a step change in feed flow, you will, your level changes a little bit to accommodate, give you a little bit extra heat transfer area, and then the pressure goes up and you get about the same heat removal, you get a balanced situation.

NPR also looked at the response of the plants to a total loss, I mean a turbine trip without a reactor trip in the system, and you can again see clearly the B&W plant does not reach as high a system pressure, for that transient tending to level off. While there is, it is less sensitive, it is not, we don't buy the global statement that it is much less sensitive. We think it is somewhat. It is not a big deal because all the plants will generally trip in response to a turbine trip with the revised set points at the B&W plants today for reactor trip, et cetera, and the adversion of the PORV.

In the area of operator burden, the NPR came up two conclusions.

MR. WARD: You skipped the third.

MR. JONES: Oh. EFW--we conclude--again, this is, this is not a surprising conclusion--that B&W plants do place a greater reliance on emergency feedwater delivery, including the proper regulation of emergency feedwater flow. What does does that mean?

MR. WARD: That surprised me. I thought we just heard a little while ago that there is greater capability of running down on main feedwater.

MR. JONES: Right. And so the question is what does this mean? First off, the issue of flow I think is straightforward. That's they have got enough, more than enough feedwater flow capability, that they had it with full food flow. They depressurize the steam generator and initiate overcooling transient, so when you do deliver EFW, if you want proper plant control, you have to control your emergency feedwater flow within reasonable values.

The issue of greater reliance comes from the loss of feedwater scenarios, total loss of feedwater scenarios. As shown earlier, there is only about two minutes in a B&W plant to, before dryout, two to four minutes, while in a Westinghouse, CE plant, those are 20 minutes or 60 minutes. Depends on the plant. So that from the standpoint of maintaining the heat sink for, with assuring the heat sink is there, you do require your emergency feedwater system sooner in the B&W plant.

MR. WARD: What that really means is given loss of main feedwater, you have got to turn on auxiliary feedwater faster?

MR. JONES: Yes.

MR. WARD: It doesn't say that.

MR. JONES: Okay. The other issue is, for example, the repressurization of the plant to the PORV, given a loss of feedwater, and in a B&W plant, that will occur in about seven, eight minutes, so you would like to have your emergency feedwater flow on before you open up another hole in the primary system, or open hole in the primary system.

And for those reasons, we think that they place a greater reliance on response to a loss of feedwater event.

With respect to operator burden, for a quote normal reactor trip, basically if most of the control systems function properly, the B&W plant and the other plants, really there isn't a great big deal of difference between them in what action the operator is required to take.

The NPR study, however, was limited. It did not look at transients which got into actuation of high pressure injection and SFRCS, et cetera. The operating experience clearly shows that when you get to one of these category C events, there is a lot of operator actions that are, that take place at those points in time, so while the NPR conclusion is valid, it is also limited in its applicability.

We clearly agree that following a failure of the ICS/NNI, you definitely have a much greater operator burden in B&W plants than the other plants.

DR. K_RR: Is that a disadvantage or an advantage?

MR. JONES: Which?

DR. KERR: To place a greater burden on the others? I am not being facetious.

MR. JONES: In, for example, loss of the ICS/NNI I think it is a disadvantage. Part of that disadvantage, and again I am going to answer from the standpoint of the, before the study to some extent because I think that's, that's the timeframe we have to look at--you have a lot of problems with the loss of ICS/NNI what instruments are valid. You don't know the state of the plant or it's difficult to determine the state of plant. You have got to diagnose which instruments are valid, et cetera. Then you have got to take the proper action, and that's what makes it much more difficult.

DR. KERR: More than placing a greater burden, the operator doesn't know what is going on. Is that what you are saying?

MR. JONES: He may have difficulty knowing what is going on or what action to take. That's correct, although there were some actions taken back in response to like the 79-27s and the Crystal River events to improve some of that. There are a lot of actions which are specified or developed as a result of SPIP to further enhance the operator's performance in this area.

We generally agree with the recommendations of NPR which are listed, although the ICS recommendations is going to be discussed more by Rick Kendall when we talk to the specific ICS/NNI review.

We disagreed with the removal of the ARTS on turbine trip. We see it has some safety advantages. They are not pursuing it anyway. It is a moot point at this point.

We also looked at the previous action that staff has taken as a result primarily of the TMI event and whether they were effective in at least responding to some of the inherent B&W plant design characteristics, action such as raising the PORV set point, lowering the high pressure trip set point, and the addition of the anticipatory reactor trip systems. Looking at them collectively, we think they have been an asset to safety.

The addition of the ARTS, especially the main feedwater, ARTS maintains inventory in the secondary system, and is, really eliminates the initial pressure overshoot for a loss of feedwater transient. It won't do it in every exact case, but if I have lost--depending on the signal employed at the plant. For many losses i main feedwater situation where they lose all main feedwater, you will get a fairly prompt reactor trip and nice orderly shutdown of the plant.

Raising the core obviously decreased the possibility of a, of a small break LOCA, so we think that the actions we have taken in the past are appropriate and indeed were shown effective by operating experience.

One other point I want to make there--I didn't have this on the slide, but the issue of pressurizer size, there was some discussion on that.

DR. KERR: You reached that conclusion based on just good engineering judgment? You didn't do--

MR. JONES: Looking at NPR results; they had analyses where they did not have the ARTS, had the ARTS.

DR. KERR: Didn't do a risk analysis or anything?

MR. JONES: No, we did not. That was engineering judgment.

One of the issues was the pressurizer sizing issue that we did look at. We looked at various sources where we have compared pressurizer sizes, and there were early reports which indicated B&W pressurizers were undersized. There were other reports such as the ATWS report that you indicated B&W pressurizers were bigger than other guys on some relative term. We looked at it in a slightly different manner which was what was the concern associated with the pressurizer size?

The primary issue we came up with was losses of pressurizer indication. Pre-TMI there had been several incidences where pressurizer level indications was lost. The post-TMI history, especially since the owners group had or all of the B&W plants have apparently raised their normal operating level a couple of feet in the pressurizer, has kept the pressurizer level on scale for all but I think it was one event.

Since about 1982, there was an earlier event at Arkansas before they raised their set point where they lost pressurizer level indication, but since then, there have been only the one. That was Rancho Seco, which is not much of a surprise.

So if they, the operating history has proved that while the pressurizer maybe could have possibly been larger, there is no need for it to be larger from the safety standpoint. In most transients, it will stay on scale.

We looked at the inherent characteristics of the plant with respect to the PTS, ATWS rules. We relooked at some of the calculations done for PTS. Clearly what the PTS rule does, the PTS rule clearly shows that what drives PTS for a B&W plant is different from the other guys. It is overcooling, secondary side events that drive it for B&W as opposed to LOCAs for the Westinghouse and CE type plants, so in looking at it, going through some of the history for the rule, it is clear that the inherent design characteristics of the B&W plant was considered.

Similarly ATWS, there was a bunch of evaluations of the basic designs, and clearly the ATWS rule which has different requirements for B&W plant, as opposed to Westinghouse plant, clearly those design characteristics differences were accounted for.

Once through steam generator design--a lot of questions about the responsiveness of the design and how if you feed back into the primary system, so we tried to take a look at is it a good design, is it a bad design? What can we say about it?

What we found in looking at it is, and again this is not really that new of a conclusion, we arrived at this back in 0667, we just confirmed it with today's operating history, there are certain operational advantages to the OTSG, primarily the superheat advantage and tube integrity advantages. The tube integrity for the B&W plants has been better for than the Westinghouse and CE designs, so clear., there is something about the design of the OTSG from that aspect which is an advantage.

MR. REED: I would like to get more information on tube integrity. The tubes on the B&W probably fail near the top I would guess, whereas the tubes on the recircs fail near the bottom, or below the, many feet below the water level.

Now certainly from an atmospheric release point of view, tube failure near the top in the steam phase is much more of a radioactivity concern than a tube failure down in the bottom, although you may if you apply differences, calculate the differences to that.

Now isn't it the case they are failing up near the top?

MR. JONES: First off, how do we come up with the issue of tube integrity? The failures that have been seen have been up top. Now failures as, is the question. What do you mean by failure? One of the things is we didn't find any tube ruptures for any B&W plant. There have been leakers, but not many ruptures. There have been ruptures on the Westinghouse, CE designs.

MR. REED: There was no sudden rupture incidents at all?

MR. JONES: There have been leaks. The histories of plugging the tubes indicative of some sort of damage mechanism for the B&W tubes, well, for any steam generator tube, it is less--B&W has had to plug a lot less steam generator tubes than the other PWR venders. All those indicate that the, there is something about the design, and I'm not the engineering type for the design aspects, but clearly the operating history indicates that they are not as susceptible to the damage mechanisms as the other PWRs are experiencing. They are not having the same type of--they are having the same types of problems, but not of the same magnitude.

MR. REED: Aren't they getting much more tube fouling?

MR. JONES: They have fouling in the tube sheets or tube support plates.

MR. REED: I am talking by that loss of power capability because of scale formation on the outside of the tubes on the secondary side.

MR. JONES: I think the fouling that has been seen has been seen at the tube support plates.

MR. REED: I don't think so.

MR. GANTHER: Yes.

MR. JONES: The broached holes, there has been crud build-up in those.

MR. REED: What has this--I read recently some, some reactors had to do a cleaning operation on the secondary side of the tubes because of tube scaling found and then couldn't get up to full power?

MR. JONES: My understanding of that is crud build-up in the broached holes in tube support plates.

MR. REED: Just in the little holes?

MR. JONES: Increasing the resistance which increases the water level in the generator, which causes them problems in operating because they can't operate above a certain level and the steam generators have to cut back power to assure --

MR. RUTHERFORD: Oconee units 1 and 2 chemically cleaned their steam generators in the last outages, refueling outages for those units.

MR. REED: It wasn't because of gross scale at the water level and above because of, or near the water level where residue was bound to be left on the tube, or you think would be? Well, it is just in the holes. All right.

MR. RUTHERFORD: Primarily the holes; support plates.

MR. REED: As I understand it, once through steam generator, the tubes are essentially in, well, except for the pressure differential, are essentially in zero stress condition at operating temperatures. In other words, the tubes are more stressed when the steam generators are cooled down than they are at the operating condition. It was designed to be that way, am I correct?

MR. RUTHERFORD: Correct.

MR. REED: Which tells me that overcooling events will increase the mechanical longitudinal natural stresses, which bothers me about your statement of better integrity. I am wondering if you need some more overcooling events to see whether you can pop a tube circumferentially.

MR. JONES: You have design limits on thermal cycles for the tubes. You have design limits on indications in the tube for when you have to plug the tubes and take them out of service, and they account for these transients cycles.

What really, what the history is telling you is you are not seeing the degradation down to the minimum thicknesses where you need to worry about or really start to worry very badly about the cracking or the failure of the tube due to these transient conditions. It is not being experienced as rapidly on a B&W plant as it is on the other designs.

MR. REED: Well, I might say that I never considered the recirculating steam generators were designed at all before Yankee-Rowe, Haddam days, or some of the others, that only in the last few years with steam generator replacements have there been the kind of design look as that there should have been when they just went and ran and picked up an old feedwater heater, turned it on, so that may be a wash in ten years out.

MR. JONES: It may be. The other, the other thing that clearly seems to pop up, well, clearly the smaller inventory and the steam generator offsets some of those operational advantageous because you can repressurize quicker. You can open PORVs quick even if you have a delay in your burdens.

The other thing that seems to pop up from the NPR study and looking at the operating history is not the design that is a problem. Not really the once through steam generator; what you are seeing is its response to failure to properly control those systems that interacts with the steam generator--the emergency feedwater system, the main feed system, ICS/NNI failures which propagate through those systems and affect it. And one way to assure proper post-trip control of these plants and keep, to keep the response in balance is not to go out necessarily and replace the steam generator--just fix those systems that connect to the steam generator and assure they are properly controlled, maintained, tuned, which is the objective of the SPIP, which is the objective of many of the SPIP recommendations, so from that standpoint, we come to the bottom line which is looking at the sensitivity issue as a whole, we don't see a specific design or safety problem associated strictly from the sensitivity of the B&W plant, and we think that SPIP is addressing those systems which the B&W plant seem to show are the most sensitive, or reflect itself in the sensitivity.

That's it.

CHAIRMAN WYLIE: Okay.

MR. REED: I certainly agree with you. If you can decide what the spray flow should be on the steam generator, what the level should be and what the accident is that you have, and you can get a control system to take all those things into recognition, and do things appropriately, it is complex.

MR. JONES: We know what the levels need to go to. I don't think there is a problem with the levels, and specific flow rates I think we can get a handle on.

MR. CATTON: Can you do that without knowing about the internal thermalhydraulics?

MR. JONES: Within reason; I think we can come up with a fair estimate, but if you try to pinpoint it within a couple of percent, no.

MR. CATTON: Who cares about a couple of percent? But well within the uncertainty?

MR. JONES: Yes, I think we could estimate it.

MR. CATTON: You really don't need to wait for the experimental program? Or maybe you don't even need it.

MR. JONES: Depends on how far the licensees propose to cut it back. The finer you want to cut it to keep your overcooling potential down, the more detailed understanding you need to know with the steam generator, of its thermalhydraulics, the wetting characteristic, the heat transfer, the flooding, et cetera. The more you cut it down, the better you need understand it. The values they have gotten now, I don't think you have got a problem, but the values are too high and you are seeing that in operating experience, so what is the proper value is a difficult decision to make.

MR. CATTON: Sounds to me like you do need it.

MR. JONES: That's our opinion. That's why we are discussing it.

CHAIRMAN WYLIE: Any other questions? Okay. Well, thank you. And let's move on to the integrated control system.

MR. STALTER: I am Larry Stalter with Toledo Edison Company. I am chairman of the B&W owners group INC Committee.

MR. MICHELSON: With which company?

MR. STALTER: Toledo Edison; I am going to discuss the ICS/NNI evaluation that was performed by the INC Committee, and first couple of slides here is going to discuss the overall process, and then I will get into some of the specifics of the program.

This process began by establishing first of all some updated design requirements, and to do that, we chose that we would consider only the existing system as it was in the plant, given we had that technology, what requirements will, would apply to that today, and we developed from that a set of design requirements. We used original design requirements that existed.

We also utilized previous failure modes and effects analysis that were performed, in this case B&W 1564, which was done following the TMI event. We reviewed industry and NRC recommendations, and we did, we did utilize INE Bulletin 79-27. We did look at NSAC 3 and did look at NUREG 0667.

We also took in developing our requirements previous industry studies, and there was a study that was ongoing before this one began which, which was to develop recommendations for ICS improvements, and that was done by another committee on the B&W owners group. We utilized that.

We looked at the operating philosophy at each plant. We reviewed the operating history and we looked at the FSAR assumptions that were used relating to the ICS/NNI, and that gave us a base, updated set of ICS/NNI design requirements from which we could work from.

We then looked at the established as-built configuration at each of the plants. We reviewed the drawings. We looked at the modifications that had been performed, and those modifications, many of them came from previous recommendations and previous studies, and had been implemented in plants. And we looked at the programmatic practices at each of the plants, and with that, we established the as-built configuration and how the ICS operated at each of the plants.

The next step in that process then was to do a comparison between those and that, in that comparison, utilize it to develop a set of problems and potential solutions.

Now the problems, potential solutions existed as supplementary documents in B&W 1919 and the two in particular are the problems of in the past the solutions that we developed, and there is also configuration matrices for both the ICS and the NNI, which also have in them cases where one particular plant would have a feature and another one may not.

Now at the same time that this was going on, we tried, we tried to incorporate in our, in our program technological improvements, and our initial look at technological improvements, we tried to see how they could fit in the existing design, and we didn't find anything in the industry that we could utilize, and this was early on in the evaluation.

Now I point this out because later on in the evaluation, some of our key recommendations depend on technological improvements, and that that's where there was a development effort to look at smart signal selection, and a development effort to, initiated by us, to develop an indicator that would assist the operator in giving him an unambiguous status of his indication if we lost ICS/NNI power.

We then looked at this list of problems, and potential solutions, and we utilized that to establish some of our initial recommendations. We also utilized in our recommendations the failure modes and effects analysis that was performed as part of this program

Now to do the failure modes and effects analysis, we took previous failure modes and effects analysis that was done by B&W. There was a previous analysis that was done on Davis-Besse specifically, and that was back in 1980, and we updated that Davis-Besse analysis and established the methodology from which we could then proceed to do the failure modes and effects analysis for the other plants.

MR. MICHELSON: Question--on your FMEA, did they reflect the observations that we have had on a couple of occasions that when certain kinds of instrument power supplies fail, some of the instruments go upscale, some go downscale, some stay where it is, some start drifting? Is that sort of thing incorporated into a FMEA so that we understand how equipment behaves when say the power supply failure?

MR. STALTER: Yes, sir. What we did was we looked at the failure modes and effects that would occur on failures, of various kinds of failures, input, various failures of the outputs, those things that we drove including indicators, recorders, et cetera, and that encompassed failures that occurred within the system.

MR. MICHELSON: How do you know--did you have to go back to the particular vender like B&W instrument people and find out how equipment behaves, or did you do some tests or how do you know what the failure effects are?

MR. STALTER: We, we had previously developed a FMEA that was performed by Science Applications, Incorporated, and to do that, we utilized the original instruction manuals that were part of the system.

Coupled with that there was a report that was done by ORNL on the Oconee units which covered--I guess I should point out here there are two different kinds or two different ICS/NNI configurations. One that is, one is called a Bailey 820 system, the other, Bailey 721 system. Those differences--the ORNL report covered the Bailey 821 system. The SEIC efforts that we performed utilized the 820 plants equipment.

MR. MICHELSON: Do those analyses reflect what happens when the failure mode of the power supply is such as to cause it to output voltage to increase above normal or to decrease below normal, but not necessarily to go to zero?

MR. STALTER: Yes.

MR. MICHELSON: Degraded voltage conditions, in other words, are they reflected in the FMEA? And if so, how do they get the data to know what the the degraded condition causes?

MR. STALTER: One thing that occurs in the B&W plant 820 system is that when the voltage starts to degrade, and I am talking about the DC voltage which is driving voltage, when it starts to degrade, the power supply monitor which is there to prevent degradation voltage takes over, and de-energizes the system.

MR. MICHELSON: Is it possible to have single failures that of one power supply such as it doesn't, it is unable to take over and do that because it is a part of the failure?

MR. STALTER: Single failures of the power supply upon--

MR. MICHELSON: Within the power supply, such that the monitor doesn't do its thing? Is that possible?

MR. STALTER: The configuration of the power supply s, there are--let me think about it a minute. Now in each plant now, there are two DC power supplies that supply each, each individual section of the ICS or the NNI. Now those two power supplies are grouped together using isolation diodes such that if one power supply were to fail, the other one automatically takes over. The power supply monitoring function is to look at the bus to see if there is a degradation of not just one, but more than one power supply.

MR. MICHELSON Auctioneering the two buses.

MR. STALTER: Auctioneering the two power supplies; the other function of the power supply monitor is to serve as an alarming condition to tell you that one power supply may have failed, so it looks at the power supplies and it looks at the buses. The power supplies fail, sets off alarm, lets the operator know that. I think if the bus were to fail, it de-energizes the bus so you don't get inadvertent controlled action. You then go to a known condition, and that is de-energized.

Fr [illegible] the FMEA, we, then we then added additional recommen[illegible]s, an[illegible] [illegible]ok the FMEA a little bit further and did som[illegible] [illegible]edictions that could result from failures [illegible] of this system, and from that add this [illegible]itional re[illegible]endations.

MR. MICHELSON: You did not consider anything like earthquake response on the part of your study?

MR. STALTER: We did not consider seismic events.

MR. MICHELSON: External events like the elevated temperature in the cabinet, was that considered?

MR. STALTER: Elevated temperature in the cabinet was, was one of the design requirements, yes.

MR. MICHELSON: I am talking about beyond design.

MR. STALTER: Beyond design, if you get a fire or something like that--

MR. MICHELSON: No, no. Like if poor circulation fails or the natural circulation, or if there are certain components that are not getting adequately cooled for whatever reason. in other words, it causes more than one failure at a time. Did you consider elevated temperature? Because it may be that the room has lost its cooling and now the cabinet sees an elevated temperature.

Did you consider that sort of thing?

MR. STALTER: If I recall the FMEA--Phil, maybe you can help me. I think the FMEA did not consider that.

MR. LIDDLE: That did not include that, but at the environment where these cabinets are located in plants, typically is the same where the safety cabinets are.

MR. MICHELSON: Typically that's a chilled water system keeping the room cool.

MR. LIDDLE: That's the case. The RPS is--

MR. MICHELSON: The problem is what happens when this one cabinet goes? What kind of unwanted action running around the plant are you going to get?

MR. LIDDLE: There are alarms for things that indicate when the failure is, but that was not considered.

MR. MICHELSON: FMEA does not consider the change in the environment of that sort of thing. Okay. Thank you.

MR. STALTER: in addition to that, our recommended solutions also had inputs from the sensitivity study, and those were previously mentioned, and we will talk about them again. And they, we looked at equipment obsolescence. We looked at aging. We looked at what kind of support was out there that was available for this equipment that we have in the plant, and what kind of availability will it be in the near future? And those all went into our recommendations, recommended solutions.

MR. MICHELSON: You said support. What did you mean? Maybe I misunderstood. What kind of support?

MR. STALTER: The vender will be there if we need support.

MR. MICHELSON: How about the support systems required for this equipment to function properly such as room cooling? Was that looked into at all?

MR. STALTER: We did not get into room cooling.

CHAIRMAN WYLIE: What is the rating of the equipment as far as temperature goes? Are these forced cooled cabinets?

MR. STALTER: Forced cooled cabinets; there is fans in there. They are designed to operate I believe at 120, forty degrees C; 122 degrees is the design.

CHAIRMAN WYLIE: That's their design.

MR. MICHELSON: Is that the air in the room, that 120?

MR. STALTER: Ambient conditions.

MR. MICHELSON: All right. And you have got forced circulation in the cabinet besides?

MR. LIDDLE: Yes.

MR. STALTER: That was the input that we had. We had some follow-on activities that are ongoing now. The output of that, we needed some additional look at our known safe state that we, that I will get into that in a little bit. We needed some additional work that we outlined in B&W 1919 on the definition of how the ICS/NNI was used in FSAR assumptions. That works on normal.

MR. MICHELSON: On your FMEA, these, these systems are powered off the vital bus I guess, four different vital buses, is that correct?

MR. STALTER: I don't know what, your term vital bus. They are uninterrupted power sources, typically battery backed.

MR. MICHELSON: Running off a converter probably.

MR. STALTER: That is correct.

MR. MICHELSON: Now if the inverter goes to full off voltage, was that considered in the FMEA? Your power supply voltage, one single failure of the power supply would cause that.

MR. LIDDLE: Individual power supply failures were considered.

MR. MICHELSON: Considered in the FMEA?

MR. LIDDLE: Losses of power supply were. I'm not sure if increased voltage was.

MR. MICHELSON: Loss, I don't have too much problem where it is increase or degradation of the voltage condition, that to some extent the equipment can accommodate to it, but not, not necessarily if it goes say to 130 when it is 125. You are not sure then on that?

MR. STALTER: In the case of Bailey 820 system design, if you have individual inverter, it would go to very high voltage. Let's say it would cause a condition where that power supply cannot function, then the other power supply will take over and perform.

MR. MICHELSON: This is not in the Bailey equipment? This is DC system in the building. Now in terms--I assume you are getting 125 DC as the feed?

MR. LIDDLE: No--118 ACR.

MR. MICHELSON: Excuse me. And that is what goes up to a 130, forty, and that has to be somehow accommodated by the Bailey equipment.

MR. LIDDLE: The Bailey system has requirements on what we can allow the AC to vary. That's put on the plant requirements.

MR. MICHELSON: That is a range. If it quits completely, it gets out of range, does it just--

MR. LIDDLE: The power supplies will shut down.

MR. MICHELSON: Okay.

MR. STALTER: We saw in that evaluation the need to look into, because of equipment obsolescence, and because of design features we would like to see, we saw a need to look at advanced control, and that's why advanced control system was a follow-on effort and that is an ongoing effort and I will get into that in a little while.

MR. MICHELSON: Present ICS non-service?

MR. STALTER: That is correct. It is a non-safety system. We visualize that any replacement system that we would have for the ICS would also be a non-safety system.

MR. MICHELSON: Not necessarily single crack in terms of power supplies to it and that sort of thing, is that right, or will you have a single power supply to all?

MR. LIDDLE: ICS presently does not have single power supply. Has redundant AC and redundant DC, and replacement system would be as good or better.

MR. MICHELSON: You are feeding it off four different trains, aren't you?

MR. LIDDLE: On the back; on the back, yes.

MR. STALTER: I will get into some of the features of the ACS toward the end of the discussion.

(Slide)

MR. STALTER: So to summarize a little bit here, we utilized previous work. We brought the documents up to date. We established the requirements and those requirements are with the given technology that we had installed in the plant. We made comparisons between the requirements and what our actual plant configuration was, formulated the recommendation, and the people involved in this process were utility INC engineers, operation personnel. We wanted to be sure to have operator input into particularly some of the recommendations. Maintenance personnel, when it came to maintaining it, those people were the ones that provided us the best input on those, those kinds of recommendations.

We had B&W's controls engineers and specialists with us, and we had some industry experts and particularly informed, we took a lot of advice from the independent advisory board, the SPIP, and we also had EPRI and different consultants.

(Slide)

MR. STALTER: The magnitude of the evaluation, and I guess I put this slide up here to indicate that this was a major project because it had a direct expenditure of over $500,000. The indirect was more than that, and it spanned a period of fourteen months following, well, it actually began in early '86.

It included eleven I&C committee meetings, and these were working meetings, four working level meetings at the NRC where we updated them on the progress, and presentation to six independent advisory board meetings.

The output was published in six major documents, 26 supplementary documents, and they are now Appendix R at 1919.

Key here was that there was over 450 different ideas and suggestions and references or recommendations that we looked at. This was a large, large number for us to deal with, and each suggestion or reference had to be dispositioned, and the effort to do that was a big effort. We had to identify each and every one of them. We developed a matrix to make sure we didn't miss anything. We went back and re-reviewed the documents, and in the end when we established our recommendations we feel that we were very, very complete.

MR. MICHELSON: Let me ask you something on the history, indicate why I am a little bothered.

Back when the light bulb occurred at Rancho Seco, that was a surprise. People hadn't thought through this situation so well, but they learned a lot and they presumably fixed the plant, yet when the next Rancho Seco event occurred, there was more surprises again that they didn't fix things the first time or learn more or just what happened?

See, that 1985 event, the whole lot, I had just assumed in my mind everything was fixed and I saw a lot of what looked very familiar in 1985, and what happened? Why was the thing so familiar? Was it not yet fixed or not really learned the first time or--

MR. RUTHERFORD: I think for the most part Rancho Seco had not installed systems that they intended to install, that would have fixed--

MR. MICHELSON: They understood their shortcomings but hadn't got around to, had not fixed them?

MR. RUTHERFORD: I won't say they understood everything, but the systems that they intended to install would have taken care of some of the problems that cropped up.

MR. MICHELSON: They were going to do it later or just never intended--

MR. RUTHERFORD: They were going to install the equipment.

MR. MICHELSON: That was quite a long time in history between the two events, but apparently it moved along slowly.

MR. RUTHERFORD: That's true.

MR. MICHELSON: So it is not like I should really believe that you can understand these things. That led me to believe we didn't understand the first event, just because I didn't know the histories, what happened.

MR. STALTER: Dealing with these many, many ideas and references or dispositioning those, the task became a great one, and we decided to do it in this manner. We chose--

MR. MICHELSON: One other question on this old Rancho Seco event, the light bulb one, and that is that you are not looking at external events, but one of the things that concerned me because I have seen more than one LER relating to it, that is if you get some water in those backlighted switches, the kind that have the bulb in, you can also get some exciting things happen because it shorts out some power supplies and so forth.

Is there something done to make sure that they don't drink coffee over the bench boards in the control room, that sort of thing? That's how you get the slight dropping--the light bulb, you drop a cup of coffee on the lighted switches, and things go into scintillating modes. Is that part of FMEA then, or did you not consider water because that is an external event?

MR. STALTER: I can't address that specifically, but I can tell you there is one of our recommendations that would help along those lines, and that is that we have a recommendation that asked that we fuse all signals leaving the cabinet.

MR. MICHELSON: That would help.

MR. STALTER: If we fuse those and we get a short in one of those, all we do is lose that individual recorder, indicator, or auto station, whatever it might be, and not the whole system.

MR. MICHELSON: As far as you know, in B&W plants do you allow coffee over the bench boards in the control room? Any prohibition against drinking coffee while on duty?

MR. RUTHERFORD: I can't speak for them.

MR. MICHELSON: There is a standard going through we heard about the other day about not going to allow them to eat.

MR. DAVIS: You have got the problem of sleeping.

MR. MICHELSON: That's another problem. That coffee cup is a real bad thing with the B&W design. Not many other people use those switches big this system uses them extensively.

MR. RUTHERFORD: The FMEA doesn't necessarily care about where the source is coming from.

MR. MICHELSON: It does it one at a time. If coffee hits several switches at once, I don't think the FMEA goes in and faults several things at once. I think it is going through one at a time.

MR. LIDDLE: Single input and power distribution.

MR. MICHELSON: Enough said. At any rate, watch the coffee cup. It really is an interesting source on some of those backlighted switches.

MR. STALTER: We categorized these recommendations, classified them into three levels, and those three levels are stated in this slide, the first being those items which will provide immediate improvements to the operation availability and reliability of the ICS/NNI systems.

Typically now the RTS handles, contains 51 recommendations, and I think at one time somebody said 53, but I believe there are a couple that have superseded that are related to the ICS/NNI, and these will in fall into this level one category.

Now there are three key areas that these provide improvement to. We improved the reliability of the power sources. We look at hardening the inputs to reduce the probability of a trip or transient, but what I mean by harden is that we want to make sure that that input, if it fails, we won't have a trip or transient.

And the third one being if we lose power to these systems, we want to be able to achieve a known safe state, and the next, the next slide, I am just going to move on to the next slide for a minute because it talks about all of the level one recommendations, or not all of them, but typically example of the level one recommendations that apply to those three categories.

And you asked about failure of the light bulk, and we said we are going to fuse an auto station. We are going to do things, install current and voltage meters so we can monitor the power supplies. There is a case where they don't exist. In the case of the 721 design, we are going to supply the hand power which is one sort on the auto power circuits from separate panels where we are now. We found in this review that they are supplied by one; 182 you here the AB, automatic bus transfer for main feed pump controllers. We are suggesting there that gee, we can protect the ICS. Here is a vulnerable case where the device we are trying to control, if we lose the power that is supplying the ICS, it can knock out all of our feed pumps.

Fuse all power leaving the cabinet, that these two really kind of go together. We wanted to, we have one case where the NNI has a wide DC power where only one power supply is supplying that, and we are, and this recommendation is saying let's put in the second DC power supply in that area.

The power supply monitor is the result of the SMUD event. The power supply monitor we have found was monitoring power in the wrong place. It was not in accordance with the drawings at most of the 80 plants, and this recommendation says make sure that it is installed in accordance with the drawings.

MR. MICHELSON: Wnen you did this FMEA, did you find that there were any single failures which would cause the flow control valves, main feedwater flow control to go wide open, for instance, and overfeed the generator, suggesting failure that did that in the present ICS system?

MR. STALTER: I am going to--Phil, I believe we did.

MR. LIDDLE: There are some things that could cause that to happen.

MR. MICHELSON: I wouldn't be surprised. So you haven't done anything about them yet, the overfill question?

MR. STALTER: We are going, we are addressing that in the known safe state issue on loss of power.

MR. MICHELSON: Okay. That's where you are going to handle it.

MR. LIDDLE: Plus the input side, we are handling that, so it--

MR. MICHELSON: Is there some kind of rule in your mind that says that no single failure should cause steam generators to start overfilling, or whe you write a set of rules like that, how do you decide what fixes to make, how much vulnerability to tolerate, what criteria, in other words, to use?

MR. STALTER: I'm sorry?

MR. MICHELSON: What criteria are you using to decido whether or not maybe something needs to be fixed?

MR. STALTER: This was primarily engineering judgment in looking at what we came up with in the recommendation area. We are saying these are the areas that we need to take care of, and it was a judgment of the, those people that were involved in evaluation.

MR. MICHELSON: Maybe I missed it then, or maybe it just isn't a complete list, but for instance--

MR. STALTER: This is an example. This is not a complete list.

MR. MICHELSON: You did something to improve the overfill of steam generators?

MR. LIDDLE: In terms of what we get from the ICS, yes.

MR. MICHELSON: ICS is one of the sources? There are other sources of overfill causes, but the ICS is one of them?

MR. LIDDLE: Right.

MR. DAVIS: Are these improvements primarily for safety considerations or reliability considerations?

MR. STALTER: These are for reliability, availability considerations. These do not, these are, do not affect the ability of the plant safety systems to perform their functions.

MR. DAVIS: Don't they decrease challenges to the safety systems, thereby--

MR. STALTER: Certainly they do.

MR. DAVIS: That would improve safety?

MR. STALTER: Yes, it would in that sense.

MR. MICHELSON: Steam generator overfill on a B&W is not presently safety grade, is it? Or is it?

MR. LIDDLE: No.

MR. MICHELSON: I don't think you have any provisions for overfill presently, although that is an engineering issue we recently reached a tentative resolution on. I think right now you, ICS is not, it is non-safety, but it could cause plant to get into some potential safety difficulties like overfilling the generator and starting to go into main steam lines.

MR. REED: On the reactor coolant flow, is that replacing the flow because it is too slow acting, or--

MR. STALTER: I was going to get into this, into this particular area right in here. This is the area where we are talking about hardening the inputs, and we had some very early recommendations in the program. As a matter of fact, these are recommendations that preceded SPIP where we tried to improve the ICS, and some of these are--not all of them, but we said that, we looked at the failures that occurred of the reactor coolant flow signal going to the ICS. Now this resulted because the signal going to the ICS came out of one single RPS cabinet, and if for any reason the power was lost to a single RPS cabinet, we lost the flow signal that went to the ICS, so we said let's reduce the probability of having that failure, cause a plant transient, so we said all right, we will do that by eliminating the flow signal and replacing that with a pump status circuit that corrects the delta TC circuits in this case, in the event that you lose one reactor coolant pump, so it has one signal that is in there for normal operation, four pump operation, and transfers in a signal on the reactor coolant pump.

MR. REED: It seems to me there has always been sort of argument against using a simple input like voltage and amperage or pump status I guess come from those two parameters, not just voltage.

MR. STALTER: It is analogue signal, combination of analogue and contacts.

MR. REED: Because flow is really the parameter. I mean if I broke a shaft, the pump will have some changes in volts and amps I expect or particularly amperage, not, it will not really be directly coupled to flow, so really what--you think that's a good signal? The status of the pump versus the actual flow?

MR. STALTER: Yes. We do feel that that is a good signal to use.

CHAIRMAN WYLIE: Is the natural contact off the breaker or--

MR. STALTER: Breaker contact.

CHAIRMAN WYLIE: Okay. Just says it is running.

MR. REED: It says the breaker is closed.

CHAIRMAN WYLIE: Yes.

MR. REED: And the shaft is broken.

CHAIRMAN WYLIE: Analogue signal, is that the power or the current signal or--I believe you mentioned analogue signal.

MR. STALTER: RC flow? RC flow was an analogue signal. We relayed that.

CHAIRMAN WYLIE: Just a motor breaker contact?

MR. STALTER: With the contact, yes, plus a voltage because we need the voltage for the analogue control within the ICS.

MR. LIDDLE: Just a signal generator representing the flow.

MR. STALTER: Represents the flow for that.

MR. LIDDLE: Or some plants actually--

MR. STALTER: There is another way to take care of this problem. This was, like I say, this was an early recommendation. At the time that this recommendation was made, there was no smart analogue signal selection capability designed or available to it for use, so we couldn't really at that time say okay, let's look at these signals and see if we can really make a good selection of signals.

Now further down the road, as we got into that evaluation, there became available from a number of venders, from two venders in particular, a means to do smart analogue signal selection or smart automatic signal selection. That could be substituted for this, and it would work fine. We could use the RC flow signal. In a case if we got failure, it would automatically transfer to the one that was good, provided it was implemented properly, and would prevent any plant transients of that single transmitter failure.

CHAIRMAN WYLIE: What was wrong with the RC flow signal?

MR. STALTER: Primarily we were experiencing two things. One was a single failure of transmitter that was selected, and these were hard wire selected, would cause the ICS to initiate a plant transient if that signal failed, and the second part of that was if the RPS channel from which that signal came, if its power supply were de-energized for some reason, it would also cause a plant transient through the ICS, so that the thrust of this was to prevent those plant transients.

MR. MICHELSON: Was that elbow tap that you were using for flow?

MR. STALTER: No. This, there is a flow element that is in the hot leg

MR. MICHELSON: Actually you have to take it right off the flow element. That is much more positive, of course, pump status--could be rather ambiguous.

MR. STALTER: We agree that it is more positive and that's the reason it was part of the original design. However, the effect of using pump status in our view is satisfactory.

MR. LIDDLE: For the uses of what this RC flow signaling is used for, the pump status is equally valid.

MR. MICHELSON: Good enough; it isn't quite the same?

MR. LIDDLE: That is correct.

MR. MICHELSON: Okay. Thank you.

MR. STALTER: The thrust of each of these others was, was a single failure would cause the ICS to initiate a transient of some sort. Those were early recommendations, and really they could all be encompassed into what we now have as this one, and that's to do auto selection of valid inputs. And we now have a technological improvements available to us for, available to us for our use in affecting that. It is being installed, has been installed at one plant, one unit, is being installed in a number of others at this time.

MR. CATTON: Are you going to go back and take another look at one?

MR. STALTER: As a part of the installation of this, we will, all of these will be considered. We may elect to leave the pump status in place, for instance, because of its perfectly performing its function, there is no reason to change it.

MR. CATTON: But somehow it seems like a step in the wrong direction. The flow is the primary variable.

CHAIRMAN WYLIE: How do you detect a broken shaft?

MR. LIDDLE: ICS doesn't care under those conditions.

CHAIRMAN WYLIE: I know, but how do you detect it?

MR. LIDDLE: RCS trip; it has happened in Crystal River.

MR. STALTER: Get a flux to flow trip in the ICS or in the RCP. Excuse me.

CHAIRMAN WYLIE: Oh, okay.

MR. STALTER: The last area that we categorized generally these recommendations into was known as safe state. We have one recommendation that is known safe state, and that is that we achieve a known safe state, balance, heat balance the plant, normal operator actions following a loss of either NNI power or ICS power.

And now this could be different things at different plants. If we implement auto selection of the valid inputs properly, when we get down to this known safe state effort, we want to be able to lose a section of the NNI, lose that power, and continue to operate. If we lose the ICS, we will end up in, may end up in a trip condition, but if we do end up in a trip condition, we come to a state where the heat balance is maintained by the operator, and we don't get into severe overcooling, overheating transients.

These other recommendations all help in that regard. One other thing to point out here is one of the other technological areas that we made some improvements was to provide this unambiguous status of indicators to the operators. We took upon a project to develop a digital indicator that could replace the existing indicator and control panel that would provide the operator with an immediate status so he could lose power that was supplying that indicator. It would, if you lost the AC power, it would be black, totally black. You would know it right away. You wouldn't try to read it. If the signal were lost to that indicator and went to mid-scale, there would be an indication on it to let him know that was at mid-scale, that it was a, may not be a valid reading, he shouldn't rely on that.

MR. MICHELSON: I notice you had pressurized heater interlocks down there.

Are the heaters such that if you, if you were to lose level and fail to interrupt the heaters, that when they melt down, which I guess they will do next, won't they?

MR. STALTER: The problem here was on the pressurizer interlocks, that if we lost power to the cabinet--

MR. MICHELSON: The control.

MR. STALTER: NNI in particular, that we lost the power to--there is an interlock in that cabinet that is utilized to prevent you from energizing the heaters. If you uncover them, then that interlock actuates the way where it won't let's you use the heaters even though they are not uncovered.

MR. MICHELSON: You have, in essence you lose the ability to apply heat to pressurizer?

MR. STALTER: Right.

MR. MICHELSON: How about the other?

MR. LIDDLE: Just certain banks of heaters, to make it clear.

MR. MICHELSON: Yes. Each NNI has certain number of heaters on it. Each has the--

MR. LIDDLE: It is actually separate controls from the NNI.

MR. MICHELSON: What prevents the pressurizer heaters presently from being powered when the level has dropped below this cabinet? Will a single failure cause the heater to burn out then?

MR. LIDDLE: It would prevent the interlock from occurring, that is correct.

MR. MICHELSON: The heater would burn out in that case.

Are your failure modes of your heaters such that don't lose the pressure boundary when you melt the heater out? Is that a design basis, that you should not lose the primary pressure boundary when the heater burns out? It will melt the sheet. You have lost the boundary on the heater, but you are using that type of rods that won't blow out.

MR. GANTHER: It is the case predicts--

MR. MICHELSON: You don't really want to blow the heaters out. That's a primary LOCA.

MR. TAYLOR: The heater is quite a distance away from the pressure.

MR. MICHELSON: It is a design basis, though, requirement that you melt the sheet without blowing out the heater.

MR. GANTHER: That's the basis. I don't know if it is design basis or not.

MR. MICHELSON: Thank you.

MR. CATTON: Is the ICS computer based?

MR. STALTER: The ICS is an analogue computer. It is not a digital computer.

MR. CATTON: Do you know what happens to it if it starts to warm up?

MR. STALTER: It starts to warm up, and you mean the temperature of the components heat up?

MR. CATTON: Yes.

MR. STALTER: We know what happens to it up to the design temperature. Beyond that, we have never taken it to a failure in the sense that we have gone beyond the design requirements for that.

That was the essence of our level 1 recommendations. We had two other categories, level 2 and level 3, level 2 recommendations being those which potentially involve major modifications to the existing equipment, and further in-depth evaluation needs to be accomplished before we approve these, and we felt that at this point the continuing evaluation of these would require some long-term commitment to the existing hardware.

The level 3 recommendations are those items which consist of replacement of the existing system. They would be much more comprehensive, and that a new, new system based on modern digital technology, technology would be utilized, and an advanced control system task force was organized to establish, and is currently pursuing the development of an advanced control system.

MR. MICHELSON: Is that for replacement of the present ones or--

MR. STALTER: The intent would be it would replace the present ICS/NNI, yes.

MR. MICHELSON: At some point down the road.

MR. STALTER: Intention was to have it available. If a utility chose to put that system in, we would have that available for use. I have got a slide further or down the road that talks about what, some of the details of that.

(Slide)

MR. STALTER: These are recommendations that we classified in level 2 and level 3, and if you look at these recommendations, many of these are ones that came out of the sensitivity study, and that is to segregate the system, separate the sub-systems, control main feed pump on delta P, separate the controls from the main feed pumps and main feedwater valves.

The elimination of the mid-scale failure was classified as level 2 and certainly the elimination of mid-scale failure would be taken care of in a level 3. Now mid-scale failures occur because we have a bipolar design. It is a plus to minus ten volts system, and in order to take care of that problem, it would be a very extensive modification to the existing system.

MR. MICHELSON: Do all of them fail on voltage to a fixed position or can they drift around?

MR. STALTER: If you lose voltage to them, we know where they fail to.

MR. MICHELSON: To fixed system?

MR. STALTER: Yes.

MR. MICHELSON: I got the impression one time that the problem was instrument drift, failed to supply voltage. That must have been folklore.

MR. STALTER: That was the major thrust of our known safe state is that we know where that failure occurs and where it goes.

(Slide)

MR. STALTER: That pretty much concluded the look at the evaluation. I now want to get into a little bit about our review of the SER, and we did a detailed review of the Supplement 1, Section 6 on the ICS/NNI, and the NRC generally communicates overall agreement with the ICS/NNI evaluation. They mentioned some 170 individual recommendations, suggestions and ideas, and generally had agreement over 90 percent of those.

There were some areas of disagreement and I want to go ahead and address those areas, and we generally categorized those in three areas. Those that involved the process of the evaluation--

DR. KERR: I am not quite sure I know who is doing the reviewing and what is being reviewed according to what is on that slide.

MR. STALTER: Okay.

DR. KERR: Review of the SER supplement was completed by whom?

MR. STALTER: This was completed by the IC Committee, B&W owners group IC Committee.

DR. KERR: At what point did the NRC communicate overall agreement?

MR. STALTER: Within the SER, they generally concurred with our evaluation; and this is--

DR. KERR: Over 90 percent of what?

MR. STALTER: Over 90 percent of these 170 areas that we defined they agreed with.

DR. KERR: Okay. Thank you.

MR. MICHELSON: Is the staff going to make a presentation on this a little bit later today? Thank you.

MR. STALTER: With regard to the evaluation process, the, they had some disagreements in the area of our requirements documents. Generally these involved in whether or not we were going to maintain them for future, in the future, and we felt that we established these requirements documents for the purposes of this study and we really didn't have any intent to maintain them as future references.

DR. KERR: What is meant by maintaining documents?

MR. STALTER: That means any time that we made a modification to the system, that we would update this document, this matrix. We intend to keep our individual plant records up to date as to--

DR. KERR: The requirements document says what you are going to do. It doesn't say you have done it, or does the staff want to have one column saying we are going to do this and another saying we have done it?

MR. STALTER: We had configuration matrices also that were part of this process and the configuration matrices are really the ones that would need updating, and that's when we implemented recommendation or made some other change to the system that we deemed necessary.

In the area of the failure modes and effects analysis, we limited the scope of that in that we did not consider operational errors. NRC comment was that we should have considered operational error as that occurred in addition to the failure modes. We limited it to the system failure modes and effects analysis, and not the operational aspects of it.

MR. MICHELSON: If I understand what you told me a little earlier, you did not include the effect of room cooling on this equipment? Was that a correct understanding?

MR. STALTER: That is correct. We did not.

MR. MICHELSON: What puzzles me is FMEA doesn't consider that when it does consider loss of supply voltage to the equipment and so forth, but not room cooling, which is equally important. In fact, it may lead to more confusion on the part of the operator board than say loss of power.

Is there some justification on why you think that

that essential service is not necessary to be considered?

MR. STALTER: I did not know of any room cooling events that have occurred that have affected the operation of the ICS.

MR. MICHELSON: I can tell you at least one. The McGuire event got one whole train of equipment, elevated temperature. All that elevated was what, 90 degrees, Charlie? Was that right?

MR. LIDDLE: I think the operator is going to know before it gets beyond the design temperatures. This equipment--that's the thing. The design temperature is 120 degrees, they are going to be taking action.

MR. MICHELSON: You are sure that's the room temperature and not the--

MR. LIDDLE: Not the internal temperature, that is correct.

MR. MICHELSON: That gives them a little more leeway, but does he know what to expect or is he just going to shut all the equipment down?

MR. LIDDLE: That is correct. He would have to shut it down.

MR. MICHELSON: Not performing any essential service; he would just kill the power to it?

MR. LIDDLE: Well, there is more control hopefully.

MR. MICHELSON: Better kill the power; the power starts the heat in the cabinet.

CHAIRMAN WYLIE: Open the door, put a fan on it.

MR. MICHELSON: If you can, yes.

MR. STALTER: In the area of IE Bulletin 79-27, which the NRC hit a little hard on us, we did consider 79-27 in our evaluation. What we did not do was to specifically document each plant's response to that bulletin and how they dealt with it.

When we looked at the up-to-date configuration of each plant, they had included in there many that we had included, many of those areas that were resolved by IE bulletin 79-27, and others in 79-27 could not be resolved on a generic basis, and needed a plant-specific evaluation, and so we suggested at that point that, that they look at the plant-specific responses and not rely on the owners.

They were, there were some areas where--

DR. KERR: Are they, you convinced they have been satisfied?

MR. STALTER: Had we provided--I don't think we could have provided.

DR. KERR: No. You said yes, that they did look at plant-specific responses. The implication is that, to me that if they looked at the plant-specific responses, they would be happy.

MR. STALTER: No. I think you need to do not only plant-specific response review, but also you need to go to the plant and see what was done. I think if you did those two things, you could probably satisfy yourself.

DR. KERR: Are you convinced they would be satisfied? I mean have the thing--are you convinced that the things that are required by IEB 79-27 have been done?

MR. STALTER: I am convinced that there was a good response by each of the utilities to IE 79-27. Now whether every single item in there was accomplished, I guess I can't answer that.

DR. KERR: You just have a good feeling about it but aren't sure whether the staff would be, if they followed your advice, would be happy?

MR. STALTER: That is correct.

DR. KERR: Thank you. We had some recommendation that they deemed that we lacked references to sources and we have gone back in a couple of areas and looked at some of the recommendations, and have even made modifications to the recommendations, including new source references, and I think that was appropriate.

The other area was the previously identified concerns. There was a list of previously identified concerns that was provided to us in a response for additional information which we responded to. That included the IE BULLETIN 79-27 and other references dating clear back to 1978.

We indicated in that response that there were additional, there was additional items that needed to be closed out plant specifically, and if you looked at some of the details of those items, one could conclude that that's the only way to close them out.

(Slide)

MR. STALTER: There were some programmatic areas where there were differences. We had a recommendation in there that we, that we maximize the dependence on the NNI-X powers or NNI-X area. The thrust of this was that if we lost NNI-X or NNI-Y at some plants, we would cause a transient.

It turns out that in most plants the majority of the controls that feed the ICS signals--excuse me. They feed the ICS--come from NNI-X so a loss of NNI-X is going to cause a transient no matter what. Therefore, we felt that we could maximize the dependence on NNI-X, we would not initiate a transient if NNI-Y failed, thus reducing the probability of failure.

It turns out that this is, this becomes a moot point when we implement the recommendation for hardening of the inputs because we intend to, if we do it properly, we intended to develop enough signals from the X and Y source. That is, we can lose either and still continue to operate and/or assure ourselves that we get to a known safe state.

MR. MICHELSON: What did you do about the problem of in some cases losing the instrument power supply but not the ICS power supply that was, that that instrument was feeding, the instrument was feeding a certain ICS panel? And there are two separate power supplies. Instrument is supplied power locally wherever it is located, and as I recall the light bulk event, they had several cases where the instruments had lost their power supplies, but the controllers hadn't, and vice-versa.

And that was creating--

MR. STALTER: The instruments, the instruments that feed that come out of NNI-X, that go to the ICS. Those instruments are fed from the NNI-X cabinet.

MR. MICHELSON: Right. There are power supplies in that cabinet.

MR. STALTER: And if likewise the signal comes from NNI-Y, that instrument is fed from Y power, so if I lose Y power totally, I have lost both the instrument and I have lost the ability to feed that to the ICS.

MR. MICHELSON: ICS cabinets are supplied by other buses, though, aren't they, instead of X and Y?

MR. STALTER: ICS cabinets have their own source.

MR. MICHELSON: The problem was that the ICS cabinet got the power, but the instrument didn't, or vice-versa.

MR. STALTER: That's right, and that's why they are hardening. That's why we are saying let's look at some different inputs, and if we lose the power to an X cabinet, we want to be able to utilize that signal that is coming through the Y cabinet, and the implementation of smart automatic signal selection will give us that ability to continue.

MR. MICHELSON: I guess you mean auctioneering of some sort.

MR. STALTER: It is not just auctioneering. It is automatic signal selection, and I can talk about that. I wasn't prepared--I don't have a slide prepared for that. The details of how that selection takes place are, get a little bit complicated, but it looks at high failures, low failures, slight drifts, and mid-scale failures.

MR. MICHELSON: That leaves me at ease. Thank you.

MR. STALTER: There was a note in there that they suggested that we put a recommendation in to check out and in this case control rod drive control system modules prior to their institution into the system, and this is a case where you have a failure in replacing a module. We have felt there wasn't any need to do that because that's already included in the procedures for, at each of the plants, so we didn't feel that there is a need forecast a recommendation in that area.

The frequency of preventive maintenance, we chose a frequency of every other fueling outage for tuning the ICS. We feel that is a good frequency. That does not mean that we don't calibrate the instruments more frequent than that. We have calibration schedules that do come around every eighteen months, but for tuning purposes we don't see enough drift in the tuning characteristics to, to tune it more often than every other refueling outage.

DR. KERR: What was the basis of selection?

MR. STALTER: We looked at the past experience that we had in tuning, and the changes that occurred. We didn't see a lot of change in tuning characteristics between the times that we tuned. The problem that we had was we, if you go back from the early Oconee days in 1970 up through the middle '80s, there was very little tuning done and we didn't look at--

DR. KERR: By tuning, you mean testing it, or what does tuning mean?

MR. STALTER: Tuning the ICS means to operate the system, and adjust it so that it, that it, its output parameters stay within a given acceptance criteria. That is, you make a rated change, you make a rated change in the reactor, and you want to make sure that all the parameters follow that. When you change the power level, you make sure the feedwater goes where it belongs, power level in the reactor goes where it belongs, turbine goes where it belongs, and then--

DR. KERR: Preventive maintenance you do not to repair things that have failed but rather to replace things that might fail? Is that what is meant by preventive maintenance? I see something up there.

MR. LIDDLE: Right. It is not just replacement, but also you know. just verification, check and calibration, to identify those things, like you say, that possibly need replacement.

DR. KERR: You are saying that your past experience would indicate that nothing is likely to go wrong? The likelihood of anything going wrong over a two-year period is so small that you don't need to do anything more often than that?

MR. LIDDLE: That is correct.

DR. KERR: What sort of likelihood of drift or failure or whatever over a two-year period would you find acceptable?

MR. LIDDLE: The module is at--we have experienced in the past, they have not had a high failure rate at all nor a drift problem associated with them.

DR. KERR: What is high and what is low? Are you willing to accept a change of one in ten or one in a thousand or one in two or what?

MR. LIDDLE: I don't know that we put a number on it that specified this was exactly what we had to have, but the past experience just from our TAP data base of the failures that have occurred, and our knowledge of what has happened in the plants, that's what we based it on.

CHAIRMAN WYLIE: You do this eighteen months to two years?

MR. LIDDLE: I am saying it is every two refueling cycles, which would be three years.

CHAIRMAN WYLIE: Is this true of your power supplies, too? Inverter and what have you?

MR. LIDDLE: We are talking here of strictly internalized--

CHAIRMAN WYLIE: Not power supplies?

MR. LIDDLE: Like Larry mentioned, a lot of this hardware is checked every 18 months anyhow, for other reasons.

MR. STALTER: Power supplies will be checked every eighteen months.

MR. LIDDLE: This is specified as a maximum and if a utility chooses to, they can go below that.

MR. STALTER: Calibration of the instrument strings would be done every eighteen months.

DR. KERR: It may be a good selection, but I haven't heard any very convincing arguments that there is much of a basis for it, other that it seems like a good time to do it.

(Slide)

MR. STALTER: The last area that we categorized these recommendations into was where the recommendation itself was not agreed to and/or the implementation process, and there were a number in this area, and they involved first of all replacement of an RC flow of the pump status.

There was one method that we used to do that with, whereby we normally had the pump contact status in there, and in the event that we had a trip of a reactor coolant pump, we then transferred the actual flow signal to allow a smoother transition from four pump to three pump operation, and what we accomplished by that was we, we eliminated the possibility of initiating reactor trip in four pump operation which is certainly the majority of the time, and improved the, improved the reliability somewhat.

We didn't--it is not a hundred percent solution because obviously during three pump mode, you still could have transmitter failure in that case. We are going to take a second look at that when we implement the other recommendation for hardening the input.

They did not agree with deleting of feedwater temperature correction circuit. Again, that was one where we felt there was not a need for that, and we wanted to get something out of the ICS where we didn't see there was a need for it.

Removal of the BTU limits was an early recommendation that was, that preceded SPIP. We endorsed it because there again these were, these were circuits that could fail that could cause the ICS to do something we didn't want it to do, and we saw a way of eliminating the BTU limits, and we said okay, let's get them out of here, but one key thing in this area is that we need to then provide a means to run back feedwater on a reactor trip, and that, that I believe was added to that recommendation, was it not, Phil?

MR. LIDDLE: It was just a recommendation was incorporated into our RTS based open draft report when the final came out that clarified it, and the whole recommendation was incorporated.

MR. STALTER: There were a couple other areas that they, that were talked about. These I have provided here as examples. SMUD had their, their implementation of known safe states as if we lose NNI power, we are going to trip the ICS, primarily to get the main feedwater out of the way so that we can go to an emergency feedwater control, and that would initiate the emergency feedwater control. We felt that hey, maybe we shouldn't trip the ICS. What we should do is actually trip the main feed pumps, initiate main feedwater control, and still have ICS control available for other things if we needed it.

The removal of the Z power is Z power at--SMUD is the only one that has Z power. We felt that that introduces one more failure mode. If we lose Z power, we lose the inability to transfer signals to the ICS.

Location of the power supply monitor, we indicated that we wanted the power supply monitor installed as it was originally designed, that is, that it monitors the voltage on the bus, and its purpose is to detect a voltage degradation that could cause the modules to do something that they shouldn't be doing, and we felt that it was appropriate to put it in that area.

Now we did look at. We utilized the study that SMUD had done shortly after their event, and we accepted that study as the way that we should go and that study looked at putting power supply monitors parallel, utilizing a two out of two systems instead of just one. It looked at putting a power supply monitor on the very end of a string of daisy chain so that it detected the voltage at last module down the road, and each of those, each of those was evaluated. We felt that the appropriate location for that was on the bus, and still feel that way.

MR. MICHELSON: The Z power on SMUD, I thought that came about because of the light bulb event, is that right?

MR. LIDDLE: Yes, it did.

MR. MICHELSON: Now you decided it shouldn't be there? Is that it?

MR. LIDDLE: That's right. The failure mode of that can cause loss of all signals to the ICS.

MR. MICHELSON: Had not been adequately elevated when it was decided to do it that way?

MR. LIDDLE: SMUD has, has done several evaluations of this since that time, and their final conclusion is that they should remove NNI-Z and replace the signal selection capabilities within the NNI-X in cabinets.

MR. MICHELSON: Okay.

MR. LIDDLE: That was done for a specific purpose, and it served one purpose.

MR. MICHELSON: Hadn't been necessarily fully analyzed at the time?

MR. LIDDLE: That is correct.

MR. STALTER: We had a recommendation, we had a condition where it has occurred already, where on start-up particularly the ARTS bistable doesn't get reset and then you reach, reach the ARTS arming point which is typically as you are going up about 20 percent in power, and it arms that and it says, gee I have lost feedwater because the ARTS bistable hasn't reached that so we tripped the reactor, and we felt that an automatic reset on that should be instituted so that that's one concern that the operator doesn't have to deal with on a normal start-up situation.

In summary, we felt the magnitude of the effort even though it was large, the methodology we used was sound. We also determined that there are vulnerabilities that still exist in the ICS/NNI design and those are that we can't eliminate the design of mid-scale failure without really replacing the systems, and that's one of the vulnerabilities that exist.

However, with the implementation in the level 1 recommendations, we can reduce the effect of those vulnerabilities. We can go make sure that the system does go to known safe state if we lose ICS or NNI power, and in addition to that, we are continuing to pursue follow-on activities and the advanced control system design is one of those follow-on activities that is heavily going on at this time.

MR. MICHELSON: What does it mean vulnerability still exists? This is a non-safety system, so what kind of vulnerabilities are we talking about?

MR. STALTER: We can still lose the power to the ICS so it is vulnerable to a power loss.

MR. MICHELSON: This is not vulnerability in the sense of any kind of safety vulnerability, just in terms of reliability of the instruments?

MR. STALTER: Reliability and availability.

MR. MICHELSON: Okay.

MR. STALTER: What I would like to do is give you a brief rundown of where we stand on the advanced control system, what we are doing, where we are headed.

This program now is leading the industry literally. We are kind of a jump in front right now at the technology that's exists especially in the United States, and there is a couple areas where that is key, and I will point those out in a little bit.

MR. MICHELSON: Before you get to that, have you read the ACRS letter on A-47, USI A-47? That's the safety implications of control systems in the title. Are you aware of that one?

MR. STALTER: I am aware of it, yes. I am aware of the issue.

MR. MICHELSON: Did you--in there we remarked, of course, that we felt that the true safety implications hadn't been fully searched out because of the failure to look at external events, and several other things in there, and degradation of voltage and air conditions, that sort of things.

Did you take issue with that letter in terms of it doesn't seem like you are correct. What we complained about in there as possible safety implications, even what you presented to us here, has not addressed those kinds of safety implications, as near as I can tell. I just wondered if--

MR. TAYLOR: Specifically is this a real recent letter?

MR. MICHELSON: Was it last meeting we got it out, wasn't it?

MR. CALVO: This is Jose Calvo. I think I saw a couple of weeks ago--I think it was too late. We had everything else.

MR. MICHELSON: B&W has seen it, or you don't--

MR. CALVO: There is a publication of the letter. I'm sure it was available to them. I just read about it.

MR. MICHELSON: Didn't get into any of--I just wondered whether or not what we complained of in there has been taken care of by some of the things that were done on the--

MR. CALVO: Some of the things--not all the way; some of the things. I think you may hear that when Rick Kendall will be talking about the other things, some of those things in there.

MR. STALTER: Things which we are including in the advanced control system program are certainly lessons learned from this evaluation, and previous evaluations. We are including a look at foreign control systems and what they are doing.

In particular we looked at the German designs. We have looked at Japanese designs, and we are pursuing a look right now at what the Canadians have done, and the Germans and the Japanese, and even the Canadians have really taken a step in the direction of implementing technology. We feel there is a lot to be gained by looking at what they are doing.

MR. MICHELSON: Have any of them considered making the ICS safety grade? In other words, feedwater control and so forth, are they still considering them as non-safety systems? Are they designing them as safety grade systems?

MR. STALTER: I believe that they are still designed as non-safety grade systems. Now there may be portions of what the ICS does that they might classify as safety grade. I guess I can't specifically answer that.

Do you know, Phil?

MR. LIDDLE: I can't add any more to what he said.

MR. MICHELSON: ICS doesn't anyway control auxiliary feedwater in the plant, does it?

MR. LIDDLE: No.

MR. MICHELSON: Just main feedwater?

MR. LIDDLE: Main feedwater.

MR. STALTER: We are going to include as part of this AP a detailed human factors study in the ICS/NNI area, instrumentation controlled. We have on board an expert advisory panel and those are, we have a representative from NASA, one from EPRI, one from Oak Ridge Natural Laboratories. Their input is, has and continues to be, have a very major effect on what the program is doing.

The ACS as we envision it now will be both a plant control system, and a monitoring system. We are going to try to include, improve on the control techniques. We are going to look at, at selective integration. We are going to look at segregation, which is the, the recommendations that came out of the sensitivity study. We are going to see if they apply in the advanced control system arena. We have an objective to keep the operator burden down, and we want the plant to continue to be responsive to the demands that we put on it, but if it loses a pump, we want to be able to respond to that pump loss.

Increased reliability is a major, major input into this program, and I emphasize that because we are going to look at it in two respects. One is fault avoidance, and that's where we are going to look at all the weak points that we can define, and we are going to try and design those out. We are going to make every effort to design out the weak points.

The second thing that we are looking at is fault tolerance, and the fault tolerance says we want to be able to take any single fault and we want to continue to operate when we have that single fault.

Now how we define those single faults is still ongoing.

CHAIRMAN WYLIE: Is component life selectivity part of that program, too?

MR. STALTER: Component life?

CHAIRMAN WYLIE: Failure.

MR. LIDDLE: That goes into the fault avoidance issue, high reliable components to be developed as part of this system.

MR. STALTER: First of all, we are going to design highly reliable components here. We are going to pick the best that we can find, and then we are going to, and then if failing this, if we, if there is some fault that still occurs even though we design fault avoidance, put fault avoidance into it, we are going to fall back on fault tolerance and say okay, we want single failure proof.

We are looking at, now at, at such things as triple redundancy and triple redundancy of the whole ICS system is, is right now unheard of in the United States. I don't believe there is anything installed at this time. We are looking at that, and this will all be a digital system. The only way you can do it is with the modern digital technology.

MR. WARD: Larry, how much increased reliability just simple redundancy give you? I mean the risk analysis people keep telling us that there is, because of common failures, there is kind of limited additional reliability as you had level of redundancy. This sort of system, what do you count on?

MR. STALTER: There is an optimum point beyond which the more you put in, the worse it gets. Our initial, and our initial review has indicated that, and I think maybe Phil can correct me if I'm wrong, but my recollection is that it falls somewhere between double redundancy and triple redundancy.

MR. WARD: What do you mean by double redundancy?

MR. STALTER: Double redundancy says you have two systems operating. Failure of one--they are sort of looking at each other, and failure of one says okay, I am going to quit doing this and you take over and do the operation because I have failed.

Triple redundancy says I have got three systems that are systems that are operating, all three systems doing the same thing, all three looking at the other three to see which ones are functioning properly, and when one fails, two of them say hey, that one has failed, we are not going to let him control anymore, and it takes over and drops that one off the system, and the problem is we have to do some other things like let the operator know that it is off the system, and it continues to operate.

MR. DAVIS: What is single redundancy?

MR. STALTER: Double redundancy is two.

MR. LIDDLE: Single system.

MR. WARD: That is what I was wondering what the definitions were.

MR. MICHELSON: how does redundant system decide which of its two channels is the misbehaving channel when we can't auctioneer between the two? Auctioneer three; I don't see how you handle two because the failure is in the device that is deciding which one is good and he picks the wrong one.

MR. LIDDLE: What you rely on is the software that has been designed to go through itself and check itself and to make sure its hardware is performing properly.

MR. MICHELSON: If you lose power or something you may lose that.

MR. LIDDLE: Power is, you account for that in different means. We are talking about module failures.

MR. MICHELSON: Modules can fail locally. Such power in that module--

MR. LIDDLE: In that case, the other module will identify that counterpart has failed. It has lost power.

MR. MICHELSON: Third module is doing the auctioneering between the two then?

MR. LIDDLE: No. No.

MR. MICHELSON: Module fails, the auctioneering circuit has got to be in one or the other, has got to be on either train A or train B.

MR. STALTER: I don't want to get hung up on this fault. I want to let you know that we are looking at this in the evaluation of fault tolerance, and how we are going to implement it is critical to the implementation of this advanced control system, and we are going to do the best job that we can do on this, and we are going to answer those questions in maybe some future date. If you want to see, if you want an explanation of how we go about this study, we will be glad to come up and talk to you about it.

MR. MICHELSON: What are you going to do about the environmental question which we have passed off earlier, but now advanced system? I hope you go back to review the cooling of this equipment as an integral part of the functioning of the equipment. And are you going to put new redundant cooling supplies, that sort of thing?

MR. STALTER: We don't know how we are going to solve that issue yet.

CHAIRMAN WYLIE: What is your schedule for this?

MR. STALTER: The schedule is that it is a three-phase project. The first phase is to develop design requirements. As part of that, we are updating the current design basis for the current, the ICS, existing ICS, and we are going to establish a design basis for the advanced control system, detailed design basis.

Phase 2 is to look at the algorithms, advanced control algorithms to be implemented in the system, and Phase 3 is to pick a hardware and implement the hardware.

The Phase 1 is ongoing right now. Phase 3 has been moved up in schedule to where it is beginning right now, and we hope to have the whole project completed early in 1990. And that's the current schedule. That schedule can fluctuate, depending on the need of the owner because it is owners group efforts. If some owner decides that he wants it available earlier, it might he a little bit difficult, but there, we might be able to adjust the schedule to accommodate that. As a matter of fact, we did move Phase 3 up because there were some interest shown in installing the control system.

CHAIRMAN WYLIE: Owners group is financing this total, in support of this total project?

MR. STALTER: The operators group instituted the project, established the task group for financing the program. However, in the process of doing that, when we went out and looked for the advisory panel, we also saw they pointed out some areas that said gee, we can, EPRI in particular--I will point that out--they said there are some things you are doing here that are leading the industry that could certainly help Westinghouse and GE and the others and we want to take advantage of those and we want to see if we can help you in some of those areas, so they have taken over a portion of that project and they have recently got approved about a $450,000 effort to help us out in doing some of the things that we would have had to do otherwise.

MR. WARD: You are calling it a project?

MR. STALTER: Pardon?

MR. WARD: Excuse me. Go ahead and finish.

MR. STALTER: Primarily funded by the owners group; we are going to receive some outside funding for it.

MR. WARD: Calling it a project. This is a design project? Is that right? I mean what is the product of this effort going to be?

MR. STALTER: The product of this effort will be a hardware that can be implemented in one of the B&W plants utilizing the advanced control system technologies.

MR. WARD: Your organization is going to build the hardware?

MR. LIDDLE: No. [illegible]ally it would be a specification to be able to purchase the hardware, both from a hardware aspect and from a software aspect for the algorithms that is implemented in that hardware.

MR. STALTER: What I meant, we are going to specify the specifications. We are going to take those out and utilize those and we are going to select hardware. We are going to say okay now, and the reason, the reason we need to do that is so that we can assure that those things that we want are implemented in the final stages so we are going to select the hardware before the end of the program.

MR. WARD: There is a good bit of software involved. Are you going to design, create the software?

MR. STALTER: Yes.

MR. WARD: You have got to buy hardware to do it?

MR. LIDDLE: We are not in terms of actual what would go in that hardware, just in terms of functionality of this is the algorithm, this is what the type of control will be, not the indiv dual programming of that hardware.

CHAIRMAN WYLIE: Your spec would spell out the information for the performance requirements?

MR. LIDDLE: Yes.

MR. DAVIS: I have a little bit of a concern that safety is not mentioned anywhere as an objective for this system. It seems to me one of your objectives ought to be that the implementation of this system will not compromise the plant safety, and maybe another objective would be that you might want to look for things in this system that would improve safety. Maybe that's implied.

MR. STALTER: This slide is a very--I want to stress this right now. This slide is a, is minimal, okay. Certainly plant safety is one of the things that is foremost in our minds, and what we intend to do is to make sure that this system can control the plant within the boundaries, within the boundaries of the existing safety systems with the intent that we reduce the challenges to the safety systems.

MR. DAVIS: Also want to avoid the possibility of system interactions and dependencies that can cause loss of all feedwater, for example.

MR. STALTER: Yes.

MR. DAVIS: I am sure you have that in mind, but we have seen examples where improvements have been made to a plant at the same time they have introduced dependencies that weren't found up front in the design. But that's all I have.

MR. LIDDLE: We realize that. Those are definite objectives of the program.

MR. WARD: Along those lines, have you thought about how you are going to control the software that is involved?

MR. STALTER: We haven't specifically defined how we are going to place the controls on the software. We know that we have to do that.

The last aspect I want, that I wanted to point out in this area was the monitoring capability, because this is something that is different than what we have now, and this is a system that we are going to try to incorporate to predict failures before they occur, and certainly to detect failures when they do occur, and to alert the operators in both those cases.

Now the prediction of failures can be such things as the system puts out a signal to a valve that it wants it to move to a certain position and the evidence says that that valve didn't move, and maybe you need a 2 percent signal to make it move or a 1 be percent signal should have made it move. This monitoring system is going to look at the parameters and try to evaluate what kind of condition exists there and let the operator know that you are starting to see a sticky valve or maybe a pump didn't move when it should have moved, and I think that this is one area where many times the existing ICS takes the blame for something when actually it is the control component that is the problem area, that maybe the ICS did present a signal that asked it to do the right thing but the valve didn't m e or the pump didn't go, and we have tried look at those areas in existing evaluation where we limited ourselves to the inputs and outputs.

MR. MICHELSON: Maybe you could make a real step forward and put in some internal temperature monitoring in the cabinet which most of our cabinets now lack. Never know when they are getting too hot.

MR. STALTER: We do have temperature monitoring in the cabinet.

MR. MICHELSON: The present ICS?

MR. STALTER: Have a monitoring in them, that is, a device to detect the fan has failed.

MR. MICHELSON: That's one device. I was thinking of a more direct measurement like what is the actual temperature? A couple more things than the fan itself; somebody might have blocked the end of the bottom of the box or something.

You are heading in the right direction a little bit. Some of them don't even have monitors on the fans.

MR. CATTON: This is particularly important I think if it is digital because they just sort of sneak away a little bit, and a thing gets flipped somewhere, and it is not a complete failure, just sort of runs the program differently.

MR. STALTER: We agree.

MR. CATTON: There is not very much known about this.

MR. MICHELSON: You can build the temperature monitor right into the cabinet.

MR. STALTER. That's all I have.

MR. WARD: Maybe you said this, I missed it, but you have got the three levels, and as I understand it, all of the owners are committed to the level 1, is that it?

MR. STALTER: Yes.

MR. WARD: And someone is going to do 2 and some maybe are going to do 3. What is the status of level 2 and 3?

MR. STALTER: The level, the level 2 and 3 recommendations are being considered presently as part of the level 3 efforts for the control system. The level one recommendations are those which we feel will provide immediate improvements. Those are in the recommendation tracking system and are being evaluated as part of that program.

MR. WARD: If you come up with something really good on level 3, everybody is going to ignore level 2, is that the idea? Just go right to level 3?

MR. LIDDLE: Level 2 is being evaluated, separate also.

MR. MICHELSON: Level 1 will be done? All the owners say yes?

MR. LIDDLE: Yes.

MR. KENDALL: My name is Rick Kendall. I was involved in the staff review of the instrumentation of, the Instrumentation Control Systems Branch review of the ICS and NNI evaluation that the group performed.

In listening to the presentation that Larry Stalter just gave, I jotted down a couple of notes on certain items.

The question was raised about lessons learned from the light bulb event, and why some things weren't, apparently may not have been done or lessons may not have been learned or things implemented.

I believe that the light bulb event involved--I probably should not say that I would be speaking for SMUD, but the light bulb event involved a loss of NNI power, and SMUD did do some modifications to the NNI power distribution system. The event in 1985 involved a loss of integrated control system power. The power distribution systems are very similar between the NNI and the ICS, but I believe that the focus at the time was strictly on the NNI and things didn't get carried over to the ICS.

Another point that was brought up was steam generator overfill protection. I believe that some plants that have the EFIC system need safety grade isolation of main feedwater to prevent overfill. I believe Rancho Seco has that. I think Crystal River has that also, and maybe some other plants have it, too.

MR. MICHELSON: It is already installed?

MR. KENDALL: At Rancho Seco it is installed. At Crystal River I believe it is installed. I think perhaps Arkansas has it. I'm not sure all across the board, but some plants do have safety grade isolation main feedwater to prevent overfill, isolation steam generator high level.

The first item on the agenda was the ICS/NNI systems requirements. I have got a very simplified version of the ICS/NNI evaluation process that are used by the owners group. It is somewhat similar to the slide you saw earlier.

The reason for this slide is to show the importance of the systems requirements and the development of the systems requirements in the overall scheme of the ICS/NNI evaluation.

There were, the owners group looked at a number of sources of information--NUREGs, FMEAs, owners group studies. They looked at LERs, information from their TAP program, transient assessment program, to try develop an optimum set of systems requirements, and the systems requirements were basically on what the original ICS/NNI designers would have used if they had had the knowledge of the experience to date, operating experience to date, so it was intended to be a very comprehensive set of systems requirements.

Then the owners group determined the as-built plant configurations for the ICS and NNI. They performed plant walk-downs, and verification of ICS/NNI drawings so that they knew exactly what the installed designs were.

Then they compared the installed designs to the systems requirements they had developed for the ICS, and NNI, and then through a comparison effort, compared the existing designs to the design requirements. From that comparison effort came forth the recommendations for improvements to the ICS and the NNI. The comparison efforts we viewed as the most important phase of the ICS/NNI evaluation. We felt that's where the most benefit was going to get gained, that's where the problems would be identified, and the recommendations would be made. Through this comparison process, you see the need to have a very good set of systems requirements. Without a good set of systems requirements, the comparison process might not mean too much.

(Slide)

MR. KENDALL: The items at the top of the slide are a list of some of the systems requirements that are common to both the ICS and the NNI systems, environmental specifications such as temperature, humidity and radiation, instrument accuracies, power supply design. Under power supply design, there is requirements for redundant AC and DC power supplies, requirements for loss of power alarms, and the next two items are what we consider to be key items.

The systems requirements are written such that the effect of loss of power should not prevent the plant from being able to achieve the known safe state, and also that upon restoration of power, the plant would remain in a known safe state and that we think that perhaps the most significant concept focused on by the owners group in their review was that of trying to ensure that the plant would achieve a known safe state given any loss of ICS or NNI power.

Down below, we have the definitions provided of a known safe state. They are summarized somewhat, but it basically involves maintaining heat transfer balance between the primary and secondary systems, either automatically or manually. Doing it manually allowed credit for operator action for which the operator is normally trained and which can be taken from the control room on a loss of ICS/NNI power.

MR. MICHELSON: Did you give any thought to the loss of environment control over the environment of the equipment and what the failure state should then be?

In other words, did you need automatically kill power at some temperature points so that you don't go into an unknown failure state?

MR. KENDALL: Well, that's something that we, the owners group didn't pursue, and in their review--

MR. MICHELSON: Certainly the staff was certainly aware of the potential difficulties that the equipment could get into. We have had enough experience now to any longer deny the problem, so how was the staff approaching that question in this particular case?

You are obviously addressing the failure state of the equipment and you are addressing voltage. That is a good idea, but how about loss of environmental cooling? You would like to know what the failure state of the equipment is.

MR. CALVO: I guess we would consider failure modes effects analysis or was that a recommendation that you made should be offered for consideration for later?

MR. KENDALL: I don't believe it was considered in the failure modes and effects analysis. Neither did we consider it in our review.

MR. MICHELSON: It was not, according to the owners group, was not in their failure mode. That doesn't mean you ignore it in your review. You just pointed it out as an area that needs to be done if that were the case or whatever. I would like to know what the staff feels about it in the absence of it in the owners group evaluation.

MR. KENDALL: I am not sure how to respond. I'm sure it is obviously a valid concern.

MR. MICHELSON: You understand the question I think.

MR. CALVO: The fact it was brought up was, brought up as part of insistent requirement, it is one thing to be considered. I think it is indicative of the the fact that everything was not pursued by the owners group, so it remains up there for the consideration.

MR. MICHELSON: The staff has kept that consideration open?

MR. CALVO: This particular subject, if I remember correctly, was discussed in either the safety evaluation report or in the contractor safety evaluation report it defines one of the very important system requirements.

MR. MICHELSON: You say the contractor discussed this. Tell me where to read it.

MR. CALVO: Maybe--

MR. KENDALL: I don't believe we discussed it. I don't think, I don't think our review even looked at that.

MR. CALVO: Okay.

MR. MICHELSON: Maybe we ought to go back and think about it at least as to whether it should be included. It is again in line with the A-47 letter.

MR. CALVO: That is correct.

(Slide)

MR. KENDALL: In general, we felt that the systems requirements were fairly good. We felt that if existing plant designs were modified to achieve conformance with the systems requirements, that many of the concerns identified from previous B&W reactor transients involving loss of ICC power would be resolved. The systems requirements from our point of view as we went through them tended to focus on improvements in two areas.

One was to minimize the effe.t of single instrument channel component failures, such as single transmitter failure. The B&W owners group recommendation to provide, to provide redundant channel and then select the valid one of those two if one of them should fail, falls along those lines.

The other was to limit the consequences of power losses by choosing equipment failure positions such that unknown safe state would be achieved. That I skipped--let's see here.

We felt that design basis documents needed to be developed for the ICS and NNI systems. The systems requirements documents dictate some design requirements, dictate some set points for different actions. It is not clear why the set points were chosen or why the requirements were selected. We felt that the design basis documents that provided the base for the systems requirements ought to be developed and ought to be maintained.

We felt that the systems requirements documents themselves ought to be kept up to date, revised and maintained as changes were made such that the system designers or the users of the ICS would have some documents to go to to understand why changes were made or why the design is the way it is. We thought it would be a useful document, useful reference document, something that would be used, and that was the basis for our recommendation for design basis documents.

We did feel that the ICS system requirements documents ought to be revised to include some areas that were not addressed or at least were not addressed in detail. Some examples of those were the power supply monitor. We felt that the systems requirements ought to specify the power supply monitor alarm trip set points.

Also a loss of instrument air we thought ought to be further addressed. We felt that a similar requirement to that of achieving a known safe state on loss of power ought to be provided for loss of instrument air. Loss of instrument air, the equipment would position itself such that the plant would achieve a known safe state.

MR. MICHELSON: By loss, do you mean degradation or do you mean reduction of the pressure to zero? It can be quite a difference in how equipment is formed.

Did you have both in mind, or only the latter?

MR. KENDALL: I would like to think we had both in mind. For power, we felt that we clearly had both in mind, both loss of power and degraded power condition. That gets, that starts to involve the power supply monitor which we will talk some more on later. We just--

MR. MICHELSON: Transmitter error we know can get plants into difficulty,. Reactor protection system, boiling water reactor is a good example of that.

MR. CALVO: That particular concern was--I think we will talk about that as one of the elements of limitations.

MR. MICHELSON: Later?

MR. CALVO: Tomorrow.

MR. MICHELSON: Thank you.

MR. KENDALL: As far as the staff review of the ICS/NNI hevaluation performed by the owners groups, we specifically concentrated our review on trying to determine whether implementation of the recommendations would resolve, resolve concerns identified from the investigations of previous reactor events involving losses of ICS/NNI power.

NUREG 1195, which is the staff's report on the December '85 event at Rancho Seco, specifically pointed out that the, that event involved the same types of concerns that occurred during previous events such as the Crystal River event, and even back to the light bulb event, that the problems were known and that in the absence of modifications, that the transient at Rancho Seco should have been expected and should have, not have surprised anybody, so what we did, we went back and we tried to compile a list of those concerns that were common to those events.

It turns out that most of those concerns are documented in three documents. Those are IE Bulletin 79-27, NUREG 0667, which was published after the Crystal River event in 1980, and NUREG 1195, which was ppublished after the Rancho Seco event of 1985.

We provided a fairly comprehensive list of those concerns in Appendix E to the NUREG. What we have got here is just a, an example of a few of the items that were common to some of those events. These are examples of items where the staff focused its review--adequacy of control room indication, enunciation, loss of ICS/NNI power, mid-scale failures, either the prevention of mid-scale failures, or provision of mechanism by which failures of indicators were easily recognizable such that operators would not use failed instruments to take action.

Procedures--inappropriate, undesirable equipment, response to losses of ICS or NNI power, things like atmospheric dump valves failing open on loss of power, turbine bypass valves failing on loss of power, load fusing to ensure proper clearing of faults, loss of remote manual control capability for ICS controlled equipment, and the, what we considered to be the major one, was resolution of IE Bulletin 79-27 concerns.

Again, we feel that probably the most important concept emphasized by the owners group during their review was a concept of known safe state, trying to ensure that the plant will attain a known safe state given a loss of power. We feel that resolution of the IE Bulletin 79-27 concerns would essentially accomplish the same thing; 79-27 was issued following the loss of ICS and NNI power event at Oconee in November of '79. The intent of the bulletin is basically to verify, to have plants verify that if you lose power to any single bus that is supplying power to instrumentation and controls, that the plant design and plant procedures be verified to be able to cope with that loss of power to make sure that the plant can attain a safe shutdown condition.

MR. MICHELSON: Question--on the next to the last bullet, you talk about loss of remote manual to develop. Are their cawes now where ICS if it were to fail in a certain way would cause the inability to go to the remote control station say for the valves?

MR. KENDALL: Not remote; remote shutdown station, what this refers to is during the Rancho Seco event of '85 they lost integrated control system power, and therefore the ability of the ICS to automatically control plant equipment. With that loss of power they also lost capability to control certain ICS controlled equipment manually from the control room. They could not close the atmospheric dump valves, turbine bypass valves, had to go into the plant, do it locally.

MR. MICHELSON: FMEA never identified any device that is, could not be controlled locally as a result of that failure, is that correct?

MR. KENDALL: I'm not--we have Mike Waterman from INN who reviewed the--

MR. MICHELSON: Did FMEA show with certain kinds of failures you might not be able to operate the device locally, from the local control station or from the control center?

MR. WATERMAN: The scope of the--Mike Waterman. FMEA addressed the failures of the equipment, but I don't think it really addressed whether or not equipment could be operated remotely.

MR. MICHELSON: Depending how you lash it together, and it is possible you may use remote. Depends on how that circuitry is hooked up.

Did the owners group ever find the case of loss of remote manual capability for local stations?

MR. LIDDLE: No.

MR. MICHELSON: You did look for it. You didn't find it?

MR. LIDDLE: That is correct.

MR. MICHELSON: Thank you.

MR. KENDALL: During the Rancho Seco event, they could have used the remote shutdown station to close the atmospheric dump valves.

MR. MICHELSON: I have seen a number of LERs that infer it wasn't for these, these particular control systems, but they had lost the remote, manual local capability as well as a result of the failure of the full system.

(A discussion was held off the record.)

MR. KENDALL: The next slide shows the, it is a summary of the technical action required by IE Bulletin 79-27. The concern being addressed by IE Bulletin 79-27 was basically that you could lose power to a bus that has supplied instrumentation and control circuits, and thereby initiate a plant transient, and you could also lose indications in the control room that the operator would use to take action to mitigate that transient.

The actions required the review of all buses in the plant, be it class 1E or non-class 1E, safety-related, not safety-related, that provides power to instrumentation and controls, to review to ensure that adequate indication of bus power was provided to the control room, to evaluate the effect of loss of power to all bus loads, to see the effects that power loss would have on plant operation and its ability to achieve cold shutdown condition.

The evaluation of bus loads, he was to include the control room indicators that the operators would use to take action to respond to the bus failure; to review the candidate, which of the procedures used to achieve cold shutdown following loss of power to each bus--that basically consisted of making sure that there were proper indications to guide operators to p[illegible]edures, and that the procedures directed the proper use of back-up instrumentation and controls that remained available that was unaffected by the power loss to be able to achieve a safe shutdown.

We believe that if the ICS/NNI buses were reviewed in accordance with IE Bulletin 79-27, and that if any appropriate actions were or changes were made to ensure that the bus failure could not cause a transient, and at the same time cause loss of control room indications and complicate the ability to achieve a safe shutdown condition, that most of the ICS/NNI concerns identified from events would be resolved. That's why we have placed so much emphasis on IE BULLETIN 79-27 throughout our review of the SPIP program. We believe it is probably the single most important document that the NRC has put out regarding this effort, and we think that it is--and we will get to it in the next slide further on--we think that it is something that still needs to be done.

MR. WARD: I guess this bulletin has been out for nine years, eight or nine years apparently?

MR. KENDALL: Right.

MR. WARD: And there hasn't been a lot of response to it or what?

MR. KENDALL: No. That's a complicated issue in itself. I will try to summarize it, and refer you to NUREG 1195. I believe it is Section 7 of NUREG 1195 provides a real good discussion of the 79-27 review process both by industry to an extent and by the staff. It turns out that when the staff initially reviewed the response to the bulletin, many of the responses were found to be inadequate, and in fact I think there were about 70 operating reactors at the time, and the staff concluded that about 69 of the 70 responses were inadequate to determine that the concerns of the bulletin were being adequately addressed.

Time went on, and the review scope was narrowed somewhat, and then I guess it was narrowed some more somewhat, and eventually the same responses were, that were found to be unacceptable originally, we found that most of the responses were now acceptable, and instead of doing a detailed review of the responses to the bulletins, we did kind of a cursory review just to see if I guess basically the plants responded to the bulletin. Again, the details are in 1195. We felt that because of the initial review or the lack of a detailed initial review, and the Rancho Seco event which clearly evidenced at least at the one plant that the concerns of IE Bulletin 79-27 had not been resolved--if they had been, we don't feel that event ever would have happened--we felt there was a real need to go back and at least for B&W plants, try to make sure that the concerns of the bulletin were adequately addressed.

We did in recent plant licensing reviews, OL reviews of GE and some Westinghouse plants, very detailed reviews to IE Bulletin 79-27. Essentially we found that there weren't many problems, and in reviewing the event at Rancho Seco, it was very clear that the problems existed there.

They did a re-review of IE Bulletin 79-27 as part of their restart efforts. They were I believe somewhat amazed at some of the things that they found and they are making a number of modifications because of their review, and this is not just solely restricted to ICS/NNI buses.

We feel that for B&W plants, and this comes in a later slide, but in a nutshell, we feel that combination of implementation of the recommendations that the owners group has put forth, are going to implement, and resolution of the concerns of IE Bulletin 79-27 would essentially lead us to the point where we would feel pretty comfortable with the ICS/NNI designs. I think at this point we would feel that ICS or NNI failures would be such that the plant essentially would achieve a known safe state.

MR. WARD: Does this tell you something about the regulatory process? I mean should--this was an IE circular?

MR. KENDALL: This was a bulletin.

MR. WARD: Should that have been issued as something with some regulatory force?

MR. KENDALL: I don't know. I guess from a--it looks to me like it was kind of an exceptional case. It was exceptional I think in several aspects.

One, I think normally a more detailed review is done.

I think secondly, the contents of this bulletin were, I think we would consider it the most significant bulletin probably ever issued in the instrumentation control systems area. That's probably a pretty broad title to give it, but--

MR. CALVO: Let me say something. At the time when the bulletin was issued, like we accepted the utilities' response to the bulletin at a face value. We do that voluntarily following TMI like the SPDS system, and sometime after that, when we started looking into the implementation, we found out that the implementation of the bulletin was not the same way the staff interpreted it. I think that was found out at Rancho Seco.

Actually what we do here, we should go back and we look in view of the fact of Rancho Seco--we want to be sure we properly understand all the implications that the actions that was recommended by the bulletin. It has a kind of slow time delay before we got into it. I guess Rancho Seco threw it to the front, whether we should revisit the bulletin to be sure it is understood now it should be properly implemented. That's what we are doing now. We also intend to follow the thing up. We want to be sure we do not miss anything.

MR. WARD: Okay, but in the meantime, we had an incident which it turned out didn't have any, well, had no public health and safety consequences. If it had, had public health and safety consequences, I should think there might be questions about whether this important information should have been dealt with in a different way.

MR. CALVO: The Rancho Seco, the problems that occurred up there, you had some of the safety systems in place. The consequences would have been acceptable. This happened to all the plants, I think would have had the transient. I think the safety systems confounded the consequences. The question is we don't know. Now the owners are aware how the Rancho Seco review has been done, how the issues have been identified. We think we should go back and relook at how the thing was interpreted, see whether they had misinterpreted like they had done at Rancho Seco.

MR. WARD: Okay.

MR. KENDALL: Another interesting sidelight is at one time, the staff had proposed that sentiment to the bulletin, but through the course of activities, whatever, we never issued it.

The next slide is just documents, the correspondence that took place from the staff to the owners group. From the very beginning, we focused our review efforts on resolution of concerns that seemed to be common to previous ICS/NNI loss of power incidents. The letters really consist of feedback letters from meetings. We had about four major meetings with the owners group INC committee. We wrote, we wrote feedback letters following three of those meetings. We also wrote several of these letters, requests for information. The requests were geared toward obtaining sufficient information for the staff to determine whether the previous identified concerns--IE 79-27, NUREG 0667, 1195, whether those types of concerns were being resolved through the owners group efforts.

As far as the staff's evaluation findings, we found that implementation of the owners group recommendations will help to resolve a number of concerns identified from the investigation of events, things like equipment responses to loss of power, reduction in operator burden, prevention of single instrument or power supply failures from being able to initiate transients, accurate indications provided in the control room of losses of power. We felt that implementation of the recommendations would go a long way to resolving a number of concerns. We put both approved and proposed recommendations there because we felt that some of the proposed recommendations were necessary. I believe the recommendation to eliminate mid-scale failure systems, proposed recommendation, I don't believe that it is one that has been approved by the Steering Committee and put forth as a level 1 recommendation.

We believe that clearly with implementation of the recommendations, with implementation of the recommendations, that the ICS/NNI contribution to reactor trip frequency and transient complexity should be reduced or will be reduced. Future loss of ICS/NNI power events are expected to be less severe.

Another thing that we felt good about in the owners group effort was that they placed, seemed to place a lot of emphasis on dictating the plant response to lots of ICS power such that the plant would go to a known safe state, placed a lot of emphasis on dictating the failure modes of valves and pumps and IRS controlled equipment. Passed efforts were more to improve power supply reliability, which they have done, but--and are continuing to do, but despite the efforts to improve power supply reliability, the losses of power still seem to occur now and then, and feel their approach to make sure if they lose power that the plant response will be tolerable is a better approach, and an improvement in their philosophy.

MR. MICHELSON: Are there any instruments or controls which upon loss of power supply fail as is?

MR. KENDALL: I believe some feedwater valves perhaps. I don't know about fail as is. I believe fail at 50 percent.

MR. MICHELSON: Controls fails in as is position or they fail--

MR. LIDDLE: Components could fail in that position. Yes.

MR. MICHELSON: Why don't you make those failsafe?

MR. LIDDLE: We work around that such as the valve fails as is, say, you run back to pump, to the condition where--

MR. MICHELSON: Instrument controls and components, I know valves have this problem. How about instruments and controls, controllers, instruments, pulling device? Do any of them fail as is? Does it fail?

MR. LIDDLE: All the ICCS components would fail mid-scale, on loss of power.

MR. MICHELSON: There are no--I was thinking of that during some of these funny events, things failed as is. Maybe not.

MR. LIDDLE: Recorders might.

MR. STALTER: If right at zero volts it failed, it would stay there.

MR. MICHELSON: You don't, the recorder would lock in the last position, but none of the other devices always fail in one of those three positions.

Thank you.

MR. KENDALL: We felt the owners group made a number of significant recommendations. The key one, number one on the list, I am sure the plant goes to known safe state on loss cf power in the ICS or NNI. Again, we feel that that resolution of IE Bulletin 79-27 concerns essentially would accomplish the same thing.

Incorporate automatic selection of valid inputs ICCS/NNI, this is where they would have to provide two signals, and upon failure of one signal, ensure that the valid signal is provided for use by the ICS. Other ones, provide the operator with an smple state of control room indications and recorders.

There have been some problems with the operators taking actions based on failed indications.

Elimination of mid-scale failures--develop unambiguous back-up controls for pressure level and pressure control; right now most of the pressurizer, I think all of the pressurizer level and pressure control instruments are NNI-X. That would provide another set of controls such that if you lost NNI-X power you still control pressurizer level and pressure.

Provide independent controls for reactor power steam and feedwater, and the first one on the next slide, provide separate subsystem for reactor coolant temperature steam pressure control. They are recommendations that would tend to lessen the effects of single failures by lessening the effect of plant to within the certain portion of the control system versus introducing the failure to the control system in total.

Ensure equipment failure modes on losses of power, making sure the turbine bypass valves, dump valves, PORVs, remain closed; having main feedwater valves fail to preferred positions--another significant area, very significant area we think is the recommendations to provide maintenance and surveillance and tuning and testing of the ICS and the NNI.

The root cause of at least one past event, loss of NNI power event, was found to be lack of surveillance of power supply overvoltage protection set points which drifted down towards the operating voltage of the supply. We felt that this would be an area of significant benefit.

MR. MICHELSON: Clarification--the second bullet on ensuring preferred equipment failure modes, is that a part of the Level 1 agreement?

MR. KENDALL: All of the recommendations are Level 1 recommendations.

MR. MICHELSON: They are going to go back and fix the equipment such that it always fails in a preferred mode. That is not necessarily a safe mode, I guess just a known mode. What do you do--

MR. KENDALL: I think known and repeatable and predictable so they know where.

MR. MICHELSON: Main feedwater, is this going to be set such that ICS fails, that main feedwater will go closed?

In other words, shut off or go wide open?

MR. KENDALL: I am not sure. I believe some valves may fail to 50 percent, but I believe most of the main feedwater pumps either go to minimum speed or eventually to stop running.

MR. MICHELSON: How do you decide what the safe mode is?

MR. LIDDLE: All this would be incorporated as essentially as part of the known safe state such that the components would go to a known position, let's say repeatable, but also the safe condition, since that, for feedwater, for example, would run back or the pumps would be tradeable.

MR. MICHELSON: Feedwater is safety as opposed to maximum?

MR. LIDDLE: That's correct.

MR. MICHELSON: Decide what is the safer then. You fix it so it will always go to that--

MR. LIDDLE: Go to that direction

MR. KENDALL: Reliance would be on the emergency feedwater system to come on and control steam generator flow.

MR. MICHELSON: I would hope you have assured isolation of main feedwater. That is probably more a danger to safety consideration.

MR. CALVO: It varies from plant to plant. Some plants may have the capability to go to status quo position.

Others may do other things, depending on the considerations.

MR. MICHELSON: Status quo may not be very safe. You are already full open feedwater.

MR. CALVO: Well, at least I guess they have to be evaluated to be considered.

MR. KENDALL: So we felt that the owners group made a number of recommendations that are good recommendations that will lead to increase in plant safety.

We did have some concerns. Most of these have already been addressed by the owners group. We will give a slightly different perspective on a couple of them.

The first one of the specific concerns is surveillance frequency for the ICS and NNI equipment.

We feel that every other refueling outage could perhaps be as long as up to four years or more. Plants are going to extended fuel cycles now. Counting down time, the time for the outage could be what we feel is excessive for an interval between calibrations of electronic equipment. It just appears to us that every other fuel outage is too excessive.

From the information in 1919, it is not clear to us that's just related to tuning of the integrated control system either. It looks like it is also being, that frequency is also being attached to other surveillances such as power supply monitor set points, power supply overvoltage set points. Whether it is being done more frequently or not, I suppose it is in a number of cases. Based on ifnormation in 1919, we felt that that time looked excessive.

As far as maximizing the dependence on NNI-X, it looked to us as if maximizing dependence on NNI-X, although it would make a loss of NNI-Y power transient more tolerable, it looked like it would also make a loss of NNI-X power more severe.

The owners group indicated that upon providing hardened inputs or multiple input channels, that this concern would go away because you always, you have a back-up. It is not--it may be true, especially with the implementation of redundant pressurizer level and pressure control circuits.

MR. MICHELSON: Is this all going to come in as a package for staff review at some future date? The things that you know the utilities are going to do, are you going to do any more review than you have just done?

MR. SIEGEL: Yes. Tomorrow we will discuss it. Implementation, we will tell you what we are going to do, if you want to wait until then.

MR. MICHELSON: That's fine.

MR. KENDALL: Elimination of some of the integrated control system functions--the reason they made the list, especially the first two, was that they were just not, we did not feel there was sufficient basis provided in 1919 to jusify the deletion of these features.

As far as removal of the BTU limits function, the primary concern there looked like it was failure of the BTU limit circuitry due to invalid input signal, not really failure of the BTU limits itself; the actual limits would take given invalid input signal; given their recommendations to harden the input signals such that the failure of an input signal would have an effect.

We don't see this as a recommendation, especially because the BTU limits function will run back main feedwater to help prevent overcooling for certain scenarios.

(The transcript continues on the following page.)

The owners group has proposed to provide a rapid feedwater reduction circuit to take the place of the BTU limits function.

However, it is not clear to us that the rapid feedwater reduction circuit has a lot of, number of benefits that the BTU limits function has.

One is it appears that the rapid feedwater reduction circuit would only be active following a reactor trip, and secondly--which is when you would need it most, but secondly, that for certain conditions such as a valid control circuit manual, that the rapid feedwater reduction circuit would not be operative.

The next one, wiring the power supply monitor directly to the plus and minus 24 volt DC buses, over the years we have received a number of conflicting stories for why the power supply monitor is there, what its design function is.

Following the Crystal River event, we were told that the purpose of power supply monitor was to prevent the modules from, integrated control modules, from operating on degraded voltage, that the modules would not function properly on voltages outside of the 24 volt DC with a plus or minus 10 percent tolerance, that at voltages, low voltages, degraded voltages, that some modules, you might have relays begin to cycle or equipment component malfunctions.

Now we have been told that the purpose of the power supply monitors is not to protect against degraded voltage, only to protect against hard bus faults, but the immediate loss of power.

We find that it is kind of curious that the set point would be chosen at 22 volts for a, to detect a hard bus fault. It looks like the power supply monitor itself has some questionable design features. We don't believe that connecting it to the bus is necessarily the optimum location to connect the power monitor. It would not detect faults downstream that could affect module, could have modules misoperating and never detect it.

We think we have provided a fairly extensive write-up in NUREG 1286 which is the restart SER for the Rancho Seco plant for their events, and we would like to see the owners group address the issues that are listed there.

We think there just exist a lot of questions surrounding the power supply monitor and its operation, and the information provided in 1919 doesn't help us to try to resolve these concerns. FSAR assumptions realy to go ICS and NNI. The ICS and NNI systems are non-safety related. Systems requirements state that they are non-safety-related. They are in no way used to mitigate the conseqences of transients or actuate or shut down the plant.

We found in review of portions of the 1919 that it appeared that for some accidents or transient scenarios, that the ICCS was assumed to function properly to mitigate the effects of the scenario. We realized that this particular portion of the owners group review is preliminary to the ongoing effort, still looking at it. Weeel that they should verify that no credit is taken for ICS or NNI performance in the accident analyses.

The 79-27 concerns were not specifically addressed by the owners group. Portions of the items addressed by the Bulletin 79-27 did appear in certain areas and were covered by recommendations, but the overall scope and focus of Bulletin 79-27 was not addressed. We were told that it was a plant-specific item, not a generic item. It was not within the safety performance improvement program scope. We really believed the need still exists to verify that the Bulletin 79-27 concerns have been resolved at the plants.

(Slide)

MR. KENDALL: Several more general concerns--we thought the guidance provided in some of the recommendations was too general to ensure resolution of the concerns. We felt that sometimes the recommendations did not drive a proper source document. Apparently that has been corrected now.

Other thing was that we could not conclude based on the information provided in 1919 that all of the staff concerns identified from the investigations of previous events

would be resolved for implementation of recommendations. Essentially all of these concerns are again summed up in 79-27, things like mid-scale failures, inadequacies of back-up instruments, and reference and use of back-up instruments by the procedures that
have not been addressed in detail.

(Slide)

MR. KENDALL: The last slide on summary of staff conclusions--we thought that the B&W owners group review plan for the ICS?NNI evaluation was an excellent, excellent plan. It took advantage of all the information that seems to be available as input for developing system design requirements. It appeared to be well thought out and to be appropriate for producing recommendations that would improve plant response to ICS/NNI failures, and that would lead to a reduction in reactor trip frequency and transient complexity due to ICS/NNI failures, and that's basically what the second bullet said, that implementation of recommendations will be successful in achieving reduction in trip frequency and transient complexity.

We found that information with the information provided in B&W 1919 was not sufficient to conclude that some of the concerns identified from previous events had been resolved. The staff tried to obtain the information through feedback letters and requests for information, but we ended up being able to arrive at the positive conclusion for some of the concerns. We really, based on lack of information, did not know whether certain things had ben resolved such as 79-27 concerns. The owners group I believe feels that they have all addressed the bulletin one time and that they feel confident that the concerns have been resolved.

What we have proposed to do is audit the implementation or the resolutions, the 79-27 concerns at B&W plants. We are developing an audit plan where we can go and look at the bus structure and bus load and try to make a determination of whether the plant design, plant procedures are adequate.

MR. ETHERINGTON: There is no additional recommendations you feel strongly about?

MR. RANDALL: I would say outside of 79-27, that that's correct. You mean recommendations that we have in addition to what the owners group has?

MR. ETHERINGTON: Yes.

MR. RANDALL: I think that's correct. It appears that the owners group effort wille successful in achieving significant improvements in design and ICS/NNI operation, and we feel that a combination of implementation of this SPIP recommendations and verification through plant audits, proper resolution of the 79-27 concerns would in general give the staff the confidence, give us the confidence that ICS/NNI concerns had been resolved in B&W plants, that upon loss of ICS or NNI power, the plant would indeed achieve a known safe state.

CHAIRMAN WYLIE: Any questions? Let's take a ten-minute break.

(Whereupon, at 6:35 p.m., a recess was taken, and it was decided by the Chairman during that recess to adjourn the meeting.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name: ACRS--Subcommittee on B&W Reactor Plants

Docket Number:

Place: Washington, D.C.

Date: May 3, 1988

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

/S/ Catherine S. Boyd

(Signature typed): Catherine S. Boyd

Official Reporter

Heritage Reporting Corporation

B&W OWNERS GROUP
SAFETY AND PERFORMANCE IMPROVEMENT PROGRAM

PRESENTATION TO ACRS

MAY 3, 1988

ARKANSAS POWER & LIGHT CO.
DUKE POWER CO.
FLORIDA POWER CORPORATION
GPU NUCLEAR CORPORATION
SACRAMENTO MUNICIPAL UTILITY DISTRICT
TENNESSEE VALLEY AUTHORITY
TOLEDO EDISON CO.
BABCOCK & WILCOX CO.

B&WOG PRESENTERS

N. A. RUTHERFORD....CHAIRMAN,
B&WOG STEERING COMMITTEE

G. R. SKILLMAN......CHAIRMAN, SPIP

S. T. ROSE..........P.M., SENSITIVITY STUDY

L. C. STALTER.......CHAIRMAN, I&C COMMITTEE

PRESENTATION OUTLINE

OBJECTIVE OF MEETING

GENERAL OVERVIEW/INTRODUCTION

ISSUE DEFINITION

INFORMATION GATHERING

SUMMARY OF PRIMARY FINDINGS

SPIP OPEN ITEMS

DISPOSITION OF PREVIOUS ACRS CONCERNS

SYSTEMS REVIEW

SENSITIVITY STUDY

AREAS OF SIGNIFICANT NRC COMMENT

- ICS/NNI
- HUMAN FACTORS

RISK ASSESSMENT REVIEW

SPIP ADMINISTRATION FOLLOW-THROUGH AND IMPLEMENTATION

CONCLUDING REMARKS

PAST ACRS AND NRC MANAGEMENT INVOLVEMENT IN SPIP

ACRS SUBCOMMITTEE MEETING ON B&W PLANTS	6/25/86
B&WOG (H.B. TUCKER) FOLLOW-UP LETTER TO ACRS (C.J. WYLIE)	7/10/86
ACRS LETTER (D.WARD) TO NRC (V. STELLO) REGARDING SPIP	7/16/86
NRC LETTER (H.R. DENTON) TO ACRS (D. WARD) REGARDING SPIP	8/14/86
ACRS FULL COMMITTEE MEETING ON B&W PLANTS	9/12/86
B&WOG (H.B. TUCKER) FOLLOW-UP LETTER TO ACRS (C.J. WYLIE)	10/20/86
B&WOG PRESENTATION TO NRC COMMISSIONERS	11/6/86
B&WOG PRESENTATION TO NRC COMMISSIONERS	8/5/87

MEETING OBJECTIVE

TO PROVIDE SUFFICIENT INFORMATION TO ALLOW THE ACRS TO CONCLUDE THAT THE B&WOG SAFETY AND PERFORMANCE IMPROVEMENT PROGRAM ADEQUATELY ADDRESSED THE COMPLEX TRANSIENT AND TRIP-RELATED SAFETY CONCERNS ON B&W PLANTS.

OVERVIEW OF SPIP EXECUTION

- o ISSUES WERE QUANTITATIVELY DEFINED.
- o IMPROVEMENT GOALS WERE SET.
- o STRONG EXECUTIVE LEVEL COMMITMENT TO PROGRAM.
- o B&WOG WANTED A PROGRAM WITH TANGIBLE RESULTS.
- o PROGRAM SCOPE DEVELOPED BY B&WOG AND AGREED TO BY STAFF.
- o PROGRAM HAD STRONG SAFETY ORIENTATION.
- o PROGRAM BASED ON HISTORICAL FACTS AND POTENTIAL PLANT PERFORMANCE.
- o ENGAGED INDEPENDENT SUPPORT AND TECHNICAL OVERVIEW.
- o IMPLEMENTATION <u>HAS</u> AND <u>WILL</u> CONTINUE TO IMPROVE SAFETY AND PERFORMANCE.
- o COMPLEMENTS AND REINFORCES OTHER INDUSTRY SAFETY AND PERFORMANCE IMPROVEMENT INITIATIVES.

ISSUE DEFINITION

ISSUE: COMPLEX TRANSIENTS WERE TOO FREQUENT AND THEIR SAFETY SIGNIFICANCE WAS QUESTIONED.

- COMPLEX TRANSIENTS WERE DEFINED IN TERMS OF SIX MEASURABLE PARAMETERS. (PREVIOUSLY DESCRIBED TO ACRS) THEIR DEVIATION FROM PREFERRED RANGES WAS USED AS AN INDICATION OF COMPLEXITY.

- QUANTIFICATION OF THE ISSUE PERMITTED PINPOINTING THE FUNCTIONAL AND SYSTEM AREAS OF INTEREST.

- INTERACTIONS WITH NRC STAFF, ACRS AND OUR INDEPENDENT ADVISORY BOARD HELPED FOCUS THE ISSUE.

DEFINITIONS: TRIP - THE UNPLANNED DE-ENERGIZING OF THE CONTROL ROD DRIVE CONTROL SYSTEM THUS INSERTING CONTROL RODS INTO THE REACTOR'S CORE.

TRANSIENT - THE AGGREGATE DYNAMIC PLANT BEHAVIOR FOLLOWING A TRIP.

B&W OWNERS GROUP SAFETY AND PERFORMANCE IMPROVEMENT PROGRAM

OBJECTIVE

IMPROVE SAFETY, REDUCE THE NUMBER OF TRIPS AND COMPLEX TRANSIENTS ON B&W OWNERS GROUP PLANTS, AND ENSURE ACCEPTABLE PLANT RESPONSE DURING THOSE TRIPS AND TRANSIENTS WHICH DO OCCUR.

GOALS

1. BY THE END OF 1990 THE AVERAGE PER PLANT TRIP FREQUENCY WILL BE LESS THAN TWO PER YEAR.

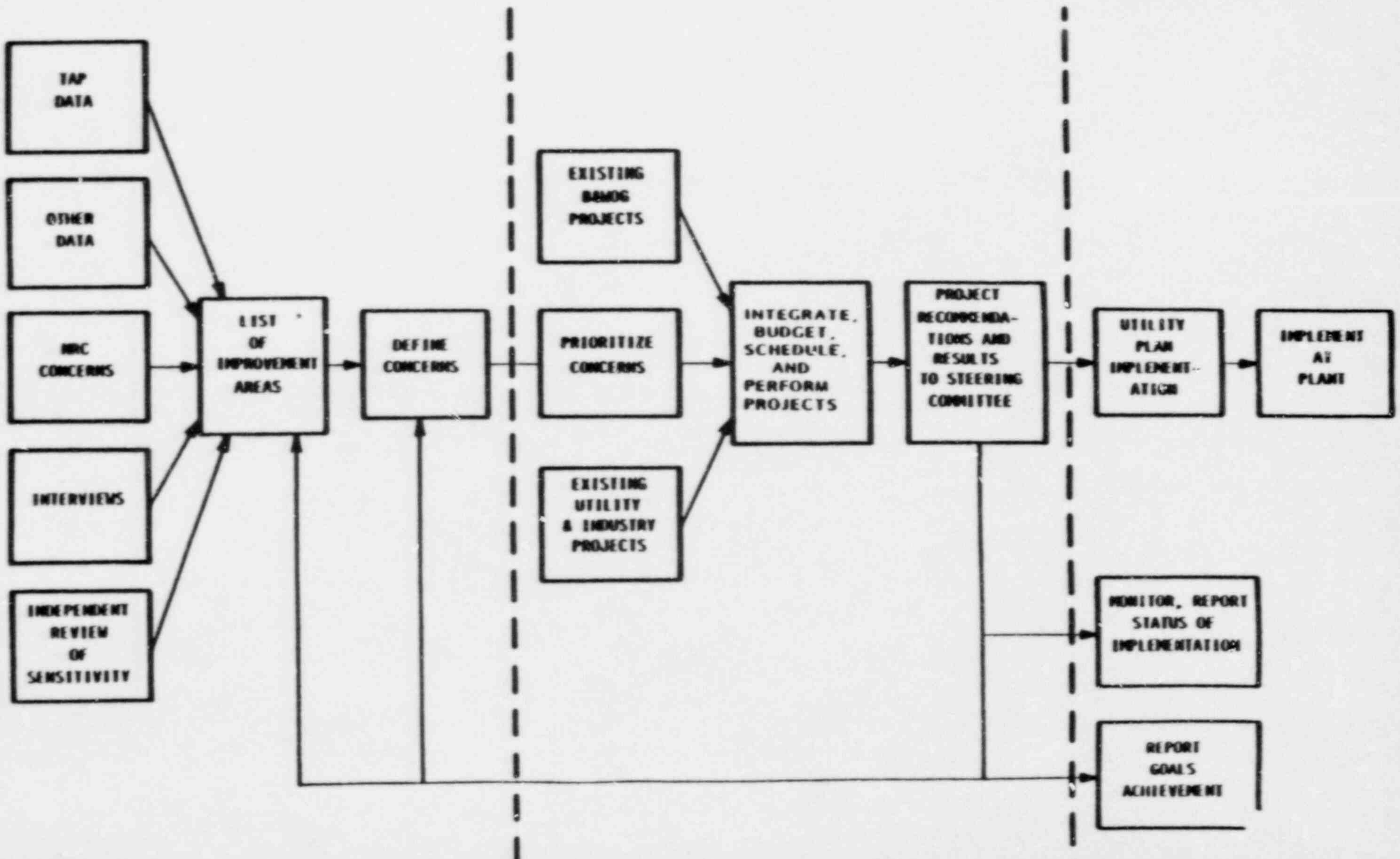
2. BY THE END OF 1990 THE NUMBER OF COMPLEX TRANSIENTS AS CLASSIFIED BY MEASURABLE PARAMETERS (CATEGORY "C") WILL BE REDUCED TO 0.1 PER PLANT PER YEAR BASED ON A MOVING THREE YEAR AVERAGE.

SPIP Program Process

I. Information Gathering

II. Integration

III. Implementation



INFORMATION GATHERING PROCESS

- o OBJECTIVE: TO DETERMINE AREAS FOR IMPROVEMENT
- o PERFORMED BROAD AND COMPREHENSIVE SEARCH FOR PROBLEMS; BOTH IN NSS AND BOP
  - REVIEWED TRANSIENT ASSESSMENT PROGRAM DATA
  - REVIEWED SYSTEM AND COMPONENT DESIGNS
  - INTERVIEWED OPERATIONS AND MAINTENANCE PERSONNEL
  - REVIEWED OTHER PERTINENT DATA
- o EMPLOYED OUTSIDE CONSULTANT TO ASSESS RELATIVE B&W PLANT SENSITIVITY
- o PERFORMED A PROBABILISTIC RISK ASSESSMENT REVIEW

REVIEWED THE B&WOG TRANSIENT ASSESSMENT PROGRAM (TAP) DATA

- REVIEWED AND SORTED THE TAP DATA TO BETTER FOCUS ON AREAS WHERE IMPROVEMENT IS NEEDED
  - DEFINED SPECIFIC MEASURABLE PARAMETERS TO "GRADE" THE COMPLEXITY FOR TRANSIENTS
  - USED THE "GRADED" TRANSIENT TAP REPORTS TO IDENTIFY SPECIFIC CONCERNS FOR ACTION

REVIEWED SYSTEM AND COMPONENT DESIGNS

A PERFORMANCE AND RELIABILITY REVIEW OF SYSTEMS/ COMPONENTS WAS UNDERTAKEN TO IDENTIFY RECOMMENDATIONS FOR IMPROVEMENT.

IDENTIFIED SYSTEMS:

1. ICS/NNI SYSTEM
2. MAIN FEEDWATER SYSTEM
3. EFW/AUXILIARY FEEDWATER SYSTEM
4. SECONDARY PLANT RELIEF SYSTEMS
5. INSTRUMENT AIR SYSTEM

INTERVIEWED OPERATIONS AND MAINTENANCE PERSONNEL

- USED INPO DEVELOPED FOCUSED INTERVIEW PROCESS
- PERFORMED FOCUSED INTERVIEWS WITH OPERATIONS AND MAINTENANCE PERSONNEL FROM EACH PLANT.
- LOOKED FOR TRANSIENTS WHICH MAY NOT HAVE RESULTED IN REACTOR TRIPS BUT WERE CONSIDERED TO BE SIGNIFICANT
- LOOKED FOR AREAS WHERE IMPROVEMENTS COULD REDUCE THE NEED FOR POST-TRIP OPERATOR ACTIONS
- TRACKED DOWN AND DEFINED CONCERNS WITH PROCEDURES, MAINTENANCE, AND OPERATOR BURDEN

REVIEWED OTHER PERTINENT DATA

- IDENTIFIED TRANSIENT OPERATIONAL HISTORY AND ANALYTICAL RESULTS FROM DOCUMENTS SUCH AS:
  - UTILITY INTERNAL EVENT REPORTS
  - NRC INFORMATION
  - INPO INFORMATION
  - PRE-TAP OPERATIONAL DATA
  - OTHER OPERATIONAL HISTORY
- DEVELOPED A PLAN FOR REVIEW OF THIS INFORMATION
- CONDUCTED THOSE REVIEWS

TO BE COVERED AS SEPARATE AGENDA ITEMS:

- SENSITIVITY STUDY
- RISK ASSESSMENT REVIEW

ELEMENTS COMPRISING THE SPIP

1. ICS/NNI SYSTEM REVIEW
2. MFW SYSTEM REVIEW
3. EFW/AFW SYSTEM REVIEW
4. SECONDARY PLANT RELIEF SYSTEM REVIEW
5. OPERATING EXPERIENCE REVIEW
6. REVIEW OF OTHER TRANSIENT INFORMATION
7. OPERATIONS/MAINTENANCE PERSONNEL INTERVIEWS
8. SENSITIVITY STUDY
9. RISK ASSESSMENT
10. NRC INTERACTION
11. INSTRUMENT AIR SYSTEM REVIEW
12. TRIP INITIATOR REVIEW
13. OPERATOR BURDEN REVIEW
14. INDEPENDENT ADVISORY BOARD
15. SPRIG (SAFETY AND PERFORMANCE RECOMMENDATION INTEGRATION GROUP)

INDEPENDENT OVERVIEW OF PROGRAM

- o B&WOG EXECUTIVES ESTABLISHED AN INDEPENDENT ADVISORY BOARD.
- o MISSION OF ADVISORY BOARD
  - EVALUATE PROGRAM COMPREHENSIVENESS AND SAFETY EMPHASIS
  - EVALUATE ABILITY OF PROGRAM FOR ACHIEVING OBJECTIVES
- o ADVISORY BOARD MEMBERS:

  W. H. LAYMAN (EPRI)
  S. LEVY (S. LEVY ASSOC., INC.)
  N. E. TODREAS (MIT)
  R. S. BRODSKY (BETA)
- o INVOLVEMENT: SEVEN, 2-3 DAY MEETINGS

SAFETY AND PERFORMANCE RECOMMENDATION INTEGRATION GROUP (SPRIG)

- o FORMAL CHARTER FROM EXECUTIVE COMMITTEE
- o MULTI-DISCIPLINED REPRESENTATIVES FROM EACH B&WOG MEMBER
- o CONCENTRATED EFFORT AFTER ESSENTIALLY ALL RECOMMENDATIONS WERE AVAILABLE

SPRIG FUNCTIONS

INTEGRATED EFFECT ON PLANT BEHAVIOR

o REVIEWED EACH EXISTING SPIP RECOMMENDATION FROM SEPARATE SPIP PROJECTS FROM THE STANDPOINT OF OVERALL FUNCTIONAL PLANT BEHAVIOR.

PRIORITIZATION

o SELECTED FROM TOTAL RECOMMENDATION PACKAGE THOSE DEEMED MOST IMPORTANT AND BENEFICIAL TO SAFETY AND PERFORMANCE IMPROVEMENT.

DIVERSE PERSPECTIVES

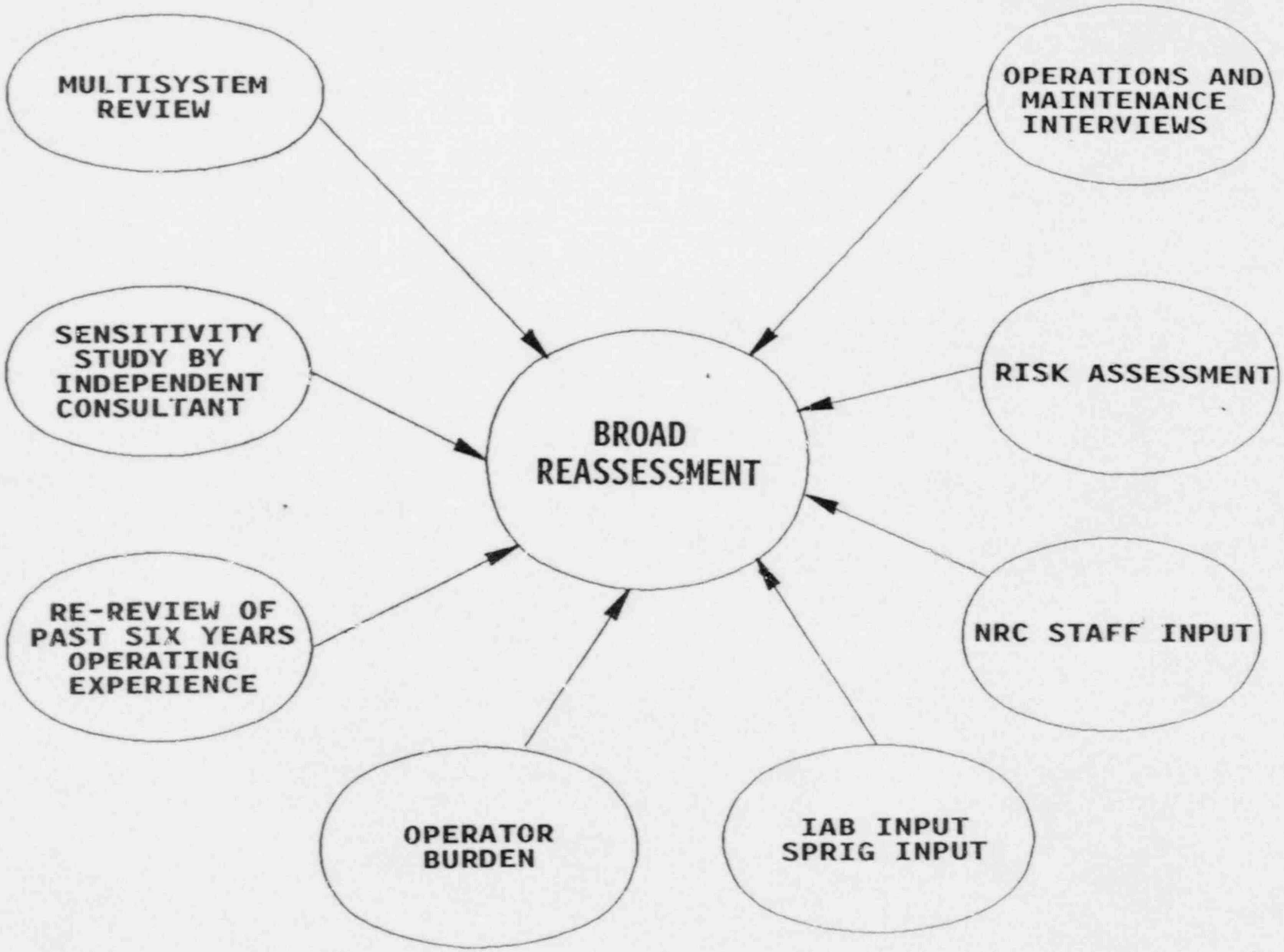
o REVIEWED TOTAL RECOMMENDATION PACKAGE FROM PERSPECTIVES OF:

- OPERATIONS
- SAFETY
- DESIGN
- MAINTENANCE

REPORT

o PROVIDED REPORT TO EXECUTIVE COMMITTEE.

B&WOG SAFETY AND PERFORMANCE IMPROVEMENT PROGRAM



SUMMARY OF PRIMARY FINDINGS AND CONCLUSIONS

FINDINGS AND CONCLUSIONS CATEGORIES

- o PLANT SAFETY AND DESIGN
- o COMPLEX TRANSIENTS
- o TRIP INITIATORS
- o SPIP VALUE

FINDINGS AND CONCLUSIONS
REGARDING B&W PLANT SAFETY AND DESIGN

- RISK OF CORE DAMAGE IS COMPARABLE TO OTHER PWR DESIGNS
- AREAS OF SENSITIVITY ARE DIFFERENT THAN OTHER PWRs
- PRESSURIZER SIZE IS ADEQUATE
- OTSG INVENTORY IS ADEQUATE
- OPERATOR BURDEN IS ACCEPTABLE
- INTEGRATION OF CONTROL FUNCTIONS IS APPROPRIATE
- PLANT IS MORE RESPONSIVE TO SECONDARY SIDE CHANGES
- RECOMMENDATION IMPLEMENTATION WILL FURTHER IMPROVE SAFETY

FINDINGS AND CONCLUSIONS

REGARDING COMPLEXITY OF TRANSIENTS

- o COMPLEX TRANSIENTS ARE PRINCIPALLY THE RESULT OF MISMATCHED HEAT BALANCE BETWEEN PRIMARY AND SECONDARY SYSTEMS

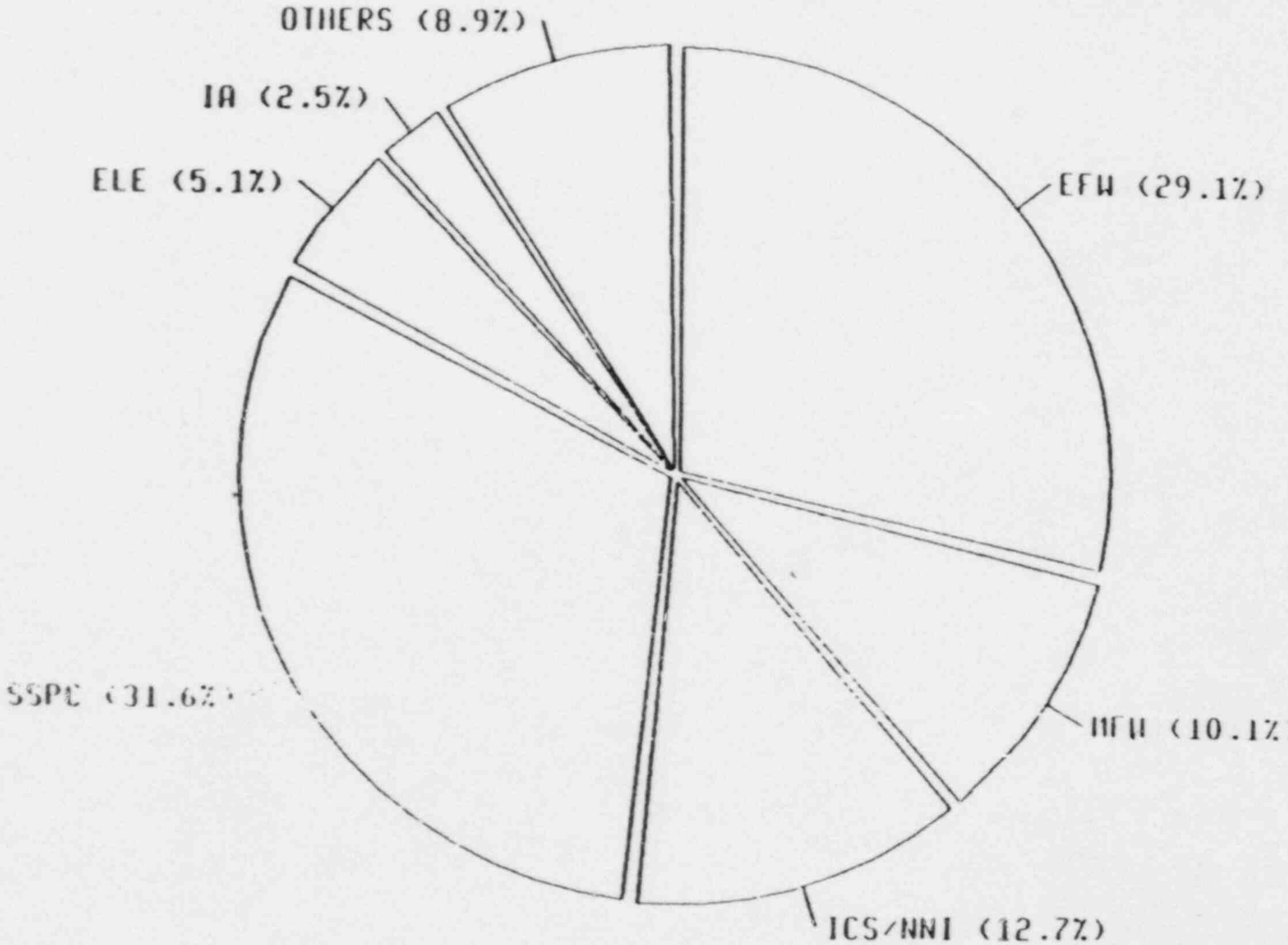
- o OVERHEATING EVENTS

  - HIGHER SAFETY SIGNIFICANCE THAN OTHER EVENTS
  - INFREQUENT COMPARED TO OVERCOOLING

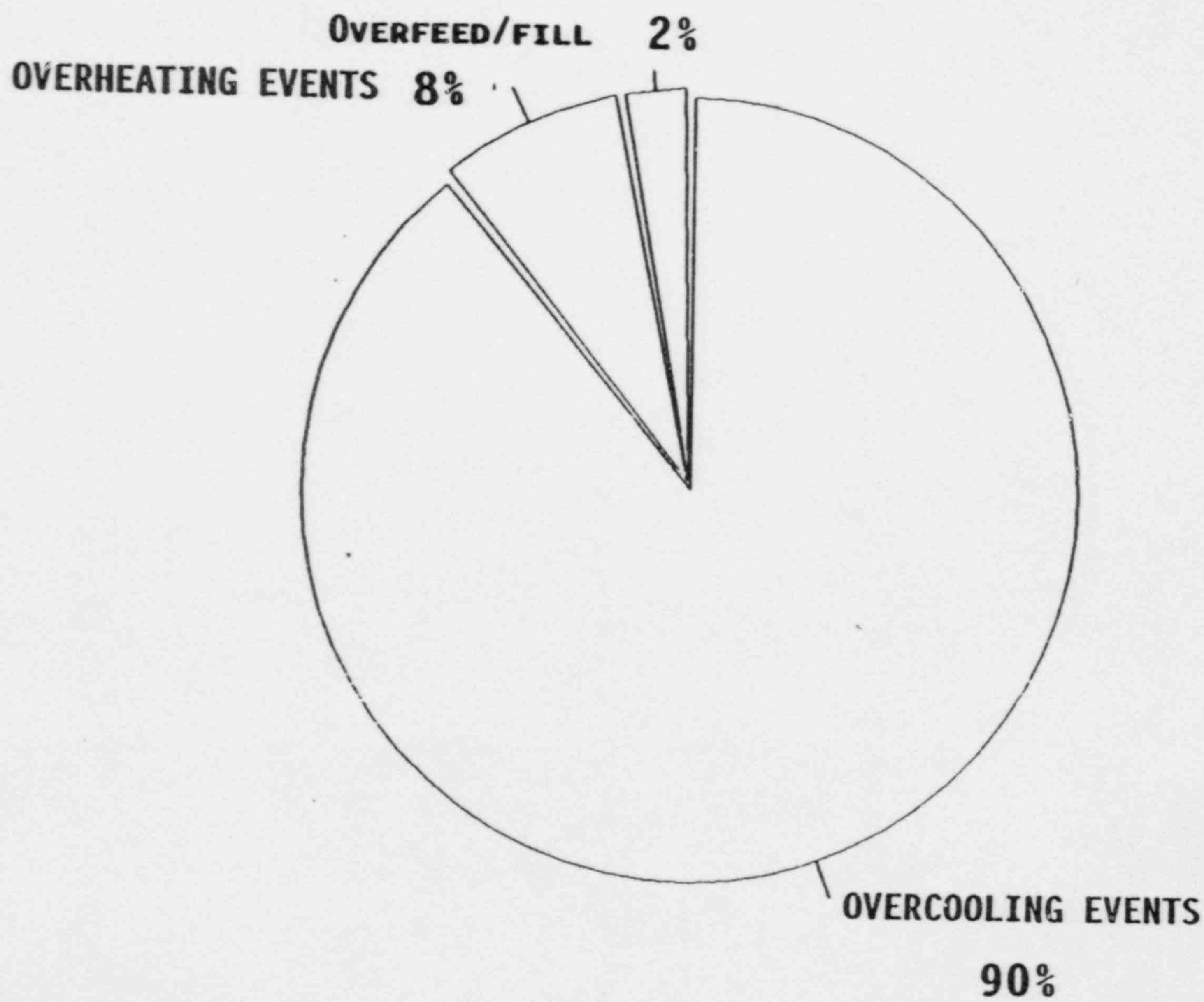
- o OVERCOOLING EVENTS

  - MAY BE PRECURSOR TO OVERHEATING
  - DOMINATED BY MISBEHAVIOR OF TWO SYSTEMS
    - -- SECONDARY PLANT RELIEF
    - -- EMERGENCY FEEDWATER
  - OTHER SYSTEMS MISBEHAVIOR IMPORTANT
    - -- ICS/NNI
    - -- MAIN FEEDWATER

Contributors to Post-Trip Complexity



COMPLEX TRANSIENT THERMAL .YDRAULIC CATEGORIES



FINDINGS AND CONCLUSIONS

REGARDING TRIP INITIATION

- o MAJORITY OF TRIPS CAUSED BY BALANCE OF PLANT SYSTEMS/COMPONENTS OR PERSONNEL

- o TURBINE GENERATOR DOMINANT TRIP INITIATOR BEFORE 1985

- o DOMINANT TRIP INITIATOR CURRENTLY MAIN FEEDWATER

- o OTHER FREQUENT TRIP INITIATORS

  - ICS/NNI INPUTS
  - ELECTRICAL

FINDINGS AND CONCLUSIONS

REGARDING OVERALL SPIP VALUE

- o FOCUSED GREATER ATTENTION ON BOP
- o REINFORCED VALUE OF QUALITY TAP DATA BASE FOR OPERATING EXPERIENCE
- o FURTHER CONFIRMED VALUE OF A GROUP EFFORT ON COMMON CONCERNS
- o SAFETY AND PERFORMANCE HAVE ALREADY BEEN IMPROVED AND WILL CONTINUE TO BE IMPROVED
- o SPIP VALUE HAS BEEN ENHANCED BY DIVERSE INPUT EXTERNAL TO B&WOG
- o SPIP VALUE INCREASED BY STRONG EXECUTIVE INVOLVEMENT

FINDINGS OF THE INDEPENDENT ADVISORY BOARD

- o SPIP WAS EFFECTIVE IN IDENTIFYING AREAS FOR IMPROVEMENT
- o SPIP EXAMINED ALL FACTORS INVOLVED IN PAST COMPLEX TRANSIENTS
- o TAP DATABASE EXTENSIVE AND VALUABLE
- o DEFINED ACTIONS SHOULD REDUCE TRANSIENT FREQUENCY AND IMPROVE SAFETY
- o CONCURRED WITH PROCESS AND BASIS OF PRIORITIZATION
- o SPIP GOALS ACHIEVABLE, BUT SCHEDULE IS AMBITIOUS; MANAGEMENT ATTENTION REQUIRED
- o SOME RECOMMENDATIONS LACK SPECIFICITY
- o MEANS TO ASSURE ACTION QUALITY NEEDED
- o ICS/NNI AND FEEDWATER RELIABILITY DESERVE SPECIAL ATTENTION

SPIP "OPEN" AREAS

SPIP ACTIVITIES/PROJECTS ON WHICH B&WOG AND NRC STAFF ARE IN SUBSTANTIAL AGREEMENT

INDIVIDUAL PROJECTS

- MFW SYSTEM REVIEW
- EFW/AFW SYSTEM REVIEW
- SECONDARY PLANT RELIEF SYSTEM REVIEW
- OPERATING EXPERIENCE REVIEW
- REVIEW OF OTHER TRANSIENT INFORMATION
- OPERATIONS/MAINTENANCE PERSONNEL INTERVIEWS
- SENSITIVITY STUDY
- RISK ASSESSMENT
- NRC INTERACTION
- INSTRUMENT AIR SYSTEM REVIEW
- TRIP INITIATOR REVIEW
- OPERATOR BURDEN REVIEW
- INDEPENDENT ADVISORY BOARD
- SPRIG (SAFETY AND PERFORMANCE RECOMMENDATION INTEGRATION GROUP)

SPIP ACTIVITIES/PROJECTS ON WHICH B&WOG AND NRC STAFF ARE IN SUBSTANTIAL AGREEMENT

OVERALL PROGRAM

- PROGRAM SCOPE AND BREADTH
- PROGRAM PROCESS
- RECOMMENDATION CONTENT
- PROGRAM MANAGEMENT AND ADMINISTRATION
- B&W PLANT SAFETY

SPIP ACTIVITIES/PROJECTS INVOLVING DISAGREEMENT

- o ICS/NNI (CONTENT)
- o USE OF HUMAN FACTORS EXPERTISE (PROCESS)

OPEN AREAS	PLANNED CLOSURE
1. IMPLEMENTATION PLANS/SCHEDULES	JULY 1988
2. EMERGENCY OPERATING PROCEDURES REVIEW REPORT	AUGUST 1989
3. TAP ANNUAL REPORT	JULY 1988
4. VALVE TASK FORCE REPORT	AUGUST 1988
5. APPLICABLE PORTIONS OF RECOMMENDATION TRACKING SYSTEM REPORT	PERIODIC UPDATE

PREVIOUS ACRS CONCERNS
(FROM JULY 16, 1986 LETTER)

1. EFFECT OF OPERATING ORGANIZATION ON SYSTEM PERFORMANCE

2. SAFETY SIGNIFICANCE OF UNIQUE B&W PLANT CHARACTERISTICS

3. ATTENTION TO DECAY HEAT REMOVAL

B&WOG DISPOSITION OF ACRS CONCERNS

1. OPERATING ORGANIZATION EFFECT

   A) B&WOG CONSIDERS MANAGEMENT ROLE VERY IMPORTANT TO SAFE OPERATION (FURTHER DISCUSSED IN B&WOG LETTER TO ACRS 10/20/86)

   B) B&WOG EXECUTIVE COMMITTEE MEMBERS RECOGNIZED THEIR INTERDEPENDENCE; THIS LED TO NUMEROUS OVERSIGHT AND AUDIT ACTIONS IN SPIP

   C) NRC CONCURS THAT MOST MANAGEMENT MATTERS ARE BEST TREATED ON PLANT-SPECIFIC BASIS - H.R. DENTON LETTER TO D. WARD 8/14/86

2. SAFETY SIGNIFICANCE OF UNIQUE B&W PLANT CHARACTERISTICS

   A) MAJOR THRUST OF SENSITIVITY EVALUATION AND RISK ASSESSMENT REVIEW

   B) SEPARATE PRESENTATIONS WILL ADDRESS THESE MATTERS

<u>B&WOG DISPOSITION OF ACRS CONCERNS</u>
(CONTINUED)

3. ATTENTION TO DECAY HEAT REMOVAL

A) IN RESPONSE TO THIS ITEM, FULL ACRS WAS GIVEN A BROAD DHR PRESENTATION

B) DESCRIBED THREE LINES OF DEFENSE;
- MFW
- AFW/EFW
- FEED AND BLEED

C) SPIP HAS ADDRESSED MFW AND AFW

D) FEED AND BLEED CAPABILITY WAS JUDGED ADEQUATE; PROCEDURE RECOMMENDATIONS RELATED TO FEED AND BLEED WERE DEVELOPED

E) THE FOLLOWING WAS STATED IN THE 9/12/86 PRESENTATION TO ACRS

"THE ISSUE OF HEAT PRODUCTION/REMOVAL IMBALANCE AND RELIABLE DECAY HEAT REMOVAL CAPABILITY IS RECOGNIZED AND ACCEPTED AS A DOMINANT ISSUE. A NEED FOR <u>ADDITIONAL</u> DECAY HEAT REMOVAL CAPABILITY IS CONSIDERED UNNECESSARY."

MFW SYSTEM REVIEW PROCESS

- FOCUS ON MFW EVENTS OF 1984-85

- INFORMATION GATHERED ON EACH PLANT'S

  - OPERATING PROCEDURES AND CHARACTERISTICS
  - DESIGN
  - MAINTENANCE PRACTICES

- SITE VISIT (ONE WEEK)

  - INTERVIEWS WITH OPERATIONS AND MAINTENANCE PERSONNEL
  - SYSTEM "WALK DOWN"
  - REVIEW OF RECENT TRANSIENT DATA AND PROBLEMS

- COMPILATION OF FINDINGS INTO 42 RECOMMENDATIONS WITH GENERIC OR PLANT SPECIFIC APPLICABILITY

MAIN FEEDWATER (MFW) AND CONDENSATE SYSTEM

o IMPROVE RELIABILITY OF MAIN FEEDWATER AND CONDENSATE SYSTEMS

TYPICAL KEY RECOMMENDATIONS

(1) IMPLEMENT A PROGRAM TO IDENTIFY IMPROVEMENTS NEEDED IN MFW PUMP CONTROL SYSTEMS INCLUDING THE ICS. EVALUATE THE INTERACTION BETWEEN THESE TWO SYSTEMS

(2) CORRECT MFW PUMP CONTROL PROBLEMS

(3) ENSURE THAT A SINGLE ELECTRICAL FAILURE IN THE MFW AND CONDENSATE SYSTEMS WILL NOT CAUSE A LOSS OF BOTH FEEDWATER TRAINS

(4) ELIMINATE UNNEEDED TRIP FUNCTIONS ON THE MFW PUMPS

(5) ELIMINATE AUTOMATIC CONTROL OF THE MFW BLOCK VALVE EXCEPT DURING A REACTOR TRIP

(6) PROVIDE CAPABILITY TO OVERRIDE A CLOSE SIGNAL TO THE MFW BLOCK VALVE

(7) PROVIDE AUTOMATIC MFW OVERFILL PROTECTION CAPABILITY

(8) INSTALL MONITORING SYSTEM ON MFW PUMPS TO IDENTIFY CAUSE OF TRIP.

EMERGENCY FEEDWATER (EFW) REVIEW PROCESS

- COMPILED FUNCTIONAL DESIGN OBJECTIVES
- COMPILED TESTING OBJECTIVES
- COMPILED A LIST OF MAINTENANCE RECOMMENDATIONS TO IMPROVE RELIABILITY/AVAILABILITY

EMERGENCY FEEDWATER (EFW)

- o EXCESSIVE EFW FLOW HAS RESULTED IN OVERCOOLING EVENTS

TYPICAL KEY RECOMMENDATIONS

(1) REMOVE EFW INITIATION AND CONTRROL FROM ICS/NNI

(2) LIMIT EFW FLOW RATE OR FILL RATE

(3) EXTEND START TIME FOR EFW TURBINE DRIVEN PUMPS

(4) ENSURE MAINTENANCE AND TEST PROGRAMS CONFIRM COMPONENTS READY FOR SERVICE

(5) REDUCE SPURIOUS EFW ACTUATIONS

SECONDARY PLANT PRESSURE CONTROL SYSTEM REVIEW PROCESS

- REVIEW OF TRANSIENT ASSESSMENT PROGRAM (TAP) DATA TO IDENTIFY PROBLEMS RELATED TO
    - MAIN STEAM SAFETY VALVES (MSSV)
    - TURBINE BYPASS AND/OR ATMOSPHERIC DUMP VALVES
- IDENTIFY AND PERFORM PRELIMINARY ASSESSMENT OF METHODS OF REDUCING THE FREQUENCY OF MSSV LIFTS
- IDENTIFY METHODS TO INCREASE RELIABILITY OF BOTH MSSV AND TBV

SECONDARY SYSTEM PRESSURE CONTROL

o CONTROL OF POST-TRIP FEED AND STEAM FLOW HAS BEEN A CONTRIBUTOR TO COMPLEX TRANSIENTS

TYPICAL KEY RECOMMENDATIONS

(1) PROVIDE (IN MAIN CONTROL ROOM) MANUAL CONTROL AND ISOLATION CAPABILITY OF ALL POST-TRIP STEAM AND FEED FLOW PATHS (EXCLUDING SAFETY RELIEF VALVES)

(2) IMPROVE TURBINE BYPASS (TBV) AND ATMOSPHERIC DUMP (ADV) SYSTEMS
- -- PREVENT EXCESSIVE STEAM FLOW ON LOSS OF ICS/NNI POWER
- -- CONTROLLABLE FROM CONTROL ROOM ON LOSS OF ICS/NNI POWER
- -- ISOLABLE AND CONTROLLABLE FROM CONTROL ROOM ON LOSS OF OFFSITE POWER

(3) DEVELOP AND IMPLEMENT STANDARDIZED PROCEDURES AND TECHNIQUES FOR MAINTAINING, SETTING AND TESTING MAIN STEAM SAFETY VALVES (MSSV) TBV, AND ADV

(4) DETERMINE CAUSES AND CORRECT ANOMALOUS MSSV PERFORMANCE

(5) ELIMINATE OVERLAP OF TBV AND MSSV CONTROL POINTS POST-TRIP

(6) IMPLEMENT A PREVENTIVE MAINTENANCE PROGRAM FOR RELIEF VALVES THAT ARE NOT AUTOMATICALLY POST-TRIP ISOLABLE

INSTRUMENT AIR SYSTEM REVIEW PROCESS

- o COMPILED AIR SYSTEM FEATURES AND OPERATING DATA
- o IDENTIFIED CRITICAL AIR-ACTUATED COMPONENTS
- o EVALUATED PLANT RESPONSE TO COMPLETE AIRE LOSS
- o DEVELOPED FUNCTIONAL TARGET CRITERIA
- o DEVELOPED RECOMMENDATIONS

INSTRUMENT AIR SYSTEM

- o CORRECT AIR SYSTEM FAILURES AND ENSURE THAT THE PLANT WILL GO TO A KNOWN SAFE STATE ON LOSS OF INSTRUMENT AIR

TYPICAL KEY RECOMMENDATIONS

(1) COMPARE THE PLANT'S INSTRUMENT AIR SYSTEM WITH THE FUNCTIONAL TARGET CRITERIA IN THE SPIP "INSTRUMENT AIR SYSTEM REPORT" TO DETERMINE WHICH UPGRADES ARE NECESSARY.

(2) PERFORM AN EVALUATION TO ENSURE THAT AIR SYSTEM FAILURE WILL NOT AFFECT THE ABILITY TO MAINTAIN THE PLANT IN A KNOWN SAFE STATE.

(3) PERFORM OPERABILITY TESTING OF CRITICAL AIR OPERATED VALVES, COMPARE WITH DESIGN BASIS STROKING TIME AND REBUILD AS NECESSARY

SENSITIVITY STUDY

PURPOSE

SCOPE

QUANTIFICATION OF SENSITIVITY

GENERAL CONCLUSIONS

SPECIFIC CONCLUSIONS

RECOMMENDATIONS

PEER REVIEW CONCLUSIONS

SENSITIVITY STUDY - PURPOSE

EMPLOYED MPR ASSOCIATES TO ASSESS DIFFERENCES IN THERMALHYDRAULIC BEHAVIOR ARISING FROM DIFFERENCES IN DESIGN

PERFORMED A COMPARISON OF TYPICAL B&W UNIT AGAINST REPRESENTATIVE CE AND W REACTORS

B&W	-	DAVIS-BESSE
	-	TMI-1
	-	OCONEE
	-	ANO-1
CE	-	1 PRE-1975 PLANT
	-	1 POST-1975 PLANT
W	-	1 POST-1975 PLANT (WITH A STEAM GENERATOR PREHEATING SECTION)
	-	LIMITED ANALYSES OF OTHER PLANTS

THE PURPOSE OF THE STUDY WAS TO QUANTIFY RELATIVE THERMALHYDRAULIC DIFFERENCES BETWEEN DESIGNS

RESULTS WERE SUBMITTED TO NRC ON APRIL 4, 1987

SENSITIVITY STUDY - SCOPE

1. THERMALDYNAMIC RESPONSE OF THE REACTOR AND STEAM SYSTEM DURING NORMAL PLANT OPERATION

   - o PERFORMED COMPARISON STUDIES OF DESIGN AND OPERATIONAL CHARACTERISTICS
   - o QUANTIFIED DIFFERENCES IN THE INHERENT CONTROL OF KEY PLANT VARIABLES

2. PLANT THERMODYNAMIC RESPONSE COMPARISONS FOR ANTICIPATED OPERATING OCCURRENCES

   - o DEVELOPED DEMONSTRABLY VALID AND QUANTITATIVE INDICES OF DIFFERENCES AMONG PLANTS TO MALFUNCTIONS

3. PLANT THERMODYNAMIC RESPONSE COMPARISONS FOR SELECTED ACCIDENTS

4. PROTECTION AND CONTROL SYSTEMS

   - o ASSESSED DESIGN DIFFERENCES AFFECTING COMPLEXITY OF HARDWARE
   - o PERFORMED OPERATING EXPERIENCE ASSESSMENT OF ACTUATIONS AND OFF-NORMAL OCCURRENCES.

5. PERFORMED OPERATOR RESPONSIBILITY COMPARISON DURING NORMAL AND OFF-NORMAL OPERATIONS

   - o REQUIREMENTS FOR MANUAL ACTIONS
   - o ASSESSMENT OF THE DIFFICULTY IN CONTROLLING PLANT VARIABLES OR SYSTEMS INCLUDING TIME RESPONSE REQUIREMENTS.

QUANTIFICATION OF SENSITIVITY

INDICES	SAFETY PARAMETERS	OPERATIONAL LIMITS/CRITERIA
o MARGIN	o SECONDARY DESIGN PRESSURE	o STEAM LINE FLOODING
o TIME	o PRIMARY DESIGN PRESSURE, TEMPERATURE	o SG OVERFILL
o FREQUENCY	o SATURATION MARGIN	o SG DRYOUT
	o Kw/FT LIMIT	o SAFETY VALVE CHALLENGE
	o MINIMUM DNBR	o PORV CHALLENGES
	o PTS LIMITS	o STEAM/FEED ISOLATION
		o LOSS OF PRESSURIZER LEVEL
		o RPS TRIP LIMITS
		o SAFETY INJECTION LIMITS
		o HEATUP/COOLDOWN RATE LIMITS

SENSITIVITY STUDY - GENERAL CONCLUSIONS

THE STUDY SHOWED THAT SEVERAL ASPECTS OF THE B&W DESIGN, WHICH WERE BELIEVED TO CAUSE "GREATER SENSITIVITY," IN FACT, DID NOT.

- o PRESSURIZERS ON B&W UNITS ARE AS LARGE AS, OR LARGER THAN, OTHER PWRs
- o B&W UNITS ARE LESS SENSITIVE TO STEAM DEMAND UPSETS
- o B&W UNITS DO NOT IMPOSE GREATER BURDENS ON OPERATORS FOLLOWING MOST (NORMAL) REACTOR TRIPS.

THESE POSITIVE CONCLUSIONS ARE AS SIGNIFICANT AS THE STUDY'S RECOMMENDATIONS FOR IMPROVEMENT

SENSITIVITY STUDY - SPECIFIC CONCLUSIONS

RELATIVE TO OTHER PWRs, B&W UNITS:

- o ARE NOT MORE SENSITIVE TO REACTIVITY UPSETS;
- o ARE NOT MORE SENSITIVE TO REACTOR COOLANT FLOW UPSETS;
- o ARE LESS LIKELY, ON AVERAGE, TO EXPERIENCE A LEAK LEADING TO A NET LOSS OF COOLANT;
- o ARE SOMEWHAT LESS SENSITIVE TO STEAM DEMAND UPSETS SUCH AS LOAD REJECTIONS AND TURBINE TRIPS; A REACTOR TRIP ON A TURBINE TRIP IS NOT REQUIRED TO ENSURE PLANT SAFETY;
- o ARE NOT MORE LIKELY TO OVERCOOL FOLLOWING A REACTOR TRIP;
- o ARE MORE SENSITIVE IN THEIR RESPONSE TO MAIN FEED-WATER UPSETS (THOUGH THE FREQUENCY OF SUCH UPSETS IS NOT GREATER THAN IN OTHER PWRs);

SENSITIVITY STUDY - SPECIFIC CONCLUSIONS
(CONTINUED)

- ARE, IN SOME BUT NOT ALL PLANTS, SUBJECT TO GREATER COOLDOWN RATES FROM OVERFEEDING OF EMERGENCY FEEDWATER;

- ARE EQUIVALENT TO MANY OTHER PWRs IN TERMS OF TIME AVAILABLE TO USE ALTERNATIVE MEANS OF DECAY HEAT REMOVAL, ON A COMPLETE LOSS OF ALL FEEDWATER;

- FOR MOST REACTOR TRIPS, DO NOT IMPOSE GREATER CONTROL BURDENS ON PLANT OPERATORS; AND

- IMPOSE GREATER BURDENS ON PLANT OPERATORS IN DIAGNOSING AND RESPONDING TO FAILURES OF AUTOMATIC CONTROL SYSTEMS; SUCH FAILURES ARE MORE LIKELY TO LEAD TO COMPLEX TRANSIENTS IN B&W UNITS.

SENSITIVITY STUDY - RECOMMENDATIONS

1. MODIFICATIONS TO ICS ARE ESSENTIAL TO SUBSTANTIVE REDUCTION IN FREQUENCY OF FEEDWATER UPSET AND TO THE ELIMINATION OF THE COMPLEX TRANSIENTS.

   - FW PUMP SPEED CONTROL BE MADE INDEPENDENT OF THE CONTROL OF MFW REGULATING VALVE POSITION (EXCEPT CR & ANO-1) (PUMP-VALVE SEPARATION)

   - FW PUMP SPEED CONTROL AND POSITION OF EACH SET OF REGULATING VALVES (I.E., ONE MAIN AND ONE START-UP VALVE) BE INDEPENDENT OF EACH OTHER (I.E., TRAIN INDEPENDENCE)

   - CONTROL OF RCS TEMPERATURES AND SECONDARY SIDE PRESSURE SHOULD BE ASSIGNED TO SEPARATE INDIVIDUAL SUB-SYSTEMS

   - CONSIDER USE OF REDUNDANT DETECTORS WITH AUCTIONEERING TO SELECT OUTPUT

   - CONSIDER USE OF PNEUMATIC ACCUMULATORS TO REDUCE LIKELIHOOD OF LOSING KEY POSITIONERS (I.E., FW REG. VALVES)

RETAIN IN THE CONTROL SYSTEM:

- COORDINATED REDUCTION OF REACTOR POWER AND STEAM DEMAND ON LOSS OF FEED PUMP

- LIMITING FEEDWATER FLOW TO EACH OTSG BASED ON THE NUMBER OF RC PUMPS SUPPLYING THAT GENERATOR

- OVERRIDING CONTROL TO MAINTAIN MINIMUM WATER LEVEL

2. REDUCE BY AN ORDER OF MAGNITUDE THE FREQUENCY WITH WHICH MAIN FEEDWATER UPSETS OCCUR

3. LIMIT THE MAXIMUM FLOW RATE DELIVERED BY THE EMERGENCY FEEDWATER SYSTEM OR REDUCE THE LIKELIHOOD OF A PERSISTENT DEMAND FOR HIGH FLOW

4. PERFORM ANALYSIS FOR AND OBTAIN LICENSING APPROVALS TO REMOVE THE ANTICIPATORY REACTOR TRIP ON TURBINE TRIP. (THIS TRIP INCREASES THE PLANT'S SUSCEPTIBILITY TO OVERCOOLING WITHOUT MARKEDLY INCREASING OVERALL PLANT SAFETY).

5. EMPLOY THE TURBINE GOVERNOR VALVES TO RELIEVE SURPLUS ENERGY FOLLOWING A REACTOR TRIP IN LIEU OF EMPLOYING ATMOSPHERIC DUMP VALVES, TURBINE BYPASS VALVES AND MAIN STEAM SAFETY VALVES.

SENSITIVITY STUDY - PEER REVIEW GROUP

PEER REVIEW GROUP ESTABLISHED TO PROVIDE ANALYTICAL INPUT AND REVIEW; INCLUDED UTILITY, VENDOR, AND NRC TH ANALYSTS

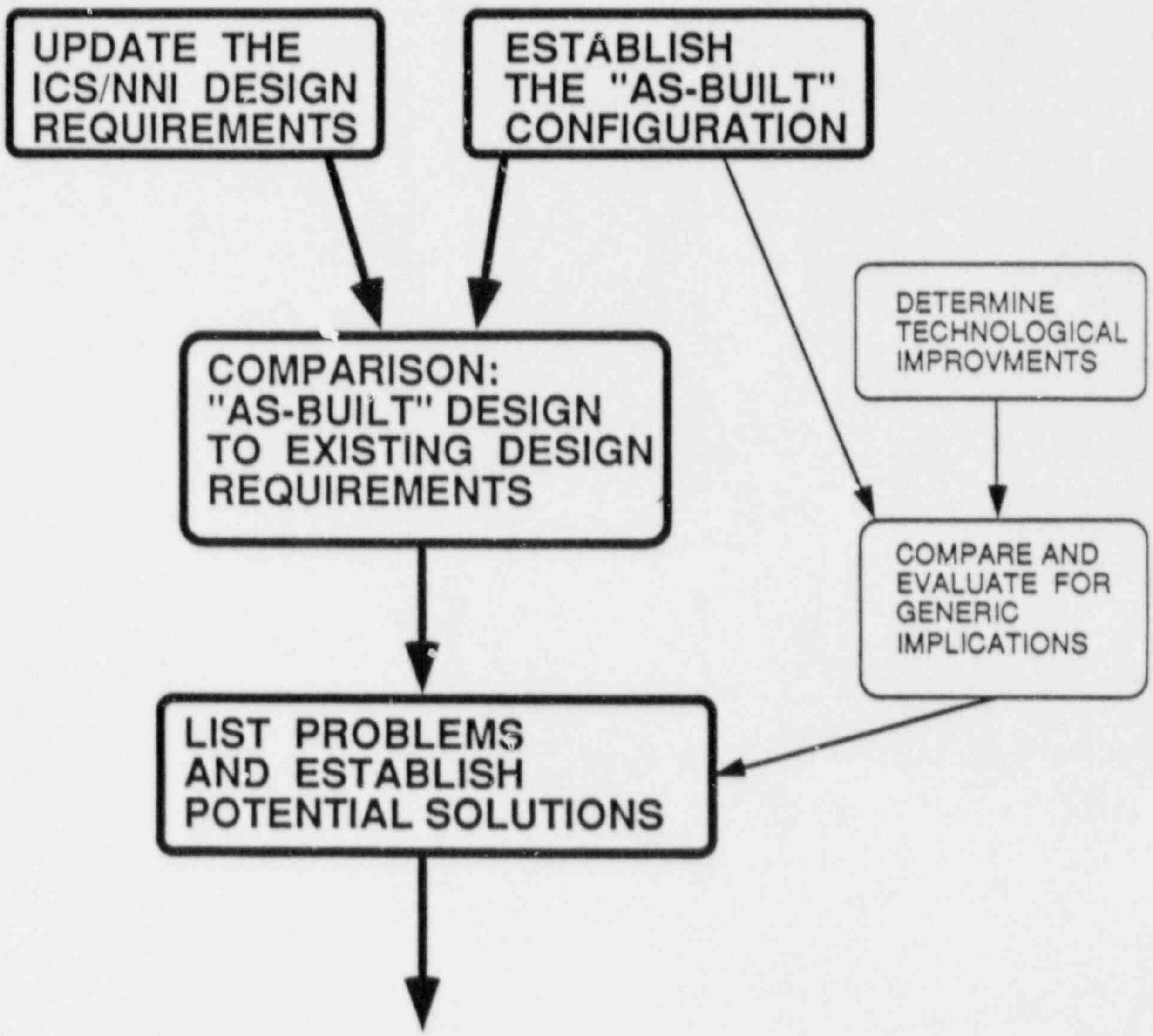
PRG CONCLUDED

- o ANALYSIS AND RESULTS ARE TECHNICALLY SOUND AND APPROPRIATE FOR THE STUDY'S COMPARATIVE SCOPE
- o RESULTS NOT SUFFICIENT TO DRAW CONCLUSIONS ON DESIGN CHANGES
- o SUBSEQUENT EVALUATION OF ICS DESIGN CHANGES SHOULD CAREFULLY CONSIDER TOTAL IMPACT ON PLANT RESPONSE AND OPERATOR/TRANSIENT ASPECTS

UP TO B&WOG TO CONFIRM THAT PROPOSED RECONFIGURATION CAN BE ACHIEVED WHILE PRESERVING CURRENT POSITIVE CAPABILITIES OF ICS

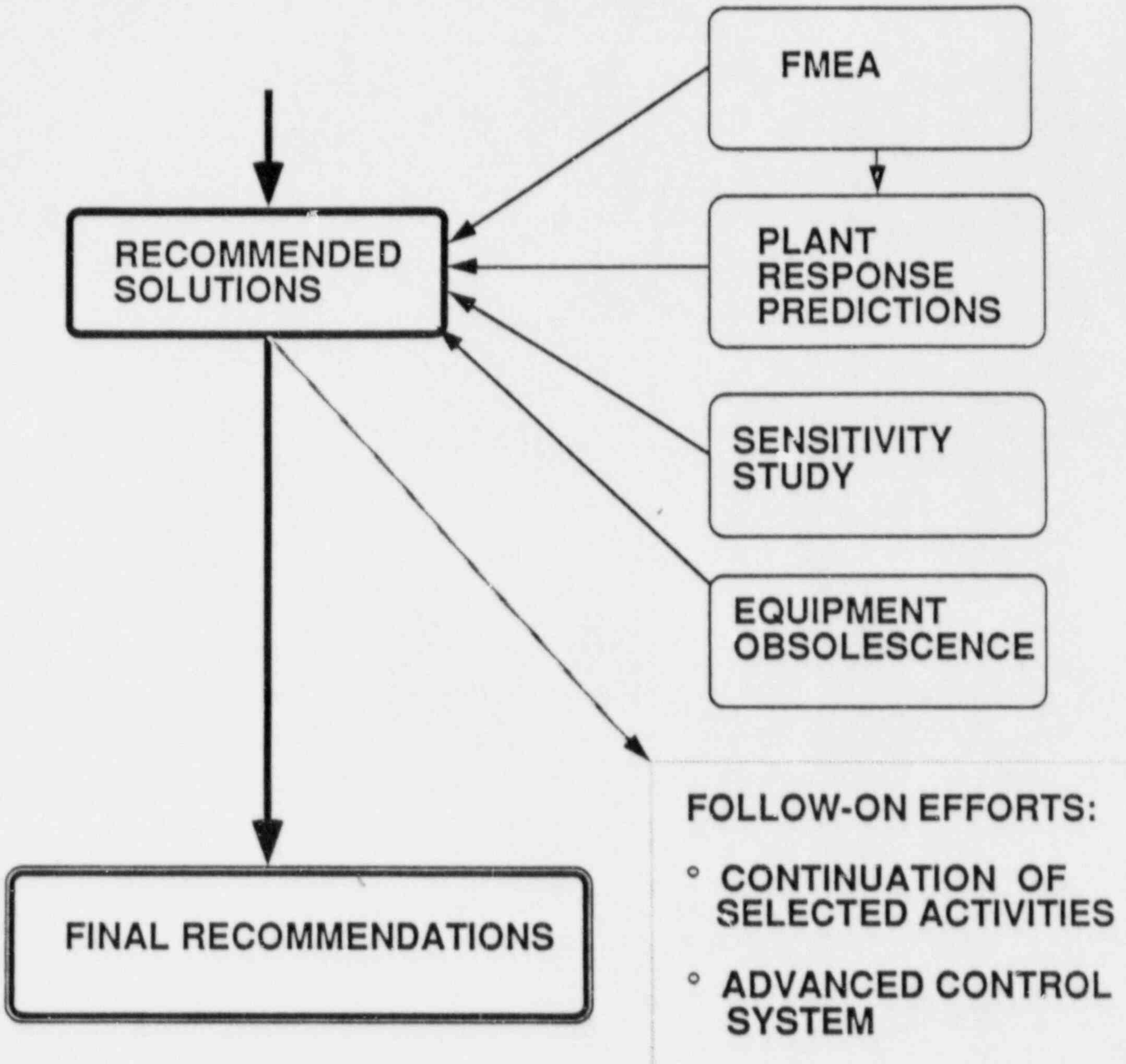
ICS/NNI EVALUATION

BASIC APPROACH



ICS/NNI EVALUATION

BASIC APPROACH



ICS/NNI EVALUATION

HOW THE EVALUATION WAS PERFORMED

- UTILIZED PREVIOUS WORK
- BROUGHT DOCUMENTS UP TO DATE
- ESTABLISHED REQUIREMENTS
- MADE COMPARISONS
- FORMULATED RECOMMENDATIONS

PEOPLE INVOLVED

- UTILITY I&C ENGINEERS
- UTILITY OPERATIONS PERSONNEL
- UTILITY MAINTENANCE PERSONNEL
- B&W CONTROLS ENGINEERS & SPECIALISTS
- INDUSTRY EXPERTS
  IAB, EPRI, CONSULTANTS

ICS/NNI EVALUATION

MAGNITUDE OF THE EVALUATION

- DIRECT EXPENDITURE EXCEEDED $500,000
- INDIRECT EXPENDITURE EXCEEDED $650,000
- SPANNED FOURTEEN MONTHS

INCLUDED

- ELEVEN I&C COMMITTTEE MEETINGS
- FOUR WORKING LEVEL MEETINGS WITH NRC
- PRESENTATIONS AT SIX IAB MEETINGS

ICS/NNI EVALUATION

OUTPUT OF THE EVALUATION

- ° PUBLISHED IN SIX MAJOR DOCUMENTS, AND TWENTY SEVEN SUPPLEMENTARY DOCUMENTS IN APPENDIX R OF BAW 1919
- ° CONTAINS OVER 450 IDEAS, SUGGESTIONS, REFERENCES, OR RECOMMENDATIONS.
- ° EACH IDEA, SUGGESTION, REFERENCE, OR RECOMMENDATION HAS BEEN EVALUATED, AND CATEGORIZED FOR DISPOSITION

ICS/NNI EVALUATION

RESULTS

Recommendations were classified into three levels:

LEVEL 1 Those items which will provide immediate improvements in the operation, availiability, and reliability of the ICS/NNI.

The RTS now contains 51 recommendations related to the ICS/NNI system.
Among these are:

- Improve the reliability of the power sources.
- Harden the ICS inputs to reduce the probability of a trip or transient.
- Achieve a Known Safe State on loss of ICS/NNI power

LEVEL 2 Those which potentially involve major modifications to the existing equipment and require further in-depth evaluation before approval.

Continued evaluation requires long term commitment to the existing hardware.

LEVEL 3 Those items which consist of replacement of the existing system with a new system based on modern digital technology.

An Advanced Control System Task Force was established and is pursuing the development effort.

ICS/NNI EVALUATION

LEVEL 1

Power source improvement-

013 Protect on loss of AC power
039 Power supply monitor
102 Additional "Y" DC source
103 Fuse power leaving cabinets
182 ABT for MFP controllers
184 Fuse hand auto stations
187 Install current and voltage meters
195 Supply hand and auto circuits form separate panels

Harden the inputs-

001 Replace RC flow with RC Pump status
002 Detect valid RC temperature to the ICS
004 Valid turbine header pressure
005 Take care of the neutron flux
006 Eliminate FW temperature correction
104 Auto select valid inputs

Known Safe State-

012 Instruments to detect loss of power
032 Resotoration of power
036 Turbine valve position on loss of power
037 MPF Speed control on loss of power
154 Unambiguous status of indicators & recorders
190 Backup controls for the Pzr lvl & press
193 Pzr heater interlock logic
195 Supply hand and auto power from separate panels
198 Sensor power on loss of hand
178 KSS Maintain heat balance normal operator actions

ICS/NNI EVALUATION

LEVEL 2

° Eliminate mid scale failures
° Sepatate subsystems for Tavg and steam press control.
° Control MFP on Press vs.ΔP
° Separate controls for MFPs, and MFW vlvs.
° Independent controls for Rx Pwr, Sltm demand, & FW

LEVEL 3

° Technological improvements to improve operability, reliability, & maintainability
° Resolve problem areas identified in the current ICS/NNI systems
° Develop optimal configuration for ACS
° Provide features to prevent challenge to the protection systems.
° Improve control and man-machine interface

ICS/NNI EVALUATION
SUMMARY OF THE NRC SER REVIEW

A DETAILED REVIEW OF THE SER (SUPPLEMENT 1) SECTION 6 ON THE ICS/NNI EVALUATION WAS COMPLETED

NRC COMMUNICATES OVERALL AGREEMENT WITH THE ICS/NNI EVALUATION

- o NRC MENTIONED 170 INDIVIDUAL RECOMMENDATIONS, SUGGESTIONS, OR IDEAS.
- o OVER 90% HAD THE SUPPORT/CONCURRENCE OF THE NRC REVIEWERS.
- o THERE WERE SOME AREAS OF DISAGREEMENT

THE LATTER WERE FURTHER CATEGORIZED AS FOLLOWS:

- o THE EVALUATION PROCESS
- o THE PROGRAMMATIC SOLUTIONS
- o THE RECOMMENDATION AND/OR THE IMPLEMENTATION PROCESS

ICS/NNI EVALUATION

SER REVIEW AREA OF CONCERN

EVALUATION PROCESS

- ° REQUIREMENTS DOCUMENTS
- ° FAILURE MODES AND EFFECTS ANALYSIS
- ° RECOMMENDATION SCOPE LIMITED
- ° INCLUDING IEB 79-27 EVALUATION
- ° SOURCE DOCUMENTS REFERENCED
- ° PREVIOUSLY IDENTIFIED CONCERNS

ICS/NNI EVALUATION

SER REVIEW AREA OF CONCERN

PROGRAMMATIC SOLUTIONS

- MAXIMIZE DEPENDENCE ON NNI-X
- POST-TRIP TROUBLE-SHOOTING
- PREVENTIVE MAINTENANCE GUIDANCE TOO GENERAL
- CHECKOUT OF REPLACEMENT CRDCS MODULES
- FREQUENCY OF ICS/NNI PREVENTIVE MAINTENANCE

ICS/NNI EVALUATION

SER REVIEW AREA OF CONCERN

THE RECOMMENDATION AND/OR IMPLEMENTATION PROCESS

- REPLACE RC FLOW WITH RC PUMP STATUS
- DELETING FW TEMPERATURE CORRECTION CIRCUIT
- REMOVAL OF BTU LIMITS
- IMPLEMENTATION OF PRESSURIZER LEVEL & PRESSURE BACKUP
- SMUD's TRIPPING OF ICS POWER
- REMOVAL OF NNI-Z POWER
- RELOCATION OF THE POWER SUPPLY MODULES
- ARTS BISTABLE AUTOMATIC RESET

ICS/NNI EVALUATION

OVERALL ICS/NNI SUMMARY AND CONCLUSIONS

- MAGNITUDE OF THE ICS/NNI EVALUATION EFFORT WAS LARGE
- METHODOLOGY USED FOR THE REVIEW WAS SOUND
- VULNERABILITIES STILL EXIST IN THE ICS/NNI DESIGN AND LOSS OF POWER MAY STILL OCCUR
- IMPLEMENTATION OF LEVEL 1 RECOMMENDATIONS WILL REDUCE TRIPS AND TRANSIENT COMPLEXITY AND COMPENSATE FOR THE VULNERABLITIES
- FOLLOW-ON ACTIVITIES ARE BEING ACTIVELY PURSUED

ADVANCED CONTROL SYSTEM

PROGRAM

° LEADING THE INDUSTRY
° INCLUDES
  ICS/NNI EVALUATION LESSONS LEARNED
  FOREIGN CONTROL SYSTEMS REVIEW
  DETAILED HUMAN FACTORS STUDY
° EXPERT ADVISORY PANEL
  NASA, ERPI, ORNL

THE ACS WILL BE A PLANT CONTROL AND MONITORING SYSTEM

PLANT CONTROL

° IMPROVED CONTROL TECHNIQUES
° MORE OPERATIONAL FEATURES
° INCREASED RELIABILITY
  FAULT AVOIDENCE
  FAULT TOLERANCE

MONITORING

° PREDICT FAILURES
° DETECT FAILURES
° ALERT OPERATORS

B&WOG PERSPECTIVE ON HUMAN FACTORS

- o MAIN PURPOSES OF SPIP
  - ASSESS RISK SIGNIFICANCE OF COMPLEX TRANSIENTS
  - DEFINE ACTIONS TO REDUCE FREQUENCY OF TRIPS AND COMPLEXITY OF POST-TRIP TRANSIENTS

- o HUMAN ACTIONS CAN AFFECT TRANSIENT BEHAVIOR

- o HUMAN FACTORS CONCERNS WERE CONSIDERED ALONG WITH OTHER IMPORTANT MATTERS. HUMAN FACTORS WERE NOT A DOMINANT CONSIDERATION IN SPIP.

- o B&WOG BELIEVES THAT ITS ACTIONS HAVE, OR WILL, CONSIDER HUMAN FACTORS CONCERNS.

- o NRC HAD THREE SPECIFIC HUMAN FACTORS RECOMMENDATIONS.

THREE NRC HUMAN FACTORS RECOMMENDATIONS

- o REVIEW OF HUMAN FACTOR LOSS OF ICS/NNI POWER EVENTS
- o USE OF HUMAN FACTORS EXPERTISE TO RE-REVIEW:
  - OPERATIONS AND MAINTENANCE INTERVIEW DATA
  - OLD TAP REPORTS
  - THE 1985 DAVIS-BESSE EVENT
  - OPERATOR BURDEN DATA
- o HUMAN FACTORS INVOLVEMENT IN RECOMMENDATION IMPLEMENTATION AT EACH UTILITY

B&WOG POSITION ON NRC RECOMMENDATIONS

LOSS OF ICS/NNI POWER EVENTS

- o ACTIONS HAVE ALREADY BEEN TAKEN TO AID IN DIAGNOSIS AND RECOVERY.

- o CURRENT B&WOG EMPHASES ARE TWO-FOLD:

  1. PREVENT LOSS OF ICS POWER EVENTS ON LOSS OF A SINGLE AC SOURCE

  2. IF THEY OCCUR, GO TO A KNOWN SAFE STATE

- o LONGER TERM IMPROVEMENTS ARE BEING CONSIDERED AS PART OF ADVANCED CONTROL SYSTEM PROJECT.

B&WOG POSITION ON NRC RECOMMENDATIONS

USE OF HUMAN FACTORS EXPERTISE TO RE-REVIEW OPERATIONS AND MAINTENANCE INTERVIEW DATA

- B&WOG IDENTIFIED SIX CONCERNS WHICH ARE BEING ADDRESSED.

- ALL B&WOG MEMBERS ARE NOW SUPPORTING INPO'S HUMAN PERFORMANCE EVALUATION SYSTEM (HPES) OR ITS EQUIVALENT.

- RE-REVIEW OF INTERVIEW DATA 1-1/2 YEARS LATER WOULD NOT BE OF SIGNIFICANT ADDITIONAL BENEFIT.

B&WOG POSITION ON NRC RECOMMENDATIONS

USE OF HUMAN FACTORS EXPERTISE TO RE-REVIEW OLD TRANSIENT ASSESSMENT PROGRAM REPORTS

- TAP REPORTS HAVE BEEN HELPFUL IN SPIP.

- PRIOR TO 1987, COLLECTING HF INFORMATION WAS NOT EMPHASIZED IN TAP.

- GUIDELINES FOR CONTENT OF FUTURE TAP REPORTS HAVE BEEN UPGRADED TO EXPLICITLY EMPHASIZE HF ISSUES.

B&WOG POSITION ON NRC RECOMMENDATIONS

USE OF HUMAN FACTORS EXPERTISE TO RE-REVIEW JUNE 1985 DAVIS-BESSE EVENT

- CERTAIN GENERIC HF CONCERNS FROM DB EVENT WERE REVIEWED BY EACH UTILITY; E.G., VITAL EQUIPMENT ACCESSIBILITY, LOCAL VERSUS REMOTE CONTROL, CLARITY OF INSTRUCTIONS TO TAKE DRASTIC ACTIONS.

- B&WOG BELIEVES THAT RE-REVIEW OF THIS EVENT WITH MORE EMPHASIS ON HF ISSUES WOULD NOT PROVIDE ADDITIONAL BENEFITS.

B&WOG POSITION ON NRC RECOMMENDATIONS

USE OF HUMAN FACTORS EXPERTISE TO RE-REVIEW OPERATOR BURDEN DATA

- o PROJECT OBJECTIVES:
  - IDENTIFY AREAS OF UNNECESSARY BURDEN.
  - DEFINE ACTIONS TO REDUCE BURDEN AND FREQUENCY OF COMPLEX TRANSIENTS.
- o METHODOLOGY WAS DEVELOPED BY HF EXPERT
- o SEVEN BURDEN REDUCTION AREAS IDENTIFIED AND RECOMMENDATIONS DEVELOPED
  - CONTROL OF STEAM AND FEED FLOW
  - DRASTIC ACTIONS
  - OVERCOOLING MITIGATION
  - INSTRUMENT AIR
  - ACTIONS OUTSIDE MAIN CONTROL ROOM
  - ANNUNCIATORS
  - EMERGENCY PLAN REQUIREMENTS
- o RE-REVIEW OF DATA NOT PROVIDE ADDITIONAL BENEFITS

B&WOG POSITION ON NRC RECOMMENDATIONS

USE OF HF EXPERTISE IN RECOMMENDATION IMPLEMENTATION

- o HUMAN FACTORS EXPERTISE WILL BE UTILIZED ON PLANT-SPECIFIC BASIS.
- o USE OF HF EXPERTISE WILL VARY DEPENDING ON SUBJECT OF RECOMMENDATION.

B&WOG POSITION ON NRC RECOMMENDATIONS

SUMMARY B&WOG HUMAN FACTORS COMMENTS

- o B&WOG AGREES THAT HUMAN FACTORS CONSIDERATIONS ARE IMPORTANT.
- o B&WOG MEMBERS ARE NOW PLACING MORE EMPHASIS ON HUMAN FACTORS THAN WHEN SPIP BEGAN.
- o B&WOG BELIEVES THAT RE-REVIEW OF OLD INFORMATION WOULD HAVE LITTLE ADDITIONAL BENEFIT.
- o HF CONSIDERATIONS WERE A PART OF SPIP.

PERFORMED A RISK ASSESSMENT REVIEW

- o ASSESSED THE IMPORTANCE OF B&W HISTORICAL CATEGORY "C" EVENTS TO CORE-DAMAGE RISK. CATEGORY "C" TRANSIENTS ARE THOSE WHERE SYSTEM CONDITIONS REACH LIMITS WHICH REQUIRE SIGNIFICANT SAFETY SYSTEM AND OPERATOR RESPONSE TO MITIGATE. THIRTEEN OF THESE EVENTS WERE REVIEWED.

- o COMPARED INITIATING EVENT FREQUENCIES OBTAINED FROM THE TRANSIENT HISTORY OF ALL B&W UNITS TO THE FREQUENCIES USED ON THE EXISTING PRAs.

- o EVALUATED THE DOMINANT ACCIDENT SEQUENCES, SYSTEMS AND INITIATORS FROM THE PRAs. COMPARED THESE TO THE CATEGORY "C" EVENTS.

- o GENERALIZED THE RESULTS OF THE ANALYSES TO ALL OF THE B&W UNITS.

  - o USED THE: OCONEE PRA -
    LEVEL 3: INTERNAL & EXTERNAL EVENTS
    CRYSTAL RIVER PRA -
    LEVEL 1: INTERNAL EVENT AND LOOP

SPIP ADMINISTRATION, FOLLOW THROUGH AND IMPLEMENTATION

SPIP RECOMMENDATION IMPLEMENTATION

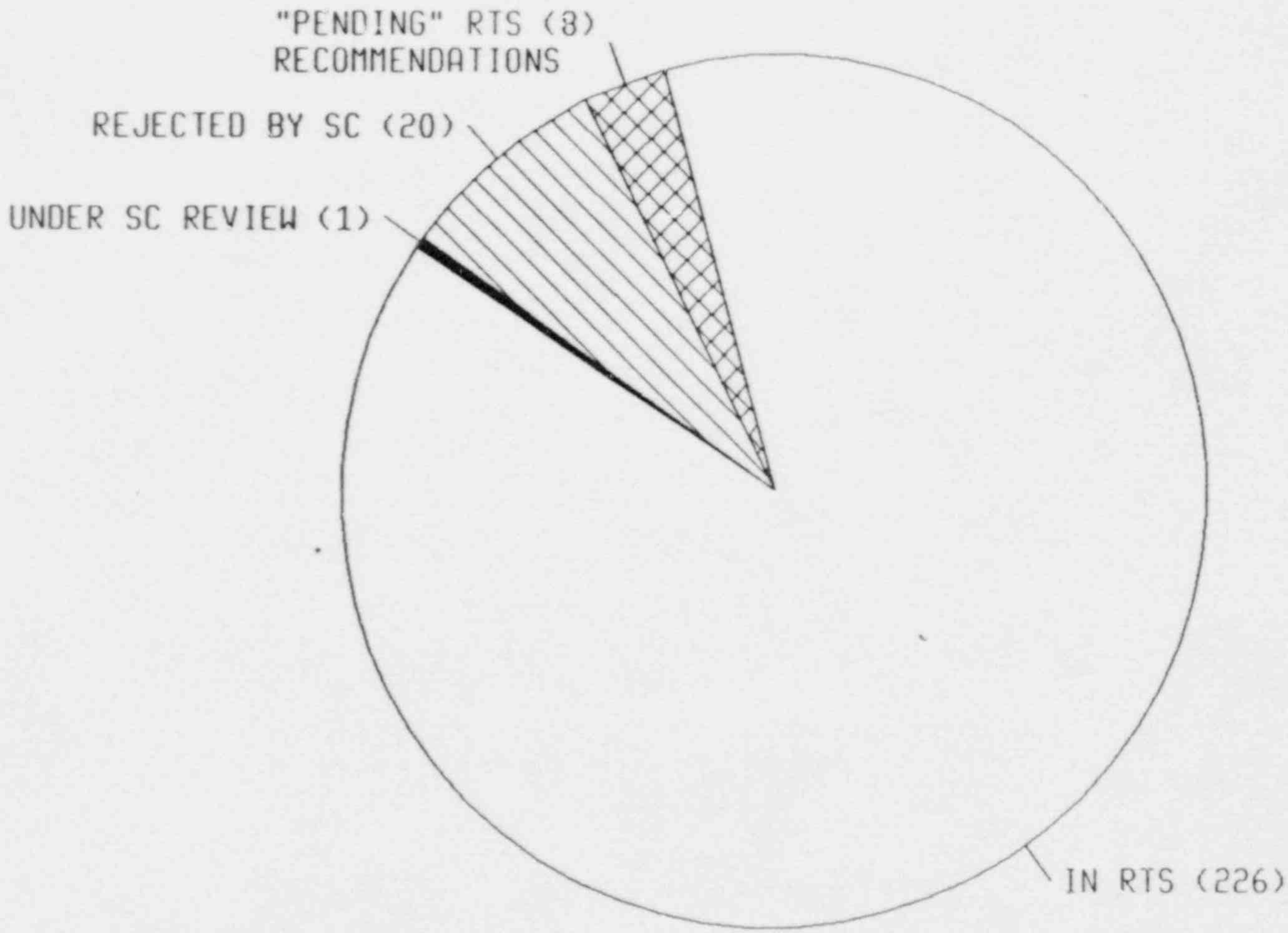
- o IMPLEMENTING RECOMMENDATIONS - CRITICAL FOR SUCCESS
- o IMPLEMENTATION IS BEING FORMALLY MONITORED BY B&WOG EXECUTIVES AND THE STEERING COMMITTEE FOR BOTH QUALITY AND TIMELINESS:
  - IMPLEMENTATION QUALITY WILL BE MONITORED FROM A PROGRAMMATIC AND TECHNICAL STANDPOINT
  - PROPER IMPLEMENTATION WILL REQUIRE CONSIDERATION OF PLANT UNIQUE CONFIGURATION, RESOURCES, AND OPERATING SCHEDULE
  - RECOMMENDATION TRACKING SYSTEM REPORT IS MANAGEMENT TOOL
- o EFFECTIVENESS IS MONITORED BY COMPARISON OF PERFORMANCE AGAINST DEFINED GOALS

B&WOG RECOMMENDATION TRACKING SYSTEM (RTS)

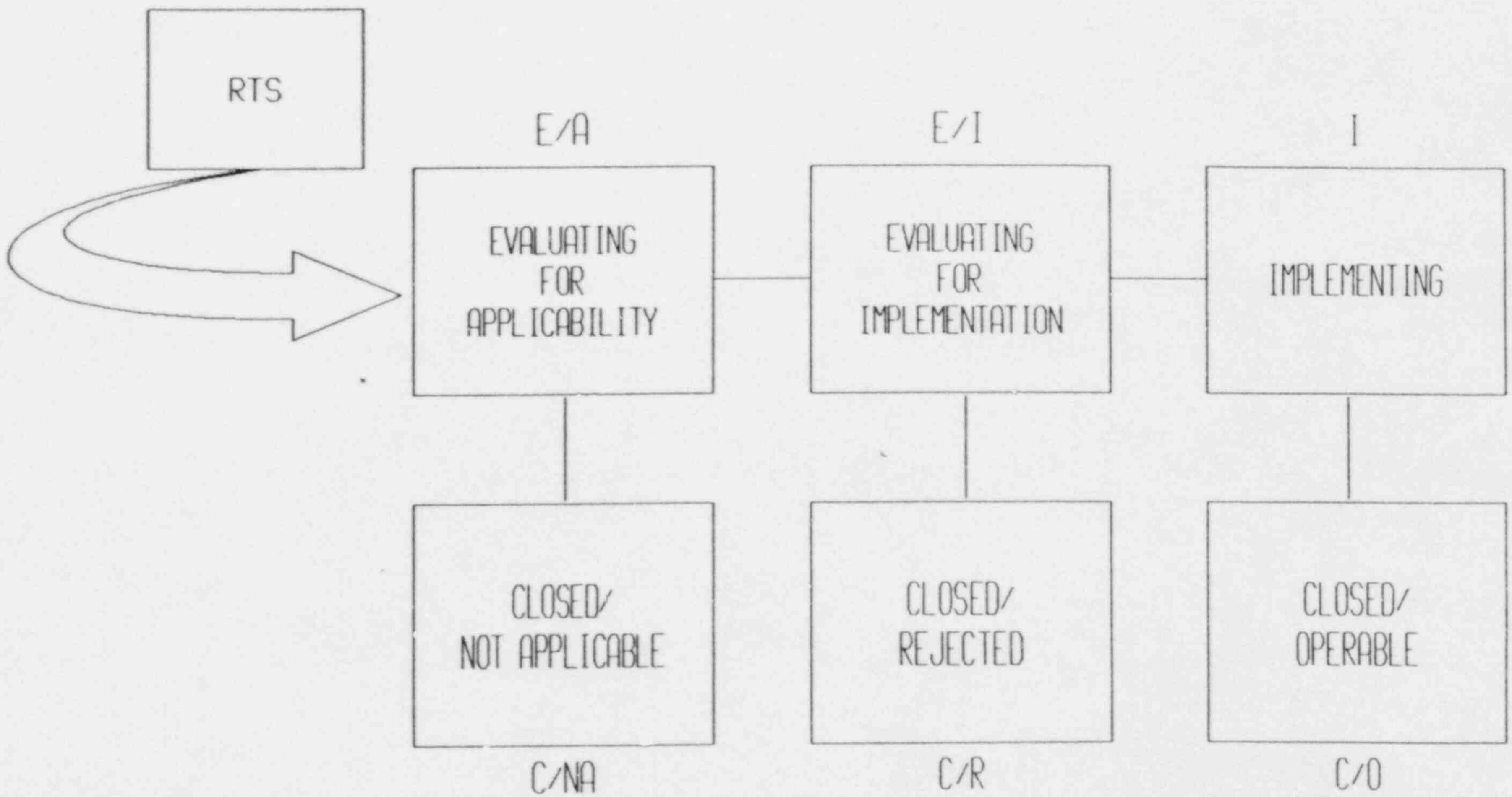
- o RECOMMENDATIONS COMPILED AND EVALUATED
- o DECISIONS AT THE VARIOUS SCREENING POINTS DOCUMENTED
- o RECOMMENDATIONS APPROVED BY THE STEERING COMMITTEE ARE PLACED IN THE RECOMMENDATION TRACKING SYSTEM REPORT
- o RTS REPORT IS UPDATED QUARTERLY BASED ON INPUT FROM THE UTILITIES REGARDING INDIVIDUAL RECOMMENDATION STATUS
- o B&WOG WILL KNOW THE STATUS OF IMPLEMENTATION AND KEEP AN ACCOUNTABILITY OF EACH RECOMMENDATION THROUGH IMPLEMENTATION. DOCUMENTATION HAS AND WILL BE PROVIDED TO NRC STAFF.
- o STATUS OF SPIP RECOMMENDATIONS NOT IN RTS
  - "PENDING" RECOMMENDATIONS FOR RTS - 9
  - RECOMMENDATIONS INVOLVING GENERIC B&WOG STUDIES (NOT FOR RTS) - 13

STATUS OF SPIP RECOMMENDATIONS

APRIL 1988

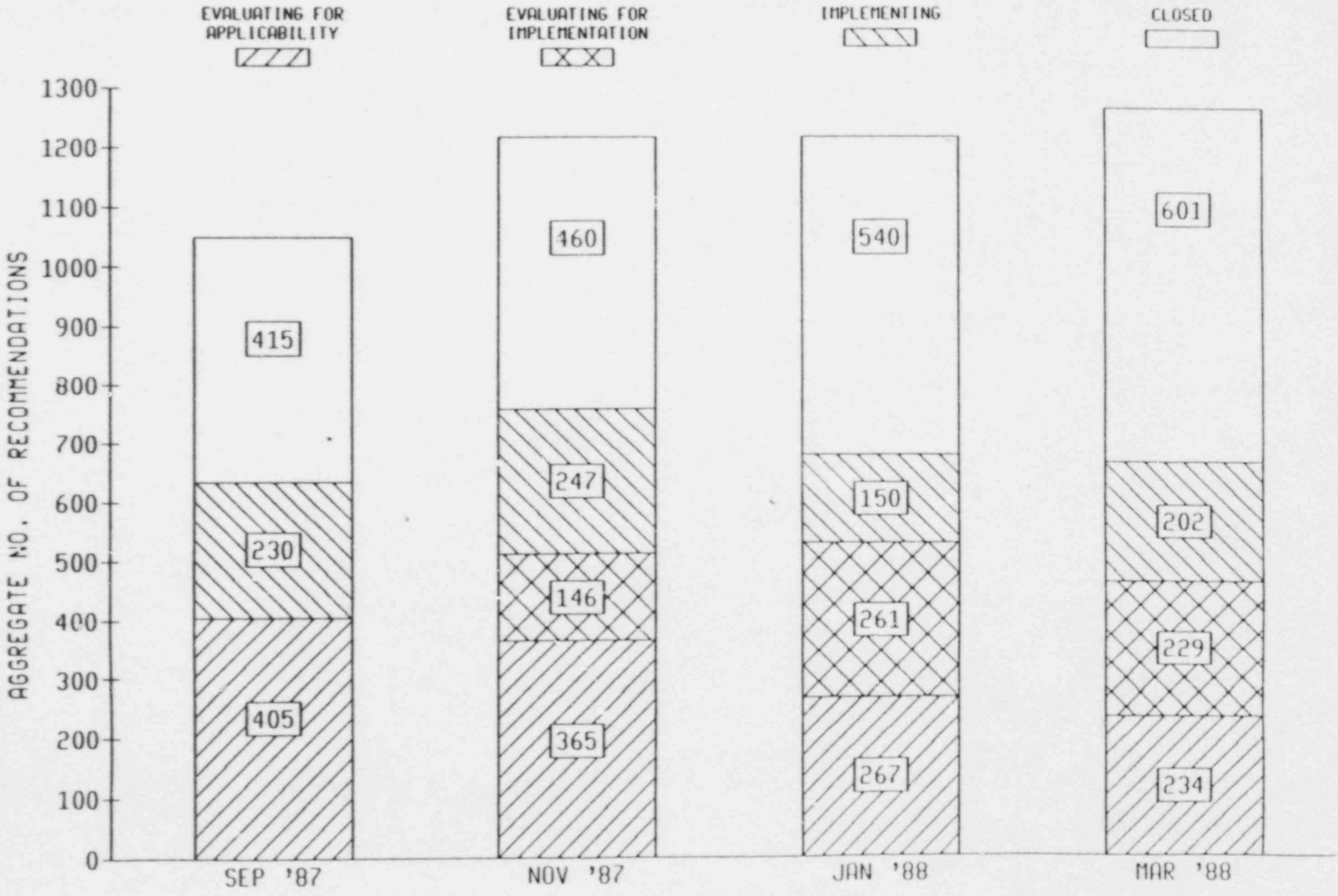


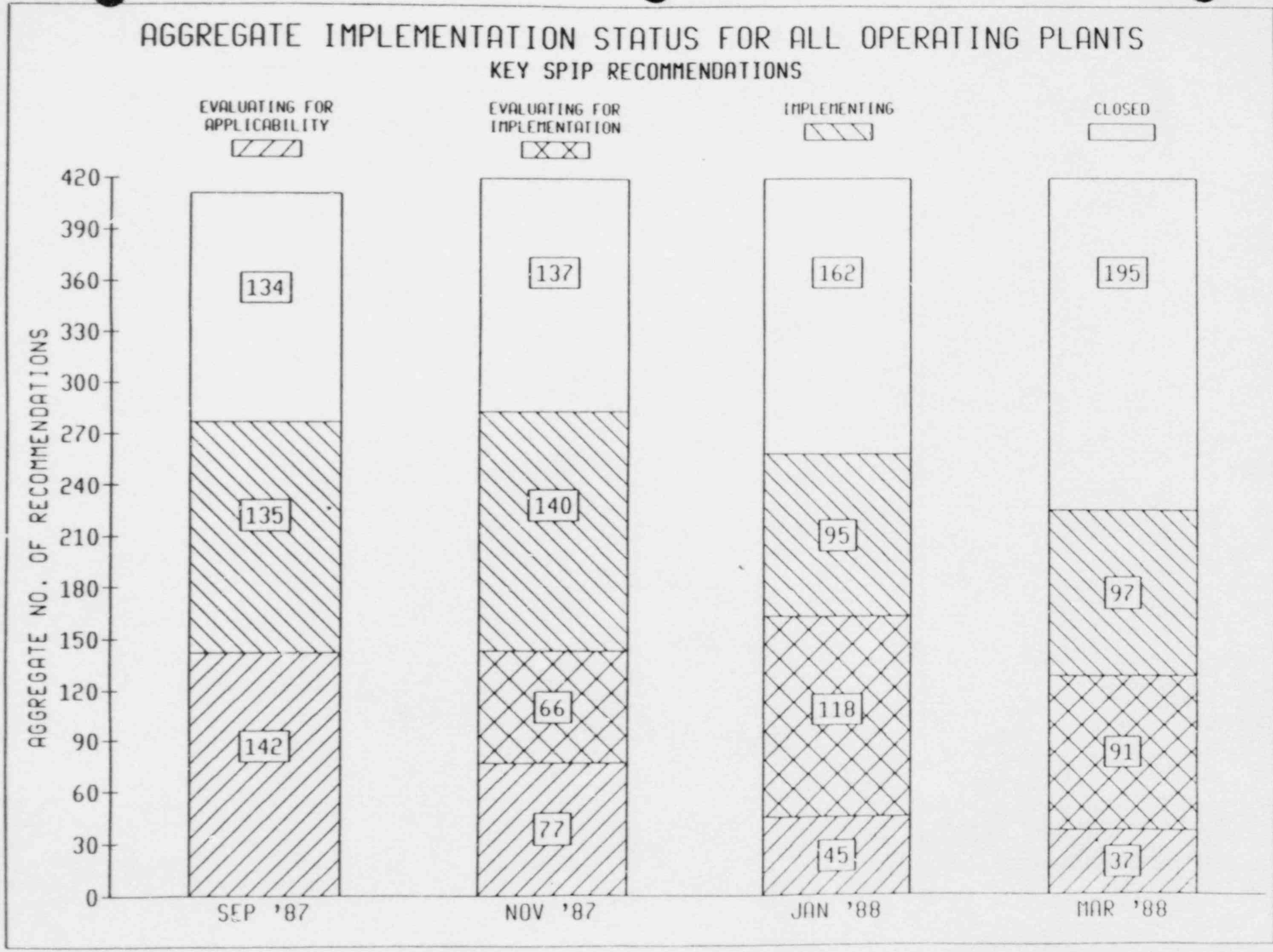
SEQUENCE OF EXPECTED RECOMMENDATION DISPOSITION



AGGREGATE IMPLEMENTATION STATUS FOR ALL OPERATING PLANTS

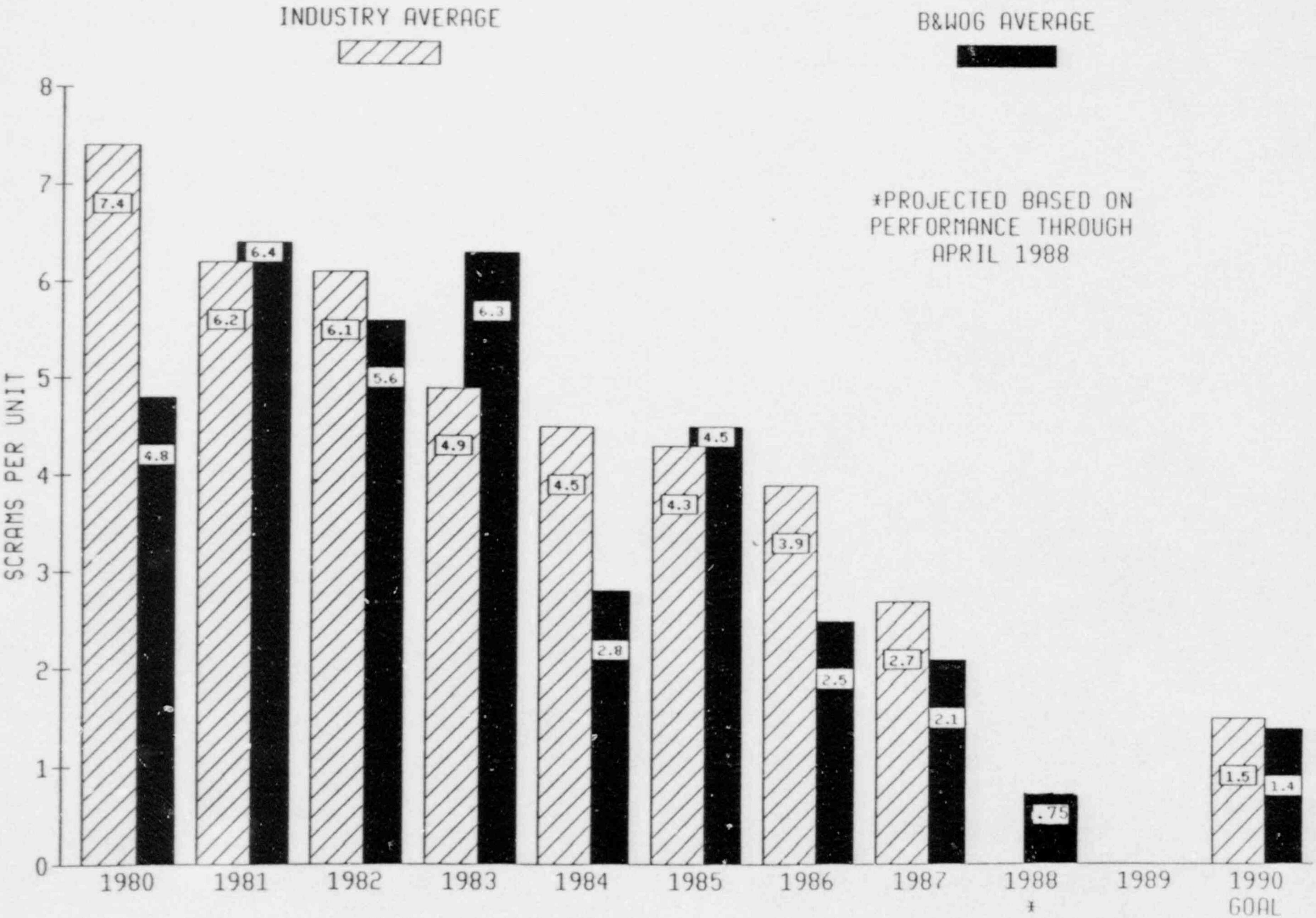
SPIP RECOMMENDATIONS



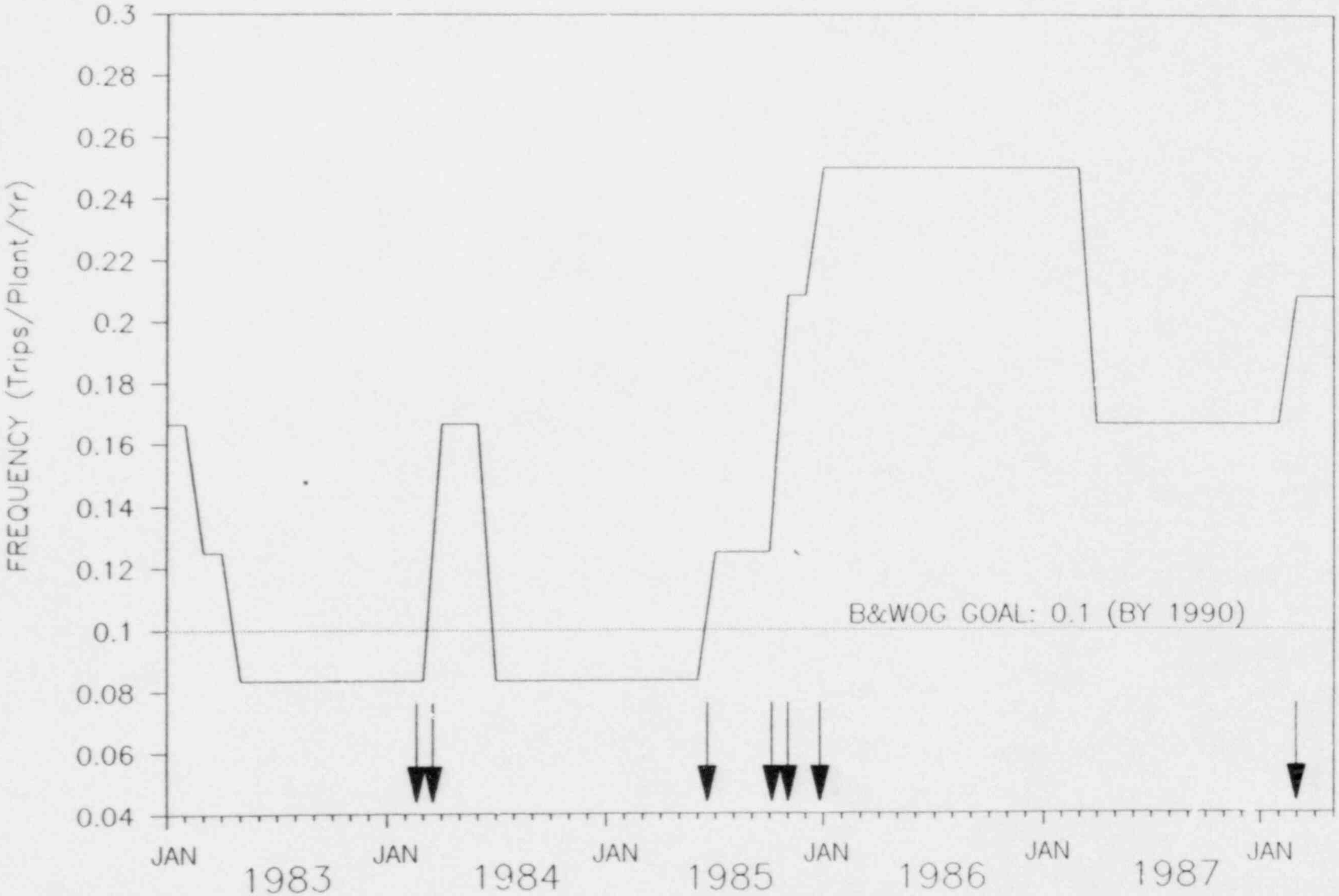

AGGREGATE IMPLEMENTATION STATUS FOR ALL OPERATING PLANTS
KEY SPIP RECOMMENDATIONS
EVALUATING FOR APPLICABILITY
EVALUATING FOR IMPLEMENTATION
IMPLEMENTING
CLOSED
AGGREGATE NO. OF RECOMMENDATIONS
420
390
360
330
300
270
240
210
180
150
120
90
60
30
0
134
135
142
137
140
66
77
162
95
118
45
195
97
91
37
SEP '87
NOV '87
JAN '88
MAR '88

B&WOG PLANT PERFORMANCE
IN AREAS PERTINENT TO SPIP

UNPLANNED AUTOMATIC SCRAMS WHILE CRITICAL



FREQUENCY OF CATEGORY C TRANSIENTS
(BASED ON A 3-YEAR MOVING AVERAGE)



PROGRAMMATIC EVALUATION OF SPIP

RECOMMENDATION IMPLEMENTATION

- o EXECUTIVES CONVENED EVALUATION TEAMS TO CONDUCT EVALUATIONS AT EACH UTILITY
  - TEAM TYPICALLY CONSISTED OF EIGHT INDIVIDUALS
  - EVALUATION PLAN DEVELOPED
  - EVALUATIONS HAVE BEEN COMPLETED AT ALL UTILITIES
  - REPORT ISSUED TO EACH UTILITY
- o EXECUTIVE INVOLVEMENT IN EACH EVALUATION
- o ONE MANYEAR OF TEAM EFFORT (EXCLUDING TRAVEL)
- o ONE HUNDRED FORTY OWNERS GROUP PERSONNEL WERE INVOLVED
- o SUMMARY REPORT ENDORSED BY B&WOG EXECUTIVES AND PROVIDED TO NRC

EVALUATION TEAM CONCLUSIONS

THE EVALUATION TEAM REACHED THE PRINCIPAL CONCLUSION THAT ALL UTILITIES HAD ADEQUATE PROGRAMS FOR SPIP RECOMMENDATION DISPOSITIONING AT THE TIME OF THE EVALUATION. HOWEVER, IN ALL CASES, SOME IMPROVEMENTS WERE NEEDED TO CREATE A FULLY EFFECTIVE PROGRAM.

THE FOLLOWING ADDITIONAL CONCLUSIONS WERE REACHED BY THE EVALUATION TEAM:

- EXCELLENT "CROSS-FERTILIZATION" OCCURRED THROUGH THE TEAM MEMBERS TO THEIR RESPECTIVE COMPANIES. UTILITY PROGRAM FEATURES WERE CONTINUALLY BEING IMPROVED THROUGHOUT THE EVALUATION PERIOD AS A DIRECT RESULT OF THE EVALUATION PROGRAM.

- THE INVOLVEMENT OF EXECUTIVE COMMITTEE REPRESENTATIVES CONTRIBUTED GREATLY TO THE EVALUATION QUALITY, THE EMPHASIS ON THE IMPORTANCE OF SPIP RECOMMENDATION DISPOSITIONING, AND THE INCREASED VISIBILITY OF THE SPIP AND ITS GOALS.

- FUTURE IMPROVEMENTS IN THE QUALITY OF DISPOSITIONING, REPORTING. AND DOCUMENTATION, AND INCREASED PROGRESS IN DISPOSITIONING ARE EXPECTED AS A RESULT OF ACTIONS TAKEN BY THE UTILITIES.

TECHNICAL EVALUATION OF SPIP RECOMMENDATION IMPLEMENTATION

- o TECHNICAL EVALUATIONS STARTED
  - FOUR-MAN TEAM FORMED TO CONDUCT EVALUATION
  - FOUR RECOMMENDATIONS INCLUDING ICS (KNOWN SAFE STATE) SELECTED FOR INITIAL EVALUATION
  - EVALUATIONS COMPLETED AT GPUN AND DPC
  - OTHER PLANTS SCHEDULED
- o DETAILED EVALUATION PLANS AND CHECKLISTS UTILIZED
- o STEERING COMMITTEE HAS REVIEWED RESULTS OF FIRST TWO EVALUATIONS
- o TECHNICAL EVALUATIONS OF ADDITIONAL RECOMMENDATIONS WILL CONTINUE

CLOSING COMMENTS

- SAFETY AND PERFORMANCE HAS BEEN AND WILL CONTINUE TO BE IMPROVED AT B&WOG PLANTS
- SIGNIFICANT RESOURCES DEVOTED TO REASSESSMENT
- SCOPE OF ASSESSMENT WAS CORRECT AND SUFFICIENT
- DEVELOPED OVER TWO HUNDRED SAFETY AND PERFORMANCE IMPROVEMENT RECOMMENDATIONS
- UTILITIES DEVELOPED A TRACKING SYSTEM TO ENSURE FORMAL AND TIMELY DISPOSITION OF ALL RECOMMENDATIONS
- IMPLEMENTATION OF SOME RECOMMENDATIONS HAS ALREADY RESULTED IN BENEFIT (TRIP AVOIDANCE)
- EXPECT THE IMPLEMENTATION PHASE TO BE CONTINUING FOR SEVERAL YEARS
- UTILITY MANAGEMENT WILL MONITOR FUTURE PERFORMANCE TO ENSURE IMPROVEMENT IS ATTAINED
- NRC CAN READILY MONITOR PERFORMANCE PROGRESS
- B&WOG COMMITMENT TO SPIP HAS BEEN AND WILL CONTINUE TO BE STRONG

COMMITMENT TO ACTION

- o COMMITTED TO TAKE LEAD AND DID
- o COMMITTED TO ALLOCATE RESOURCES AND DID; (\$10M AND 100MY)
- o COMMITTED TO MONITOR OURSELVES AND WE ARE
- o COMMITTED TO OPENLY CONSIDER NRC AND OTHER OUTSIDE INPUT AND DID
- o ESTABLISHED TRIP AND TRANSIENT FREQUENCY GOALS AND WE ARE PROGRESSING TOWARD THEM
- o COMMITTED TO FOLLOW-THROUGH AND PLANT IMPLEMENTATION AND IT IS HAPPENING

ACRS SUBCOMMITTEE MEETING-BWOG SAFETY AND PERFORMANCE IMPROVEMENT PROGRAM (SPIP)

STAFF PRESENTATIONS

OVERVIEW OF SPIP	SIEGEL
SUMMARY AND CONCLUSIONS	JONES
INFORMATION GATHERING	JONES
SENSITIVITY EVALUATIONS	JONES
SYSTEMS REVIEW	
ICS/NNI	KENDALL
MAIN FEEDWATER	LeFAVE
AFW/EFW	LeFAVE
SECON[illegible] PLANT RELIEF	LeFAVE
INSTRUMENT AIR	LeFAVE
VALVE TASK FORCE	HAMMER
EVALUATION OF HUMAN FACTORS	DeBOR
EVALUATION OF OTHER BWOG REPORTS	JONES
RISK ASSESSMENT	RUBIN
REACTOR TRIP INITIATING EVENTS REVIEW	JONES
BWOG PROGRAMMATIC AND MANAGEMENT ACTIONS	SIEGEL
IMPLEMENTATION	SIEGEL
ADDITIONAL CONCERNS IDENTIFIED BY STAFF	SIEGEL

CALVO 5/3/88

B&W PLANT REASSESSMENT
NUREG-1231

STAFF SUMMARY AND CONCLUSIONS

PRESENTED TO
ACRS SUBCOMMITTEE
ON B&W REACTORS
MAY 3-4, 1978

PRESENTED BY

R.C.JONES
NRR/DEST/SRXB

BWACRS1

PROGRAM SCOPE

- OPERATING EXPERIENCE FORMS MAJOR BASIS FOR PROGRAM
- EMPHASIS PLACED ON BALANCE OF PLANT SYSTEMS
- STAFF COMMENTED THROUGHOUT ENTIRE PROGRAM
- BWOG DID NOT INCORPORATE ALL OF STAFF'S COMMENTS
- STAFF BELIEVES SPIP WAS COMPREHENSIVE AND WILL IMPROVE SAFETY OF B&W PLANTS
- SINCE ALL STAFF COMMENTS NOT RESOLVED
    - LIKELY FUTURE TRANSIENTS WILL BE CAUSED OR COMPLICATED BY SYSTEMS STUDIED IN SPIP
    - ENCOURAGED BWOG TO CONSIDER STAFF CONCERNS AS PART OF CONTINUING BWOG PROGRAMS

BWACRS6

SUMMARY OF RECOMMENDATIONS

SYSTEM/ AREA	APPROVED RECOMMEND	KEY RECOMMEND	HIGH PRIORITY	STAFF DISAGREE	STAFF GUIDANCE
TURBINE	10	4	1	0	0
MFW	47	14	1	0	0
ICS/NNI	53	20	1	6	20
EFW	9	7	0	0	2
IAS	34	3	4	0	2
ELECTRICAL	11	3	1	0	2
VALVES	9	7	0	0	4
MAIN STEAM	10	5	1	1	2
OPERATIONS	32	8	2	1	1

BWACRS7

BWOG KEY RECOMMENDATIONS

ICS/NNI

- ENSURE PLANT GOES TO KNOWN SAFE STATE ON LOSS OF POWER
- INCORPORATE AUTOMATIC SELECTION OF VALID INPUTS
- IMPROVE MAINTENANCE AND TUNING FOR ICS/NNI
- PROVIDE OPERATOR WITH UNAMBIGUOUS STATUS OF INDICATORS IN MAIN CONTROL ROOM FOR LOSS OF ICS POWER

MAIN FEEDWATER

- IDENTIFY CAUSES OF MFW CONTROL PROBLEMS
- ENSURE SINGLE ELECTRICAL FAILURE WILL NOT CAUSE LOSS OF BOTH FEEDWATER TRAINS
- ELIMINATE AUTOMATIC MFW PUMP TRIPS WHERE POSSIBLE
- PROVIDE OVERFILL PROTECTION FOR MFW SYSTEM

EFW

- REMOVE AUTO INITIATION & CONTROL OF EFW FROM ICS/NNI
- EXTEND TIME TO ACHIEVE DESIGN EFW FLOW
- REVIEW MAINTENANCE, SURVEILLANCE AND TEST PROCEDURES

BWACRS8

BWOG KEY RECOMMENDATIONS (CONT'D)

MAIN STEAM PRESSURE CONTROL
- CORRECT ANOMALOUS POST-TRIP PERFORMANCE OF MSSV's
- REVISE TURBINE BYPASS VALVE MAINTENANCE PROGRAM

MOTOR OPERATED VALVES
- ENSURE PROCEDURES PROPERLY SET TORQUE AND BYPASS LIMIT SWITCHES
- CHALLENGE VALVES TO OPEN/CLOSE UNDER DIFFERENTIAL PRESSURES WHICH SIMULATE OPERATIONAL AND ACCIDENT CONDITIONS

PLANT ELECTRICAL SYSTEMS
- ESTABLISH MAINTENANCE PROCEDURES FOR INVERTER AND ELECTRICAL BUSES
- MODIFY INVERTER OVERCURRENT PROTECTION TO ENSURE BREAKER/FUSES OPEN PRIOR TO INVERTER FAILURE

INSTRUMENT AIR SYSTEM
- OPERABILITY TEST CRITICAL AIR-OPERATED VALVES
- PERFORM PLANT SPECIFIC AIR SYSTEM FAILURE EVALUATION

OPERATIONS
- IDENTIFY HIGH PRIORITY TASKS DURING EMERGENCIES FOR TRAINING
- REVIEW EOPs TO ASSURE WHENEVER DRASTIC ACTIONS ARE SPECIFIED PLANT CONDITIONS REQUIRE THE ACTION

HIGH PRIORITY RECOMMENDATIONS

DEVELOP BACKUP AUTO AND MANUAL CONTROL FOR PZR LEVEL AND PRESSURE CONTROL FROM ANOTHER POWER SOURCE

TEST DIESEL GENERATORS UNDER EXPECTED LOADING CONDITIONS

VALIDATE EOPs TO ENSURE ADEQUATE STAFFING & PRIORITIZTION EXISTS

VERIFY INSTRUMENTATION AND DISPLAYS FOR ATOG STABILITY PARAMETERS

IMPROVE RESPONSE OF MODULATING TURBINE BYPASS VALVES

SYSTEMATICALLY INSPECT THE IAS FOR LEAKS

INSPECT ACCUMULATORS AND THEIR CHECK VALVES IN IAS

REVIEW TRAINING AND LOSS OF AIR RESPONSE PROCEDURES

ENHANCE RELIABILITY OF MFW AND CONDENSATE SYSTEMS AND CONTROLS

REVIEW EHC OVERSPEED AND FAST CONTROL AND INTERCEPT VALVE CIRCUITS

BWACRS10

STAFF DISAGREEMENTS

- STAFF DOES NOT ENCOURAGE PUSUIT OF RAISING MSSV SETPOINTS

- DISAGREE WITH RECOMMENDATION TO SET SELECTOR SWITCHES FOR MAXIMUM NNI DEPENDENCE

- DISAGREE WITH REMOVAL OF BTU LIMITS FUNCTION

- DISAGREE WITH WIRING POWER SUPPLY MONITOR DIRECTLY TO THE OUTPUT BUS

- DISAGREE WITH REMOVING AUTOMATIC ICS TRIP ON NNI SINGLE POWER FAILURE

- DISCOURGE PURSUIT OF DESIGN MODIFICATION FOR AUTOMATIC RESET OF ARTS

BWACRS11

STAFF SUGGESTIONS

ENCOURAGED PURSUIT OF DAVIS-BESSE MAKEUP SYSTEM UPGRADE

CONSIDER RECOMMENDATION FOR GRADUAL LOSS OF AIR TEST

CONSIDER ANALYSIS TO ASSESS LOSS OF INSTRUMENT AIR ON LOOP

CONSIDER REEXAMINATION OF BWOG HUMAN FACTORS STUDIES BY A HUMAN FACTORS EXPERT

ENHANCE REFERENCES FOR RECOMMENDATIONS

CONSIDER DEVELOPMENT OF ICS/NNI DESIGN BASIS DOCUMENTS

CONSIDER PERFORMING ADDITIONAL INVESTIGATION OF THE POWER SUPPLY MONITOR DESIGN AND OPERATION IN ICS

ENCOURAGES ACTIONS TO ACHIEVE KNOWN SAFE STATE AS DEFINED IN BAW-1919

RECONSIDER REJECTED RECOMMENDATION:

- TROUBLE SHOOTING PROCEDURE FOR DIAGNOSING ICS MODULE FAILURES
- CHECKOUT OF REPLACEMENT COMPONENTS PRIOR TO USE

SIGNIFICANT IMPROVEMENTS

- IMPROVED RESPONSE TO ICS/NNI FAILURES
  - KNOWN SAFE STATE
  - RECOVERY OF ICS/NNI POWER

- IMPROVED HEAT SINK RELIABILITY
  - MFW RELIABILITY IMPROVEMENTS
  - EFW RELIABILITY IMPROVEMENTS
  - IMPROVED SECONDARY SIDE PRESSURE CONTROL
  - IMPROVED MOTOR OPERATOR VALVE PERFORMANCE

- IMPROVED INSTRUMENT AIR SYSTEM

BWACRS13

OTHER IMPROVEMENTS

- REDUCED REACTOR TRIPS
  - ICS INPUT SIGNAL FAILURES
  - ICS MAINTENANCE AND TUNING
  - MFW SYSTEM IMPROVEMENTS
  - TURBINE SYSTEM IMPROVEMENTS

- REDUCED CHALLENGES TO SAFETY SYSTEMS
  - IMPROVED MAIN STEAM PRESSURE CONTROL
  - REDUCED OVERCOOLING BY MFW & EFW
  - IMPROVED RESPONSE TO ICS/NNI POWER LOSSES

- REDUCED OPERATOR BURDEN/ENHANCED OPERATOR PERFORMANCE
  - ICS/NNI MODIFICATIONS
  - IMPROVED MSSV PERFORMANCE
  - ENHANCED PROCEDURES AND TRAINING

- REDUCED PTS RISK

BWACRS14

SIGNIFICANT ISSUES

IMPLEMENTATION

- FOR SAFETY GAINS TO BE REALIZED, RECOMMENDATIONS MUST BE PROPERLY IMPLEMENTED
- STAFF WILL MONITOR UTILITY IMPLEMENTATION PLANS AND PROGRESS
- PLANT SPECIFIC AUDITS ARE NECESSARY TO ENSURE PROPER IMPLEMENTATION

HUMAN FACTORS ISSUES

- STAFF POSITION – HUMAN FACTORS EXPERTISE NEEDED TO IDENTIFY HUMAN FACTORS CONCERNS
- BWOG DID NOT USE HUMAN FACTORS PROFESSIONAL THUS, STAFF UNABLE TO CONCLUDE SCOPE OF HUMAN FACTORS ISSUES EXAMINED IN SPIP WAS COMPLETE
- SUGGESTED BWOG REEXAMINE EFFORTS WITH HUMAN FACTORS PROFESSIONAL (REJECTED)

BWACRS15

SIGNIFICANT ISSUES (CONT'D)

IE BULLETIN 79-27 "LOSS OF NON-CLASS IE INSTRUMENTATION AND CONTROL POWER SYSTEM BUS DURING OPERATION"

- RANCHO SECO EVENT INDICATES THAT PLANT MODIFICATIONS TO RESOLVE IEB 79-27 MAY NOT BE ADEQUATE
- BWOG REQUESTED TO, BUT DID NOT, ADDRESS IEB 79-27 AS PART OF ICS/NNI REVIEW
- STAFF CONCLUDED THAT PLANT MODIFICATIONS TO RESOLVE IEB 79-27, ALONG WITH KNOWN SAFE STATE RECOMMENDATION, WILL RESOLVE ICS CONCERNS
- STAFF RECOMMENDS VERIFYING IMPLEMENTATION OF IEB 79-27 AS PART OF PLANT SPECIFIC AUDITS

B&W PLANT REASSESSMENT
NUREG-1231

SENSITIVITY EVALUATION

PRESENTED TO
ACRS SUBCOMMITTEE
ON B&W REACTORS
MAY 3-4, 1978

PRESENTED BY

R.C.JONES
NRR/DEST/SRXB

BWACRS3

STAFF ACTIVITIES

- REVIEWED MPR'S SENSITIVITY EVALUATION
    - MODEL ADEQUACY
    - CONCLUSIONS AND RECOMMENDATIONS

- REEXAMINED ADEQUACY OF PRESSURIZER SIZE

- EVALUATED EFFECT OF B&W DESIGN ON OTHER SAFETY ISSUES (ATWS & PTS)

- EVALUATED ADEQUACY OF OTSG

STAFF FINDINGS

- CONFIRMED B&W PLANTS MORE SENSITIVE TO FEEDWATER UPSETS
- B&W PLANTS NOT MORE SENSITIVE TO OTHER UPSETS INCLUDING UPSETS IN STEAM FLOW
- B&W PLANTS PLACE GREATER RELIANCE ON EFW, INCLUDING PROPER REGULATION OF EFW FLOW
- OPERATOR BURDEN:
  - NOT GREATER FOR NORMAL REACTOR TRIP
  - GREATER FOLLOWING FAILURES OF ICS/NNI
- MPR RECOMMENDATIONS GENERALLY ACCEPTABLE
  STAFF DISAGREES WITH REMOVAL OF ARTS ON TURBINE TRIP
- PREVIOUS STAFF ACTIONS EFFECTIVE IN ADDRESSING INHERENT B&W DESIGN CHARACTERISTICS
  - RAISING PORV SETPOINT
  - LOWERING HIGH PRESSURE TRIP SETPOINT
  - ADDITION OF ARTS

BWACRS20

STAFF FINDINGS (CONTINUED)

- INHERENT CHARACTERISTICS OF B&W PLANTS CONSIDERED DURING DEVELOPMENT OF ATWS & PTS RULES

- ONCE THROUGH STEAM GENERATOR DESIGN
  - OTSG HAS CERTAIN OPERATIONAL AND TUBE INTEGRITY ADVANTAGES
  - BENEFITS OFFSET BY INHERENT RESPONSIVENESS OF OTSG AND SMALL WATER INVENTORY
  - IF SYSTEMS THAT INTERACT WITH OTSG PROPERLY CONTROLLED (e.g. ICS/NNI AND EFW) POST-TRIP RESPONSE WILL BE ACCEPTABLE

- SPIP WAS RESPONSIVE TO B&W PLANT SENSITIVITY ISSUES

NRR STAFF PRESENTATION TO THE ACRS

SUBJECT: ICS/NNI SYSTEMS REVIEW

DATE: May 3, 1988

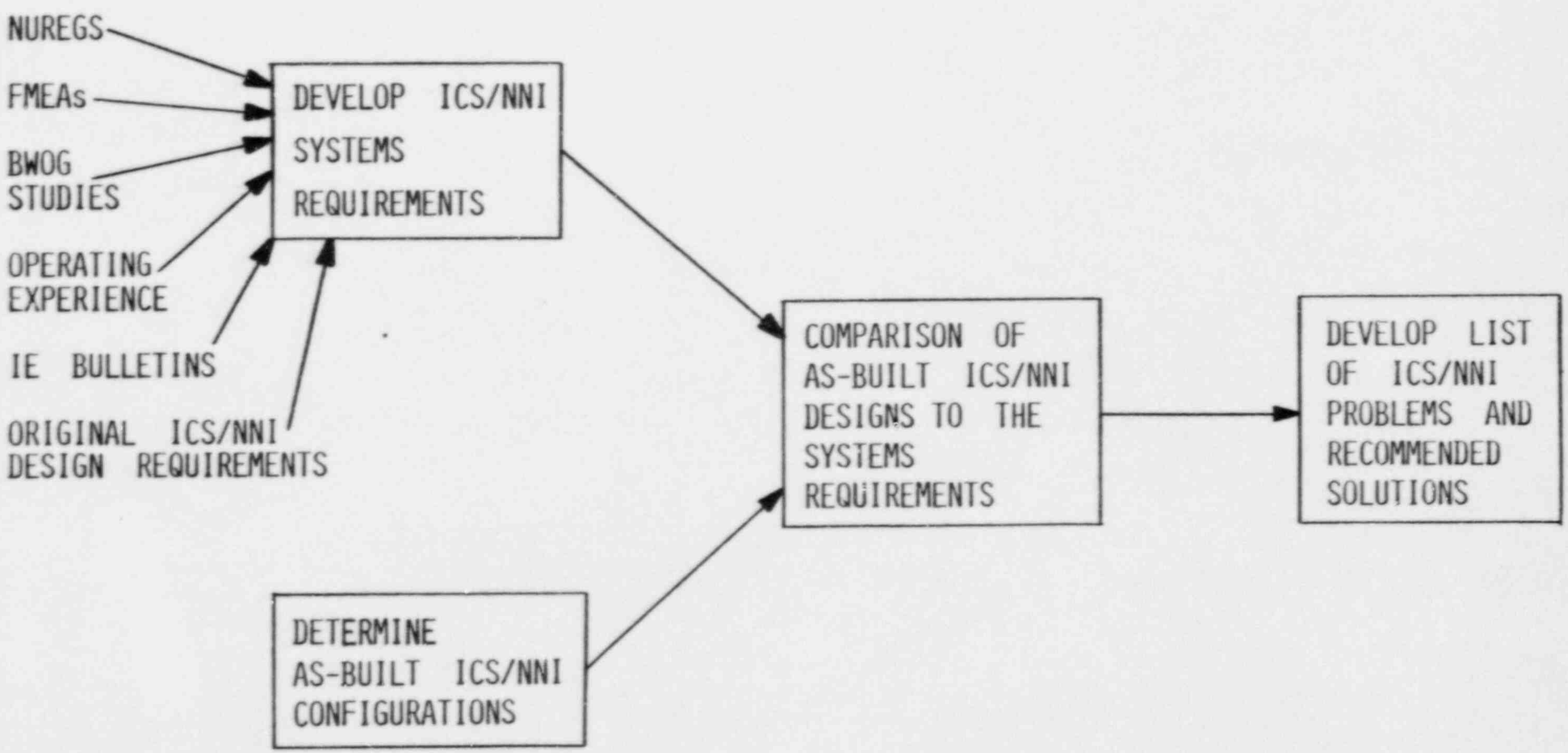
PRESENTER: RICK KENDALL

PRESENTER'S TITLE/BRANCH/DIV: SR. ELECTRICAL ENGINEER
INSTRUMENTATION & CONTROL SYSTEMS
DIVISION OF ENGINEERING & SYSTEMS
TECHNOLOGY

PRESENTER'S NRC TEL. NO.: x20778

SUBCOMMITTEE: B&W Reactor Plants

ROLE OF ICS/NNI SYSTEMS REQUIREMENTS IN THE BWOG ICS/NNI EVALUATION



ICS/NNI SYSTEMS REQUIREMENTS

- ENVIRONMENTAL SPECIFICATIONS
- INSTRUMENT ACCURACIES
- POWER SUPPLY DESIGN
  - REDUNDANCY
  - LOSS OF POWER ALARMS
  - EFFECTS OF LOSS OF POWER } KNOWN SAFE STATE
  - RESTORATION OF POWER } KNOWN SAFE STATE
  - EASY DETECTION OF FAILED INDICATORS/RECORDERS
- SIGNAL RELIABILITY
- INTERFACE REQUIREMENTS
- SYSTEM TEST/CALIBRATION/MONITORING

KNOWN SAFE STATE

CONDITION IN WHICH SECONDARY PRESSURE AND INVENTORY AND PRIMARY PRESSURE AND INVENTORY ARE CONTROLLED TO ACHIEVE PRIMARY-TO-SECONDARY HEAT TRANSFER BALANCE EITHER AUTOMATICALLY AND/OR MANUALLY (ACTIONS FOR WHICH THE OPERATOR IS NORMALLY TRAINED AND CAN BE TAKEN FROM THE CONTROL ROOM ON LOSS OF ICS/NNI POWER)

MAINTAINING THE REACTOR COOLANT SYSTEM PRESSURE/ TEMPERATURE RELATIONSHIP WITHIN THE BOUNDS OF THE ABNORMAL TRANSIENT OPERATIONAL GUIDELINES (ATOG) NORMAL POST-TRIP PRESSURE-TEMPERATURE WINDOW (ALLOWS CREDIT FOR NORMAL OPERATOR ACTIONS FROM THE CONTROL ROOM ON LOSS OF ICS/NNI POWER)

ICS/NNI SYSTEMS REQUIREMENTS

- MANY PROBLEM AREAS IDENTIFIED FROM THE INVESTIGATIONS OF B&W REACTOR TRANSIENTS INVOLVING THE ICS/NNI WOULD BE RESOLVED IF EXISTING PLANT DESIGNS WERE MODIFIED TO ACHIEVE CONFORMANCE WITH THE ICS/NNI SYSTEM REQUIREMENTS
    1) MINIMIZE THE EFFECTS OF SINGLE INSTRUMENT CHANNEL COMPONENT FAILURES
    2) LIMIT THE CONSEQUENCES OF POWER LOSSES BY CHOOSING EQUIPMENT FAILURE POSITIONS TO ACHIEVE A KNOWN SAFE STATE

- ICS/NNI DESIGN BASIS DOCUMENTS SHOULD BE DEVELOPED

- ICS/NNI SYSTEMS REQUIREMENTS DOCUMENTS SHOULD BE REVISED
    - POWER SUPPLY MONITOR
    - LOSS OF INSTRUMENT AIR

STAFF REVIEW OF BWOG ICS/NNI EVALUATION

- CONCENTRATED ON EVALUATING WHETHER IMPLEMENTATION OF RECOMMENDATIONS WOULD RESOLVE CONCERNS IDENTIFIED FROM THE INVESTIGATIONS OF B&W REACTOR TRANSIENTS INVOLVING LOSS OF ICS/NNI POWER

3/20/78	RANCHO SECO	-	LOSS OF NNI-Y POWER
11/10/79	OCONEE UNIT 3	-	LOSS OF ICS/NNI POWER
2/26/80	CRYSTAL RIVER	-	LOSS OF NNI-X POWER
6/24/81	DAVIS-BESSE	-	LOSS OF ICS/NNI POWER
1/18/83	DAVIS-BESSE	-	LOSS OF NNI-X POWER
3/19/84	RANCHO SECO	-	LOSS OF NNI-X POWER
12/25/85	RANCHO SECO	-	LOSS OF ICS POWER

- DOCUMENTATION OF STAFF CONCERNS RELATING TO THE ICS/NNI
  - IE BULLETIN 79-27 "LOSS OF NON-CLASS 1E INSTRUMENTATION AND CONTROL POWER SYSTEM BUS DURING OPERATION" (11/30/79)
  - NUREG-0667 "TRANSIENT RESPONSE OF BABCOCK & WILCOX - DESIGNED REACTORS" (MAY 1980)
  - NUREG-1195 "LOSS OF INTEGRATED CONTROL SYSTEM POWER AND OVERCOOLING TRANSIENT AT RANCHO SECO ON DECEMBER 26, 1985" (FEBRUARY 1986)

CONCERNS

- ADEQUACY OF CONTROL ROOM INDICATION/ANNUNCIATION OF LOSS OF ICS/NNI POWER
- MIDSCALE FAILURES OF CONTROL ROOM INDICATORS/RECORDERS
- ADEQUACY OF BACKUP/ALTERNATE INSTRUMENTATION
- ADEQUACY OF PROCEDURES FOR LOSS OF ICS/NNI POWER
- INAPPROPRIATE/UNDESIRABLE EQUIPMENT RESPONSE TO LOSS OF ICS/NNI POWER
- ICS/NNI LOAD FUSING
- LOSS OF REMOTE MANUAL CONTROL CAPABILITY FOR ICS CONTROLLED EQUIPMENT
- RESOLUTION OF IE BULLETIN 79-27 CONCERNS

IE BULLETIN 79-27

- CONCERN — IF REACTOR CONTROLS AND VITAL INSTRUMENTS ARE POWERED FROM COMMON ELECTRICAL SUPPLIES, THE FAILURE OF THE SUPPLIES MAY RESULT IN AN EVENT REQUIRING OPERATOR ACTION CONCURRENT WITH FAILURE OF INSTRUMENTATION UPON WHICH THE ACTIONS WOULD BE BASED

- ACTIONS
  - REVIEW THE CLASS 1E AND NON-CLASS 1E BUSES SUPPLYING POWER TO SAFETY RELATED AND NON-SAFETY INSTRUMENTATION AND CONTROLS THAT COULD AFFECT THE ABILITY TO ACHIEVE COLD SHUTDOWN USING PROCEDURES
    - REVIEW THE INDICATIONS (ALARMS) OF LOSS OF POWER
    - EVALUATE THE EFFECTS OF LOSS OF POWER TO BUS LOADS
    - DETERMINE IF MODIFICATIONS ARE NEEDED
  - REVIEW THE ADEQUACY OF PROCEDURES USED TO ACHIEVE COLD SHUTDOWN FOLLOWING LOSS OF POWER TO EACH BUS
    - REVIEW THE DIAGNOSTICS/ALARMS/INDICATORS/ETC THAT GOVERN USE OF THE PROCEDURES
    - CONSIDER THE USE OF ALTERNATE INDICATION AND/OR CONTROL CIRCUITS POWERED FROM SUPPLIES UNAFFECTED BY THE POWER LOSS
    - REVIEW METHODS FOR RESTORING POWER TO THE BUS
  - RE-REVIEW IE CIRCULAR 79-02 "FAILURE OF 120 VOLT VITAL AC POWER SUPPLIES"

APPENDIX F

NRC LETTERS TO THE BWOG CONCERNING THE ICS/NNI REASSESSMENT

1. Letter dated June 24, 1986, from D. M. Crutchfield (NRC) to C. Doyel (BWOG I&C Committee). This letter provides staff feedback to the BWOG concerning the ICS/NNI reassessment portion of the SPIP based on information presented by the BWOG during meetings with the staff on April 29 and May 21, 1986.

2. Letter dated August 1, 1986, from D. Crutchfield (NRC) to H. B. Tucker (BWOG Executive Committee). This letter requested clarification of the BWOG reassessment program with regard to retrospective issues raised by the Incident Investigation Team in its report on the loss of ICS power event at Rancho Seco on December 26, 1985 (NUREG-1195).

3. Letter dated September 12, 1986, from D. M. Crutchfield (NRC) to C. Doyel (BWOG I&C Committee). This letter provided staff feedback to the BWOG concerning the ICS/NNI reassessment based on information provided in preliminary documents developed by the I&C Committee and discussed during a meeting with the I&C Committee on August 26, 1986.

4. Letter dated December 17, 1986, from D. M. Crutchfield (NRC) to H. B. Tucker (BWOG). This letter provided a list of concerns identified during the staff's review of the BWOG SPIP, as documented in BAW-1919 and its revisions, and requested that the BWOG address these concerns in a future update of BAW-1919.

5. Letter dated February 13, 1987, from D. M. Crutchfield (NRC) to L. Stalter (BWOG I&C Committee). This letter provided staff feedback to the BWOG concerning the ICS/NNI reassessment based on information provided in revised documents developed by the I&C Committee and discussed with the I&C Committee during a meeting on December 10, 1986.

6. Letter dated April 7, 1987, from D. M. Cruchfield (NRC) to G. R. Skillman (BWOG). This letter provided staff comments and questions concerning the BWOG ICS/NNI reassessment and requested that the BWOG address the associated concerns in a future update of BAW-1919.

7. Letter dated November 24, 1987, from J. A. Calvo (NRC) to R. P. Rogers (BWOG). This letter requested additional information needed for the staff to complete its review of Appendix R, "ICS/NNI Evaluation Final Report," to BAW-1919, "B&W Owners Group Safety and Performance Improvement Program (SPIP)."

STAFF EVALUATION FINDINGS

- IMPLEMENTATION OF THE BWOG RECOMMENDATIONS (APPROVED AND PROPOSED) WILL HELP TO RESOLVE A NUMBER OF THE CONCERNS IDENTIFIED FROM THE INVESTIGATIONS OF B&W REACTOR TRANSIENTS INVOLVING ICS/NNI POWER LOSSES

- IMPLEMENTATION OF THE BWOG RECOMMENDATIONS (APPROVED AND PROPOSED) SHOULD HELP TO REDUCE THE ICS/NNI CONTRIBUTION TO REACTOR TRIP FREQUENCY AND TRANSIENT COMPLEXITY (FUTURE EVENTS INVOLVING LOSS OF ICS/NNI POWER ARE EXPECTED TO BE LESS SEVERE)

- MORE EMPHASIS ON DICTATING EQUIPMENT FAILURE MODES (AND HENCE PLANT RESPONSE) TO LOSSES OF ICS/NNI POWER

<u>SIGNIFICANT BWOG RECOMMENDATIONS</u>

- ENSURE PLANT GOES TO A KNOWN SAFE STATE ON LOSS OF POWER TO THE ICS/NNI (TR-178-ICS)

- INCORPORATE AUTOMATIC SELECTION OF VALID INPUTS FOR ICS/NNI (TR-104-ICS)

- PROVIDE OPERATOR WITH UNAMBIGUOUS STATUS OF CONTROL ROOM INDICATORS AND RECORDERS ON THE LOSS OF ICS/NNI POWER OR SIGNAL (TR-154-ICS)

- ELIMINATE MID-SCALE FAILURES THAT CAN AFFECT INDICATION OR PLANT CONTROL (C.8)

- DEVELOP BACKUP CONTROLS FOR PRESSURIZER LEVEL AND PRESSURE CONTROL (TR-190-ICS)

- PROVIDE INDEPENDENT CONTROLS FOR REACTOR POWER, STEAM DEMAND, AND FEEDWATER (C.1)

SIGNIFICANT BWOG RECOMMENDATIONS

- PROVIDE SEPARATE SUBSYSTEMS FOR REACTOR COOLANT TEMPERATURE AND STEAM PRESSURE CONTROL (C.7)

- ENSURE PREFERRED EQUIPMENT FAILURE MODES ON LOSS OF ICS/NNI POWER (TR-036-ICS, TR-037-ICS, TR-096-MSS, TR-097-ICS, TR-172-PRV)

- IMPROVE ANNUNCIATION/INDICATION OF ICS/NNI POWER LOSS (TR-012-ICS, TR-158-ICS, B.2.4, B.2.9)

- DEVELOP AND IMPLEMENT A PREVENTIVE MAINTENANCE PROGRAM FOR THE ICS/NNI (TR-038-ICS)

- IMPROVED MAINTENANCE AND TUNING OF ICS (TR-107-ICS)

- IMPROVED SURVEILLANCE AND TEST PROCEDURES/PROGRAM FOR EFW (TR-163-EFW, TR-164-EFW, TR-165-EFW)

STAFF EVALUATION FINDINGS - CONCERNS

- SURVEILLANCE FREQUENCY FOR ICS/NNI EQUIPMENT
- MAXIMIZE DEPENDENCE ON NNI-X (TR-189-ICS, B.2.14)
- ELIMINATION OF ICS FUNCTIONS
  - ICS RUNBACK ON ASYMMETRIC ROD CONDITIONS (TR-204-ICS)
  - DELTA T-COLD FEEDWATER CORRECTION (C.5)
  - BTU LIMIT FUNCTION (TR-007-ICS)
- WIRE POWER SUPPLY MONITOR DIRECTLY TO ICS/NNI ±24 VDC BUSES (TR-039-ICS)
- FSAR ASSUMPTIONS RELATING TO ICS/NNI
- IE BULLETIN 79-27 CONCERNS
  - INDICATION OF POWER LOSS
  - PROCEDURES
  - BACKUP/ALTERNATE INSTRUMENTS AND CONTROLS (INCLUDING SURVEILLANCE)

STAFF EVALUATION FINDINGS - CONCERNS

- GUIDANCE PROVIDED IN SOME RECOMMENDATIONS MAY BE TOO GENERAL TO ENSURE RESOLUTION OF CONCERNS

- THE INFORMATION PROVIDED IN BAW-1919 IS NOT SUFFICIENT FOR THE STAFF TO CONCLUDE THAT ALL OF THE CONCERNS IDENTIFIED FROM THE INVESTIGATIONS OF B&W REACTOR TRANSIENTS INVOLVING THE ICS/NNI WOULD BE RESOLVED UPON IMPLEMENTATION OF THE RECOMMENDATIONS

SUMMARY OF STAFF CONCLUSIONS

- BWOG REVIEW PLAN FOR THE ICS/NNI EVALUATION IS CONSIDERED EXCELLENT

- IMPLEMENTATION OF BWOG RECOMMENDATIONS RELATING TO THE ICS/NNI SHOULD PROVE SUCCESSFUL IN ACHIEVING A REDUCTION IN REACTOR TRIP FREQUENCY AND TRANSIENT COMPLEXITY

- INFORMATION PROVIDED IN BAW-1919 IS NOT SUFFICIENT FOR THE STAFF TO CONCLUDE THAT ALL ICS/NNI CONCERNS WILL BE RESOLVED AS A RESULT OF SPIP

- ADEQUACY OF B&W PLANT SAFETY SYSTEMS TO MITIGATE THE CONSEQUENCES OF TRANSIENTS INVOLVING ICS/NNI FAILURES IS NOT AN ISSUE

- IE BULLETIN 79-27 WAS CONSIDERED TO BE A PLANT SPECIFIC ISSUE, AND THEREFORE, NOT WITHIN THE SPIP SCOPE. THE STAFF HAS RECOMMENDED THAT RESOLUTION OF IE BULLETIN 79-27 CONCERNS BE EVALUATED ON A PLANT SPECIFIC BASIS (AUDIT REVIEWS)

- IT APPEARS THAT THE BWOG SPIP EFFORT WILL BE SUCCESSFUL IN ACHIEVING SIGNIFICANT IMPROVEMENTS IN ICS/NNI DESIGNS AND OPERATION

B&W PLANT REASSESSMENT
NUREG-1231

INFORMATION GATHERING

PRESENTED TO
ACRS SUBCOMMITTEE
ON B&W REACTORS
MAY 3-4, 1978

PRESENTED BY

R.C.JONES
NRR/DEST/SRXB

BWACRS2

STAFF ACTIVITIES

- REVIEW OF SPECIFIC BWOG REPORTS
- INDEPENDENT ACTIVITIES
  - AUDITED 40 TAP REPORTS
  - REVIEWED YEARLY TAP SUMMARY REPORTS
  - REVIEWED PREVIOUS NUREGS
  - OBTAINED REGIONAL INPUT
  - EXAMINED STATUS OF UTILITY COMPLIANCE TO NRC ACTIONS
  - REVIEWED DAVIS-BESSE DECAY HEAT RELIABILITY IMPROVEMENT PROGRAM FOR GENERIC IMPLICATIONS

STAFF FINDINGS

- MAJOR REACTOR TRIP INITIATORS WERE IDENTIFIED
    - TURBINE SYSTEMS
    - MFW SYSTEM AND CONTROLS
    - ICS/NNI INPUTS
- COMPLEX TRANSIENTS PRIMARILY RESULT OF FAILURE TO BALANCE HEAT REMOVAL/PRODUCTION
    - MAJORITY OF EVENTS WERE OVERCOOLING (34 OF 46)
    - ONLY 4 WERE UNDERCOOLING
- SPECIFIC RECOMMENDATIONS DEVELOPED WERE APPROPRIATE
- SYSTEMS IDENTIFIED FOR DETAILED REVIEW APPROPRIATE
- OVERALL THRUST OF SPIP RESPONSIVE TO OPERATING EXPERIENCE

NRR STAFF PRESENTATION TO THE
ACRS

SUBJECT: B&W Owners Group Plant Reassessment Program - Overview of B&W Plant Reassessment Program

DATE: May 3, 1988

PRESENTER: Byron Siegel

PRESENTER'S TITLE/BRANCH/DIV: Lead Project Manager, B&W Owners Group Plant Reassessment Program

PRESENTER'S NRC TEL. NO.: 492-3019

SUBCOMMITTEE: B&W Reactor Plants

STAFF APPROACH

CONTINUOUS INTERACTION WITH BWOG ON SCOPE OF SPIP PROJECTS

REVIEW AND EVALUATE SPIP RESULTS (BAW-1919)

INDEPENDENT WORK PERFORMED IN CERTAIN AREAS

- RISK EVALUATION (BROOKHAVEN)
- HUMAN FACTORS (SAI)
- LIMITED THERMAL HYDRAULIC ANALYSIS (INEL)
- LIMITED OPERATING EXPERIENCE REVIEW

OVERSIGHT ROLE

- EVALUATE RECOMMENDATION APPROVAL PROCESS (BWOG)
- EVALUATE IMPLEMENTATION PROGRAM AT UTILITIES
- EVALUATE IMPLEMENTATION PROCESS
- VERIFY IMPLEMENTATION
- TRACK IMPLEMENTATION PROGRESS

SER AND SSER

CONTAINS NO NEW POSITIONS

CONTAINS NO REQUIREMENTS, ONLY RECOMMENDATIONS OFFERED FOR CONSIDERATION

SER ADDRESSED

- 9 OF 11 MAJOR PROJECTS
- BWOG PROGRAMMATIC & MANAGEMENT ACTIONS
- IMPLEMENTATION
- ADDITIONAL STAFF RECOMMENDATIONS
- CONCERNS IDENTIFIED BY STAFF MEMBER

SSER ADDRESSED

- INTEGRATED CONTROL SYSTEM/NON-NUCLEAR INSTRUMENTATION
- REACTOR TRIP INITIATING EVENTS REVIEW
- ACCEPTABILITY OF EFIC TYPE SYSTEMS
- STAFF IDENTIFIED HIGH PRIORITY RECOMMENDATIONS
- STAFF IMPACT ASSESSMENT OF PROPOSED BWOG RECOMMENDATIONS
- MISC. OPEN ITEMS IN SER
- ADDITIONAL STAFF RECOMMENDATIONS
- REMAINING CONCERNS IDENTIFIED BY STAFF MEMBER
- COMMISSION ISSUES IDENTIFIED IN CHILK MEMO