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# NUCLEAR REGULATORY COMMISSION

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IN THE MATTER OF: )
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BABCOCK & WILCOX )
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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 BABCOCK & WILCOX REACTOR PLANTS

Tuesday,
May 4, 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

PROCEEDINGS

MR. WYLIE: This is a continuation of the subcommittee on Babcock and Wilcox reactors. The subject is the Babcock Wilcox Owner's Group Plant Reassessment Program. We'll continue from last evening.

I'd ask the subcommittee members and consultants to speak up, and others making presentations to speak up and speak into the microphones in making their presentations so that everyone can hear them.

I'd like to begin by asking the subcommittee members and consultants to identify those questions which were deferred from yesterday that they still want answers to so that we'll be sure and cover those.

MR. REED: I have four. I don't think I got an answer to the PRV issue, or the fact that it's a single valve, its reliability, the kind of valve. And related to that is the issue of how do they reasonably and rapidly depressurize in case they had a tube leak and they wanted to get the pressure down and keep it from further opening.

The second deferred question had to do with the claimed advantage of primary makeup for charting pumps running continuously and having a running system, and the advantages of a running system versus a standby system or shutdown system.

Along with that one I want to make a point. I don't

know that the charging pumps are really a running system. I think they have to shut down in order, if you have a loss of AC, a very simple accident, the pumps have to be transferred from normal outside AC to the diesels or something, and so is it really a running system, and is it really an advantage? I think that's a key and important issue for this whole business, to make that decision.

The other thing I'd like to know is the reasons why Babcock and Wilcox in their later sold plants, not entirely sold, but in Bellefonte and WOOPS and Davis-Besse and they went to the raised loop plant. What was the fundamental reason behind that since it obviously contains much much more faulty sale.

The fourth thing is the issue of Oconee and Rancho Seco and Three Mile Island not having main steam stop valves. And going along with that, they have non-return valves. I probably should have looked it up, but do they? And even if they do, it sets up the situation for a steam line break inside containment, which I would like to know if the containment was designed for.

MR. WYLIE: Okay. Any others?

MR. MICHELSON: I just wanted to make a couple of comments. I think the presentations were very good and gave excellent information. I really am quite concerned though, that this is another example of the same problem we ran into

on A47 and that is the scopes of the safety investigations are being very narrow. We wrote this in our A47 letter. I had asked yesterday whether B&W had any reaction to it. I wasn't sure they'd seen it. If we need more copies we can get you copies of it. I would just like to have them read it and see if they are covering part of what we seem to be concerned about, or are they leaving the same things out that were left out in the A47 review. I'd like to get their view on that, perhaps before they leave today.

How many copies would you like to have?

VOICE: We'd like to have ten copies.

MR. MICHELSON: We'll just ask you to give us whatever views you have. This is essentially the same problem. It's the control system for feed water and we were concerned about the way it was looked at in the A47 work that the staff had done, and we'd just like to know if you're looking at it any differently or are you leaving out the same things they left out in their investigation?

I believe that takes care of my comments for the moment, at least.

MR. WYLIE: Any others that anyone wishes to identify?

Let me ask the group when they'd like to address this?

MR. RUTHERFORD: I think the question was first of

all on A47, we'll have to take a look at the concerns, later on. I think some of Mr. Reed's questions are clearly beyond the scope of what we've covered, and I would not propose to respond to those today.

MR. WYLIE: When would you respond to them?

MR. RUTHERFORD: We'll be glad to talk to Mr. Reed any time, to explore that subject, but not in the contents of this meeting.

MR. REED: I don't know that that would be an appropriate exchange. I think the Chairman would have to decide whether I should be talked to individually as a consultant. I would prefer that it not be that way, that it be open and on the record.

MR. WYLIE: Do you prefer not to answer these questions?

MR. RUTHERFORD: Some of them we're not prepared to respond to. And like I say, some are beyond the scope or view of the B&W plants. I don't think they can be addressed in this particular forum.

MR. WARD: What about getting some written responses in the near future?

MR. WYLIE: Why don't we do that. We'll submit these formally then, as questions and you can answer them from that.

MR. RUTHERFORD: That's fine.

MR. WYLIE: Mr. Reed, you'll prepare those for us?

MR. REED: Yes.

MR. WYLIE: Harold?

MR. ETHERTON: Maybe I'm out of order now, but I had hoped that Glenn was going to say a little bit more because I wanted to give him a little support in connection with the, is it all right for me to express what I think you had in mind, Glenn?

MR. REED: Sure.

MR. ETHERTON: In the event that the natural circulation was lost, you have this cold loop at the bottom which acts as a seal and may make it difficult or impossible to restart natural circulation.

There is an analogy for this which I'm sure B&W engineers of 70 years ago were familiar with. If you have a furnace with a deep flue and a chimney, you can't just light up the furnace and let it run. There's a cold loop below the ground that will not clear. It isn't a question of time. You can go on pumping fuel into the furnace forever and it won't start. You'll have flames coming out of the doors and maybe through the brickwork. You have to clear the chimney first to get rid of this cold loop, and you can do that by lighting a fire at the bottom of a stack. You can use a steam jet.

In this case, Glenn is visualizing a cold loop at the bottom and it may not clear easily. I think it would

clear ultimately. But in doing so you might get quite a high hot leg temperature, and conceivably even boiling. Then of course you would have these pressurized elaborations that caused all the trouble at Three Mile Island.

I don't really think there is a problem, but this could be resolved in two hours by looking at some steam tables for border densities and I don't think this should go on forever, at least on theory. But I think we should know if we did develop a static condition what it would take to reach out and how hot the hot leg temperature might rise, and whether you would in fact get any boiling.

Have I more or less expressed your thoughts on that?

MR. REED: You have expressed something that I didn't know about. I would want to say that I don't know that I could agree with your two hours and some tables and references and perhaps a few doctors of thermodynamics studying it, because this thing has been gone through before. Thermoblock occurred in the first PWR ever built in the United States of America. For two years it was a controversy after that to decide whether or not the caic heat could have been removed and whether or not thermoblock did occur.

I might say that as an operating type person involved, a measurements person involved, my position at that time was that thermoblock had occurred and there was no flow. Some two years later one of the doctors of thermodynamics did

call me and say yes, you were right. Thermoblock did occur and there was no flow.

So I'm not so sure that two hours will work. I think really this is an issue, if I was involved, I would have to do a number of tests, different types of trips, different types of feeds or lack of feeds, and see if you could span the worst case and you would always get initiation.

MR. ETHERTON: That's postulating a block, no matter how you get it. The worst possible case, and then if you find that clears then you don't need to worry much about --

MR. REED: Yes, but you mentioned the issue of time. How long to core damage? That's the important issue.

MR. SKILLMAN: I would like to respond to this please. The period from the TMI-II accident until January 1, 1980, I was head of support engineering for Babcock at TMI-II. From January 1 of '80 until late '82 I was head of recovery support engineering at Three Mile Island Nuclear Station, Unit II. Approximately 30 days after the accident TMI-II was secure. The final reactor coolant was -- That was the driver, the daily pump that didn't vibrate. We stopped that pump when we realized we could no longer see a primary coolant level in the pressurizer. We had worked earnestly for the month following the accident to ensure that the primary coolant system was cool and pressurized.

The question which we had was Babcock, combustion

engineering, was wouldn't the TMI-II core naturally circle? Would the system cool itself? Our numbers showed that it would. The combustions number showed that it would; Westinghouse's number showed that it would. We stopped the primary coolant pump, TMI-II's reactor coolant system, and I have to say in hindsight, the core blockage, primary system blockage, ran in smooth natural circulation until October 1979. It did so with what we calculate to be about 3000th of a psi, differential pressure, between the core column hydraulic height and the steam generator column height at the identical elevation. It was simply the differential density between the block of water in the core, and at that same elevation the block of water in one generator or the other.

The best is the next story. When smooth natural circulation terminated, we were concerned that natural circulation would not restart. Initially there was a four hour time delay between the stoppage of smooth, natural circulation and the automatic restart. The reactor coolant system of TMI-II persisted for the next year, 400 and some cycles by itself, stopping natural circulation and then by itself starting natural circulation. So we were in a long period of what we called intermittent natural circulation.

Natural circulation finally terminated itself when the DPE generation rate was so low that the reactor vessel, the internals, and the ambient around the reactor vessel was

able to absorb the heat. We retained a minor flow to the steam generator during that period in the neighborhood of 15 gallons a minute. Clearly we had water in the generator, we had generator water levels available to us.

But in response to the concern that's been expressed, I would have to say, being an operator and being involved first hand, the TMI-II experience with massive core blockage with 36 inch ID hot legs, and 26 inch ID cold legs, and 30,000 tubes generally available, natural circulation worked just fine, and not in a test facility, but in an actual facility.

MR. REED: I don't think your one month later sub-cooled liquid situation is at all relevant to right after trip, transients, and all these other kind of things. I have to say that what you are talking about is an ideal condition by comparison.

MR. SKILLMAN: I beg your pardon. That wasn't ideal in any sense at all.

MR. REED: The only difference is pressure drop in the core.

MR. SKILLMAN: That's a big difference, Glenn.

MR. REED: Well let me say, having gone through the first nuclear PWR, thermoblock situation, right after trip, right after power with the varying fluids and conditions and having seen thermoblock occur, my story is exactly 100 percent

different from your story one month later.

The issue is, probably the heat's not very much after a month, either.

MR. MICHELSON: I think there have been a couple of real plants that have had to undergo instantaneous recirculation from the loss of off-site power conditions.

MR. ETHERTON: That's true.

MR. MICHELSON: Those went through fine, as I recollect.

MR. ETHERTON: Do we know the circulation ever completely stopped?

MR. MICHELSON: No, you don't know what the momentum cosine was.

MR. ETHERTON: If they stop completely, that's the only time --

MR. MICHELSON: That makes sense.

MR. ETHERTON: If it was related, did it stop circulating all together?

MR. SKILLMAN: Yes sir, our temperature indication would indicate that not only did it stop, it reversed for some number of minutes. In other words, it moved forward, stopped, regressed, and then automatically began flowing forward again. The time period between those, if you will the period, this began at about four hours and then it continued to expand into days over the course of approximately a year. But it was

stopped, we believe based on our reactor coolant system indication which is accurate and timely. It tended to regress and then propel itself forward again.

MR. TAYLOR: Mr. Chairman, I'd like to just make a comment. I think the dialogue that took place between these folks here really tends to amplify the importance of asking that these questions be put in some kind of a context, because I can see us going back and forth on this thing a couple of times. I would only ask Mr. Reed to try to really clarify the context in which the questions are asked, and particularly if it would be possible to relate them to the complex transient issue which this was really aimed at addressing. Just a request.

MR. WYLIE: Well the name of the game is reassessment of the safety aspects of B&W reactors as far as the ACRS subcommittee is concerned. As to whether we're in a small box or a larger box is the real question. The scope and breadth of the program is the question. That's a valid question, regardless of whether you want to put us in a small box or a large one.

MR. TAYLOR: The thing I was trying to get at, Mr. Chairman, is that there have been many many tests run, there have been many many reports written about natural circulation. We're kind of curious as to whether these things are outside the scope of these previously submitted documents and

previously answered questions or whether they're within that and perhaps they're just not available to the subcommittee.

MR. WYLIE: I think the subcommittee has the responsibility to ask whatever questions we need to assess our opinion regarding the adequacy of the reassessment program.

MR. TAYLOR: We agree with that, and we just want to make sure we understand the questions.

MR. MICHELSON: Mr. Chairman, let me ask for clarification. In reading Stello's letter it appeared that we were looking at the overall safety of the plant.

MR. WYLIE: That was the subject.

MR. MICHELSON: That appeared in Stello's letter. The staff, it appears, has narrowed the assessment because B&W narrowed the assessment down to these 13 transients of particular interest, if I recall the numbers correctly. So where does that leave us? If we want to look at the overall safety we have to ask is there anything unusual about the accident responses which were not treated by B&W or by the staff. The other question being external event responses, which again, were not treated by either B&W or the staff.

MR. RUTHERFORD: Let me offer a perspective. Certainly the letter was issued because we had complex transient, or had experience with complex transients on the B&W plants. So I think for us to, Mr. Stello's letter was to look at those aspects of the plants. Otherwise, I think it

would have been appropriate to go out to every vendor and plant in the country and relook at these other issues, tube breaks or small break locals or external events. We're no different, essentially, from other plants in that respect. Anything about our plants where the experiences that we were having. That's what we went after, and I think really that was the proper thrust behind the Stello letter.

MR. JONES: If I could offer a perspective from the staff. We did look at the Stello letter when it came out in January and we put together an overall program plan before the owners group was involved and had defined their spit program. What you are seeing here in the last two days and in the specific documents is the staff's assessment of the spit program and the other activities performed by the staff under essentially that program plan.

That program plan was modified to incorporate or reflect what the owners were doing, what the staff was going to do. But that plan was developed very early, had management approval as of roughly March of '86 and was transmitted both to the ACRS, the EDO's office, and the owner's group in or around that time frame.

So we did not narrow the scope of this program because the only proof that it's spit, we incorporated spit and integrated it as part of the program in order to conserve our resources and to get a broader view by the people that

best understand the plans which are the specific B&W Owners Group Utility Members.

MR. WYLIE: Can I conclude from that that you have a larger program in progress?

MR. JONES: No, this is the program. This program, to the best of my knowledge, satisfies the Stello letter. That program was, said that copies were sent to the EDO's office, and when we were negotiating in the May/June time frame, the content of the spit program, when we were trying to get them to do more so we could do less, so to speak, from an original thinking type activity where they would take the brunt of the workload and we would be into a more historical look.

Representatives from the EDO's office were at those meetings. As I've said, to the best of my knowledge, we have never heard any complaints from the EDO's office that this program did not satisfy the intent of his letter. In fact we briefed the Commission on this in '87, and as far as I know, Stello was happy with the scope of the program. He understood what we were doing.

So I don't consider that we narrowed the scope from what Mr. Stello intended. I think that is an interpretation that the subcommittee is making. As far as we know, we are in concert with the intent of that letter. At least what Mr. Stello's thoughts were.

MR. MICHELSON: Can we get a clarification as to whether or not the ACRS reviewed that plan before we wrote our letter in June? I don't recall.

MR. WYLIE: I don't think we did.

MR. MICHELSON: I don't recall ever seeing it, but that could be verified. Maybe Richard could find out in a little while whether we saw it.

MR. KERR: Gentlemen, let me suggest that I think this subcommittee and the committee has the responsibility to pursue questions which it considers relevant to reactor safety independently of what Mr. Stello may have written or what the staff may conclude. We may be wrong, but our responsibility is to pursue those things that we consider important.

If we are simply repeating what we have done before,that's unfortunate. Sometimes we do that. Sometimes we ask questions from ignorance, and I would hope that we would avoid that insofar as feasible. But I don't think this committee should feel constrained about what somebody else has written in a letter or whatever. We certainly should be responsible, but we should pursue those things that we consider relevant to safety.

MR. WYLIE: Thank you, Dr. Kerr.

Let me advise you that we are beginning this meeting by asking for identification of outstanding questions from yesterday that were deferred. Various subcommittee members

have identified some, and I don't know whether you had any that you wanted that were deferred from yesterday.

MR. KERR: I have none.

MR. CATTON: I'd like to ask a question.

The scope of the owners group study was limited to transients where there was no two-phased flow. Is there any reason for this?

MR. RUTHERFORD: The program was based on the complex transients that we have experienced and the reasons behind those complex transients. Certainly the things we're doing in this program have benefits in regard to a lot of transients beyond what we looked at. That was a scope of our study, what drove us.

MR. CATTON: The reason I ask is that I'm not surprised at the conclusions they come to. Most of the differences, at least from my point of view, result when you have two-phased flow. The loss of natural circulation because of the candy cane or something and the vent valves. Things like this really only become important when you have two-phased flow in the primary system. I think they ought to have looked at it.

MR. RUTHERFORD: Realize that a number of things have been done outside the context of this particular program. We've had the Miss facility and the testing that has been done there. Small break locos received extensive look-sees and

modeling etcetera. A wealth of studies in these areas. I'm not saying we haven't done anything at all, but we didn't do anything in the context of this particular program.

MR. CATTON: The question is plant sensitivity. I don't know that plant sensitivity should be limited to just what you did. It should be the whole spectrum. That spectrum includes two-phased flow in the primary system if it's important.

MR. RUTHERFORD: Those issues to a limited degree were looked at in the sensitivity study.

MR. CATTON: I asked the question yesterday and was told no, and it was one of your people who was speaking when I asked.

MR. RUTHERFORD: From the standpoint of looking at small break locos, that's true, we did not look at the two-phased flow.

MR. WARD: But Ivan, the reason these plants have been singled out for this look was people got worried, nervous, about the series of events that had occurred. There is sort of an agenda other people have who have been nervous for some reason about the design of B&W plants for some other reason, but not related to this particular set of experiences. But it's that set of experiences which really drove the EDO to write the letter and not this other agenda coming from somewhere.

MR. CATTON: So if sensitivity is limited to this particular cloth, then my comment has no meaning. But it seems to me sensitivity is --

MR. WARD: I think there are probably two questions. With regard to this set of experiences which got us into this, raised the question. The sensitivity study provides some answers about that. Now you've got another question, what about sensitivity in accidents that go into two-phased flow.

MR. CATTON: What we worry about is core damage. So when you go through this series of transients, you're coming up right to the edge. They catch it every time. Does sensitivity beyond that point matter? If it does, then this study is incomplete. If you want to stop it right at that point, then you're right and this is an irrelevant concern.

MR. WARD: All I'm saying is what leads you to the concern that there may be some unusual problem or sensitivity beyond the point of which has been studied.

MR. CATTON: We know basically there are three differences in the plant. There's the tall candy cane, there's the vent valves, and the 116 generator. What role do they play between the limit of the transients we've looked at and the degraded core? Do they make the process worse from that point on or is it better or what? Is the system more sensitive because of it, or isn't it?

MR. WARD: More sensitive than what?

MR. CATTON: More sensitive than the other PWRs. Isn't this a relative sort of study?

MR. WARD: I don't know. I think you're suggesting another study, and it may be appropriate. But it's clearly another study.

MR. CATTON: That's fine.

MR. WARD: Have you concluded that the other PWR's are appropriately insensitive or stable or something in the range you're talking about?

MR. CATTON: No, I've made no such conclusions. But when I read this, the question was sensitivity relative to the others.

MR. WARD: But it's sensitivity in the range of interest that's been pointed out to us by these events that have occurred, and none of those have involved two-phased flow.

MR. CATTON: That's true because for some reason or another they were caught soon enough. We wouldn't worry about them at all unless there was the potential for getting into the two-phased flow because that's where core degradation comes from.

MR. WARD: I think the conclusion is that, the way it looks to me, it's bad news for a PWR to get into two-phased flow. They're not designed for two-phased flow, so it's bad news. So the question is does this design of a plant have

unusual sensitivity in the pre-two-phased flow region so it's more likely to get over this threshold into two-phased flow? Now I don't know whether we agree with their study, but the MPR study seems to be saying well, probably not all that much.

MR. CATTON: If that's the question, then I think the study was okay.

MR. WARD: I think it is certainly a question, and it's a good question. There may be other questions.

MR. CATTON: That's right.

MR. WARD: Mr. Chairman, I think we've gotten into this problem of scope and disagreement on what the scope should be really because of something that happened a couple of years ago, a year and a half ago. After we had the first meeting I think the committee fully expected to have some follow up meetings to further discuss the scope of the study. Our original concern was whether the staff was going to be able to accommodate this operating reliability study which the B&W owners group had started on, and which was certainly appropriate for them to be doing, whether the staff was going to be able to accommodate that to the staff's concern which was talking about safety rather than operating continuity. I think we wanted to have some follow up meetings at that time to talk about that and review that. For some reason those meetings kept getting postponed for 18 months until this one, and now the chickens are home to roost, I think. The

subcommittee, obviously, isn't satisfied that the staff has successfully accommodated and combined these two programs. I don't know what we can do except stumble through it.

MR. WYLIE: Thank you.

MR. MICHELSON: Let me make one more comment. I just looked briefly at B&W's 1919 document to see if they've made the same overstatement of scope. So far just flipping through, it appears that what they are doing and they say here is "a major expansion of efforts focused on reducing the complexity of transients and frequency of reactor trips." That's what they did. But I read the staff's assessment of this whole thing and it says in here, referring back to the B&W document, it says, "The study compares the overall safety of B&W plants with that of other pressurized water reactors," which the study clearly did not do.

MR. CATTON: That's correct.

MR. MICHELSON: Yet the staff keeps pushing because it came from Stello's letter that says you are to "look at the overall safety," and those are the words that Stello said. He talked about overall safety. They just didn't do it.

So my concern is that they're overselling what was done. They're going to come back and say we've looked at the overall safety of B&W plants and it's no worse than the others, and I can't agree with that. They haven't looked at it. B&W did a very fine job of looking at these transients

and seeing what they can do about them in terms of safety of the plant and I think it was a fine job, but it was not the overall safety they were looking at. They were looking at a restricted aspect of it. That's why I really get a little concern about the way it's being oversold for what it is.

MR. WYLIE: Thank you. Any other comments or questions that we want to identify?

If not then let's proceed with our meeting and I believe we left off under Systems Review, Item 7. The next subject was Main Feedwater Systems Review, and I believe Mr. Skillman is going to speak on this.

MR. SKILLMAN: Good morning, I'm Dick Skillman. I was the Chairman of the Safety and Performance Improvement Program activity for the B&W owners.

I'd like to start by saying who did this effort. This effort was done by the Babcock and Wilcox plant owners, and that includes people from Arkansas, Duke, Florida, GP Nuclear Sacramento, SMUD, TBA, Toledo, and Babcock and Wilcox. In addition, we hired contractors. We used SAIC for our risk assessment review; we employed MPR Associates for the sensitivity study; we had our independent advisory board use some human factors experts in our operator burden activity. My only point is, there were a lot of people involved: those who own the plants, those who designed the plants, and consultants that we thought were needed to do a thorough job.

Yesterday we talked about information gathering, the integration phase, and the implementation phase. Neil Rutherford will talk about implementation later. In the information gathering stage we did a lot of work in our tap data that pointed to the need to review in detail certain fluid hydraulic systems and control systems. Which systems and why.

The data showed that the secondary plant relief, the emergency feedwater, the main feedwater, and the ICS/NNI systems deserved a great deal of attention, of review, and the instrument air. So my goal this morning will be to briefly touch on what we did in the systems review. I will not touch on ICS/NNI because Larry Stolter covered that yesterday with comments from the staff about that review.

What did we do on main feedwater system review? Please bear in mind that the main feedwater system review activity was being conducted in late 1985 and in early 1986. The basis of that review was the main feedwater events of the years 1984 and 1985; clearly the Davis-Besse transient on June 9, 1985; and the Rancho Seco event on December 26, 1985 played into the need for interrogation of the main feedwater system.

What was done was information was gathered from each plant site by approximately a one week visit at each of the six B&W owners group sites for understanding of the procedures

and the characteristics of the different main feedwater systems, the design of the different main feedwater systems, and the maintenance practices on the main feedwater systems. There were interviews with the operations and maintenance personnel about the operation of the main feedwater systems, a walkdown of each system, and a review of the data, particularly of the problems that had been experienced on those systems.

That information was compiled into approximately 40 recommendations that had both generic, that is all B&W owners' applicability, and specific, i.e. for that particular plant, applicability.

We were looking for root causes of feedwater problems. We were looking for recommendations to lead to improved performance of the main feedwater systems. In short, we were trying to increase the reliability of the main feedwater systems.

I would expect you would say, "So what did you find? What did you come up with?" I've listed here just typical key recommendations. I would assume that you can see from the recommendations the kind of detail the reviews went into.

Implement a program to identify improvements in main feedwater pump control systems including the ICS. Evaluate the interaction between these two systems. Clearly there is a relationship between ICS and main feedwater during normal

operations. We needed to understand that because we had had the experience where these two would somehow get out of kilter.

Correct the main feedwater pump control problems. What we found is in the governors, the over speeds, the electrical power that supplies the main feedwater pump controllers, the lube oil systems, and so on. We have had problems and we were setting about to correct those problems.

Ensure that a single electrical failure in main feedwater and condensate system will not cause loss of both feedwater chains. This came from the recognition that both feedwater pumps might have their control system powered by a single electrical circuit. Hence, loss of that circuit for any reason could take out not only main feed but condensate as well.

Eliminate unneeded trip functions on the main feed pumps. That sounds like hokey. That sounds like malarkey. But what we found is there's a monstrous main feedwater pump, an enormous turbine-driven packaged unit, and when it arrived on site those who were responsible for hooking it up read the instruction book and said well we need a low lube oil sump trip, we need a low lube oil pressure trip, we need a low lube oil flow rate trip, we need a high lube oil temperature trip, we need a vibration trip, we need a proximity trip, and so on. What we found is the very heart of our heat removal system was

subject to what we would call nickel-dime trips that in fact interrupted the entire thermohydraulic process of an 800 megawatt plant.

So the real question was what can we get rid of that in no way jeopardizes the safety of that component so as to increase the reliability of the component and of the plant. The short answer is maybe you need an over speed and a failure of lube oil altogether, but you certainly don't need all that clap trap, and we set about to get rid of that stuff.

Eliminate automatic control of the main feedwater block valve except during a reactor trip.

Provide the capability to override a closed signal to the main feedwater block valve. We had in at least one plant, once the main feedwater block valve was commanded closed, the operator could not interrupt that and prevent the termination of feedwater. We wanted to give him the ability to get back in control thermohydraulically.

Provide automatic main feedwater overfill production capability. Install a monitoring system on the pumps to identify the cause of the trip. We had so many of these minor pump trippers we said what is causing the problem. The operators would know that he lost a main feedwater pump, but wonder why, and we wanted to understand how come.

My only point is that in reviewing all of the sites' main feedwater systems, the B&W owners came up with a host,

and these are a fraction of the recommendations, but we came up with recommendations that really get into the way in which those components were installed in the plant. Some of these findings are generic. They apply not only to the Babcock owners, but to anybody that owns PWR.

And we found a lot of site-specific issues which when corrected would increase the reliability of the main feedwater system. If you recall the chart that I showed yesterday regarding the dominant plant tripper today, the dominant plant tripping system today for the B&W owners is main feedwater. Take a step back and look at the gray book and say what's tripping PWR's in general, it's main feedwater. I just submit to you that it's not that the pumps are bad, or it's not that the system is bad. There are a lot of small things down in the bowels of the system that are able to interrupt main feedwater flow. We are going after these.

Many of these recommendations are key recommendations regarding main feedwater system reliability. Clearly we want to eliminate the overheating transient causers, preferentially over the trip causers. But many of these are plant trippers, even though they're rather minor in the control of the main feedwater.

MR. KERR: It certainly seems to me that you have selected a key symptom and have worked to improve the reliability of the people in the system, I think. But one

could get the impression from number four, for example, that to make the system more reliable you should take out those things where you indicated you were having trouble. It seems to me an alternate way to make the system more reliable is to make those things that are causing trouble more reliable. I must be missing something.

MR. SKILLMAN: No sir, you're right. An interpretation of that could be just to pull the plug on the things that get you. We're not saying that. Let's make sure we eliminate the things that we earnestly do not need.

For instance, we have found orifices where they shouldn't be. Parts in the lube oil systems of main feedwater pumps that are parts adrift, parts that came from some previous outage and were left in the system.

The tone of the recommendations causes the utilities to look in detail at the types of problems that have been experience and to get rid of or to make changes so that past efficiencies are corrected. Part of that has to do with the maintenance practices at the units. But at the same time, clearly, there seems to be a group of trippers at each plant that earnestly are not needed for pump protection, for personnel safety, and so on. We're saying those things that earnestly are not needed, need to be gotten rid of because there are just too many series trippers that will eliminate main feedwater when they shouldn't eliminate main feedwater.

For instance, loss of lube oil pressure is not in and of itself an immediate cause to shut off the main feedwater system. It may be that there should be a time relay to let the trip occur only after a backup booster pump has had time to come up to speed. But the way the circuits are currently designed, once the pressure goes down, you've lost main feedwater. We're saying that's not cricket. We should not pull the plug on main feedwater unless you earnestly have to take the system down.

MR. WYLIE: With those original trips in there, it seems the designer certainly had in mind his first priority was to protect the pump.

MR. SKILLMAN: Protect the component, yes sir.

MR. WYLIE: That's really not your first priority. You're changing the system to reflect a better balance of priorities.

MR. SKILLMAN: What we're really saying is the transients that really are of concern to us are the overheating transients. In a hierarchy of what functions you need, you need heat removal, and therefore main feedwater is vital. Let's don't remove main feedwater unless we really, really have to take it down. Let's make sure that what trips main feed should trip main feed. The flip side is true. Let's make sure that we don't lose main feed for fearless reasons.

But that's the tone of the comments. If you were to look through the executive summary of B&W 1919 and see where the main feedwater items fit, they fit in a hierarchy of the undercooling transient eliminators.

Let me move on.

The emergency feed. What did we do? We compiled the functional design objectives of all of the six sites' emergency feedwater systems. We compiled testing objectives, and we compiled a list of maintenance recommendations to improve reliability and availability. Woven through the systems review including ICS/NNI yesterday, is a clear recognition of the relationship between smooth, reliable operation, maintenance, maintenance practices, and those types of things; hence, you will see that coming up persistently as we talk about these BOP systems.

Our real goal here was to improve the response of the emergency feedwater system, the loss of main feedwater. In the B&W type plants with 30,000 tubes, with emergency feedwater injected high in the secondary side of the steam generator, excessive flow in the emergency feedwater will overcool the primary coolant system. So our goal was to find out how to trim emergency feedwater flow rate, trim emergency feedwater start-up times so there is a thermohydraulic match early on after loss of main feed.

The types of recommendations that came forward:

Remove emergency feedwater initiation and control from ICS/NNI. That has been done. Emergency feedwater is not controlled by ICS/NNI. Emergency feedwater is controlled by a safety system at each of the six sites. They come in different names, but their goal is to control emergency feed following loss of main feed as a safety grade function.

Limit the flow rate or fill rate. This is where we spent some time yesterday. Suffice it to say what we were trying to do as an objective of the emergency feedwater review is to get the post-trip heat balance quickly in balance by trimming the rate at which emergency feed is introduced to the steam generators.

Extended start time for emergency feedwater turbine-driven pumps. That might sound like a regression from a hard requirement. What we find is most of these emergency feedwater pump turbines are terry turbines. They are very susceptible to the density of the operating media.

MR. MICHELSON: Which side? The steam side?

MR. SKILLMAN: Yes sir. Consequently, you might have a long, long steam line feeding the terry turbine that is now filled with condensate. When the command is given, the valve opens, high density water, terry turbine winds up instantaneously, and in many cases over-speeds. So there are a couple of problems. Make sure that the steam line that feeds the terry turbine is drained and that there is warm, dry

steam ready to operate the turbine. But the second thing is, don't wind it up so quickly. Give it a chance to come up to speed gently so that it doesn't over-speed, which means extend the start-up time. When you look at the point in time when you need to match the energy balance post-trip, it is not instantaneous. You have some seconds, 100 seconds, 120 seconds, 150 seconds. So where before we were trying to light these turbines off in 30 and 40 and 50 seconds, now we're saying let's give them two minutes.

MR. KERR: Is that an automatically controlled sequence or a manually controlled sequence?

MR. SKILLMAN: That's an automatically controlled sequence. We're saying let's give those turbines time to do what they do well, which is run at constant speed. But let's run them up carefully so that we don't trip them on the start.

MR. KERR: Does that mean a change in the operators on it?

MR. SKILLMAN: Yes sir, that type of thing. Perhaps the stroke time of the valve, other things like that.

Again, ensure maintenance test programs confirm that --

MR. WARD: Does that mean that with that longer, I guess it's the speed or supply valve in longer stroke, takes longer, does that mean that the concommity of line full of condensate?

MR. SKILLMAN: No. What it really means is take a look at your maintenance and test program, and take a look at your design. Make sure that when the terry turbine is called upon to operate it has a high chance of success. That means extending the start time, making sure the driving media is what it ought to be, making sure the valves do what they are supposed to do, and so on.

MR. MICHELSON: Those turbines were purported to be able to digest large amounts of water. That's what GE used to tell us all about how good they were. Of course experience has shown that they don't do that so well unless they're already up to speed and running smoothly, and then you can shoot the water through it. But they don't start worth a darn unless --

MR. SKILLMAN: Our fifth recommendation, and these are typical. There are many more recommendations besides these, but we wanted to make you aware of these.

Reduce spurious EFW actuations. That seems kind of diminimus, but that's important. If you look at many of the significant B transients. Bear in mind yesterday we talked about 250 trips. We talked ten category C's which are the most severe; we didn't say much about the 40 significant B's, but we regard those as significant and worthy of a great deal of attention.

If you look at the significant B's and find out when

they occurred and why, many of those are emergency feedwater actuations at very low power. For instance, when the plant is coming back from a refueling outage, the core has virtually no decay heat; the metal tends to be colder than warmer; you're operating the generator at about 15 percent power; the generator levels, water levels, are very low; and any perturbation in main feed that would take the generator water level below approximately 30 inches will light off emergency feed because that's a key signal for getting emergency feedwater rolling.

So what we were having was a preponderance of low power emergency feed starts. What did that do? Severe overcooling. No decay heat. So we said hey, let's see what we can do to knock off those spurious EFW actuations. Clearly those actuations were not needed for plant safety. The types of things we talked about doing are raising the start point to give a command to emergency feedwater.

Suffice it to say, we were seeing spurious actuations and we were saying we've got to knock that off. We're overcooling and we're tripping too often. Let's don't do that.

MR. MICHELSON: By raising, you meant lowering, it's at a lower level than the generator now?

MR. SKILLMAN: Yes sir. We were knocking from 30 down to 24 or 30 down to 18.

MR. MICHELSON: That means the generators dry out even faster under some of these other conditions than they would have with less water.

MR. SKILLMAN: The signal would be raised for power operation. It was only for a start up mode.

MR. MICHELSON: You're having a two step signal.

MR. SKILLMAN: Yes sir. I'm looking for Angelo back there to support me if I've --

MR. MERCADO: We're looking for margin difference. We're raising the level of the --

MR. WYLIE: I don't think the reporter can hear you.

MR. MERCADO: What we're trying to do in this particular case is to raise the margin between the low level in the main feedwater low level signal, and the emergency feedwater initiation signal so we won't have any spurious signals.

MR. MICHELSON: At what level do you now initiate emergency feedwater?

MR. MERCADO: I'm not sure. It varies from plant to plant.

MR. MICHELSON: How does that affect the dry out rate for some of these other events? You talk about dry out in terms of four to twelve minutes depending on the conditions. This means it dries out just a little fast doesn't it? Perhaps.

MR. HENSON: Where you initiate feedwater you dry out its phase, and are not initiating feedwater.

MR. MICHELSON: But unless you put in a variable set point on this thing.

MR. HENSON: I'm with Toledo Edison. Your dry out is really dependent upon where you operate the main feedwater. Some plants increased that, and that was a way of decreasing the margin for main feedwater control on EFW actuation.

MR. MICHELSON: You raise the normal operating level?

MR. HENSON: Yes.

MR. MICHELSON: Thank you.

MR. DAVIS: I have a question. What did you do to initiate number two?

MR. SKILLMAN: On some plants there are cavitating venturies that will choke and therefore slow at a fixed amount. On others is the adjustment to the emergency feedwater injection valve decision so that when the valve strokes open only so much water can deliver. That can later be overridden. What we're really trying to do is to drop back from the 600 or 700 gallon per minute delivery rate to something less than that that more accurately reflects the removal of decay heat at the point in time that this system, the secondary plant releases, can be in balance. So it's either cavitating venturies or throttle valve position.

MR. DAVIS: It appears that most of these recommendations were instituted to avoid overcooling transients. Have you concluded that these recommendations would likely improve the reliability of the system when it's needed to avoid overheating problems? Which is a more serious transient, of course.

MR. RUTHERFORD: I think certainly in some cases that's true, that they do help the overheating aspect also. When you look at cavitating venturies, at least in the case of Oconee, it precludes certain runout conditions we might get into in certain events.

MR. SKILLMAN: My answer would be very similar to Neil's. I would say those things that make the system more reliable, particularly with regard to the overcooling transients, are equally as beneficial in terms of system reliability to ensure it's available for undercooling transients. I see a double benefit here. Increasing the reliability in any case, whether the transient is an overcooling transient or an undercooling transient, will render the system available for whatever. The problem we were getting into here was too many failures of the emergency feedwater system; too many complex transient involvements.

MR. KERR: The key to that, it seems to me if I understood your earlier comment, is that you're trying to match the water supply to the decay heat.

MR. SKILLMAN: Yes sir.

MR. KERR: It seems to me you ought to do this, whether one is talking about an overcooling or undercooling transient if you can indeed do that.

MR. WARD: I think Pete's point is, and it seems apparent to me that at least for some of the things that you can control, you're getting contrary demands put on you. You have to figure out how to balance it.

MR. KERR: But Dave, you don't ever want more water than you need to remove the decay heat.

MR. WARD: But If I wanted to be conservative I might say yes, let's provide more water.

MR. SKILLMAN: That's the problem. That's exactly the problem.

MR. WARD: I know. But you've got a narrow line that you have to walk.

MR. DAVIS: That's the side you want to err on.

MR. WARD: I don't know which side you want to err on. That's the question you were asking. It's not always clear.

MR. SKILLMAN: How wide is the walkway.

MR. DAVIS: Right. And have you really appropriately balanced it.

MR. SKILLMAN: It's the wide walkway that's giving us the trouble, because what we've done in so many cases is

say we want copious amounts of water, we want lots of margin. In getting copious amounts of water, particularly on emergency feed, we are extremely susceptible to overcooling transients which have been the dominant types of complex transients that we've had, and as we said in our slide regarding conclusions, regarding complex transients, while they give us comfort that the core is cool, they lead to a whole host of further operator interactions that cause us to say we want to stop that because those can lead to operator error that can give us later problems.

So the real issue here is let's get this system under control. Let's remove the right amount of decay heat at the right point in time. Let's make the pumps operate properly. Let's make the control systems work properly. Let's get it disconnected from the ICS/NNI. Let's get a dedicated safety system. Let's make this system do what it's supposed to do.

MR. WARD: You want to have fewer transients, but since an overheating transient really places the plant more at risk directly than an overcooling transient, maybe you ought to put the narrow walkway in the place where you get five times as many overcooling transients as you do overheating transients which is about where you are now.

MR. SKILLMAN: We're about 10 to 1 right now.

MR. WARD: That's sort of the question. We know you

want to reduce them all, but what's the right ratio?

MR. SKILLMAN: In a large number of the cases the overcoolings have led to an undercool. What does the operator do when he sees the plant overcool? The first thing he attempts to do is to crank her back, not overcool. The next thing you know, he's undercool. So what we're saying is instead of driving the people through those hoops, let's make this one perform properly and let's make its analog, which is the secondary plant release system, also operate properly, so the operator is not, in a dominant number of cases, fighting his way from an overcooling to an undercooling to an overcooling to an undercooling.

MR. KERR: In any event, it seems to me if you can remove the decay heat you're not going to have an overcooling trend.

MR. REED: This is a little point, but on the turbine, I assume that such little things as steam being brought right through on the DC stop valve ahead of the turbine and trapped out so it's always a hot line, that's done. And in fact the valves that are going to initiate and support the turbine start-up on an all DC operated valve, off the -- box. Is that the case?

MR. MICHELSON: Glenn, it's a little hard to hear some of what you say.

MR. REED: I was asking about two little things. If

in fact the steam line coming to the emergency feedwater turbine was hot and trapped right to the DC stop valve for initiation, and if in fact the other valves associated with water supply in the turbine are all DC operated from the vital box.

MR. SKILLMAN: The scope of the recommendations from SPIP clearly address ensuring that the driving media is available and that the valve that controls the driving media is also available. Where it's powered from, I can't answer. I just don't know. I'll get you an answer later.

MR. REED: It's a funny thing, we've run into the fact that people have designed plants and provided decay heat removal systems and then on a loss of AC they have AC valves in and around the steam drivers.

MR. LeFAVE: Bill LeFave from the staff. At least one of the pumps is completely battery packed, DC power, in accordance with 2E11. That was a requirement for all the plants, to have at least one of their turbine drive pumps completely independent of AC power and that includes ventilation, lube oil, that kind of supporting systems.

MR. MICHELSON: And steam supply?

MR. LeFAVE: And steam supply, yes. They can be operated independent of the AC power.

MR. REED: I thought that would probably be the case.

MR. MICHELSON: When you make these proposed changes to improve essentially the reliability of the system, do you go back and reexamine your safety analysis each time to see if that changed, what effect that has on the overall safety which is more in my interest, at least?

MR. SKILLMAN: I'd like to defer that question to Neil Rutherford.

MR. MICHELSON: Okay.

MR. SKILLMAN: He'll talk about recommendations, implementation, follow up, quality, those types of things.

MR. RUTHERFORD: Let me go ahead and respond to that. That's something each utility would have to do when they implement a modification or change. They would have to do the safety analysis. It's going to vary utility to utility, depending on exactly what the case is.

MR. MICHELSON: But that would be a requirement, when the SPIP is made, and you said in some cases these have already been done, and in other cases they'll be done. As they're done, the submittal will go to NRC, or does it go as a 50-59?

MR. RUTHERFORD: In most cases those would be done under 50-59.

MR. MICHELSON: Then the NRC is supposed to be reviewing these by whatever means it reviews such change as that. What would the NRC, at least on an audit basis, look at

these 50-59s? Normally it's just the resident inspector that's required to look at them once a year, but I'm not sure he's the man that should be looking at them.

VOICE: I think it is -- that normally screens all the 50-59's. If he feels something there is more significant or complex than he can do it, he'll defer that to the staff.

MR. MICHELSON: Clearly this particular class we're looking at here at the moment is a class that you would certainly want to audit on a little more frequent basis than some of the other things.

VOICE: I agree.

MR. MICHELSON: Thank you.

MR. SKILLMAN: I'd like to talk briefly about the secondary plant pressure control system. I sense it's worthwhile to give you the opportunity to see again the almost equivalent participation in post trip misbehavior of the emergency feedwater and secondary plant pressure control systems. For each misbehavior of this system we seem to get about one of this system leading us to believe, and this was a clear finding of SPIP that was something we had never really understood before or reckoned with before, perhaps a dominant relationship between these two systems, post trip.

Again, this is the participation. If you will, the number of misbehaviors out of 50 complex transients of these systems. In about 30 percent of the cases you get emergency

feed, secondary plant relief, somehow operating in concert with each other.

What do we do on secondary plant pressure control? Secondary plant pressure control is the main steam safety valves, turbine bypass valves, and atmospheric compounds. Those systems that have the prompt energy relief responsibility following a trip.

We were trying to identify the problems regarding main steam safety valve performance at the turbine bypass end or atmospheric dump valve performance. We'd had problems out in those areas. What we did is we did a preliminary assessment for the methods of reducing the frequency of main steam safety valve lift, and we're trying to increase the reliability of both the main steam safety valves and the turbine bypass valve, atmospheric dump valve components.

MR. KERR: Mr. Skillman?

MR. SKILLMAN: Yes sir.

MR. KERR: I understood you to say that it was a surprise to you to discover that these two things were making about equal contributions.

MR. SKILLMAN: Yes sir.

MR. KERR: I would hope that not only in this area but in the area of plant operation generally, someone in some group is looking for these kinds of things so that you know where the problems arise. I know you have so many things you

have to be looking at that perhaps you were not driven to this particular study earlier, but it would seem to me that there ought to be some watchdog group that looks for this kind of thing on a continuing basis.

MR. SKILLMAN: There is. Neil, would you like to speak to that?

MR. RUTHERFORD: I think the problem arises that we do that on an individual plant basis. We all have operating experience assessment programs where we go in and look at our own experience. But sometimes you get a little bit different viewpoint when you look at collective experience in a group of plants. I think this is where we picked up some of the things that Dick was alluding to.

MR. SKILLMAN: It might be worthwhile for me to tell you how we came up with this. We asked ourselves three questions. If we were in the control room at the time the complex transient was occurring, if we were omniscient and if we could understand every proper behavior or misbehavior, and if we were omnipotent, that is we could fix each flaw as it occurred, what would the pattern be like in each of the 50 complex transients? As we worked our way through there we realized that in many cases there wasn't a single misbehaving system. There were, in fact, clusters or multiples of misbehaving systems, and in some cases the emergency feed might do a peculiar thing, and then secondary plant relief

might do a peculiar thing, and then ICS might do a peculiar thing causing still another iteration of emergency feed or secondary plant relief.

So instead of trying to globally choose one bad actor we said hey, how many bad actors were there in how many of these complex transients, and what were they? What were the specific things we would have to fix? Hardware fix. That means a piece of paper at the site, a drawing change, something that would be the basis of an engineering change.

With that question being asked, having gone through those complex transients, we came up with a completely different picture of what the misbehavior pattern was for all of the Babcock plants. From that, came this participation picture.

MR. KERR: That's impressive, and I applaud you. My point is, I hope it won't be restricted to this study, because it sounds to me as if it could be a very valuable, generally useful approach.

MR. RUTHERFORD: We do have an ongoing program through our transient assessment committee that has looked and will be looking at this type of data now and in the future.

MR. SKILLMAN: What did we find in secondary plant pressure control? The control of post trip feed and bleed, post trip feed and steam flow is going to contribute to complex transients. In a nutshell, that is the post trip

energy balance. Providing the main control room manual control and isolation capability of all post trip steam and feed flow paths, excluding the safety relief valves. Go through the complex transients and say where did the plant get away from the operators. It's normally in an area where the operator is not able to take control promptly. The reason he didn't have manual control over it. He had a relief valve opening or he had something going on and he really couldn't get control.

Using the term bypass valve and atmospheric dump valve systems prevent excessive steam flow and loss of ICS/NNI power, previously some of these components were on ICS/NNI.

MR. MICHELSON: Let me ask you, on item one, did you do some kind of a PRA or something that led you to the conclusion it was better for the operator to be able to intervene to keep the transient more under control than it was for him not to intervene and allow the equipment to respond to what might be really an accident and not even a transient alone? In other words, it's kind of a balancing you've got to do when you talk about manual intervention. It means you can also improperly intervene in a bad situation.

MR. SKILLMAN: No sir, we did not do a PRA. What we did do is we went back to the Davis-Besse event and the Rancho Seco event and said where did these people really have a complex time in the middle of those transients. What we found

was that in those transients there was inordinant operator participating outside the control room to catch up with the transient.

MR. MICHELSON: This was moving to a centralized control point more than anything?

MR. SKILLMAN: Give the operator what he needs at his place of business.

MR. MICHELSON: Of course that means he can use it incorrectly, but that's what you have to think about when you decide this way.

MR. SKILLMAN: Develop and implement standardized procedures and techniques for maintaining setting, testing, main stream safety valves, bypass valves, and atmospheric dump valves, and so on. The typical key recommendations are recommendations that are intended to get the secondary plant pressure control systems promptly settled, and also to give the operator the ability to control those from where he normally is.

Let me make a comment about instrument air. Staff has talked about the program, setting up the program by about March of 1986. Instrument air was not part of our original program. Together we said this one needs to be in there. We added in a major effort on instrument air that was extremely thorough. The point is, we did not stop on the least common denominator. This program went ahead. We and the staff said

this is missing, this missing, let's add this in, let's add this in. Consequently, instrument air got added in and the risk review got added in.

What do we do? Compile the system features operating data again, from all six of the plant sites. These are plant site visits, people a week or so, trying to collect data and understand what each plant site had. Identified the critical or actuated components. The marching orders we gave to the instrument air review people were marching orders that said the thing you're really looking for is this system's participation in decay heat removal: how it works, what it does, what components are needed to get heat balance under control.

We looked at the planned response to air loss, developed target criteria, and we developed recommendations.

MR. MICHELSON: You didn't look, though, at degraded conditions such as air pressure or dirt in the system throughout, or that sort of thing?

MR. SKILLMAN: The utilities are doing that.

MR. MICHELSON: Under what program? Under this program?

MR. SKILLMAN: Yes sir.

MR. MICHELSON: So they are looking at degraded air effects?

MR. SKILLMAN: Let's go through the recommendations.

MR. MICHELSON: All right.

MR. SKILLMAN: The heartbeat of the instrument air system review is virtually identical to the ICS/NNI, go to known safe state on loss of air. But as you know, this one has a peculiar characteristic in that you can lose subsystems, part systems, you can terminate an inner artery, you can have one side of the plant behaving one way and one behaving another.

Compare the plant system and air system with the functional target criteria to determine what upgrades are necessary. To do this, we set out about 24 key items regarding instrument air requirements. Of the most important are the ones pertaining to clean drive, oil free, particulate free air. In a dominant number of cases that has been the problem with instrument air systems. That is, the air is dirty.

Perform an evaluation to ensure that air system failure will not affect the ability to maintain the plant in a known stage state. That recommendation is over into each utility for evaluation and for implementation.

MR. MICHELSON: What did you mean by air system failure? Loss of air or degraded conditions? It still isn't clear what you're covering. Yeah, you want to keep the air clean, but what happens if it gets dirty anyway, or water gets into the air system because a cooler fails, something of that

sort?

MR. RUTHERFORD: The testing that we were talking about there is under total loss of air conditions. We are still examining the question about effects of partial degradation, -- air supply. We haven't arrived at a final conclusion.

MR. MICHELSON: You are thinking about it seriously?

MR. RUTHERFORD: Yes.

MR. MICHELSON: Thank you.

MR. SKILLMAN: And perform operator testing in critical air operated valves, compare with design basis, giving time to rebuild as necessary. I think it might be helpful for me to tell a sea story here.

In one of the plants this air control turbine, bypass valve, and atmospheric dump valve, those are key components in post trip energy control. The stroke time on those air valves is three seconds. In the one plant the air valve is prone to open in 45 seconds. We said how come? The answer was, well it probably hasn't done enough preventive maintenance. So the valves, once open, showed rusted barrels and filled with sand. Until that point in time those valves were controlled by the integrated control system. The integrated control system had been given the bum rap of failing to control properly. When we checked with the integrated control system, the integrated control system gave

a prompt, accurate signal for those valves to open. But the valve says no way, I'm stuck.

Again, we cleaned, the valves, put the valves back together, and we found that the sand in the valve was really silica jell that had broken through the screen in the dryer. the heaters weren't working. There had been no real preventive maintenance. Once the valves were rebuilt and the signal applied to the valve, the valve stroked open in three seconds like it was supposed to.

It sounds like a "so what," but if you look at the post trip energy balance, those valves have the duty of taking the pressure lift off the secondary system which translated over to the primary system gives the high pressure trip point. So was it a maintenance problem? Yes. Was it a design problem? It was an attention to duty problem somewhere along the line. Suffice it to say, let's make sure the valves do what they're supposed to do when they're supposed to do it. If that involves preventive maintenance, design change, putting reservoirs on the valves to ensure that they stay where they're supposed to, all of those are part of the instrument air recommendations.

MR. DAVIS: I have a question related to that. Your previous slide also indicated that improving the reliability of the turbine bypass valve and the atmospheric dump valve was an important consideration. But on page 1-3-21 of BAW 19-19,

item six, and maybe you can clear this up for me. Item six says, "Ensure that relief valves other than main steam stop valves, turbine bypass valves, and atmospheric dump valves, are in a preventive maintenance and test program." Why are you excluding these valves that you just said are extremely important and need preventive maintenance?

MR. SKILLMAN: We are assuming that these valves are in fact a major part of the preventive maintenance program. But particularly in the area of moisture separator reheater relief valves, which are about a 14 inch diameter open plug if they fail open, some of those valves because it is so far in the bowels of the balance of the plant, were not preventively maintained. What we were trying to get to is those other valves which normally are not considered so important, in fact get swept into the preventive maintenance program.

There are other recommendations in the executive summary pertaining to these valves that basically say make sure these valves can and will do what they are supposed to do when they are supposed to do it. These valves are already in a preventive maintenance program. So what is on that paper is not intended to exclude these. In fact, it was intended to incorporate others that might fall through the crack.

MR. DAVIS: Just reading it alone, it gives the impression that these are excluded.

MR. MICHELSON: On your example, you might want to give some thought, although I realize it's not the scope of this study, but you might give some thought to the seismic qualification of the desiccant in the control air system, you'll find those are extremely fragile in design. In an earthquake you're going to end up with desiccant in all your air systems, the possibility. You might want to think about that a little bit, or maybe not use that particular example.

MR. SKILLMAN: Thank you. Any other questions?

Please let me end on this note. The BOP systems that were reviewed, and I need to caution because while ICS like BOP is clearly a jugular vein to the success of the plant, those reviews were performed by and the recommendations were built by people who designed, build, operate, and maintain, whose day to day responsibilities are the care and feeding of these systems.

The thought I'd like to leave you with is this was done with somewhat of a loving hand. The people who did this really want to be successful and want these plants to operate smoothly. But more importantly, they want the plants to operate safely. I think we have within the B&W owners a renewed perception of what it takes in terms of plant safety. What it takes is a tremendous attention to duty on the plant.

You might say why didn't you review the safety systems. The reason we did not is because those systems have

proven themselves capable. They operate when they are supposed to. They are preventively maintained. They are tech spec time clocks. They have all the best of everything. What we found is the systems which haven't been given that attention are systems which are causing trips, and which are integrally related with the complex transients that we've been having. Consequently, when we said how do we settle on the safety issue, we said let's go after those things that are putting the plant in what we consider to be a risk situation. Those are the systems which cause tripping, and if you read the data, one in every five trips results in a complex transient. We said what are the complex transient misbehaviors? These systems are those systems.

Thank you.

MR. KERR: I think what you have just said is extremely important. If we were starting the process over with the accumulated wisdom that has occurred over the years, do you think we should make the sharp demarcation that has been made between safety and so-called balance of plant systems?

MR. SKILLMAN: Are you asking me that question?

MR. KERR: Yes.

MR. SKILLMAN: I do not think that such a sharp distinction should have been made in the first place. If you were to ask me how would you do it, I'd say your primary heat

balance systems, starting from the core and extending out to those backups necessary to control, those trip energy heat balance, must be treated about equivalently. That would save reactor coolant pumps, motors, pressurizer heaters, next stage seal injection, co ponent cooling water, next stage main injection systems, condensate, main feed, circulators, lube oil, in service cooling water, component cooling water, and all those that lie in between are vital to just the smooth heater group.

MR. KERR: I would hope you can preach this gospel to your colleagues so that the NRC doesn't have to get involved in this.

MR. SKILLMAN: Thank you, sir.

MR. LeFAVE: I'm Bill LeFave. I'm going to talk about basically the same staff review aspects of what Mr. Skillman just talked about.

When we point out that the mechanical aspects of the sy tems what we really mean is that it's separate from the ICS/NNI review and the in-depth electrical review of the PFW/AFW auto initiation and control.

MR. MICHELSON: We didn't hear about those from others, necessarily. The feedwater instrumentation and control we haven't heard about.

MR. LeFAVE: I can discuss some general aspects of that.

MR. MICHELSON: I didn't know. I'm just pointing out that wasn't a part of the agenda. But there were B&W owner groups talking about the ICS/NNI.

MR. LeFAVE: It was not directly a part of this program, no. But it was somewhat embodied in the AFW stuff. But specifically looking at the adequacy or acceptability of those systems was directed to the staff by the commission.

MR. MICHELSON: That was a separate issue then.

MR. LeFAVE: Yes.

MR. MICHELSON: I just wanted to make sure. Thank you.

MR. LeFAVE: I just want to point out some observations that we have made. We agree with the BWOG that implementation of recommendations will definitely reduce the frequency of these trips. The actual reductions of trips at a particular plan can vary depending on the implementation of these recommendations, many of them involve evaluations and analysis, depending on what depth the individual utility is willing to go, fully dependent on how much reduction did they get.

The recommendations do address design, maintenance, and testing aspects of the system, and they're aimed at improving reliability. I think that's basically based on root cause determinations from all the studies they performed including the operator or interviews and what have you.

At the time of our review, there were recommendations that were made from the trip initiating events review, and at that time they were not yet entered into the recommendation tracking system. We recommended that we basically agree with the recommendations that are in there, that they should indeed enter them into the tracking system.

The recommendations made regarding the feedwater system are responses to the MPR sensitivity study that was done for this trip program which is basically the reliability of the main feedwater system and the ability to maintain the two main feedwater pumps running to not have a single failure take you down.

I think a difficult area for implementation that's going to take some coordination at the utility level is that comments in the operator burden report which is Appendix S to 19-19, should be considered during the implementation phase. How this is going to be done, what kind of oversight is done, is probably one of the most difficult tasks of doing the actual implementation of these recommendations. Hopefully there will be some management oversight in that area.

In addition to the recommendations that were on the key list by B&W, we suggested that they also suggested they add, they already have this recommendation on one non-key list, but enhancement of reliability of main feedwater condensate systems [illegible] controls should be added [illegible] they have

recommendations already on the key list that are very much related to this, and this is a pretty general recommendation, but we thought it ought to be on the key list since it is the basic cause of most of their trips.

Going to the agenda, I'm supposed to give you some insights on --

MR. KERR: Excuse me. Do you have any reliability goals for the main feedwater condensate systems? You say the reliability should be enhanced. To what point should it be enhanced?

MR. LeFAVE: I don't believe there's any, we didn't do any reliability studies ourselves, and I did not look at reliability. I'm just talking about availability in general. There are no numbers involved. We don't have any goals that I know of.

MR. KERR: So you're just saying let's make them better.

MR. LeFAVE: Yes. I think that is basically what B&W should also. We feel they didn't have any reliability goals.

MR. KERR: I'm not being critical. I'm just asking a question.

MR. LeFAVE: I understand.

MR. RUTHERFORD: Other than its influence on reactor trip transients, we didn't set any specific goals for main

feedwater.

MR. LeFAVE: I don't really have any insights into the importance of the balance of plant. I think everybody here is aware that balance of plant is an important contributor to risk since about 70 percent of reactor trips throughout the country are caused by the balance of plant, or somewhere in that area.

The major causes for the balance of plant related trips are with the main feedwater and turbine control systems. At B&W since the study began, the leading cause used to be the turbine control problem, and they've already initiated some changes or modifications to tne turbine control such that in the last, this is through '86, that that part of the review was involved, the studies of the -- that now the turbine has been reduced to the extent that the main feedwater system now is the major contributor to the balance of plant-related trips at the B&W plant.

They have not yet, the recommendations for the main feedwater improvements and reliability I don't think, maybe for the last couple of years they have shown some improvement, but up until 1986 they still have not, even though many modifications had been made. You might want to elaborate if there's been any changes in the last couple of years on any reductions in main feedwater initiated trips.

MR. KERR: Mr. LeFave, I get the impression that

although you're convinced that the balance of plant has some influence on risk, you aren't quite certain what it is, and indeed, perhaps in a subsequent slide there is some indication that you're asking SAIC to perform a study of programs. Again, implications could be that you're asking them to find out how much influence balance of plant has on risk.

MR. LeFAVE: Yes, that's the basic thrust. What is the safety significance.

MR. KERR: It is my impression that the NRC, another branch at least, has recently spent a lot of time and effort analyzing about five plants to do what is called a rebaseline study of risk. Surely somewhere in that study there must be some indication that the balance of plant either does or does not have an influence on risk. If it isn't in there, then one either has to conclude that it doesn't have any influence, or else that the study is not very thorough. I would commend that as an important resource for the staff to look at and draft a new reg 11-50.

MR. LeFAVE: Those studies including that will be part of the SIC review. All the programs are NRC programs related to the balance of plant or the baseline study for risk estimates, we'll use all those resources when we do the balance of plant review.

MR. KERR: But you can't tell whether the balance of plant has any influence until SAIC looks at it?

MR. LeFAVE: No, it's definitely a contributor. I think I've already said that. It's got to be considered as I would say a major contributor because it's a major precursor.

MR. KERR: I don't think that I understand page 97 of the safety assessment for the staff then where it clearly says the B&W group concluded that Category C events are not likely to be significant contributors to core damage frequency.

MR. LeFAVE: I say precursors, they are potential precursors.

MR. KERR: Sure, but not significant contributors to risk. Unless this report --

MR. LeFAVE: I don't want to say they are not significant, but they are a significant precursor.

MR. SIEGEL: If I could comment on that, that statement on section nine in the risk assessment is addressing the historical Category C events that have occurred. You can do a precursor type study on those. You will find that they are not significant contributors to risk at most plants. I think we've got it broken down into not significant, moderate, etcetera, depending on the specific plant design. But we'll discuss that in more detail when we get up on the risk assessment stuff. But it's put in the perspective of the existing Category C events that have occurred, and primarily the basis for that statement is the fact that they majority of

them were overcooling transients.

MR. LeFAVE: And obviously we don't have any plant trips, the risk is reduced. Every time you have a trip, that's somewhat of a precursor.

Obviously aggressive BOP programs including maintenance, testing, design modifications, programs at particular plants think that plant will have higher availability. These are kind of general things. A lot of this is not specifically related to the B&W, but it's kind of related because what was looked at basically on the B&W was a balance of plant.

What we have found is that the economic incentives for reliable balance of plant operation have a definite positive effect on safety.

MR. KERR: What does that bullet mean? Does that mean if you find them --

MR. LeFAVE: This means what we have found out over the past couple of years, that the utilities that, there have been some utilities paying a lot of attention to the balance of plant on their own. They basically from the standpoint of plant availability. Those plants have significantly reduced the number of trips they've had over the past couple of years, and we believe that's a definite improvement in safety. That's really all that means. Even economic incentives can go on hand in hand with safety.

This basically brings us up to where we are with respect to balance of plant issues. Back in 1986 the policy issue gives a good description of the balance, the NRC or industry balance of plant programs that were in effect at the time for a plant, and gave a pretty good discussion of the statement significance of BOP items. The safety significance basically boiled down to two things, how do balance the plant failures effect the frequency of challenges to safety-related systems, and its direct effect on safety-related systems; and the effects on operator control of the reactor following trips and the ability of the operator to mitigate or control the challenges for the safety of related systems.

In the past we basically focused our review on the impact of safety-related systems. This has been the historical way the staff reviewed these things. For instance, floods caused by pipe breaks, environmental effects, and missiles, impingement. Today's focus is basically switching to, we're trying to reduce the frequency of balance of plant challenges rather than mitigating the effects themselves. To try and reduce the frequency of balance of plant challenges due to balance of plant system failures.

In this vein, temporary instruction for the balance of plant trial inspection was performed at five plants. Right now those inspections are complete. I was involved in two of them. I'm familiar with the others. Right now that temporary

instruction is being extended while an inspection procedure is being written and being published for comment. So during that time period, we'll have the temporary instruction in place.

The results of the temporary instruction inspections show that the utilities are concerned with the balance of plant systems, and a lot of them do have aggressive programs. We can see a definite difference between plants that have just recently got involved with this balance of plant stuff.

MR. KERR: Excuse me, but I can't imagine an operating utility that wouldn't be concerned with the balance of plant. I must be missing something, that you had to do inspections to discover that.

MR. LeFAVE: The degrees of concern and the methods of addressing BOP problems vary significantly from plant to plant.

MR. KERR: Well again, surely this doesn't come as a surprise.

MR. LeFAVE: It came as a surprise that the attention that was being paid, it did come as a surprise to most of the inspectors, yes, that --

MR. KERR: They didn't realize that people who operated power plants were interested in balance of plant?

MR. LeFAVE: We knew they were interested, but the depth of the modifications and, put it this way, the programs they had in place for performing root cause analyses,

determinations, and follow up on identified possible problem areas were, in some cases were identical to those that, they gave them the same priority as safety-related systems. That was surprising.

The biggest thing that makes a difference is that a lot of times just to keep the plant running, rather than to do a total root cause determination is to just fix the symptom rather than the root cause. That has been done a lot in the past, but we think that's changing.

MR. KERR: I guess the inspection was worthwhile then. If staff came to realize that some of the utilities really were concerned about the total plant.

MR. LeFAVE: Yes.

MR. WARD: Is your conclusion that some utilities were and some weren't, or they all were?

MR. LeFAVE: They all were to some degree. Some of them had started on an early time frame, and you could tell the difference in the number of trips that the plants that had just really started getting more in-depth, detailed programs to address BOP, complete engineering departments just focusing on the balance of plant. Those that, they were a couple of years behind, some of them that had really got on board earlier, there's a definite improvement in the number of trips. A significant improvement in the number of trips.

Where we're at today is we have a task action plan

that it attempting to assess the safety significance of the balance of plant and develop rules, regulations, guidance or whatever is necessary based on the study. This contract apparently just went out, I think they start work last week or this week with SAIC to, among other things, to perform a study of the industry programs, utility programs, and staff programs that are associated with the balance of plant systems.

MR. KERR: You're going to be sure they know about draft 11-50?

MR. LeFAVE: I'll make sure. I am involved in this right now.

MR. MICHELSON: Are they addressing the full safety significance, or are they looking at only the transient and trip aspects? I mean are they looking at the effects of external events on the safety of the plant as it may come through the BOP and so forth?

MR. LeFAVE: I don't know that any of that will get to that point.

MR. MICHELSON: I want your definition of safety significance.

MR. LeFAVE: Actually I think it's basically going to deal with internal events from the balance of plant. What the reliability, not the reliability of the numbers per se, or maybe they will be studying risk and risk assessment I understand. With regard to external events and that kind of

thing, I don't know if that really would relate to the balance of plant per se.

MR. MICHELSON: That's what you have to do by doing a study. That's what you find out by doing a study is whether it relates or not. Such studies haven't been done in the past and I just wondered if this was finally the one.

MR. LeFAVE: The external events you are talking about, that's being investigated in A17. One of the A17 systems interactions is making --

MR. MICHELSON: I know a little bit about A17.

MR. LeFAVE: As broad based as this external event category is and the types of studies you are talking about, are very broad in themselves.

MR. MICHELSON: A47 is really the right number to name. That was supposed to have looked at the safety implications of these balance of plant systems. We already got through the resolution of that, and this is not in the resolution of it even, as you got a letter from us.

MR. REED: I worry about what I perceive as the enthusiasm for regulatory involvement in-depth in balance of plant. I might point out that probably utility initiatives for looking at balance of plant is spurred on by the plant that spinning reserves in this country are declining all the time, and the outage becomes ever, unscheduled outage becomes ever more of a problem. Therefore, there is this natural

inclination because of state regulatory authority investigations, for the utilities to try to prevent outages unscheduled.

Now I might point out something. In my opinion, reactors that will be successful in the future should have more independence of safety systems from balance of plant. We've neard the words dedicated, separated, decay heat removal. I don't know who it was that ever in the regulatory thought that auxiliary feedwater systems or emergency feedwater systems, secondary site equipment, were not safety systems. But somebody apparently thought that was the case 10 or 20 years ago. So utilities in the industry got started off on safety systems that were not declared safety systems.

Whenever you're going to use emergency feedwater, which is spread-eagled and spaghetti'd all over and supported all over throughout balance of plant, whenever you're going to use this as your only and perhaps most successful way of decay heat removal, then damn it, it should never have been that way. It should have been a safety system, and then I think it would have been built more separated and more independent.

End of speech.

Quite frankly, NRC may get all wound up on balance of plant oversight, and reactors ought to be much different from that in the future, and yet they had like created the great regulatory empire pursuing balance of plant which I'm

not so sure they'll have the budget and competence to take care of.

MR. LeFAVE: You may be right. In fact this new maintenance rule, that's one of the things that will be studied under this, that it's a factual imbalance of plant, and there may be nothing, no rules or regulations, or guidance come out of the balance of plant program based on improvements that have been done just due to maintenance, the new maintenance rule.

MR. KERR: You're really serious about a maintenance rule?

MR. LeFAVE: Isn't it in the mill now, or has it already been --

MR. KERR: I guess so, but I would have thought it might be reversed.

MR. LeFAVE: AFW system. Recommendation to ensure that does not conflict with rules, regulations, or guidelines. We found there were no conflicts.

With respect to the benefit of the actual recommendations, many of the call for, and this is true of a lot of recommendations throughout the program, call for analysis and evaluation by the utilities. We won't be able to tell the actual benefit until the implementation phase of these recommendations, because they can be taken to different depths by different utilities. This is especially true with

the design objectives, the design recommendations. So we will not see any immediate impact on the AFW system except maybe in the area of testing and maintenance where these recommendations can be put into place without a whole lot of analysis and evaluation.

At the time of our review the steering committee had not acted on many of the recommendations in Appendix Q related to testing and design objectives. I believe that's because they're related to a lot of the recommendations that are already in the tracking system. I don't know where they stand now, how many of them have been entered. But there are many recommendations already in the tracking system related to the AFW systems. I think it would be prudent to review the ones that are already in there. Some of the design objectives are probably already met by the recommendations that are in there.

BWOG did not make an effort to address the addition of a third AFW pump. We are pursuing this separately under generic issue 124.

MR. KERR: I'm sorry, I didn't understand. What did you say? B&W did not --

MR. LeFAVE: They did not address the addition of the third AFW pump with respect to reliability of the AFW system.

MR. KERR: What kind of AFW pump?

MR. LeFAVE: Third. Number three. Some of the

plants only have two.

We are pursuing this. -- gives you 124. I guess it's related to something that was brought up yesterday regarding the feed and bleed, that the present, the staff objective now and under GI-24 is to make the system or a system that can remove heat through the heat exchange, through the steam generators, meet the reliability criteria of 10 to the minus fourth, 10 to the minus fifth unavailability as defined in the standard review plan section, 10-49 related to the AFW system. So we are not relying at all on the feed and bleed with regard to the generic issue 124. That was, I think proposed. Either the AFW system has to meet the 10 to the minus fourth, 10 to the minus fifth unavailability, or other compensating factors would be considered that the system itself didn't meet them, but that would not be feed and bleed. So we have two plants now that I believe we are still pursuing this with.

MR. KERR: Are you telling me that in effect 10 to the minus 4 is now a regulation?

MR. LeFAVE: It's in the standard review plan as an assessment criteria. I wouldn't call it a regulation.

MR. KERR: You said a plant would have to meet something.

MR. LeFAVE: It's a generic issue. We went out with generic letters, I believe it's a generic letter. I don't

know if you call it a regulation.

MR. CATTON: It's the same effect.

MR. KERR: If a plant has to do something, as far as I'm concerned it's a regulation. What I'm trying to find out is whether you're telling me that now plants have to have off speed water systems, they have to have a reliability of 10 to the minus 4?

MR. LeFAVE: Only in about six plants, we are looking only at the plants that only have two AFW pumps, and yes, I would say basically they have to have a heat removal system that will meet that criteria.

MR. KERR: Why should they have to meet the criterion and other plants not?

MR. LeFAVE: We believe the other ones already do.

MR. KERR: You believe they do?

MR. LeFAVE: Yes.

MR. KERR: On what basis?

MR. LeFAVE: On the basis of the 2E11 review that we did following TMI-I and the improvements made on the systems, we're pretty sure that they would all pass that criterion. We didn't do a recalculation of them. We did calculations of the individual plants, but we didn't do a recalculation after all the improvements were made. We didn't think it was necessary.

MR. KERR: Okay.

MR. LeFAVE: If these recommendations are

implemented properly to the degree that they ought to be, then the reliability, availability of the AFW system should be enhanced by varying degrees dependent upon the individual utility.

With regard to turbine controls, the turbine pumps, we have a recommendation that they start a research program to possibly determine improvement, to come up with a completely new design for a turbine control system. There are already many recommendations in the tracking system for improvement in the reliability, and they rejected this recommendation. We just suggest that they keep it in mind pending the implementation of the recommendations already in the system if they don't get the reliability improvement in turbine control that they hope that they ought to maybe reconsider this research program.

MR. REED: I thought I heard you say, and correct me if I'm wrong, I thought I heard you say that the auxiliary feed water system is the system that you want to meet 10 to the minus 4, and you do not consider the bleed and feed activity as supportive.

MR. LeFAVE: That's only from the generic issue standpoint.

MR. REED: I see. I was trying to see how that jived with B&W's claimed advantage yesterday for bleed and feed compared to PWR's. I guess they can claim that advantage

for their bleed and feed, even though apparently they're not claiming an advantage for their auxiliary or emergency feed.

MR. LeFAVE: Yes.

MR. KERR: In this third pump you're recommending, you do not give credit for a pump that is not safety grade.

MR. LeFAVE: Yes we do. It must be tech spec'd. It has to be tech spec'd, but we do give credit for -- with respect to unavailability.

MR. KERR: And the tech spec simply says it has to be there?

MR. LeFAVE: It has to be operable. It may have a down time of seven days or something like that. But it has to be tech spec's.

MR. WYLIE: Let me ask the owner's group. On the staff recommendations on the research program turbine generator controls, I know you have a recommendation regarding improving the reliability of the turbine generator by doing certain things to the control system. Was there any other actions you plan in this area?

MR. RUTHERFORD: Other than the recommendations that we presently have?

MR. WYLIE: Yes, you have one regarding the drain tank level controls and the EHC controls, improvements. Those are the only two, they recommend you list in summary now. Do you have another program to improve the reliability? Since

that is a major contributor to your trips.

MR. RUTHERFORD: This is an auxiliary feedwater system turbine.

MR. WYLIE: No, I'm talking about, no this is the turbine generator.

MR. RUTHERFORD: No, this is the auxiliary feedwater turbine-driven pumps.

MR. WYLIE: Oh, okay.

MR. RUTHERFORD: Really to address your question on turbine control, I think we pretty well cured that problem. In fact Oconee was a chief contributor to that in the early '80s and we made some changes at Oconee that pretty well have eliminated that as a source of trips at Oconee. So the experience over the last two or three years has been very good in that respect, even though it shows up as a dominant contributor when you look at the experience in 1980.

MR. LeFAVE: The secondary plant relief system is basically a main steam pressure control review to reduce the number of safety valve actuations following reactor turbine trips. The slides you have, the last slide in the series of slides is one that Gary will talk about, that are related to this regarding the valve task force.

Along with that we talk about the testing and maintenance and performance of safety valves and the raising of the safety valve set points that was one of their

recommendations from B&W. They basically were talking about a three phase approach to this reduction program. The second phase was raising the set points of the safety valves.

AFW recommendations are responsive to the concerns identified during this particular review which, as you recall, the overcooling effects on pressure, adjust of flow, trying to limit the flow rate of the AFW, smooth flow control, raising of the level rather than an on/off situation which some of the controllers had, was giving problems due to overshooting and trying to keep the safety valves closed.

The staff basically agrees with the phased approach and that the phase one of the program is involved with the testing/maintenance/performance of the safety valve systems themselves, the safety valves themselves.

Phase three is the combination that, BWOG made studies of a combination of different modifications that could be done to the plant which included high capacity, bypass systems, quick acting bypass valves, increasing the MSSV set points, the safety valve set points, and possibly changing the signals that actually actuate the turbine bypass system. And also possibly using the turbine to handle the initial high heat load from the reactor. Made studies of these different combinations of these which they don't plan to complete unless phase one and phase two don't give them the performance they are looking for regarding reduction in the safety valve relief

actuations.

Actually phase three, we recommended that they continue to investigate these possible modifications, kind of in parallel with phase one. According to what we understand they are still doing some of those investigations. I understand at one plant they did substantially reduce these safety valve inadvertent openings, not inadvertent, but excessive openings, by just reducing the turbine bypass, that point where you don't overshoot the reseat, the reseat point from the safety valve reseating does not cause the go below the turbine bypass system at that point. Did I get that right?

The turbine bypass set point is set to control, probably trip at a certain level. Sometimes the safety valve reseat point drops below that so you don't even get out of the turbine bypass system which causes operator action to try and reduce the, take manual control of the turbine bypass system and reduce it to reseat the valves. This is a major cause of the pressure complexity following the plant trips.

The staff feels that proper implementation of these recommendations will result in a definite improvement of the performance of the relief system, and the post trip pressure control, and operator burden and ultimately result in an enhancement of plant safety.

I think that's all we have on secondary relief.

Gary will again talk to the instrument air system.

MR. KERR: At what point will the staff conclude that safety enhancement is sufficient?

MR. LeFAVE: We don't see any further recommendations that have to be made. I don't know how to answer that question.

MR. SIEGEL: I think what's going to happen is once the audit group implements these recommendations, the staff is going to review the plant performance to see how they operate and see, once they're all implemented it may take several years to make a determination of acceptability of the program. But we're going to be reviewing it at the time or looking at their performance at that point in time, and we should be able to see, or we hope based on all these recommendations, be able to see a significant improvement, and that the owners group would exceed the goals they've set for themselves as far as the number of complex transients and reactor trips. So it's not a short term assessment. It's going to take awhile.

MR. KERR: It won't be based on adherence to regulations or anything of that sort, it would just be --

MR. SIEGEL: Essentially surveillance.

MR. KERR: That the number of transients has been reduced sufficiently.

MR. SIEGEL: That's right, and that we see a reduction in the number of transients. And also I would hope

that as a result, as we said, we want to eliminate all the transients, but we would hope that the complex transients would be less severe as a result of these programs, too.

MR. LeFAVE: Instrument air system. The instrument air system was included because their failures, they were similar in extent and character to loss of the ICS power in that they increased the complexity following the trip, although they didn't experience as many failures as they did in the ICS.

During our review we compared the recommendations made by BWOG with the recommendations and the AEOD report related to the instrument air with very favorable results. The recommendations made by the BWOG go well beyond the scope of the AEOD report, but I guess mainly because they're more specific. I think there are about 50 recommendations regarding the air system.

We agree with the conclusions, basically we agree with the conclusions and recommendations made by BWOG with regard to the air system. We think we should see a quicker turn around on the safety impact or the improvement in this air system related to some of the recommendations made for the other systems in that they do not require an extensive evaluation or analysis before they are implemented. So implementation of these can be done a lot quicker than can be done with some of the other systems where the individual

utilities require their own analysis.

The recommendations made address the staff's recent concerns, mainly regarding the cleanliness of the air, emergency procedures and training, testing of the system, and the basic overall performance of the instrument air system.

We did make recommendations that BWOG should consider making a recommendation for a gradual loss of air system test which is something that Mr. Michelson was talking about. This was one of the recommendations in the AEOD report that although the instrument air system study by BWOG did address the fact and did make note that they could have some problems due to gradual air loss, they didn't make a specific recommendation. In any rate, the staff is, I think within the next year, will have a recommendation out with this type of test for all plants, B&W, Westinghouse, GE, what have you. There's a presently ongoing study on that.

There's a generic letter about to be issued also, that doesn't include this gradual loss of air test mainly because this is considered a back fed item and needs a lot more regulatory analysis to go through a CRGR.

Another item we recommended, that although the BWOG report said that they didn't consider analysis regarding loss of off-site power and causing a loss of instrument air, but they did make note of where these things did occur. We thought they ought to make a recommendation that an assessment

be made regarding the loss of air due to the loss of off-site power. We think each plant ought to do that.

MR. KERR: Has that ever been done in a PRA?

MR. LeFAVE: I don't believe so. The individual plants may have done it, but I don't think the staff has done a PRA.

MR. KERR: Is that what you had in mind? That they do a PRA?

MR. LeFAVE: No, not a PRA. Just to make sure that they know what's going to happen through an analysis, basically, to know that they have looked at the effects of the loss of air following a loss of off-site power. Maybe they might want to consider --

MR. KERR: When you say assess the impact on safety, you just mean look and see what would happen?

MR. LeFAVE: Yes.

MR. MICHELSON: That's with a gradual loss of air most likely.

MR. LeFAVE: That's true.

MR. MICHELSON: Unless you put in a dump valve it's going to be a gradual loss of air.

MR. LeFAVE: That's true.

There were four recommendations we thought ought to be added to their list of key recommendations because the first one, inspection for leaks, that is not a difficult

recommendation to perform, and such leaks could lead to contamination and may lead to exceeding the capacity of the air system.

MR. KERR: Offhand, one would say if you have a gradual loss of air likely your accumulators are going to slowly bleed down with that gradual loss of air, and when you need the accumulator, it's going to be too low a pressure already.

MR. MICHELSON: It may only be half full.

MR. KERR: Just offhand, you would say gradual loss of air is going to be kind of a tough proposition in some cases.

MR. LeFAVE: Keeping line with the accumulator and shut valves, we made the recommendation that that be a key recommendation because all the safety-related valves have accumulators and since this has a definite safety impact because it has to do with performing a safety function, we thought that ought to be on the key list. There was a recent experience at Fort Calhoun where they saw a potential serious problem due to the same effect. They performed a test on the accumulator for, actually an instrument for the -- storage tank, air bubbling instrument, saw that the accumulator didn't have enough in it to bleed down to the point where the ECCS would shift over to reserve before you had enough water in there to assure enough positive suction -- So we think this

is one that definitely ought to be on the key list.

MR. KERR: What did you have mind when you talked about inspection of leaks? How does one inspect for leaks?

MR. LeFAVE: I think that -- the system or a -- of the system by flow rates, capacities. You can get a feel for the air usage by turning the flow capacities, the actual flow rates, the usage factors of the system.

MR. RUTHERFORD: That's difficult to do. It involves walk downs.

MR. KERR: You go around and put soap bubbles on everything and see if the bubbles burst or something like that?

MR. RUTHERFORD: Go around and listen.

MR. MICHELSON: That's an inspection.

MR. RUTHERFORD: Not necessarily soap bubbles.

VOICE: I think you can actually look at how many times the air compressors take to refill the tanks.

MR. RUTHERFORD: I disagree. That's not a very easy way, you don't know what air demand is. If you've got that big a leak that it's increasing demands on your compressor, then you're going to know about that. What you're going into is a lot of very small leaks. That's difficult to sort out in just looking at compressor run time and that sort of thing.

MR. KERR: What is your view on check valves on accumulators, if you're getting a slow degrading of the air

system? What's seating the check valve, or why isn't the accumulator just coming on down with the air system? Unless there are spring-loaded checks or something, and even that, I'm not sure would quite do the trick in this case. It looks to me like degraded air, you've lost on accumulators. If it comes down slowly. We found that on the BWR's. We had to put dump valves in to knock the air pressure off quickly.

MR. SKILLMAN: I think the real way out of this mess is to ensure that we're monitoring the pressure at the right point in the system and making it necessary for the operators to take action on certain air pressure --

MR. KERR: We're worried about loss of off-site power and that sort of thing. We may end up with dump valves that try to break the air line real quick so that the accumulators can -- and hold what they've got left. I think that's a way out of that mess, but it's not a nice way.

MR. SKILLMAN: Right.

MR. LeFAVE: Any other questions?

MR. MICHELSON: One more point. You're aware now that the generic issue is in the process of being established on air systems with a high priority. How is that going to be fit in, since I'm sure that will come out with a resolution three or four years from now.

MR. LeFAVE: That will be planned to be done I think by the end of the year.

MR. MICHELSON: The resolution?

MR. LeFAVE: Yes.

MR. MICHELSON: Oh, I haven't had time to read it. I got it in the mail but I didn't have time to read it.

MR. LeFAVE: It's actually being done in two phases. The first phase is the generic letter to ensure all the plants actually meet what they have, what they're supposed to have now with regard to testing, maintenance. Even that should have been out three or four months ago, but now we have to go through --

MR. MICHELSON: It's going to be factored into the B&W owner's group very quickly so that when they finish --

MR. LeFAVE: They have pretty much addressed everything we wanted to come up with except for the gradual loss of air. That's something they know about, and hopefully they'll factor that in.

MR. MICHELSON: The other issue then is going to come to a head very quickly in terms of a resolution.

MR. LeFAVE: Yes.

MR. MICHELSON: Thank you.

MR. WYLIE: Before we get into that, I think we'll take a break.

MR. LeFAVE: This is part of the system. There's one more slide.

MR. WYLIE: But we haven't heard B&W owner's group

on this, I don't think.

MR. LeFAVE: They don't have a separate valve test program, I don't think, but this is basically related to the secondary plant system review, the steam pressure control review, secondary relief valves.

MR. MICHELSON: I would think, Charlie, that we'd want to hear about that program once they issue their report which I gather was August, a valve report. So the next valve meeting might be scheduled --

MR. LeFAVE: Let me show you want the slide is and see if you want to, it really has to do with the secondary system pressure control.

MR. REED: Is this open for discussion?

MR. RUTHERFORD: We don't have any specific presentation on this. This is really part and parcel of the systems reviews that we've already gone over.

MR. WYLIE: Okay.

MR. REED: Are you going to consider this now or are you going to take a break?

MR. WYLIE: Let's take a break. We'll come back at ten after.

(Whereupon, a brief recess was taken.)

MR. SKILLMAN: I was asked to take a minute, so with the clock running and 59 seconds left, valve task force activities came as a follow up activity to the secondary

system pressure control review that we did. Please regard this information as preliminary. The areas we were looking at were the areas of main steam safety valve performance, turbine bypass, atmospheric dump valve performance, motor operator reliability with regard to this relief function, and general post trip secondary pressure control.

We developed a guideline for MSSV set point testing, looking at these maintenance procedures. We have evaluated and are evaluating efforts to reduce the main stream safety valve lift and we're developing a generic program guideline for the testing.

Let me speak a few numbers to put this in the proper perspective. How many main steam safety valves are there per plant? How many lift on a trip? So when you look at the trip frequency, and the number of valves that are involved, -- you find there is indeed a loss of lift because -- coupled with the number of trips per year at a plant, because there are 18 lifts per turbine --

MR. MICHELSON: Are those spring loaded safeties?

MR. SKILLMAN: Yes sir. These are the codes.

There are 16 to 18 lifts at the highest point.

MR. MICHELSON: They have a bad reputation for sticking don't they?

MR. SKILLMAN: That's what we want to go after.

Dave mentioned earlier that one of the key aspects

of a Babcock trip is for the operator to take manual control of steam header pressure, drop steam header pressure until these valves reseat. That is what has been driving a portion of the owner's group effort in this regard. Let's get the operator out of the loop and let these valves seat when they are supposed to and open when they are supposed to.

MR. MICHELSON: They relieve to atmosphere?

MR. SKILLMAN: Yes sir. These are the ASME code valves. They are able to take full lift speed pressure to protect the system for ASME section three.

MR. MICHELSON: There are no block valves?

MR. SKILLMAN: There are no block valves. These go right to the atmosphere.

What we wanted is the blow down range to be seven to nine percent. In some cases we have in fact overshot. We have done below that. We should not blow down that far.

MR. RUTHERFORD: Excuse me, let me clarify that. We found that the blow down is in the range of seven to nine percent. The original design was three to five percent. That's the reason the operator has had in certain instances to step in and lower turbine pressure so that valves reseat.

MR. SKILLMAN: In the final bullet there, we would like to get the main steam safety valve performance and the turbine bypass valve performance corrected to improve the post trip secondary pressure control. This ties into much of our

discussion yesterday regarding what parameter is being controlled. What we're saying here is we need to get the secondary pressure under control so as to get into a prompt energy balance post trip.

My sixty seconds are up.

MR. REED: Two points.

You recognized that main steam safety valves spring loaded have been around for a long time, and there have been a lot of people that have been annoyed for a long time about their malfunctions. You realized that taking on this effort --

MR. SIEGEL: Excuse me, at the point of being rude, I don't intend to be, but we have somebody that has to leave at 12:00. If you could defer your questions until after, we'll come back to them. If it's all right with you.

MR. REED: Should I put them in writing and send them tomorrow?

MR. SIEGEL: No, he's been waiting around he came back this morning with a quick schedule.

MR. DeBOR: Good morning. My name is Joseph DeBor. I'm with SAIC. I'm here to discuss the human factors evaluation of the reassessment program.

SAIC was tasked by NRC to evaluate the human factors adequacy of the B&W reassessment program. We had four tasks. We were tasked to review the operator/maintenance personnel

interview project. We were tasked to review the operating experience reviews, the procedure reviews, and the operator burden and sensitivity studies from a human factors perspective.

The review was conducted on behalf of NRC by SAIC, COMEX Corporation, and Carlow Associates.

The first task we reviewed was the operator and maintenance personnel interview project. We determined as a result of our review that B&@ had identified 11 very specific hardware problems, and identified concrete recommendations to go along with those hardware problems.

We also determined that B&W had identified six human engineering problems, but they didn't identify any concrete recommendations or follow-on actions as a result of their identification of human factors problems.

The operators and maintenance people identified, for example, ICS feedwater control of T-Ave is poor. That's a human factors problem. They also stated that it was difficult to tune a secondary system at less than 100 percent power. They also concluded that the delayed subcooling margin instrumentation was potentially confusing to operators during emergency operations.

Our concern was when we looked at this operator and maintenance personnel interview project that B&W was very good at identifying concrete solutions to hardware problems, but

when it came to man/machine interface problems, they didn't identify specific recommendations associated with them.

The second task we were involved in was the review of operating experience which was basically the review of the transient analysis program reports. We determined that B&W conducted a comprehensive review, and that the human factors issues were summarized and characterized appropriately. For example, human interface involved operations and operating procedures, surveillance and testing and maintenance issues, and they also identified problems associated with training and displays.

The third task we reviewed was the procedures review. This is basically the review of the ICS/NNI procedure, and we determined that B&W again identified significant human engineering concerns involving components and displays on loss of ICS/NNI. We also determined that the B&W recommendations for labeling and component modifications were appropriate, but they're very general and not plant specific.

The fourth task we reviewed, actually it was a combined task of operator burden and sensitivity analysis. We determined that the operator burden study findings are valid human engineering issues, and B&W recommendations were appropriate. We felt the assessment of the human engineering issues and their recommendations were quite valid. The top

human engineering concern identified under the operator burden project was the control of steam and feed flow on loss of automatic control. Then they went down the list through drastic operator actions such as being afraid to turn off the pump because they were afraid it wouldn't restart. The third item in the list was overcooling mitigation strategy. That's an interesting problem where the operators face the problem of whether they should overcool or undercool the plant in an emergency, and then they had a number of other problems and recommendations associated with operator burden.

MR. MICHELSON: Could I get a clarification?

MR. DeBOR: Yes.

MR. MICHELSON: You were looking just at the results of the owners group work on these 11 transients, is that right?

MR. DeBOR: That's correct.

MR. MICHELSON: You weren't attempting to think or look or wonder about accident situations and so forth. Just the transients.

MR. DeBOR: That's correct. SAI only looked at the products produced by B&W as a result of their review of the six transients.

MR. MICHELSON: So even looking at those particular transients the operators were worried about during a transient of stopping a pump that they might have to restart, that sort

of thing?

MR. DeBOR: Yes sir.

MR. MICHELSON: Thank you.

MR. DeBOR: The second part of task four was the sensitivity study. The B&W sensitivity study we concluded was comprehensive. We determined that the B&W recommendations imply far reaching man-machine interface changes to the control room. One of the ones that sort of startled me was the elimination of anticipatory reactor trip on turbine trip, which I learned yesterday from Dick that B&W decided to shelve that idea for whatever reason, that they're not going to pursue it. But that's a very significant man/machine interface problem if they do decide to pursue it. They made a number of other very general recommendations such as reducing the probability of overcooling on turbine trip.

Our overall assessment of the B&W findings was that the B&W studies did in fact result in valid human engineering concerns. However, because we determined that human factors professionals were not involved in the reassessment effort, the completeness of the effort in identifying human factors concerns is uncertain.

The second conclusion is that the proposed corrective actions imply very significant changes in the man/machine interface environment in control rooms, but they are very general and not plant specific.

The proposed corrective actions also do not have any specific implementation dates associated with them.

MR. MICHELSON: Can you give me an approximately example of a significant change to the man/machine interface just so I can get a feeling for how significant we're talking about?

MR. DeBOR: If they decided to eliminate reactor trip on turbine trip, that's a very significant change.

MR. MICHELSON: I thought that, the second bullet is the one I'm referring to. I thought that you were talking here about the bench board changes or something like that. Is that not what's being referred to?

MR. DeBOR: Yes, they are planning --

MR. MICHELSON: Besides the anticipatory trip question, give me another example of a very significant change to the man/machine interface.

MR. DeBOR: Planning to review the enunciator systems and make changes to the enunciator systems, dividing up multi-point enunciator alarms. They have recommendations to reduce the probability of overcooling the plant. In order to do that they have to go through a very significant process, by looking at issues such as the emergency feedwater initiation control system and determining if that man/machine interface is appropriate to the tasks that face the operator on an emergency.

MR. MICHELSON: That's a little different than I understood from the bullet. I thought they had already in mind some very significant changes in the man/machine interface itself.

MR. DeBOR: A lot of the recommendations are very general. They're interested, they, the owners group, have asked me individual plants, to review issues such as the drastic actions issues, and then take plant specific action based on the plant specific reviews.

MR. MICHELSON: Thank you.

MR. WYLIE: On your first bullet, can you point to a significant deficiency in the review that warrants the professionals being involved in the process?

MR. DeBOR: The problem with the process as it was undertaken by B&W is they only looked at a small set of transients. They looked at their six Category C transients. We over the years have been working with a number of B&W plants on detailed control room design reviews where each of the plants had human factors staff participating in a multi-disciplinary team to look at comprehensive sets of operator tasks during emergency operations.

MR. WYLIE: That was the result of a TMI action plan. As far as I know all the B&W units have adhered to those, have they not? Conducted human factors reviews? That has been done.

MR. DeBOR: They have conducted them.

MR. WYLIE: What I read in what you say is there are significant deficiencies out there that weren't looked at. I'm just asking you the question can you point to one.

MR. DeBOR: We can't point to one that is a significant deficiency. As I've said, the human factors deficiencies that were identified are valid. Our only concern is that --

MR. WYLIE: You didn't look under every rock.

MR. DeBOR: Since they didn't have the same type of people who participated in the control room design room use, were very familiar with the control rooms and issues that operators were concerned about, or a comprehensive set of operator tasks, they really didn't take advantage of those people who had that comprehensive knowledge of the control room and the operator tasks in emergency operations.

Each of these plants has a group of human factors operations and design engineers who designed the modifications to their control rooms as a result of these detailed control room design reviews. These people, at Rancho Seco for example, looked at systems like the emergency feedwater initiation of control system. When that system was first proposed at Rancho there was no manual override for the epic system. It was strictly an automatic system that was being implemented in the control room. The operators and the

control room design review human factors people said we need at least a manual override for this, so consequently they got approved panels and they saw the problems that operators were facing.

We were just a little disappointed in the fact that these people, the people who have had so much experience with the control room design and the modifications that are being implemented over the next few years weren't included in this study. I think a major recommendation that we made out of this study was for B&W to include human engineering experts such as those who participated in the development and modifications resulting from the recent control room design reviews as members of the modification teams, when these recommendations get to the point where they're actually going to redesign panels and systems, include very experienced human factors people in those designs.

MR. MICHELSON: I think, Charlie, they're saying if you don't hire snake hunters to look for snakes you may not find any.

MR. WYLIE: They might bite you.

MR. MICHELSON: Well, that's the only ones they'll find are the ones that jump out and bite you. But we hope we don't have too many of those cases.

MR. WYLIE: I agree.

MR. WARD: By the same token, we don't rely on

mechanical engineers to review electronic designs, even though they might be able to do it more or less capably by the seat of their pants or something. I think there is a prevalent view that somehow human factors engineering is not a disciplined engineering art, and I think Mr. DeBor is saying that it is and it's problems that human factors engineers have learned to deal with that create much of the residual risk in nuclear power plants. It's kind of foolish not to take advantage of the technology that exists. I endorse what you're saying.

MR. DAVIS: I have a specific question. One of the important conclusions that the owners group came to, according to their report on page 311, states the following: "Operators may be at times reluctant to take what they consider to be extreme actions, such as feed and bleed cooling initiation."

Did you examine this issue? This looks like an important one to me because if credit is going to be taken for feed and bleed, then the operator should be well aware of when he needs to initiate it and not be reluctant to do so when it's required.

MR. DeBOR: That falls into the issue of drastic actions. Again, the owners group has stated that yes, there are problems where drastic actions present an operator burden problem. The owners group sent a very general recommendation out to each of the plants to look into the issue of drastic

actions. What does the plant actually do when they get this recommendation from B&W on feed and bleed and other issues where operators are really reluctant to take the action required?

What I suggest here is that each of the individual plants needs to bring that human factors person back into the loop and review these issues on a plant specific basis and participate as part of the overall team to develop a solution to the problems.

MR. DAVIS: I guess what I'm asking is you didn't look specifically at the instructions the operator goes to for feed and bleed cooling to see if they are appropriate and would help him get through this activity?

MR. RUTHERFORD: Let me respond to that. Maybe I can clear up that issue a little bit for you.

You've really got two parts to this puzzle. First of all, are the drastic actions you've got in your procedures correct? Are they being taken at the right time? Second of all, the operator reluctance, perhaps, to act in accordance with this procedure. We're addressing both of those concerns, one being a technical concern, and the other being a management/training concern.

MR. DAVIS: But isn't this beyond the scope of the present study?

MR. RUTHERFORD: No.

MR. DAVIS: I thought you stopped before you got to two phase in your primary system, which is when you really need to be sure feed and bleed is going to go.

MR. RUTHERFORD: As I mentioned, there are a lot of things we're doing that cut across a lot of different events. We didn't say okay, we get into two phased flow here so we're going to stop and we won't go any further. When we saw this as a concern, we --

MR. CATTON: From a sensitivity point of view, do you think a dried out steam generator would unsettle an operator more than one that still had some water in it?

MR. DeBOR: Obviously a dried out steam generator creates a problem for the operators in B&W plants. For those that have done task analysis on B&W plants, they know that it does, the plant operates a little faster and it can present a problem, yes.

MR. RUTHERFORD: Let me offer a comment here, too. If the operator understands his system and the time he has available and the scenario that he's in, obviously he's going to be in a somewhat stressful situation there, no matter what the plan -- feed water. But if he has an understanding through his training, I don't think there's going to be a material difference.

MR. MICHELSON: Does he have any precautions on how fast he can reflood that dried out generator from a thermo

shock viewpoint?

MR. TAYLOR: I think the only precautions, Carl, would be related to his normal precautions on tube to shelf Delta T. But you've got to remember that the once-through steam generators are 90 percent dry at full power. When he introduces off-speed water, that's always into the dry part of the generator.

MR. MICHELSON: But there are no restrictions on how quickly --

MR. TAYLOR: Except for tube to shelf Delta T's.

MR. MICHELSON: He is restricted on that?

MR. REED: Since this is a good time to throw a barb on an old issue of mine, when you talk of training operators, there are all kinds of personalities. There are nervous personalities, and those that don't hardly react to a tornado in their own backyard. I wonder if in this human factors aspect and in this stressful scene of responding to, taking action for a bleed and feed, if it's important to you in human factors to know if the people have been aptitude tested and personality evaluated? The operators, that is, that are going to take this action.

MR. DeBOR: Well, all of the operators have been through a training program.

MR. REED: Training doesn't do anything to personality embedded in their characteristics.

MR. DeBOR: You're asking have they been given psychological tests that --

MR. REED: Personality evaluation and aptitude tests.

MR. DeBOR: That's an area that I haven't worked in. We're reviewing now, as part of another project, the adequacy of the emergency operating procedures at a number of plants. That gets into some of the training areas.

MR. REED: I might point out in this comparison that I know the Oconee people were aptitude tested and personality evaluated.

MR. DeBOR: I'm not familiar if there is a specific requirement to do that.

MR. REED: You're being made the goat for a longstanding argument. (Laughter)

MR. DeBOR: It is an important issue, and certainly in Navy operations those tests are there and have been since the onset of the submarine nuclear program, but I'm not familiar with the status of those on the land-based ones.

MS. RAMEY-SMITH: Anne Ramey-Smith. I'd just want to make a general point here. The focus on the part of staff in this regard, you may be well aware, is rather than addressing the aptitude, personality testing, and such as that, to rather go into the field of human factors where you have proven means of reducing stress and improving

performance. So rather than before the fact determining how someone will react in a situation, rather we try to present each one of the operators or maintenance personnel or whoever it may be in a plant with a situation that has been proven empirically to reduce stress and improve performance. So therefore we come up with guidelines for improving and upgrading emergency operating procedures, providing a physical environment in the control room that is conducive to improved performance, improving human engineering layout of the control room so it doesn't all look stereotyped, and things of this nature. Just a general comment.

MR. RUTHERFORD: One other general comment here, I think we all can talk about "the operators" and what we're really talking about here is a team of people that work together to solve an event versus this one lone individual who is hung out to dry, so to speak.

MR. DeBOR: If there are no further questions for me, Chairman Wylie and Gentlemen, thank you very much.

MR. WYLIE: Is the owner's group going to address this?

MR. SKILLMAN: I would like to in the next few minutes point out the owners' point of view. In the area of SPIP review of B&W owners and the staff were in substantial agreement with one another. There were two areas where we had some disagreement. We had some disagreement regarding the

process, ICS/NNI review, and the content in terms of the human factors area.

I'd like to remind myself of what the purpose for SPIP was. The purpose for SPIP was to assess the risk significance of the complex transients and define actions which would reduce the frequency of trips and reduce or eliminate complex transients altogether. I explained the system by which we graded those transients. In other words, we have a thick magnifying glass to sort out normal performance from unacceptable performance. The unacceptable performance is the C behavior trip, the significant B's are also not wanted. In any case, we want to get rid of or eliminate complex transients, and we want to knock out the trip frequency. We see the plant in the early minutes following complex transient response clearly at risk, particularly if it's an overheating event. And because in one trip out of five we have a complex response, significant B or C, knocking out the trip frequency helps in terms of total risk reduction.

We accept and acknowledge that human actions can affect, and I would add significantly affect, transient behavior because of the interactive exchange that the operator erring, making a transient perhaps more complex, ending up with still a different situation to deal with.

We did consider human factors concerns obviously

not to the satisfaction of the staff and extent, but we did consider it. But they were not a dominant consideration. We were going after overall plant behavior. We make no apology for that.

We believe that our actions have or will consider human factors concerns appropriately, and I'll get to that in a minute. Review of the staff report, SER December '87, chapter 7, identifies three basic concerns, and I'd like to talk about those.

These are the concerns in the safety evaluation. The review of human factor activities on loss of ICS/NNI power. We acknowledge that that is significant.

The staff would like for us to have used human factor expertise in the operations and maintenance of personnel interviews. They would like us to have used human factors expertise in review of the old TAF reports. They would like for us to have used human factor expertise in review of the 1985 Davis-Besse event. And they would like for us to have used human factor expertise in the review of operator burden.

A third comment, there should be human factors involvement in the implementation stage of the recommendations implemented by the B&W owners.

Loss of ICS/NNI power is a major event for us. It has been in the past. Four of the thirteen Category C's have

involved loss of ICS/NNI power. Clearly the operator significantly pressed a loss of ICS/NNI power. Our position is we have already taken actions to address that. Probably the most important recommendation we've made is the known safety state recommendation which has as its functional intent settling the plant promptly following loss of ICS/NNI power, but as important, knock off that event in the first place to prevent the ICS from losing its power sources.

Longer term actions are being considered with regard to ICS/NNI in accordance with the advanced control systems project that Larry Stolter pointed to yesterday. So our response with regard to the recommendation one of the staff to do something about human factors ICS/NNI, we believe that we have done that. We believe that we have in fact considered the human factors portion of this as the most important. That is getting the plant to where the operator can control it promptly, but we did not use human factors expertise to get there. We used the review by our own people in the plants, our own operators, our own ICS/NNI people to steer us in this direction.

With regard to the second grouping of concerns expressed by the staff: operations and maintenance interview data. The staff says we should have used human factors expertise to re-review, I want to punctuate, re-review the operations and maintenance personnel interview data. We've

identified six concerns in the operations and maintenance personnel interview data. Those are being concerned. All the owners group members are supporting INPOs HPES or its equivalent. Our position is that re-review of the operations and maintenance personnel data which now is two years old would just not be of significant additional benefit. We have already gleaned from the operations and maintenance personnel interviews that information which has been evasive, exists for recommendations, and we think it's appropriate to move on and simply not review that data.

The second piece of recommendation two regarding human factors expertise in the old TAF data reports, our position is that the TAF data reports have been immensely helpful in SPIP. They've given us the data base from which to steer into the areas that have been of significant plant performance and concern. Up until this time, collecting human factors information has not been part of the TAF activities. We're developing guidelines to weave into future TAF activities. Items pertaining to human factors.

Regarding the Davis-Besse event. There were certain generic concerns, human factor concerns from the Davis-Besse event reviewed by each utility, i.e. vital equipment accessibility, local versus remote control, clarity of instructions to take drastic actions. We've touched on a whole host of these already, but as in so much of SPIP, it's

invisible. Human factors things are there. If you go back to the recommendations regarding main feedwater, the bulk of these have to do with elimination of items that are truly operator burdensome. Particularly in the secondary plant relief system. Getting back into the control room, the controls that are approximate to the position of the operators so they can regain manual control post trip.

We'd offer to you that for lack of any other name, these are truly human factors items, although we didn't use human factors expertise to get there. If I can argue just instantly with one comment, and it's not a big issue. Mr. DeBor said it's unfortunate that the people who run these plants weren't involved in these reviews. My counter to that is the very people who run the plants, the operators and the people in the control room, our operations and maintenance personnel from each of the plants, were the ones who built the recommendations in the first place. They were the ones who were saying we have this problem, fix this problem for us. that's what SPIP is doing. It's addressing those problems of those people who said, for instance at Rancho Seco, "I couldn't control that. I had to go outside in the freezing cold winter air to try to fix that thing," and bango, one man collapsed. Part of these recommendations have to do with that incident.

So our response is, yes sir, we did not use human

factors professionals. But we used people who understood the problem and who understood what it is like, the operator burden to the point of not being able to manage the post trip plant behavior. We're fixing that.

Operator burden data. A very important point we like to make. We did in fact use a human factors expert to develop the methodology for the operator burden project. If you recall yesterday when I talked about operator burden, the point that I made is we did not do a relative burden comparison. We did not say that a Babcock plant with this upset, how many galleries of operator energy go into worrying about the response and taking strong action in the control room of a Babcock plant versus a Combustion plant versus a Westinghouse plant? We didn't do that. We said is the operator able to handle this plant? Is the team that's in the control room able to steer through this event?

We did six Category C events and laid them on each control room in the Babcock plants, all six plant sites. We defined actions where the operators perceived that they had problems, and we are pursuing those. The types of things that come out are control of steam and feed flow, the drastic actions issue, overcooling mitigation, concerns regarding instrument air, actions to be taken outside the control room thus leading to bringing controls back to the proximity of the operator, enunciators, how many there are, how much

information comes in promptly, how much can be seen, how the information is segregated, and what's common? And the emergency plan requirements, notifications and things of that nature.

Our belief is that we used human factors expertise right up front on this. We can discuss that with the staff later. We sense that this may not have been recognized.

Finally, would re-review of the operator burden information be beneficial or sensitive? Not significantly so. Clearly there might be some small benefit, but we think in the overall scheme of things there is no real substantial benefit to redoing the operator burden piece with human factors professionals. That doesn't suggest that professionals couldn't bring something to it. We just think there is not enough additional benefit to warrant it.

Finally, human factors involvement, human factors expertise should be involved in recommendation/implementation in each utility. It may be used on a plant-specific basis, and would be used depending on the subject of the recommendation. If the recommendation is a cut and dried, hardware issue, we certainly won't use a human factors expert. But if whatever it is that we're getting into has to do with the control room, has to do with what the operator is going to do versus what he otherwise would have done, involves emergency procedures or re-orienting procedures and their

connection to the behavior of the plant, we might. But that's at the call of the utility, if they judge that appropriate.

In closing, we concur that human factors considerations are very important, but we would also bring to your attention, to the staff's attention, the way in which the recommendations knit with each other, if you will, relate with each other, and relate to the operator and to the control room, we feel as if we really put our finger upon this human factors area. We're placing more emphasis on human factors now than when SPIP began. We believe that there is little benefit to re-review of old information. And clearly, human factors, particularly in the operator burden area where we think the greatest benefit comes from, human factors involvement, human factors was involved, was a major part of the safety performance program.

That's all I have to say.

MR. WYLIE: Any questions?

MR. MICHELSON: Can I ask a question of the staff on this subject? The staff seemed to have made a pretty strong point of the importance of human factor involvement in the analysis of these situations and corrective action. I was just wondering, the agency's principal evaluator of such experiences is AEOD. Do they have on their staff so-called human factors professionals? Do you know?

MS. RAMEY-SMITH: Yes. The answer to that, from my

perspective, is that no they don't, and yes they should. Just as other parts of the agency also should have people in operating events, evaluations, and so on.

MR. MICHELSON: So really we should be pushing this at home as strongly as we seem to be pushing it outside the agency if we really believe it.

MS. RAMEY-SMITH: And that's what we're trying to do.

MR. MICHELSON: I didn't think they had some experts, but I'm not always up to date on that.

MS. RAMEY-SMITH: As a matter of fact, just recently I was told that the office director for AEOD has become very interested in the whole area of human factors and intends to, I don't know whether increase his staff, but certainly to increase his program to better look at human performance aspects of operators.

MR. MICHELSON: Is it going to do you much good to operate in a branch dedicated to human factors? That's not where the action really is. It's the same way with B&W. I'm not advocating it one way or the other, but I was kind of curious to see if the agency was following through on what it seems to strongly believe in.

MR. WYLIE: Mr. Hammer?

MR. HAMMER: Again, my name is Gary Hammer. I'm from NRR. I looked at some of the valve reliability issues of

this review as sort of a sub-task to Bill LeFave's system review. This is the only slide I have. It's sort of a synopsis of the different areas we looked at that Mr. Skillman also talked about a little bit.

Main steam safety valves, multi-operated valves, power operated relief valves and block valves, and check valves. On main steam safety valves, there were several areas of improvement that the B&W owners group came up with. They involved these items: Improving performance of the valves for better setpoint procedures, ring setting adjustment procedures, and better maintenance. All of those areas are something that the staff is interested in in a generic sense, a little broader than just B&W concerns.

I guess the emphasis for the B&W plants on improving valve reliability for the main steam safety valves was due to the fact that there's a more frequent and greater challenge of those valves.

Some of the things they looked at were to try to reduce the challenges that Bill LeFave talked about. One of them was to possibly increase the turbine bypass and atmospheric vent valve performance either by making the valves bigger or improving the control systems associated with them.

Along with that they also looked at reducing the challenges by increasing the so-to-speak simmer margin of the valves, by raising the MSSV setpoints. This was not

encouraged because it would not only violate the ASME requirements of having the safety valves set at the design pressure, and what this would effectively do is increase the design pressure in the system. It would also reduce by some amount the intended system margin, the stress margin. We didn't want to see that as a very active pursuit in accomplishing their goal of improving the safety valves.

This did get folded into a valve task force that's to be done later. I think someone mentioned a little earlier that they hope to have the report by August. We did receive a commitment from them that that would be submitted to us and we did want to look at it.

MR. KERR: Excuse me, would you go over again please why it was that you did not find their proposed method of approach appropriate?

MR. HAMMER: Concerning the third bullet, I guess, is what you're talking about. Increasing the setpoints.

MR. KERR: Yes.

MR. HAMMER: If you increase the setpoint you will increase the simmer margin, so it's called, between the normal operating pressure and the valve actuation setpoint by raising the setpoint at a higher level. So you will reduce the number of times that the valve will actuate. For some of the milder transients where you would be able to take care of the old pressure transients by some of the other mitigating pressures

of the plant such as the turbine bypass system and some of the other things.

The problem with that is that it, in raising the pressure of the system you reduce the margin to failure of the system due to over-pressure. The ASME code specifically addresses that.

MR. KERR: It addresses what? You mean what they were doing is a violation of the ASME code?

MR. HAMMER: By raising the setpoint of the valves above the design pressure of the system, yes. That is specifically addressed by ASME.

MR. KERR: I'm surprised that the licensees would recommend something that they knew violated the ASME code.

MR. RUTHERFORD: Comment please. This was a suggestion to look at whether we could raise the design pressure. If we did that, we would have to go through the appropriate calculations to show that indeed the design pressure of the system could be raised, and then we could change the setpoints accordingly to be in compliance with the ASME code.

MR. KERR: You didn't understand that they were going to do that?

MR. HAMMER: We didn't want to encourage them to do it because it looked like something that would raise a whole lot of questions in terms of things like actual material

properties of the system, some of the problems we've seen with erosion/corrosion in the secondary system. In other words, actually knowing what the material thicknesses are.

MR. KERR: Did you actually do some sort of balance and said the risk reduction that might be achieved by this is less than the increased risk that would be caused by raising the design pressure?

MR. HAMMER: No, it was more in a general qualitative way. We felt the other things that they were going to do to improve main steam safety valves would probably improve the performance of the system enough without getting into this.

MR. KERR: So you have no particular reason to make this decision except it's sort of a good feeling?

MR. HAMMER: Right.

MR. RUTHERFORD: We're not currently pursuing this option.

MR. HAMMER: I might say, this whole thing is still sort of up in the air. They have it wrapped into this valve task force.

MR. KERR: It puzzles me a little as to how decisions are made in an area where there are obvious tradeoffs. I was really seeing if there was anything as a basis for the decision other than it looked difficult. So be it.

MR. MICHELSON: Are they downstream or upstream of the main steam --

MR. HAMMER: I think for all practical --

MR. MICHELSON: It's either up or down. It isn't in between.

MR. RUTHERFORD: It's near by.

MR. MICHELSON: I sit upstream of the valve or downstream of the main steam isolation?

MR. RUTHERFORD: It's upstream of that, I believe.

MR. MICHELSON: The atmospheric dumps. Are they downstream of the main steam isolation valve, or upstream?

MR. RUTHERFORD: They would be upstream, I believe.

MR. MICHELSON: I don't know. They can be either way. The safety valves are upstream, obviously, they have to be.

Now these 16 valves you've talked about were main steam safeties, don't they open only after the atmospheric dumps have already opened and handled the transient?

MR. RUTHERFORD: That's the way they should work.

MR. MICHELSON: So in addition to opening all the atmospheric dumps you still have to open nearly all the safeties on a trip from full power?

MR. RUTHERFORD: It depends on whether the valves are groaning open because they're full of clap trap, or whether they're operating properly.

MR. MICHELSON: But even if the atmospheric dumps are handling the transient you still have, even though they're there and they all open, you still have to open a bunch of safeties. I used to think that the atmospheric dumps were supposed to preclude the opening of the safeties, but I think on Westinghouse and CE that is the case, I thought.

Now what this is leading to is another question. Are you allowed the same primary side activity level as other PWR, Westinghouse and CE?

MR. RUTHERFORD: Yes.

MR. MICHELSON: And you're allowed the same amount of steam generator leakage and still operate?

MR. RUTHERFORD: Yes.

MR. MICHELSON: But yet your leakage may all be up above the water line which in the case of other plants it's always below the water line, and you're just going to have quite a bit more release when you trip from full power because you're going to release a lot of steam to atmosphere on a full power trip. If you're allowed to operate at the same activity level and the same leakage rates. I hadn't thought about that, but that's kind of interesting.

MR. REED: Carl is encroaching upon my questions that were deferred. Is this now the opportune time for me to ask my questions even though the speaker is a staff speaker rather than B&W? If so, I will proceed with my main steam

safety valve questions and observations.

I started out by trying to say that main steam safety valves have been around a long time, spring loaded type, and they've been worried about for a long time, and they've been tuned for a long time, and they've been designed for a long time. A task force on main steam safety valves, if it gets into a closet of the nuclear closet, which many times this has happened in the past, that people have designed it in the nuclear closet without reviewing total history, they will probably not have much success. And even if they were the smartest task force in the world and they went outside the closet and throughout the industry, I'm not sure that in the final analysis they will make much headway in improving main steam safety valves. End of statement on that.

Now, B&W in yesterday's presentations, said that inventory wasn't a big problem or a big disadvantage by comparing inventory to the other reactors. Now I'd like to point out that if in fact these safety valves lift, as he said, every higher power level trip, then what's causing them to lift? Is it delayed tripping of the reactor? Is it the inventory? I sort of suspect it's the inventory, and that claim that non-advantage, no disadvantage is probably not realistic.

Now to get to something Carl was starting to open, there are radioactivity inventories in the secondary side of

the steam generators. If the release of this radioactivity, however small it may be, it doesn't concern me but it would concern the regulatory staff, if the release is by main steam safety valves, it will be labeled at uncontrolled and unmonitored, probably, release, and unquantified release.

So therein, with these valves opening every trip you have a very serious regulatory issue with respect to quantifying and accounting for the radioactivity. Quite frankly, I think it will keep a couple of people busy.

MR. HAMMER: Let's see. The next item is the motor operated valves and other power operated valves. There were several recommendations made by the owners group which enhanced, which if implemented would enhance the performance of motor operated valves and power operated valves. The key thing there was that they were looking at including all of their safety-related valves in a program that would be consistent with Bulletin 85-03 which for those of you not familiar with Bulletin 85-03, it required diagnostic type testing and limited torque switch setting improvements in order to handle high differential pressure loads and other type loads to make sure that they would operate properly. That bulletin only addressed three systems, though, which were the EFW, and AFW turbine supply, and high pressure injection.

What they're recommending here is to include all the other safety-related valves in such a program. That's also

getting folded into the valve task force so we'll be seeing more about that a little later.

The next item is power operated relief valves and block valves. They're recommending an increased maintenance and testing in order to improve their reliability with some recommendations. That's going to be consistent with the draft standard OM-13 which really isn't officially on the street yet, but which we, the people involved in that including myself on the staff, are in agreement with in terms of that being a good document.

MR. DAVIS: Excuse me, I have a question on that. Do you know if the plants operate with their block valves open or closed normally?

MR. HAMMER: I think you find a mix on that. If you look at the tech specs for most plants, they're able to operate with the block valves closed if they remove power from it. That keeps them from exceeding leakage limits.

MR. DAVIS: That would affect the reliability of bleed and feed?

MR. HAMMER: Yes. I should say, GI-70, generic issue 70 which is being pursued in the office of research, is looking at reliability of power operated relief valves and block valves. Improving the technical specifications is one of the things they're looking at in that, and they don't have a complete resolution to that yet, but there are things that

should be done to improve it.

MR. DAVIS: Thank you.

MR. HAMMER: The last items is check valves. As many of you are aware, the industry is experiencing a number of check valve problems not only with B&W reactors. There is an industry initiative going on to improve check valve reliability. There was an INPO SOER issued which contains some guidelines, that was number 86-03, which addressed design, operation, and maintenance of the check valves. In terms of improving the stability, wearing characteristics of the check valves, ensuring that they're tested properly and things like that. That's also been folded into the valve task force. If those things are implemented, that would be a significant improvement of the check valves.

MR. DAVIS: Excuse me. Are these check valve problems that you referred to leakage, back leakage, fail to seat, or stuck open?

MR. HAMMER: It's been a variety of things. Most notably it came about, one of the big events was not at the B&W plant but at San Onofre 1. They had a severe water hammer due to failure of many check valves, including high pressure and low pressure interfacing system. It was a very serious event. But there have been several check valve problems in the industry.

MR. JONES: This is Bob Jones of the staff. Two

comments were made I'd like to address. Dr. Kerr, on how the staff based their decisions, we said we didn't encourage pursuit of this modification to raise main steam safety valves. What we said was pursue the other options first. That by changing the design pressure of the system, possible reliance on actual thicknesses of the pipes, etcetera in order to demonstrate code compliance we didn't think that was the beset way to go. We were saying please don't pursue that first. We'd rather you go look at other ways of improving the overall system performances to make sure the main part of the system is functioning properly before you start eating into design. So it wasn't just quite an arbitrary statement or if you wish, decision on our part.

While we didn't do a risk study, what we really did was look at the overall system as a whole and say there are other options available which we think are better to pursue first, and thus we did not want to encourage this at the front end of putting together a valve task force.

MR. KERR: Very good. I'm reassured.

MR. JONES: Mr. Davis, the comment on reliability of feed and bleed with respect to use of the PORV, for the majority of the B&W plants, they do not need to rely on the PORV for feed and bleed. They can rely on just use of the safety valves. Davis-Besse is the exception on that, however.

MR. MICHELSON: But they have to stay at full

pressure to use the safety valves.

MR. JONES: Yes, they would. And I'm sure in a pure risk sense there would be some impact. But in the initial core-cooled impact, whether or not the valve was in fact reliable or not or whether you had the block valve closed, which I take is your question, would probably have a small impact on the overall reliability.

MR. DAVIS: You're saying the charging point shut off head is above the safety relief point?

MR. JONES: Yes. On most of the B&W plants they're around 2700 to 2900 PSI.

MR. MICHELSON: The picture gets pretty complicated, though on the steam tube rupture case where you really want to start getting the pressure down and you may have to go to feed and bleed if the natural circulation isn't doing the trick or whatever. Then I don't know quite how you handle that.

MR. JONES: On the multiple-tube rupture scenario and losses of off-site power and those types of things you may end up using the PORV's under those circumstances..

MR. REED: Those pressurizer safety valves, are they loop-sealed safety valves, or are they spring loaded safety valves without loop seals? Just what are those?

MR. JONES: Those are spring loaded without loop seals.

MR. REED: How would you expect their reliability to

be with respect to the reliability of the main steam valves? Similar?

MR. HAMMER: I can address that. There's a separate issue that the staff pursued for the pressurizer safety valves. That's a TMI action. In that, there was a large generic test program to show that the valve discharged correctly, the correct capacity. And the adjusting rings were set properly and things like that.

MR. REED: I might point out that for some time I've been concerned by the claims of all the manufacturers and owners that bleed and feed cooling is a really viable way to do it, or is it viable? I'd like to hope that it is, but I do not believe there has been rigorous evaluation and testing of bleed and feed cooling, and I would expect, my guess would be, that it hasn't been done for PORV's rigorously, and I've asked many times the staff for a test program. It hasn't been done for PORV's rigorously, and it hasn't been done for spring loaded safeties which I think will be more of a problem, much more of a problem, than certain kinds of PORV's.

MR. JONES: Let me make one comment with respect to the reliability of feed and bleed. We do not credit feed and bleed in demonstrating compliance with the regulations. We view feed and bleed for something that is useful in emergency procedures, in the event that you should have a loss of all feedwater, to provide a means to keep the core cool while he

attempts to recover his feedwater system, and get back on the normal cooling mode. We do, however, give credit for it in the risk space, in trying to determine whether or not the fact that certain other safety issues, we do do it there, certain safety fixes. But from a regulatory standpoint there is no credit given to feed and bleed. We looked at feed and bleed in the context of this overall assessment because it had a bearing on the overall risk of the plant. But we do not give credit for the regulatory sense.

As Bill LeFave mentioned earlier today, in looking at things like feedwater reliabilities and how to resolve the issue of reliability of two pump AFW plants, we're not giving credit for feed and bleed. We are giving credit for standby pumps which will be useful to get water back to the steam generator, but as a means for decay heat removal for that issue, we're not giving credit for it.

MR. REED: It's very unfortunate that you aren't, and it's very unfortunate that we do not move forward to rigorously evaluate the merits of bleed and feed or primary blow down or whatever you want to call it. That's very very unfortunate.

MR. WARD: As the years roll on and we keep hearing the same sort of thing, I'm getting less and less impressed by the distinction between regulatory space and risk space. I don't care two cents for regulations unless they control risk

in some way. That's really what we're interested in. I agree bureaucratically there's a distinction, but I don't think this committee is all that impressed with --

MR. JONES: What I wanted to make of one, there wasn't an impression left that we are, in evaluating the safety of these plants in response to transients, that we're crediting feed and bleed as the fantasy or the save-all for these plants, because we're not. What we're crediting is reliable feedwater systems. We recognize that a means of decay heat removal is there. What we want to assure is that the feedwater systems are reliable and they take the actions there as a very specific example. I understand the comment that it is frustrating at times when you run feed and bleed into the risk studies, you do run some problems in back fitting.

MR. REED: Do you realize you just shot down another bullet of yesterday that B&W, where they claimed that superiority or equivalency because they had a better bleed and feed system and were not relying on the emergency feedwater system?

MR. JONES: I don't remember the specific bullet they had, but from the sensitivity evaluation which is the area it came out of, what they said is they were equivalent, or at least what the MPR study came up with was they are equivalent in terms of time available to initiate an

alternative means of heat removal in the event that they lost all feedwater. Or at least that's what they should have been saying. I could find the right quote in here and know what it is. We evaluated that and we generally agree, that is a true statement. If you've lost all feedwater on any PWR where you go to is feed and bleed ultimately. Under those circumstances, B&W has approximately 40 minutes of combustion engineering plants with the low head HPI's on the order of 20 and 25 minutes, and the Westinghouse plants are in the 100 minute time frame. That's a wide disparity, but it's at least in the middle. Certainly they do not stand out in the event of a loss of all feedwater event, that there is something from a time standpoint they have to take drastic action.

MR. RUTHERFORD: That's a correct summary. We did not state that we don't depend on emergency feedwater. What we said was that it is a backup in the case where you do lose all sources of feedwater.

MR. MICHELSON: Mr. Chairman, I'd like to ask an unrelated question to this, but related to valves.

MR. WYLIE: Go ahead.

MR. MICHELSON: I'm wondering if B&W could give us maybe about a one minute explanation on why so many safeties seem to open on B&W plants but do not have to open on other types of PWR's? What's unique about B&W that so many safeties open on a full power trip?

MR. RUTHERFORD: It's the inventory advantage.

MR. MICHELSON: It's not intuitively clear to me why that should be the case.

MR. KANE: My name is Ed Kane from B&W. The question, as I understand it, is why do safety valves open on B&W plants versus not on other plants. There are several differences. I'm going to have to speak from my assumption on operations of certain parts of the Westinghouse plants or the non-B&W plants, and you'll have to forgive me there.

The recirculating steam generators that have full power operate at a larger temperature difference between the normal operating set point or pressure difference in the secondary side, between the pressure at the 100 percent power on a recirculating steam generator, and the main steam safety valve set point. That's correct, right, on the Westinghouse plants? That pressure difference is on the order of 200-300 pounds if I'm not mistaken.

MR. MICHELSON: The main steam pressure is about 300 pounds higher?

MR. KANE: Their pressure drops as they go up. Ours are constant.

MR. MICHELSON: Super heat effects?

MR. KANE: We operate at a constant 900 pounds pressure in the steam generator over the total load range, where there's drops as they go up a pound.

MR. MICHELSON: That's part of it.

MR. KANE: I'm going to continue on. The early designs of the B&W plants operate in the range of, with turbine bypass valve and atmospheric dump valve capacity ranging from somewhat over 15 percent to around 30 percent. Most of the non-B&W plants operate significantly greater than that. The TVA plant, I understand, is about 80 percent turbine bypass atmospheric dump capacity.

MR. MICHELSON: That's like the -- turbine bypass.

MR. KANE: This is in relation to the question of why there are more. So the TVA plant, for example, the later generation of the B&W plants, would not get the large number of reliefs, in fact the BBR plant in Germany, my understanding is they do not, the main steam safety valves. So you've got a much larger capacity to turn it over even on a later generation B&W plant, so you do not get the lifting of the safety valves.

The second reason, as I pointed out earlier, is the larger pressure difference between the 100 percent operating set point and the lift point. I think it's about, my numbers are around 250 to 275 pounds on a typical Westinghouse plant; 125 on a typical B&W plant. So you have larger capacity for turning around quicker and a larger differential.

MR. MICHELSON: You're running a lot closer to your set points in other words.

MR. KANE: Just as a point of reference, that was one of the reasons why it was suggested we look at potentially increasing the setpoint. We're also looking at other alternatives as pointed out to not do that, but to keep from --

MR. MICHELSON: Are there any other significant differences?

MR. KANE: Those are the ones that come to mind right away.

MR. MICHELSON: Those all make sense. I understand.

MR. REED: I am concerned that you do not mention the secondary site inventory.

MR. KANE: That shouldn't be a problem. That does not really have a significant impact on the results. As I indicated, our BBR plant which has 100 percent capacity does not let the safety valves, on a normal reactor trip. Obviously if you have other things going on you may cause them to let, but the inventories per se on a normal reactor trip, as long as you keep inventory in the generators and you can remove the heat through another means, steam path to the condenser or whatever, will turn it around.

MR. REED: Well it's the first time I've heard that inventory doesn't have anything to do with cushioning of transients.

MR. KANE: What I'm saying is they're sufficient

there that if you have other means of getting the steam out of the system, given the amount of heat there, it would do that.

MR. MICHELSON: You've got so many BTU's you've got to move out somehow.

MR. SKILLMAN: In response to Mr. Reed's comment, the inventory question is important because if they stick open -- safety valve on an RSG type plant, you have immensely more inventory to pump into the environment until you finally settle the plant. In that regard the smaller inventory of the Babcock design --

MR. REED: Will give you a faster dry out.

MR. SKILLMAN: Is a benefit.

MR. WARD: I think we should have Westinghouse comparing pros and cons and benefits.

MR. KERR: I'm about to become confused. We need to get rid of these PWR's.

MR. REED: If we could ever get a standardized PWR, it is the machine that will carry the world for many years.

MR. WYLIE: Are there any more questions for the staff on valves?

If not, let's move on. Let's go into risk assessment.

MR. SKILLMAN: In February-March 1986 as our original program was being described and as we were working with the staff regarding the program, the owners did not have,

the B&W owners did not have a risk assessment task. The staff encouraged us to include a risk assessment view. To their credit, we did include a review. It was beneficial for us, but we need to give credit to the staff for encouraging us to pick up this task.

In 20 words or less what we did is two phases of PAR review. First, using the Oconee level three, which considered internal and external events, the Oconee PRA and the Crystal River PRA which is the level one that included loss of off-site power. Using the skeletons of those two PRA's we took the Category C events, 13 in number. That included the '77 loss of feedwater at Toledo Edison; '78 light bulb at Rancho Seco; '79 TMI-II; and 10 Category C transients beginning in 1980. We evaluated, that is reviewed those 13 events against the two fault trees derived from the Oconee and the Davis-Besse PRA. What was our goal? Our goal was to assess the importance of the Category C transients.

Let me say that differently. As we entered this task the question we were posing to ourselves was besides that which we had seen in 13 Category C events, are there other outlying events likely to cause a significant transient such as Tuleso Cordenne. Is there a boogey man out there? Is there something we haven't considered that we should be considering?

MR. MICHELSON: But you did not consider external

events in that sense?

MR. SKILLMAN: The reason we did not consider external events in that sense is because we were limiting our review to the complex transients that had occurred.

[illegible]ICHELSON: I just wanted to make sure you hadn't [illegible] gears.

[illegible] SKILLMAN: Bear in mind, a complex transient is one that r[illegible]quires significant safety system operation, or really involves operator burden. A lot of operator responsible mitigation.

So we compared the initiating of that frequency obtained from the transient history, Babcock units, that is those 13 Category C's. We evaluated the dollar and accident sequence systems and initiators, and we compared those to the Category C events, and we generalized the results.

The actual B&W trends in history is adequately represented in both of the PRA's. That is the 13 Category C's we had experienced are represented in the Crystal River and the Oconee PRA. The corollary is true. Thirteen Category C events do not lie outside of those two PRA's.

Now phase two of this activity, and we paid SAIC as a subcontractor to do this work for us, phase one was to review Oconee and Crystal River PRA, look at the 13 C's and make sure they fit on those event charts, if not give a signal they were found to fit. Then phase two, customize the

event trees so we could review the other plants, so we could have covered the spectrum of the Babcock and Wilcox Owners Group plants.

Crystal River III and Oconee PRA's indicated minimal core damage to the Category C's of those units. Feed and bleed cooling is an important accident mitigator for Babcock units. Service water and AC power, relatively risk important to both accident initiation and mitigation. Generalization of PRA results indicate Category C events not likely to be considered dominant contributors to core damage risk for most Babcock plants.

Davis-Besse and TMI slightly different. Davis-Besse because of their unique requirements for HPI cooling because they have the split system with the smaller HPI pumps; and TMI-I due to differences in the PRA analysis.

Finally, while we intend to reduce the frequency of Category C events or attempt to eliminate them all together, our review, our results of this review is that Category C events are causing a greater core melt damage concern than these events truly warrant.

That's all I really intended to say. I'll be glad to answer questions.

MR. MICHELSON: I believe that's a very significant slide, of course, because it says that we're really spending an awful lot of time worrying about a fairly modest

contributor to risk, or very minor, perhaps, contributor to risk, and that the main reason you're devoting this effort is because of reliability, economic considerations, etcetera. Is that a reasonable conclusion or an unreasonable one?

MR. RUTHERFORD: Let me respond to that. As I mentioned before, it's true the focus of our program is on prevention of these particular events that have occurred. But if you look at the recommendations you'll see that many many of them cut across all kinds of answers. When you look at motor operated valve reliability, that doesn't just speak to the events that we've had on the B&W plants. That speaks to all plants. Doing good root cause evaluations, all incidents. It cuts across all links. There are numerous things in the programs and the recommendations that are going to have benefit across the board, and not just specific to these particular ones.

MR. MICHELSON: That's certainly intuitive observation, but you didn't substantiate that with any kind of study showing that. What are the major contributors for risk, those kinds of changes would help to reduce that risk. That was not apparently done.

MR. RUTHERFORD: Not systematically, no.

MR. MICHELSON: Of course in cases of external events it may even have a lesser effect, we just don't know. We haven't done an external event analysis.

MR. RUTHERFORD: Certain of the plants have, but that's the plant's decision.

MR. MICHELSON: While we're waiting on our next speaker, maybe B&W could answer this question. Apparently you found that the event trees didn't match too well with Category C events that you actually experienced over the years. Is that correct?

MR. RUTHERFORD: -- That's partly why we did our own assessment.

MR. MICHELSON: So B&W apparently does believe that you did see in the event trees the Category C events you were experiencing?

MR. RUTHERFORD: Yes.

MR. MICHELSON: Okay, then you'll pick up on an explanation.

MR. RUBIN: My name is Mark Rubin. I'm with the Division of Engineering and Systems Technology.

Some questions have been raised earlier in your meeting on the scope of the risk evaluation. I'll be providing just a brief perspective on the staff's goals and objectives, and then Dr. Youngblood from Brookhaven will be providing details on our evaluation of the owners group risk work and the staff's re-evaluation of that work.

I would like to comment that the owners group risk evaluation was a very useful product. We did feel on

evaluation that some areas need to be looked at with some more vigor, and we proceeded to do so.

The entire reassessment program, of course, was prompted by a number of operating events that were perceived to be relatively severe, and in a sense in some cases near misses. Yet this raised a lot of questions because the few PRA's that were available on operating B&W plants did not identify any substantially different risk profiles for their plants versus the Westinghouse plants, for instance.

Because of this, and in light of the perception that the events were significant, we wanted to rethink the B&W risk profiles in light of the information that was coming out of the operating events and was the reason for encouraging the owners group working for us, conducting their own.

Specifically, we were trying to decide whether the events that had been observed, did they raise any new issues due to B&W generic design features or operational features that would be different from the other PWR's, from the other vendors, and consequently substantiate a difference in risk profiles that had not been reported in the literature in the previous studies. We were trying to find out if there was something that was a very significant dispute on the prior risk conclusions on the B&W plants.

Because of this, our focus was restricted to internal events for damage frequencies, looking at the B&W

systems for sequences, for damage scenarios, that had been identified as possibly impacted by B&W design differences such as the RCS, feedwater, secondary site, quick response, possibly operator response constraints. Consequently, we looked at such things as loss of feedwater, transients, overcooling transients, pressurized thermo shock possibilities, small break locos to be initiated by repressurization following a loss of cooling or an overcooling and then bringing on HPI injections and not terminating as the pressure --

We were looking for differences that were identified by the operating events. Brookhaven, as I mentioned, will be providing results of the reassessment. I want to emphasize that we did not attempt to provide a new complete requantification of B&W plant risk profiles. As has been mentioned a number of times, external events weren't looked at. The whole long list of plant accident sequences were not reassessed. Only in those areas we felt there were B&W unique differences that were worth looking at.

That's pretty much what drove us in this study, again, to find out if their previous risk profile conclusions were still legitimate.

MR. MICHELSON: Did you look at accident situations as well to make sure there was nothing unique about B&W or did you just look at these severe transients as did the owners

group apparently. Did you go beyond that to see if any accident situations, there was no reason to believe there was a unique problem?

MR. RUBIN: Only in a limited sense.

MR. MICHELSON: Your statement earlier kind of led me to believe that you did look to see where the unique differences were. I'm not sure now, are you looking only at transients, or were you looking at accidents as well when you made that statement?

MR. RUBIN: We looked at the accidents that would be impacted by B&W specific design differences. But it wasn't solely an attempt to recreate the Category C events.

MR. MICHELSON: But in the SER you didn't mention that aspect of the work then, I guess. I didn't find a discussion of going back and looking at accidents to see if they were unique situations, such as when you get into two phased flow and so forth. That wasn't discussed in the SER was it? I realize it's a lot to read and I didn't perhaps read it all, but I never sensed it coming through comparing accidents. you only seemed to be tracking back on what B&W owners group looked at, and you're doing the verification job.

MR. RUBIN: No, we went quite a bit further than the owners group.

MR. MICHELSON: You didn't document how much further you went, or if you did, please tell me and I'll read it.

MR. RUBIN: We can provide some details when Brookhaven presents details of their evaluation, but we're -- amount of time.

MR. MICHELSON: Okay.

MR. WYLIE: Before we hear from them, what's the bottom line? Is the risk profile revealed by experience different?

MR. RUBIN: The bottom line largely substantiated the overall conclusions of the owners that the Category C events as a general class are not terribly significant. No one would expect a higher frequency of these type of events on the B&W plants, overcooling events. But the more detailed precursor study and risk work that Brookhaven undertook identified that the vast majority of these overcooling events especially were not terribly risk significant. They would not be expected to produce a high frequency or damage. Damage events were very much produced by the undercooling scenarios, which is a small number of Category C events. So you would expect a larger frequency of events of concern at the B&W plants versus the other vendors, but the results didn't substantiate significantly different risk profiles for the plants.

The evaluation produced by B&L did result in some upward requantification of core damage estimates due to these type of events. In some cases over a decade. But still, the

total contribution or damage contributions were only in the small to moderate level, on the order of a few -- for instance.

What we were concerned about was the existence of a radically different risk profile, risk dominance, and we couldn't identify it.

MR. MICHELSON: From Category C events only?

MR. RUBIN: From Category C events only. That's absolutely true.

MR. WYLIE: Was the precursor to Three Mile Island a Category C?

MR. RUBIN: I believe it was, yes. We thought a traceable precursor study for each of the Category C events was one of the most valuable aspects in the Brookhaven report and we'll be discussing it with you.

MR. CATTON: What do you mean by ' e precursor to Three Mile Island?

MR. WYLIE: I've been hearing about how Category C events really weren't very meaningful.

MR. WARD: What event are you talking about? Davis-Besse?

MR. WYLIE: No, Three Mile Island. The precursor that led to core damage at Three Mile Island. I just wanted to know if it was Category C, and the answer was yes. What's different about it than the others that lead to nothing very

meaningful?

MR. JONES: Operator action. There is also the inversion of the PORV setpoint and the high pressure trip setpoint which is a biggy on decreasing frequency of the potential loco due to a stuck open PORV which is -- That was the big action taken fairly quickly after the TMI event, within a week, if I remember the time frame.

MR. RUBIN: The evaluation that we performed was pre any of the proven program fixes, but in some cases after TMI fixes, some of the modifications that came out of the TMI plant. So looking at the precursor results, they were probably accurate reflections at a point in time when the event occurred. In some cases, though improvements are underway or will be underway that will modify the results of those.

MR. MICHELSON: Wait. If you're finished now I have to ask a question. I thought you had more to say. I referred to this question on page 9-9.

MR. RUBIN: That's Brookhaven.

MR. MICHELSON: Okay, that will cover it.

MR. YOUNGBLOOD: I'm Bob Youngblood from Brookhaven. Also here today from Brookhaven are Bob Fitzpatrick and Charlie Soo. Accompanying us from Applied Risk Technology is Paul Ameko. The four of us are the Brookhaven people involved in this project.

It's been gone over enough times this morning that this will be a little repetitious in places, but I'd like to not skip anything in order to make sure that the emphasis that I end up communicating is the emphasis that I mean.

Our job was to try to put the observed events in the context of PRA. When we started there was a perception that PRA did not single out Babcock and Wilcox plants as a class as being different in terms of core damage frequency, and yet there are these transients occurring more frequently. So before the project we were essentially being asked should we be doubting PRA results based on the fact that these events are happening? Is PRA missing something important? If it is, should we be going with different estimates of frequency?

Fairly early on in the project we were asked to look at the owners group submittal which was summarized earlier. They looked at the events, characterized the failures that occurred in those events, and looked at the PRA models to see whether those events had been addressed, modeled in the existing PRA's. They pointed out correctly that those events were within scope and part of the existing PRA treatments, and from there concluded that the PRA results could continue to be trusted and went on to argue further that support system faults which adversely affect more than one front line function as still the kind of thing that are going to get you to core damage.

Some of the questions that have come up in the last few minutes, this is not properly identified on the handout. This is actually a figure from the submittal, and just with the Davis-Besse event in mind, the '85 one, just look at the first few headings here where the question is asked whether emergency feedwater actuates, delivers flows. This is a fairly simple event tree in the sense that it's got one branch here, B&W either fails or does come on, and the only other question asked is whether it's controlled. On this tree, the Davis-Besse event where feedwater was lost for awhile and then recovered, counts as a success.

That's not wrong. They did eventually cool with the emergency feedwater system, but the event tree doesn't tell that story, and as you'll see in a minute, a large part of what we did was try to build a tree that would tell that story.

Also arguing that the failures experienced are a part of the model doesn't go one step further to say that the model also would predict the correct Category C frequencies. Knowing that certain failures are in the trees, you can still ask, if I asked this model what's the frequency of overcooling, what's the frequency of Davis-Besse type events, we felt it would be useful to try to build a model that would provide those results as well, and a model which could do that correctly, a model which could correctly predict complex

transient frequencies, would be more credible in its core damage frequency prediction. So that's pretty much what I'm about to try to summarize. That's the approach we took.

This is not as legible as I would like it to be. It's a little more legible on your handout. We don't have to walk through it, but without reading it you can tell that we have many more headings. These things across the top here are event tree headings. We have several which ask whether emergency feedwater came on, if it didn't, how did the operator respond, were they able to get it back, then did they control it, and so on. So there's more structure here which allows for a more narrative description of events like the Davis-Besse event. The stair step thing here actually is the path through our vent tree that was taken in the Davis-Besse event. So if you start off here, they eventually lost main feedwater, emergency feedwater did not come on but they did realize that they needed to get it back. Eventually they did get it back. So these first several steps is that part of the story, and eventually they ended up okay.

MR. CATTON: Does this mean the probability of a Davis-Besse event was two times ten to the minus ten?

MR. YOUNGBLOOD: No. The numbers in each step here are the probability given that you're standing there on that plateau, and without knowing how the next thing is going to go what was your chance of getting core damage. So at worst, the

dark before the dawn according to these numbers here which are still undergoing a little tuning, is about three and a half percent. That comes from about a .2 chance that they weren't going to get back emergency feedwater given that it was lost, and another .1 that they were not going to succeed with makeup cooling. So .2 times .1, well it's two percent not three percent, but in round numbers that's where it's coming from. So that's what Clark Rubin was alluding to in the precursor part of it.

This is some measure, according to one event tree breakdown of how close that one was. This and one other were the only two that were anywhere like that significance. A corresponding plot of this for the undercooling events has numbers nowhere that large.

MR. RUBIN: You mean overcooling.

MR. YOUNGBLOOD: Overcooling, yes. I misspoke.

MR. MICHELSON: What this shows it that given an event you can go back and draw a tree for it, right?

MR. YOUNGBLOOD: That did not need to be shown.

MR. MICHELSON: But this does show that once you know what the event is you can figure out where to put all the branches. How well can you figure out how to put all the branches in before the event occurs, since there are now many many possibilities at each step even than you have necessarily drawn here?

MR. YOUNGBLOOD: Yes.

MR. MICHELSON: There are a lot more branches than I could have imagined in a given situation might appear, that didn't in this case but might in this case. It's almost an unlimited tree you end up with when you get done so you don't do that too well because it's such a big job. Is that the reason why we don't draw detailed trees?

MR. YOUNGBLOOD: No. I believe that most people who don't go to quite this much detail, although I have to say I think increasing use of the kind of event sequence diagram, narrative analysis that was behind this, I believe that's more common now than it used to be. You may not see this level of detail in an executive summary, but I think increasingly people are resorting to it in some of the basic work.

But remember that part of our goal here was to back out the Category C frequency to see whether the basic model parameters were right. If you don't have that goal then you may believe that a much simpler event tree can capture the core damage picture for you. Of course that's what was in doubt before that was a part of the project. But I have to agree that if a sufficiently wacko event occurs next week, it may not be on this and then if we were to do the project over we'd have to add headings. But nevertheless, the plots of this for the overcooling cases have small numbers because as close as they got, too much more was going to have to go

wrong.

MR. MICHELSON: That was already concluded even from the more elementary tree?

MR. YOUNGBLOOD: Yes. So to go forward a little, we made a number of plots like this, and again, I don't consider the results here to be definitive, but this is a pie chart that's showing you, and I would like to study your pie chart in more detail now that I've seen yours to see what's going on here, but this is based on, this is trying to say what kind of thing contributes to Category C. This is trying to say what kind of thing contributes to core damage, and there is a rather different importance ranking. Undercooling, this I think perhaps understates the case a little bit. But according to this there would be relatively many Category C events are overcooling, relatively few are undercooling. But in the core damage events that's reversed. It's undercooling that gets you into core damage.

MR. MICHELSON: You're also not considering external events --

MR. YOUNGBLOOD: Absolutely. We are not only not only not considering external, we're considering a very restricted class of internal events.

MR. MICHELSON: So we don't know even when you make that statement, observing undercooling and overcooling, we don't know yet whether this is really all that important

anyway compared with the real contributors to risk.

MR. YOUNGBLOOD: That's right. In a draft report which is currently undergoing review, there are numbers for these sequences, and most of them are ten to the minus six or less -- particularly for the undercooling. And knowing that PRA bottom lines tend to cluster around an order of ten to the minus four or thereabouts, that's not large, but I'd like to correct a possible misimpression that not all of these events are risk significant. I think we consider the undercooling events risk significant, and I believe everybody considers them risk significant. But they're not related to the kind of basic B&W versus the rest of the world comparison that was the motive of this study.

If you look at the Davis-Besse again, a full blown accident sequence would be initiating event, initial failure of the EFW, and then failure either to get EFW back or to get makeup cooling going.

This part of the sequence I think has to be considered utterly plant specific. A good part of this part of the sequence is also utterly plant specific because they have the particular makeup cooling. There are B&W generic things in here having to do with time frame, but even those are not overriding. So the fact that we attribute significance to the undercooling events does not mean that there's a yes answer to the original question of whether this

class of plant has been understated in previous PRA's.

So these are some of our conclusions. As a class, they cannot presently be said to have core damage frequencies significantly greater. Any plant that has a non-diverse emergency feedwater system will have certain contributors, but that's not a B&W thing.

Overcooling events dominate the frequency of Category C events, but in our analysis and in many others, they're not significant contributors to core damage frequency. That's basically said in another way in the third bullet.

Of those events which are experienced, of the initiator types that we considered, loss of ICS function was the most important, partly because it affects main feedwater and partly because it just generally creates --

MR. REED: You're now saying as a class, now, with modified or changed or whatever in this present reassessment, B&W plants cannot be said to have a core damage frequency significantly higher than others. But certainly in the past that wasn't the case. After all we had an actual and a near actual out of seven or eight units.

MR. YOUNGBLOOD: That's right.

MR. REED: So there's been a tremendous upgrading in what you're saying, now, because you can make this statement.

MR. YOUNGBLOOD: Yes, we're saying that, yes. All of the event tree modeling that's shown here absolutely

reflects a lot of post-TMI thinking. I believe the credit is taken in many important areas for people being less likely to be fooled by it, but they were fooled by it at Three Mile Island.

MR. CATTON: So you could actually go back and ferret out the benefit of all of those changes?

MR. YOUNGBLOOD: Yes. Maybe not in an afternoon, but in principle, yes.

MR. CATTON: I've heard in the past that that was impossible to do.

What do you think about the use of safeties for steam dump valves? Is that something that a PRA can tell me anything about?

MR. YOUNGBLOOD: I don't understand your question.

MR. CATTON: It seems to me that safeties are there for a purpose. They're to protect the steam generator and not to be used as steam dump valves. Yet in essence, with a B&W reactor they are. I was just wondering if that's something that's of safety significance, or maybe we don't need safeties when we have steam dump valves. I don't know.

MR. YOUNGBLOOD: There's a heading here, and collaborators feel free to chime in, there's a heading here which allows, are you asking about them sticking open for example?

MR. CATTON: Yes, and the fact that you're using

them really almost on a continual basis.

MR. YOUNGBLOOD: There's a heading on this tree which asks the question did any of those stick open. We have some number for that which is not a terribly small number. We could reexamine it. If they do, then further questions are asked. How long does this go on, does anybody take control, does HPI come on, do you end up making such a mess that you cause a primary site loco by running the HPI too hard, or do you, there are a lot of questions like that are actually on this tree.

MR. CATTON: So it really doesn't matter?

MR. YOUNGBLOOD: I think we used a not too small number and it still didn't come out big, so off the cuff, yeah, I think it does not loom in this as a problem.

MR. MICHELSON: Did you look at events then that went beyond the Category C in terms of things that happen, like I don't know if any of the Category C's ever stuck open a safety. I don't recall --

MR. YOUNGBLOOD: Yes, I think they did. The tree goes all the way out to where some states are core damage and some states are okay.

MR. MICHELSON: Your tree went on out to the end?

MR. YOUNGBLOOD: Yes.

MR. MICHELSON: Okay.

MR. RUBIN: Even with the safeties stuck open you

still need HPI failure, so there are other failures that have to occur. It's not obviously a -- event.

MR. CATTON: What about the ASME guidelines for this sort of thing? Do they allow that? That you use the safeties on a regular basis as steam dump valves?

MR. YOUNGBLOOD: I'd have to defer that question.

MR. CATTON: What does the code say about that?

MR. MICHELSON: You're in the mechanical end there. What does Harold Hetherington say about that?

MR. HETHERINGTON: No comment.

MR. SKILLMAN: I'd like to register a comment for B&W owners. Our intent is to knock out the use of the main steam safety valve -- energy relief on secondary site. The way we intend to do that is to get turbine bypass and -- and get integrated control systems to the point where it does what it's supposed to when it's supposed to do it. So our goal is to address the concerns of events, and that is to get the post trip energy balance -- so that we do not call upon main steam safety valves so frequently and to such an extent.

MR. REED: The key word in what you said was the word prompt. You will find that this pressure change is so prompt that I doubt you can get any sensing and equipment reaction to curtail it.

MR. MICHELSON: Was that a level one type of recommendation, or level two or three? This idea of getting

off the safeties?

MR. SKILLMAN: -- regarding emergency feedwater control, secondary plant relief.

MR. MICHELSON: They're level one.

MR. SKILLMAN: They are among the 71 or 73 key recommendations we regard most beneficial. The level one terminology came from ICS/NNI recommendations that fit with this.

MR. MICHELSON: I see.

MR. WYLIE: Any other questions?

Let me ask the B&W owners group, if we break now do you have people here to support the rest of the meeting?

(Pause)

MR. WYLIE: You'll have somebody here after lunch?

MR. RUTHERFORD: Yes.

I would like to address the recommendation implementation process, and I'll try to speed this presentation up here a little bit and hopefully break for lunch here before too long.

As we said at the beginning of the presentations, we regard implementing the recommendations obviously as key to the success of the overall program. That's going to determine what impacts we have in actual plants. In order to ensure that we are doing a good job in this area, implementation is being formally monitored by the B&W owners group, at both the

executive and the steering committee levels.

We're looking at implementation quality both from a programmatic and a technical standpoint, and in some later slides I'll get into more details in exactly what we are doing in those areas.

We recognize that proper implementation of the recommendations depends on the unique position the plant is in in terms of resources, other modifications they've got to do, outage schedules, etcetera. But we are looking for each of the owners to implement the recommendations on a reasonable schedule, and we'll be looking for outliers during that process of evaluation.

As a tool to use in monitoring this progress we have developed the recommendation tracking system report, and we alluded to this report earlier in the presentations. This is this document here that contains all the recommendations and the status for each utility. This is our Bible, if you will, for monitoring implementation progress.

I'll briefly go over just how a recommendation goes through the review and approval process and gets into the tracking system. The numerous studies, committee activities, etcetera, that we've alluded to today have generated the recommendations initially. These have gone through the review and approval process via committee review, through the SPIP management team we set up to manage the SPIP activities, and

subsequently, these have been elevated to the steering committee for final review and approval. Once the steering committee reviews that recommendation and accepts that recommendation, it's placed into the recommendation tracking system report.

This report is updated on a quarterly basis based on inputs from each of the utilities. By that it means the owners group as a whole will know what the implementation status is and will be able to review progress of each of the individual companies. This documentation has and will continue to be provided to the staff so that they can also monitor implementation progress.

We have currently got 226 recommendations in the tracking system report. There are a small number of items yet to surface and make their way into the report. As you note there on the slide, we do have potentially pending recommendations totalling nine that may make their way to the recommendation tracking system report.

There were also recommendations from a number of the studies that indicated more studies needed to be done. It wasn't a recommendation that was right for an individual utility to handle, and thus we do have 13 that fall in the category of additional studies, if you will, that may result in additional recommendations.

I'll quickly put this slide up. This just gives you

a pie chart breakdown of just where those recommendations do stand at this point in time.

Once the recommendation is entered into the tracking system it then flows through this process. These are the categories that we have set up for dispositioning of the recommendation. First of all, it's evaluated for applicability by the individual company, and either closed as being not applicable at that point in time, or moved on for evaluation for implementation. At that decision point the recommendation is either closed as being rejected by the individual utility or it's moved over into the implementing category. Of course at that point in time it moves to the closed operable category once its implemented.

To give you an idea of the present status, this is a stack bar chart of the status. You can see the various categories: the closed is the clear; implementing is cross-hatched; and evaluating for implementation and evaluating for applicability categories.

Starting out with September of '87, originally we were on a faster update of the report. We were updating the report every couple of months, but we subsequently moved to a quarterly frequency. It was updated in November, January of this year, and then most recently in March. You can see we've gone from 415 to a total of 601 of the recommendations have been dispositioned by the operating plants. These numbers

represent the total for all the operating plants. So you can see as of March we're approaching the 50 percent mark as far as dispositioning of the total recommendations.

Likewise, there's a pretty similar pattern up to this point in time for the key recommendations. These are the 70 recommendations that we have denoted as being key recommendations in the tracking system report. You can see there also that we are approaching the 50 percent mark in terms of dispositioning of the recommendations.

Of course the bottom line for this whole thing is how it impacts plant performance. I'd like to briefly go over just where we do stand in that regard right now. We have already implemented some of the recommendations from the study and we've seen where they have had an impact on plant performance. Certainly all of this trend cannot be laid at the feet of the SPIP program and the recommendations that have come from that program, but it has had a contribution to this overall trend of reducing automatic trips while critical.

If you'll recall from the initial presentation on the program, we originally set a goal here in 1990 of two trips per plant per year. Subsequently to that we have revised that goal downwards to 1.4 trips per plant per year. That's based on the trends that we saw here in '85, '86, and '87 where for the last year we got down to a level of 2.1 trips per plant per year.

Thus far in 1988 we have only had two plant trips for the year, which projects out to a rate of .75 trips per plant per year for this year if we continue at that experience rate.

MR. DAVIS: I have a question on that. There seems to be a perception that by reducing the number of trips you not only improve plant performance but you improve plant safety. My concern is that that is not necessarily a correlation because you can reduce the number of trips by eliminating some of the reactor trip system logic and some of the setpoints and actually increase the probability of an anticipated transient without scrap.

MR. RUTHERFORD: Oh sure, but that's not the way we're getting the trip reduction. If that were the case, I'd agree.

MR. DAVIS: I hope you're not doing it that way. I must confess, the evidence suggests that you're not doing it that way, but in our enthusiasm to reduce the number of trips, I think there is a risk that we can make the plant less sensitive to upset conditions and actually increase the atlas risk contribution. I just say that as a general concern and urge you to keep that in mind as you go through the trip reduction program.

MR. RUTHERFORD: I think the only thing even remotely related is something like raising the high pressure

trip setpoint. You're not eliminating the trip, you're adjusting the trip setpoint up a little bit. But I don't believe anything we've done would contribute to increased risk.

MR. DAVIS: I did see, I thought, some anticipatory trip reductions and some trips associated with turbine trip were being eliminated. That's not the case?

MR. RUTHERFORD: No, that was a preliminary recommendation. That was not adopted. We are in that particular case raising the trip setpoint also, but we're not eliminating the trip.

MR. DAVIS: We, of course, have a recent example of where a trip didn't occur that caused an extremely severe accident because the operators disconnected some safety functions that would have caused a trip. I want to make sure we're not moving in that direction.

MR. RUTHERFORD: I agree with your concern.

MR. KERR: You want to have one per year just to make sure the thing works.

MR. MICHELSON: That's the only test you've got left in some cases.

MR. REED: Now that you're talking about it, I've always maintained that trips are not all bad, and if a new reactor coming on line, starting up of its own unique and specific design, which they all are, doesn't have six or eight

trips the first year, I don't think you're going to find out whether the design is flawed. Trips are not all bad.

MR. RUTHERFORD: That is one way of looking at it.

The other part of our goals set for the program relates to the frequency of complex transients, the Category C events. We had some discussion yesterday on the appropriateness of the goals we had set in this area.

As you see from this particular graph, our trend does not appear to be as good as it is in the trip category. However, if you look at the points here, you've got to realize that this is based on a three year moving average, so we've got some experiences back here in 1985, four events, Category C events, that are really driving this curve still. If we continue to have good experience over the next few months, by the end of the year this curve will be way below our .1 goal by 1990.

Along those lines, we're going to look at whether that goal should be lowered, as we did the trip reduction goal that we have already lowered.

MR. REED: I'd like to add a little humor here about a very very early event on the first pressurized water reactor. We were having a number of trips almost daily, trying to get it into operation. An order came down from on high, and we'll say the order came from Admiral Rickover, who is even higher now than then, (Laughter). The order was,

"There shall be no more reactor trips." It was a very interesting order.

MR. WARD: What did you do about it? Don't leave us hanging. (Laughter)

MR. REED: Well you can take your choice. Either not operate or try to operate at all, or try to defeat as many trips as you can think of.

MR. WARD: What did you do about it?

MR. REED: I don't recall what was done about it. (Laughter) I was not in charge.

MR. DAVIS: Is there some reason you use a three year moving average? It sounds like that may distort the data somewhat and obscure any trends that you may want to pick out from your operating history.

MR. RUTHERFORD: It does to some degree. I guess we wanted to make sure that we did capture a long enough period of data that would be significant. But you are correct, it does stay around for a long time if you have a Category C event.

MR. SKILLMAN: It might be worthwhile to point out that the last Category C event we had was December 26, 1985. Then we had another one just recently. If we had done this on an annual average we would have gone on a Category C trip frequency of zero. So the point is by making it three years versus one year we get a longer sampling time so we can see a

trend.

MR. DAVIS: I think you could argue it either way, and it's probably not worth.

MR. RUTHERFORD: When you get to zero we won't have to worry about it one way or the other.

When I first started out I mentioned that we were doing a couple of different evaluations in order to monitor each of the owners and make sure that indeed we are properly implementing the recommendations. The first program that we had was a programmatic evaluation. Back late last year the executives formed evaluation teams to go to each utility and look at the program process that we had in place with each of our companies, the disposition of each of the recommendations. This team typically consisted of eight individuals. They developed an evaluation plan. All of these evaluations have been completed at this point in time, and reports issued to each of the utilities with findings from those evaluations.

We had an executive member participate in each one of these evaluations. Obviously he didn't do his own utility, he went to another utility and participated in that evaluation. We had over a man year's effort involved in this with the people that were participating in the evaluations, and over 140 owners group personnel involved in interfacing with this evaluation team.

We prepared a summary report which was endorsed by

the B&W executives and the summary report of evaluations has been provided to the NRC.

Just briefly touching on the conclusions of those evaluation teams, in general they found that all the programs that the utilities had set up were adequate, but in each case they found weaknesses or areas of improvement that should be implemented to in all cases strengthen the programs. A couple of extra observations from those evaluations was that we did get a lot of cross-fertilization between the utilities and the evaluation team members would pick up good ideas from one utility and bring that back to their particular utility. it was also very helpful to have the executive involvement in these evaluations. It helped show the flag, if you will; show that indeed there was an executive committee endorsement in support of the program across the board.

In addition there were a number of comments related to documentation reporting, etcetera, involved with the recommendation disposition, and we expect to see improvement in those areas as actions are taken to close out those findings.

We have also initiated a technical evaluation of selected SPIP recommendations. This is being done under the auspices of the steering committee. We formed a four man team to go out and look at four selected recommendations. They went out and did a pilot, if you will, at GPU and Duke Power.

Those have been completed, the results reviewed by the steering committee, and we have subsequently schedule remaining visits at the other utilities to look at some selected recommendations. Once this group is done, we will come back later and select another group and conduct further evaluations.

I might make just a few brief closing comments or observations. As I noted, we certainly feel that the program that we undertook in the owners group has and will continue to improve the performance of the B&W plants. We feel like we did devote significant resources to this effort, and that the scope of the assessment was correct and sufficient.

We've had some discussions here today and yesterday about well was the scope of the program on target? Was it too small, etcetera? I think we were responsive to Mr. Stello's letter. I think we did address the issues of complex transients and trips on B&W plants. And in the process, provided benefit across the board in terms of safety performance of the B&W plants.

Also I think we are in general agreement with the staff in terms of the effectiveness of the program. The staff's had some comments in certain areas, but I think in total when you look at the general agreement, that we're not that far apart.

We developed over 200 recommendations out of this

program. We do have a tracking system to ensure that we are going to timely disposition all of these recommendations. As I previously mentioned, we've already seen cases where we have implemented recommendations and they have saved us trips and improved plant performance already.

This is a process, an implementation phase that will continue over the next few years, and that certain recommendations do involve modifications that have to be evaluated, designed, and then introduced into the plants. But we're going to make sure that progress towards final implementation or disposition in all the recommendations is appropriate, and we're providing sufficient documentation to the staffs, so they can also draw that conclusion.

In closing, I'd like to say that our commitment here has and will continue to be strong, and we want to ensure that everything we've gone through does pay off in the bottom line. These recommendations are promptly implemented and appropriately implemented in all the plants. We want to take the lead, if you will, in the industry in ensuring that we've got the best running plants there are.

Any questions?

MR. WYLIE: For clarification, on your bar charts where you show the implementation, when you say implementing, that's not implemented until it's closed, is that correct?

MR. RUTHERFORD: Right.

MR. WYLIE: Closed also includes those that you've thrown out, right?

MR. RUTHERFORD: That's correct.

MR. WYLIE: So you can't really tell from the bar chart how many have been implemented?

MR. RUTHERFORD: That's correct. You've got to go to the tracking system report, and the tracking system report does break that down.

MR. WYLIE: But not by utility.

MR. RUTHERFORD: Yes.

MR. WYLIE: It does by utility.

MR. RUTHERFORD: By utility.

MR. WYLIE: Now you've got utilities that have submitted schedules and utilities that have not submitted schedules for implementation?

MR. RUTHERFORD: I think all of us have some deficiencies in terms of having schedules for the items. It's a goal to have schedules for the particular phase we're in by the time of the June update. That's the commitment we've given the staff.

MR. WYLIE: By individual utilities?

MR. RUTHERFORD: By individual utilities. That will be a schedule just for the particular phase in evaluation and implementation. We've got a lot of schedule information in there now, but it is not complete at this point in time.

MR. WYLIE: By June you still won't know for each utility what their final implementation date is?

MR. RUTHERFORD: Not necessarily, because you'll still have some in the evaluation phase, and until you evaluate the recommendation and decide what you've got to do, you won't be able to set an implementation schedule. But certainly, let me put the chart back up.

MR. WYLIE: Is there a date when you'll know when all of them have been scheduled? All the implementations.

MR. RUTHERFORD: We have not set a drop dead date at this point in time. I think what we're really looking for are outliers, somebody falling outside the trends that we're all marching on. You can see that this evaluation category is steadily shrinking. We're moving these on up. So we would expect by the end of the year to have very few remaining down in these first one or two categories.

MR. WYLIE: Any questions?

MR. MICHELSON: Is this going to be the end of the B&W presentation?

MR. WYLIE: Yes.

MR. MICHELSON: I just wondered if the B&W owners group wished to make any comments on the A47 letter.

MR. RUTHERFORD: Not at this time.

MR. WYLIE: Thank you.

MR. DAVIS: Excuse me, Mr. Chairman. I just have

cne comment.

Your goal of .1 for Category C transients, it seems to me like you're going to have to wait a long time to show that you've achieved that goal. That's like one transient in ten years.

MR. RUTHERFORD: No, that's about .7 per year.

MR. DAVIS: Oh, for the seven plants?

MR. RUTHERFORD: Yes.

MR. WYLIE: They could look at their Category B's and see what happens to them.

MR. DAVIS: If you use a three year average, though, it's going to be several years before you can really demonstrate that you've achieved that goal, I guess.

MR. RUTHERFORD: As I pointed out, we are going to have several drop off the board here very shortly. Once we get to the end of the year these will drop off, and given that we have good performance between now and the end of the year this curve will come way down.

MR. DAVIS: Thank you.

MR. WYLIE: Any other questions?

(No response)

MR. WYLIE: Okay. I'd like to call on the staff to comment on the implementation schedule.

(Continued on following page)

MR. SIEGEL: -- the magnitude of it, the number of people involved in it, the effort involved both on the part of the Owners Group and the staff. I don't know if all of you have seen the AW-1919, but it probably is about two and a half or three feet long. It covers the book shelf. And considering that this was started, this program, in roughly January of '86 and the staff just started reviewing this in August of '87, I think it's been a considerable effort.

And one of the things that's a little more gratifying about this than some of the other programs is the fact that since it is balance of plant systems primarily, the Owners Group has started implementing the program. So we're not just waiting for the staff to complete their review until this is being implemented.

But because we think the program overall is going to improve the reliability and predictability of the way the plants respond--but that's predicated on the fact that they do have proper implementation of the recommendations and in a timely manner. And since the program, in all essence, is completed as far as the staff review goes, there is still we feel a need to assure that a proper implementation and implementation in a timely manner.

Some of these numbers may be a little different than the Owners Group, because this is only updated through January and the slide that Neil showed--they have more recent

information through March. But basically the whole program from the start, the recommendations that came from the subcommittees, probably total about 375 recommendations.

During the course of consolidating all these, they have identified about 75 duplicates. Some were rejected. Neil said I think there's 226 that are now approved, and this number is probably a little high. But all told, there is probably going to be about, I would guess, 250 total recommendations, give or take a few one way or the other.

We in the SER addressed all of them. The SPIP identified seventy recommendations as key. We've looked at the process. We looked at what they did. We looked at their SPRIG group and how they categorized the recommendation. Did not have any problem with them. In addition, the staff in the report identified eleven additional recommendations that we felt had safety significance. But B&W Owners Group is tracking these through the recommendation tracking system. They are providing us this report. We are not totally satified with the report because the report doesn't really give us all we think we need to get a handle on how much progress the Owners Group is making.

They have, as they mentioned before, agreed to implement all the applicable recommendations. The Owners Group is overseeing the program and the mechanism by which the reporting is the recommendation tracking system. And the staff

will audit the program.

And the next Vu-Graph--

DR. LEWIS: Before you leave that one, I just wondered--I really shouldn't beat on you with this, because it's a generic question. But you have some things listed there as high priority because they enhance safety. And the question that came up earlier is does that mean than you feel these plants aren't safe enough? If so, what are the criteria and is enhancement of safety a good thing in itself?

MR. SIEGEL: Yes, I think it is.

DR. LEWIS: No matter of safety?

MR. SIEGEL: We don't think that the plants are not safe. We think that what these are going to do is eliminate--prevent them from getting into situations that these complex transients may lead to where they would have a harder time controlling the plants and recovering fr[illegible] them.

DR. LEWIS: No. I'm completely happy with the understanding that these things enhance safety. It's just that the ancient question of how you know when you've met success and can lay off. I'm not saying that these plants are perfect. But the whole Commission has been fighting this--

MR. SIEGEL: We're still groping with it. I don't think we've decided. You know, we've expanded the areas that we're looking at. We're considering looking at

maintenance. We're considering at looking at a lot of different areas. We've got performance indicators that we're using now. We're much more deeply involved in tracking how the plants--how their management is, how the maintenance is, how they perform, than we ever were before. And as we keep getting into this more and more. I don't think we've totally decided on how far to go on this yet.

DR. LEWIS: No, I understand. I know your tools. It's just that--and I know how you grade the people. I'm groping for what the passing grade is. I teach for a living, and students always want to know the first day of class, "What do I need to do to pass this course? Because gosh knows, I don't want to do any more than that."

MR. SIEGEL: I don't know how to respond. I don't know--

DR. LEWIS: Okay. I don't want to beat on you. But the reason the Commission issued safety goals some while back is to try to cope with this type of problem.

MR. SIEGEL: That's true.

DR. LEWIS: Please go on.

MR. SIEGEL: Okay. The staff intends to verify implementation of the recommendations by the utilities. As a matter of fact, in one area the staff evaluated the Owners Group's recommendation process back in October of 1987. We sent a team of five or six people to B&W. We looked at how

the recommendation tracking system--not the recommendation but how the process that the Owners Group used to--the recommendation process they used, how they evaluated the recommendations.

The recommendations are generated by subcommittees. They go through the SPIP and then they go to the Steering Committee and then they are approved by the Steering Committee and go out to the individual utilities for implementation.

So we are concerned that perhaps--and also involved in this was the SPRIG Committee that also was involved in eliminating duplicates, deciding which were the key recommendations. Their Advisory Committee got involved in this too. So we were concerned that perhaps some of the recommendations were being diluted once they came out of the Steering Committee. So we went through and we probably reviewed probably three quarters of the total recommendations that came out of the system. And found in essence that what the Owners Group had done in their approval process was adequate essentially. We did not find any place where they tried to dilute the intent of the recommendations in any way. When they combined recomme..dations, it was acceptable. The ones that they rejected, we disagreed with the ones that they rejected. So overall, we were quite satified with the results of that audit and found that they were doing an adequate job.

What we intend to do now is implement--audit the

implementation of the program. Similar to what the Owners Group did. The Owners Group just completed their auditing of the programs at the individual utilities. We also intend to audit the programs at the utilities to see if they have adequate programs in place.

One thing I should mention is that a lot of recommendations are fairly general in nature. Some of them as a result of their generalities have been sent back from the Steering Committee back to the subcommittees to provide more detail, but even a lot of the ones that coming out are fairly general and they have to be implemented at the plant.

We are concerned that they are properly interpreted by the individual utilities. We are going to audit the implementation process at the individual utilities to assure that they are interpreting the recommendations properly. The Owners Group has performed a similar function. We'll probably, when we first go out and audit the process that they have in place, the program that they have in place in each utility, we'll probably also pick at several recommendations and look at them and see if they are doing an adequate job to get a flavor of whether or not we think they are interpreting the recommendations properly. And then go back--if we think they are doing an acceptable job, then go back when they've completed a larger percentage of the recommendations and the ones that we consider the most important ones and audit the

implementation of some of those.

And finally we are going to verify that any recommendations, that the recommendations have been implemented and are in place.

So that's what we intend to do to ensure that the program--that we're satified with the proper implementation of the recommendations.

One of the biggest concerns I think the staff has in addition to that is whether or not the Owners Group is really implementing these in a timely manner. And these numbers are again back from January and not from March. But the numbers that Neil gave were a little misleading in the sense that these are percentages of the total recommendations. This is overall utility progress of all the operating plants. And this is the percentage of the recommendations that are being evaluated, implemented, closed operable, closed not applicable, closed rejected and not started.

This "closed operable," "closed not applicable," and "closed rejected," were all lumped together on Neil's slide.

And the point that I was really making is the fact that even though it shows that a lot of the recommendations have been closed, a lot of them have been closed because they were closed not applicable.

And if you read the report, the supplemental report,

you'll see that the progress in the past seven or eight months has not been in closing the recommendations and also in evaluating and implementing, there has been progress made, but not as much as the staff feels is necessary. We would like these to be done in a timely manner so that we are assured that these are in place and we can achieve the goals that have been set for the program. And we'll be monitoring these and deciding whether or not the Owners Group or in particular individual utilities are in some way dragging their feet or not.

That concludes what I have to say on implementation. Does the subcommittee have any questions?

MR. DAVIS: I have a brief comment. You seem to be somewhat critical of the sluggishness with which these recommendations are being implemented. But I noticed on the slides that the Owners Group presented, they've already achieved one of their goals of 1.4 transients per year and it appears they will achieve the other goal of complex transients over the next few months and yet they have only implemented 20 percent of their recommendations.

Do you have different goals on that that you are--

MR. SIEGEL: Well, like Bob said earlier, we haven't set any goals with regard to number of complex transients.

MR. DAVIS: What are your goals?

MR. SIEGEL: I think we are going to--essentially

the goals are to try to get the Owners Group to implement these recommendations as soon as possible. And then probably for a period of two or three years track what happens and see where we're going. See how many Category C events we get. See how many high Category B. Compare that to what was done previously. If it looks like--I'm just postulating--if it looks like this situation in our mind is under control, we will think that the Owners Group has done an adequate job and that we can put this to rest. If it turns out that there isn't any significant improvement over what it was before we initiated this program, then obviously we will consider taking steps to correct the situation. I'm sure the Owners Group will too.

For instance, they've got an advanced ICSNNI system. If that's one of the areas that's causing a problem, maybe at that point in time they may consider implementing that. I don't know.

It's hard--we don't have any specific goals in mind at this point.

MR. DAVIS: But the goal you are using is the number of transients per year. You are equating that--

MR. SIEGEL: I think we would evaluate the transients and see how complex they were if they were involving systems that hadn't been involved in this program. And if there is something that we're missing or not. Hopefully--

it's hard to assess it right now--hopefully I would think--I wouldn't say hopefully--I would expect that even if you do have Category C events their severity wouldn't be as severe as they were previously because you've taken all this corrective action. So I don't really--you know, I don't think you can really at this point in time say what would be a triggering point to say, yes, this is acceptable or--

MR. DAVIS: I don't want to belabor it, but we've already heard that Category C events are not risk significant. So eliminating them isn't going to make the plant much safer. Isn't that true?

MR. SIEGEL: From a core melt standpoint, that's true. From an operational standpoint--I think the staff feels that anytime you challenge safety systems, anytime you have severe transients where the operator can't predict what's happening to the plant or understand what's happening at the plant, and this is the type of events that some of these Category C were--that's unacceptable. And I think that's what we're concerned with. The fact that you are working in a gray area where the operators really don't understand what's happening in transients because they don't have the proper controls and instumentation to know where they are.

MR. DAVIS: Thank you.

MR. WARD: When you say that, Byron, what you are saying is you don't trust PRA.

MR. SIEGEL: That's right.

MR. MICHELSON: That's right. Because PRA isn't included.

MR. WARD: I think that might be a healthy attitude, but-- because the PRA analysis has come to a rather different conclusion than your operative conclusion.

MR. SIEGEL: I'm not qualified to really answer that. I mean, if you look at the numbers, that's true.

DR. LEWIS: This is really a very important point that Dave is raising. Because, you know, you can't regulate by--you can't just do it on the basis of feeling good because there's a general principle of American law, I guess, or English law, that whoever is being lawed has to know what he has to do to obey the law. I mean he wants to, but at least he ought to know what it is. And it's not clear to me that if I were a B&W owner, which praise the Lord I am not, that I would know what to do to satisfy the staff. I'm not sure the Commission has given you much help on that score, but there's got to be some kind of set of criteria so that regulatee knows what he has to do.

MR. SIEGEL: I'll draw a comparison. Would you feel comfortable driving down the road at 65 MPH blindfolded even though you knew you weren't going to crash into something?

DR. LEWIS: Well, but you know, even there, there

are a set of fairly specific rules. You know, in fact I shouldn't drive with my vision obstructed, whether I put a drape on the windshields or on my eyes. There's actually a rule that says that I can't do that. So at least I know it. It's not just a matter of common sense, although it's certainly that too.

MR. SIEGEL: In that respect, you can take the blindfold off and look. But if you've lost your instrumentation, for example, you still have the blindfold on, you can't do anything about it.

I don't know. I'm not the one I think that can answer that question. This program started a long time ago. I think that what the Owners Group is doing personally to eliminate these types--to try to reduce these types of Category C transients is the right approach. And I think what they've done has gone well beyond what we normally have done in the past and covered areas that we haven't--that we've never done before.

They did a much better job than we could have if we initiated the program ourselves because they have the expertise and the manpower to do it. We could not have had as extensive a program as this if we had done it ourselves.

DR. LEWIS: Well, doing too much is sometimes worse than doing the right amount of stuff. I think--you know, as I sense it, you are adopting a position that anything that

can be done is a good thing. Now, I think that's a simplification--

MR. SIEGEL: I don't think that all the recommendations that they've proposed, for instance, the staff would have necessarily considered to be necessary. There are a lot of the recommendations that we feel are necessary. There are some that they are putting in for their own uses and purposes too.

DR. LEWIS: But you are making that judgement on the basis of your feelings and your experience, which I'm not quarreling about. But I was delighted to hear my friend, Mr. Ward, defending PRA. He doesn't do that very often. But--

MR. SIEGEL: I didn't hear him defend it.

MR. MICHELSON: PRA says these are no never minds though.

DR. LEWIS: That's right.

MR. MICHELSON: This is a voluntary program. The utilities are doing this on their own.

DR. LEWIS: I understand. In a ficticious world in which there were no NRC, I bet a nickel they wouldn't be doing this.

MR. MICHELSON: I think I agree.

DR. LEWIS: Unless the economic hazard became--

MR. MICHELSON: Economic and safety. Because doing things you don't need to do to a plant has a negative effect

on safety. And I'm just concerned that there are no standards we're using here that can be expressed. And I'm not blaming it on the staff. I think the Commission has the responsibility here, but we're sort of seeing it--

MR. JONES: If I may comment a little bit. We do deal--to some extent you are given a risk base in the PRA world, but we do also deal in the world of perceived risk. And clearly the Rancho Secos event which the risk study says were not that risk significant. Have a lot of perceived risk. A lot of perceived risk.

MR. WARD: Where in the atomic energy laws does it say you are supposed to deal with perceived risk? Perceived by whom?

DR. LEWIS: Perceived risk is a new concept in safety analysis.

MR. JONES: Well, in a sense it--it was perceived risk and you may be right about the atomic energy law, but that transient was an awful nasty transient that got a lot of attention. Now, what we found--now, this was a perceived risk. The transient in and of itself was not a risk significant transient. Put that on the shelf. What we found from that transient was a lot of problems with the plant design, maintenance, all sorts of management issues, that has kept that plant down for a long time. That's perceived risk which you cannot pick up in a PRA directly. Because the PRA makes

certain assumptions about the quality of the equipment, the care and maintenance of that equipment to come up with the numbers. And a lot of time a lot of the recommendations received from the Owners Group comes down to proper care, maintenance, tuning of equipment. And in short fills the original function it was put in there for.

DR. LEWIS: I don't need a speech about the importance of precursors. I know something about it. But could you tell me where in the NRC regulations or issuances I can find the expression "perceived risk"?

MR. JONES: You won't, but that's the basis on which we got out on AITs and IITs. To some extent, we judge the significance of the transient. It's a perception at that time. We don't have a PRA to judge it with. It's a perceived risk at that time.

MR. SIEGEL: At the start of this program we really didn't know. If we were where we are now at the beginning of the program we may have changed it.

MR. WARD: Good. Rational comment. Good. Because you are kind of going around in a circle. You say this event occurred at Rancho Secos. The perception was that it was a nasty event and a lot of people shared that. So you went out and the IIT found a lot of things wrong. Well, those things were defined as wrong because they apparently contributed to that event, which was believed to be a nasty event.

Now you've gone through a more elaborate exercise and if you believe the analysis, you have to come to the conclusion that that event wasn't really all that nasty. And that means that maybe those maintenance problems weren't all that nasty and so forth.

MR. JONES: And except the maintenance problems with respect to the valves were found to be widespread in the plant, which said it would be nasty.

See, I think when you get a nasty transient you have to look at it. You have to look at it hard and you have to go out and look at the operation of that plant. That's what I'm going now with under the restructure we went through about a year and a half ago. Is to look at the operational safety of these plants. And if you are getting a lot of transients, some fairly complex transients, go out and study them, and see whether there are generic problems that exist at those plants. That will not be picked up very easily from a PRA or a risk study.

DR. KERR Did Rancho Seco have a resident inspector?

MR. JONES: Sure, they all have resident inspectors.

DR. KERR: Isn't it possible that a resident inspector might pick up poor maintenance?

MR. JONES: Sure. And we've got other programs, other processes--

DR. KERR: No, wait a minute. You've had to send out an IIT team to discover that there were maintenance problems? If that's the case, I don't see why we're spending as much money as we're spending on resident inspectors.

MR. JONES: We sent out an IIT team to look behind that event for what were the causes of that event and what was going on at that utility. And I think they found things above and beyond what a resident could ever have found.

MR. SIEGEL: Yes. If you looked at the number of man hour inspection that goes on at these sites, it's impossible for the resident inspector to get into the depth and scope in some of these areas--he may have a general feeling for the plant and its maintenance may not be as good as he thinks it should be, but unless you do an in-depth study and you send out enough people so that you can go into it and determine it, it's really--

DR. KERR: How many people on an IIT team?

MR. SIEGEL: I don't know. I've never been on one of those.

MR. JONES: If I remember, that was a seven-man team.

MR. SIEGEL: It was probably a week or so?

DR. KERR: A resident inspector spends fifty hours a week, forty hours a week presumably at a plant doing something or other. Now, did the IIT team spend more than that

time?

MR. SIEGEL: Absolutely.

MR. JONES: The IIT team was there I think on site for over a month. I can't remember the exact dates. I wasn't a member of that IIT either.

DR. KERR: So they had to be more than eight people.

MR. JONES: They were out there, about seven people, very concentrated on the very specific issues, and then expanding into trying to figure out generically what was going on. The residents have a lot of other--as I understand it, they've got a lot of things they do.

MR. SIEGEL: They've got fixed types of--

DR. KERR: They don't look at maintenance, in other words.

MR. SIEGEL: Yes, they do to some degree, yes. They do. But they do it sort of broad brush. If they see a problem in a specific area, they'll look into it in detail. But they don't do an overview of the whole maintenance program at a particular site. Probably through their walks through the plants and their observations, they may periodically look at them doing maintenance on one particular component or they may, walking through, spot something that they don't think is being done right.

DR. KERR: But there had not been any hint from your resident inspector up to that point that maintenance was

a problem?

MR. SIEGEL: I don't know.

MR. JONES: I wouldn't want to say that because as I remember Rancho was at that time probably a low performer and many of these issues were probably there. There is a lot of activities that involves the resident inspectors. He's got performance indicators, et cetera. But trying to get ahead of the game on these poor performers and the enhanced inspection programs performers.

So I think we've taken a lot of action in that area.

MR. SIEGEL: One thing I forgot when you mentioned about the Category C events and the core melt risk involved with them. There was, if you look at the original SER, there was some core melt risk associated with those. And in the supplement we identified the fact that if they took corrective actions, the corrective actions that they are taking in the area that they are would reduce that to the point where it was essentially not significant at all. Insignificant.

MR. WARD: It seems to me that what's at issue here--or one thing that's at issue here is what approach to perfection is required in the operation and the maintenance of nuclear power plants? I mean, sometimes I think we behave as if our goal is perfection and that's not only impossible,

it's a silly aim. It's a wasteful aim. Because the Commission has taken a courageous position I think for a government regulatory body and it has provided a safety goal, which is really far, far short of perfection. But it's an attempt to balance, you know, a number of societal issues in a reasonable way. And I think it's a good way.

But it seems that when we're faced with a real application of it, and I know you are not directly comparing it with a safety goal, but in a general sense, this is what we've got here, is beginning to regulate from a risk perspective and a risk perspective means a mature understanding that perfection is not attainable.

I mean, an IIT or an ACRS committee can always find things that are wrong. And always think of better ways to do something. But that doesn't mean those things are necessary. And we've even got a way now of judging whether they're necessary or not. It's an imperfect tool. I mean the PRA and the safety goal are tools for doing that. But I think we ought to be using--I mean, I think--you know, I don't know whether to believe the whole B&L analysis or not. But if we take that as a valid look at this whole issue, I think we have to take what it says. What it says has some pretty profound implications I think.

MR. CATTON: But, Dave, on the other hand, it seems to me that if you periodically put this plant through a state

of frenzy or a period where you're not really sure what's going on, that has to increase risk.

MR. WARD: Well, you are saying it does. And so-- I mean what I'd like to do is to take that opinion of yours and that other people seem to have and may be right, and somehow get that ground into these PRAs that we take.

MR. CATTON: I don't know why it doesn't show up.

MR. WARD: Maybe that's--well, one reason is that you're wrong. One possible explanation is that you are wrong. I don't know whether that's the correct one, but that's a possible explanation is that you are wrong.

DR. LEWIS: It looks wrong.

MR. WARD: Well, it may well be. It may well be.

MR. MICHELSON: And if it's wrong it's because it isn't modeled into the PRAs. Another reason is even where they've attempted to model, say, the unit factor, which is one of the big contributors, and if they've attempted to model it in, they haven't got the data with which to run the calculation. And that's just on the human factor alone. And I don't think there's any disagreement about all these Category Cs. The staff and B&W both say these are non-significant from the viewpoint of core melt. We're working on them for other reasons than risk. We have to be. Because they are not risk significant.

MR. WARD: I think we're working on it because we

don't quite believe that.

MR. MICHELSON: Well, both sides have agreed that it is not risk significant.

MR. WARD: Well, that's the only reason. I mean--

MR. MICHELSON: Isn't that right?

MR. WARD: Well, the Owners Group could be working on them because they want to have better operating plants which is a perfectly valid reason. I mean the only reason we or the staff should be worried about it is because we don't believe the PRA results.

MR. MICHELSON: Well, I thought the reason--

MR. WARD: We don't have full confidence in them. And that's okay. That may be necessary.

MR. MICHELSON: I was originally of the opinion that the reason to get into all of this is we were trying to get a new reassessment of the overall risk. But it turns out they didn't do the overall risk. They did the narrow risk of those certain set of transients. And, of course, that was the set that had no risk in it to begin with so we came up with a no set.

MR. WARD: Well, we didn't know they didn't--no. I don't think a year ago--I mean I sure didn't have that understanding that there was a no risk from those. I mean that's something new.

MR. MICHELSON: I think that's a good conclusion to

reach but now we ended up--even though we've ended up as being non-significant to risk, we've got some kind of a program here to get these changes made. And I think it's only because the utilities have agreed to do it.

MR. WARD: If we really had full confidence in this PRA conclusion, and I guess--I don't have enough guts to say we should have--at this point I'd say the NRC ought to back out of this whole thing and just let the utility run its own--conclude their operation.

MR. MICHELSON: I do too. I believe the PRA. But now when you start looking at the PRAs a little more carefully, we realize the deficiencies and the modeling of these various factors--

DR. KERR: Well, first of all with the PRAs, they are no damn good and I disagree with your intuition.

DR. LEWIS: Well, that's what troubles me about the whole thing. Because there was an IIT on this particular transient. The charge to an IIT is to find out what happened and determine the root cause. You know, find out what it is you need to fix in order to reduce the probability that this will happen again. You can't eliminate the chance that that will happen again, but you can at least reduce the probability. And the IIT report I think didn't say, after it was finished--I don't remember what it said--but I bet a nickel it didn't have a line that said, "Besides these plants don't

look very good to us." It didn't say anything like that.

So what troubles me is that when this proceeding passed the point of analysis into a land in which there is no map, there is no guidance, and that's why we're floundering. I think it's wrong to pit PRA as one thing in which my good friend, Mr. Ward, doesn't have as much confidence as he will someday, against just wandering around, because PRA is one possible map. But the real issue is whether wandering around without any map at all is a sensible thing to do. And the only reason we're talking about PRA is that it's one possible map.

There are other possible maps. There's one map provided by the regulations. Do these plants meet the regulations? If we feel they are not safe even if they do, we should fix the regulations. You've said that yourself many times. But somehow just wandering around fixing them because they don't look good or because you perceive more risk than was actually found is just not good regulatory procedure in my view.

End of speech.

MR. WYLIE: Any other questions?

We'll adjourn to 3:30.

(Whereupon, there was a recess.)

MR. WYLIE: We'll resume our meeting.

We have several items that the staff is to address,

starting with Item 9, evaluation of other B&W Owners Group reports, and 11, reaction trip initiating event review of the B&W Owners Group Programmatic and Management Actions, and additional concerns identified by the staff. So I'll have the staff address those.

MR. JONES: It's very short. These will be real quick. They were actually put together assuming that the Owners Group was going to go first. You don't have a lot of background on it, but I'll try to run through them quick.

There's a chapter in the report which discusses other B&W Owners Group reports which were incorporated into SPIP that were not directly part of the SPIP Program per se. And also included a section or parts of 1154 which the 1154 Task Force report which didn't seem to easily fit within the nice neat categories for the system reviews. It's kind of in a section of quote "others."

As part of earlier efforts in the Owners Group to decrease the reactor trip--the Owners Group proposed--they sent in two topical reports dealing with raising the high-pressure reactor trip set point back to its original design values of about 2355 psig, and to raise the so called arming threshhold for the anticipatory reactor trip on turbine power. to about 45 percent power, or 40 percent power.

Those two actions were based on operating history which indicated that there were some transients wherein they

could probably have written out the transients without having these anticipatory trips or determine whether they had had several that occurred at about 20 to 25 percent power level. And the high reactor trip was back within its original design basis for the plant.

We looked at that, not really under SPIP, but as part of just the earlier topical review effort. We said, yeah, they should reduce reactor trips associated with those by I think it was about 20 percent of the trips at that time or 10 percent of the trips they were experienced from these could be avoided by making these changes. And the design criteria was basically used in the regulatory criteria was do not end up actuating the PORV basically for design basis transients and accidents and they did a study wherein they showed that previous conclusions about the opening of the PORV as a result of transients or the frequency of opening of them would essentially not be changed.

On that basis we endorsed the changes, approved the topical reports and since that time we have in fact approved tech spec changes for all the B&W plants except the Davis Besse which we just got recently changing theirs and we're in the process of reviewing that now.

Another report that was included in SPIP was a report which had some recommendations to decrease unnecessary turbine trips. These dealt with a variety of changes to the

electric hydraulic control system and some other miscellaneous items to include the performance of the stock valves, et cetera. Those all appeared to be reasonable to us. They would basically just improve the performance of the turbine system as opposed to having any big safety implications, so we endorsed that report.

The last one was the 1154 Task Force report which was primarily the valve recommendations or some of the valve recommendations which Gary Hammer talked about earlier today.

And that was it on that one.

The next subject I want to talk about was the reactor trip initiating events review which was performed by the Owners Group. The Owners Group had a couple of activities associated with reactor trip initiating events. On the last slide on the previous subject you saw that they were already taking some actions before SPIP to reduce reactor trips.

Earlier on in the SPIP program they initiated some tasks to get an idea as to what were the systems that appeared to be major contributors to reactor trip frequency and to take a look at those systems as part of the overall system review.

Late in the SPIP program chronologically speaking they decided, gee, maybe we ought to go back and concentrate some efforts on those initial reactor trips, analyzing the root cause and see if there was any additional recommendations that could be derived from a detailed review of the

initiating events that would minimize or tend to reduce the number of reactor trips.

A lot of the early SPIP efforts were devoted towards reducing post trip complexities.

So they went back and reanalyzed--I think the number at that time was probably 235 I think it was reactor trips from 1980 to 1986. And they came up with recommendations above and beyond those which were already identified by the SPIP program dealing with turbine trip system, main feed system, the ICS, control rod drive system, and a series of recommendations to improve transient response pre-trip. These dealt with items such as lowering the low-pressure reactor coolant system, pressure trip set point for the reactor protection system on the Davis Besse plant, some actions to improve the effectiveness of the pressurizer spray to tend to mitigate the initial response to the system for a reduction, for example, of feedwater or any transient which would start you towards an over pressure condition. There are about seven of those.

We concentrated our review primarily on whether or not any of the recommendations appeared to have negative safety impact. For example, if you wanted to remove a reactor trip of some sort, would that be a safe thing to do? That was kind of the focus of our review.

Generally we found that the recommendations they

came up with were acceptable. There was one recommendation which the Owners Group developed and rejected dealing with when they replaced components, electrical components, or modules for like the ICS, they'd had experiences where they put in the replacement module and the thing tripped again, because the module itself or the replacement module was defective. And they recommended--there was a recommendation to check out these replacement components before you put them into place. They rejected that as not feasible or not very cost effective. We thought that was just a reasonable thing to do and asked them to reconsider.

The other item we noted was a lot of those transient improvement recommendations while on the surface appeared very valid, it didn't look like there was much of a safety assessment associated with those, so we basically said, before you put those in, please assure that you do appropriate safety evaluations before you implement them. Things like lowering the reactor protection pressure trip set point would have to have the safety evaluation done by the plant just to assure that they have no negative safety consequences because the evidence wasn't there in the reports.

That's all I have.

MR. WYLIE: Any questions? No.

Byron Siegel.

MR. SIEGEL: We were asked to address two areas.

One of them was the B&W Owners Group Programmatic and Management Actions. And I'm just going to go over this briefly because there's really nothing that's really terribly significant in it.

The Owners Group developed a generic program to look at the root cause process. It included evaluation methods, initiating conditions for doing the root cause determination process and guidelines for the evaluation.

I believe the utilities in concert with the Owners Group approved the process that was developed and the staff believes that the process should improve the way the owners evaluate transients and identify causes of equipment failure.

They have a transient assessment program report upgrades. Several improvements to their transient assessment program have been implemented. In addition, the Owners Group has stated that in response to some of our concerns about human factors, that they would address human factors in future events, for future events. And the staff believes that these improvements should improve the usefulness of the transient assessment program.

There were two boards that we discussed earlier. One was the Advisory Board and the Safety and Performance Recommendation Integration Group. The Advisory Board we believe provided added assurance that all important aspects addressed in the program would be accomplished and provided

recommendations for program improvement and implementation of recommendations.

We feel that the processes utilized by SPRIG for prioritizing and grouping the recommendations and assessing tests and high priority recommendations for completeness is also acceptable.

As I previously mentioned, the staff during its audit of B&W Owners Group determined that neither of these groups diluted the effectiveness of the recommendations in any way.

The SPRIG also identified or had a method or developed a method for identifying what they considered key recommendations, and the staff--we looked at their approach and thought it was acceptable. We didn't go through and try to specifically identify recommendations that we didn't feel were key. We just took essentially on face value based on the criteria they used that the key recommendations were indeed key.

But we identified independently eleven recommendations as I previously mentioned that the staff also feels have safety significance. And these key recommendations and the eleven that the staff has identified will probably be the nucleus from which we'll pick the recommendations when we do our audit.

This I think we covered before, so I'm not going to

belabor it. The Owners Group has submitted to the staff a letter that identifies their evaluation program and we essentially concur with the fact that they are having an evaluation program and with the scope of it.

But we, as I said, are doing our own independent one so we're not too concerned about it.

The other thing I was asked to address was the concerns identified by one of the staff members, and the only reason that these were flagged was because Demetrius sent a letter, as you are aware, to both the NRC Commission and also to the ACRS. And we were asked to essentially address his concerns. The staff itself had concerns. We've identified it during the program. These were concerns that he specifically identified.

The first one has to do with the potential lack of independence of MDR associates performing a sensitivity study for the BWR Owners Group and related work for a B&W plant owner. And the staff feels that we didn't ask them to do an independent--that that work be independent nor did we believe it was necessary that the study be performed by an independent organization so therefore we didn't have any problem with it.

The second one dealt with a potential lack of independence at Science Applications International Corporation performing similar work as a subcontractor for the NRC and for the B&W plant owners. This was reviewed by our Office of

General Counsel and they felt there was no conflict primarily because at the time that that work was initiated for the Owners Group, the staff program was essentially done. There was only about two or three weeks overlap. It was essentially complete. Oak Ridge, who was a subcontractor, did an evaluation of their assessment of whether there was any conflict of interest with regard to the person that was involved in the work and they believed it wasn't. They have since tightened up their requirements so that this sort of thing won't happen. But they did an investigation and study and determined that there wasn't any effect of that two to three-week overlap because the work was essentially complete. Our legal department agreed with that.

MR. WARD: The NRC work you're talking about, was that reported on today by Mr. Debor, or whatever his name was?

MR. SIEGEL: Human factors. No, it wasn't, it wasn't.

MR. WARD: What work are you talking about?

MR. SIEGEL: Good question.

MR. JONES: I believe it may have been some FMEA work being done by NRC as part of the A-47.

MR. SIEGEL: That's what it was.

MR. JONES: I guess SAIC did some of the FMEAs for the Owners Group also.

MR. SIEGEL: Yes, I think you're right.

There was another item. The third item had to do with a premature finding by the Owners Group of the adequacy of the ICS NNI. The Owners Group assumed the system can be modified and therefore did not consider replacement at this time. The staff believes, as was discussed by Rick Kendall yesterday that the existing system can be modified and that there wasn't a premature finding.

The Owners Group in addition is planning or looking into an advance system, so they haven't totally abandoned looking at new type systems and they are looking at those as a possible replacement.

The Owners Group or utilities did not analyze effectively the proposed SPIP recommendations to determine the effects on other parts of the plant.

The Owners Group performed some systems interactions studies; however, many of their recommendations are general in nature and the staff requires specific evaluations. Both the Owners Group and the staff intend to evaluate these aspects during the audits. I didn't mention that, but there were two old items that we were going to look at during the audits.

One was which Rick Kendall mentioned yesterday was on the 7927. INE Bulletin 7927. As part of our review, we are going to, at the same time, look at whether or not they

satisfy the requirements of that bulletin and also determine if any of the modifications that are made, there are any system--interreactions with those systems as part of that effort.

MR. MICHELSON: Is this an A-47 kind of safety implication? This is a non-safety system.

MR. SIEGEL: No. It's strictly looking to see if any of the modifications have any interactions with other systems.

MR. MICHELSON: Well, that's what A-47 is all about, safety implications and control system.

MR. SIEGEL: Yes, but it isn't just related to control systems. It's across the board for all the recommendations.

MR. MICHELSON: Oh, okay. Some of them may not be control systems.

MR. SIEGEL: Not necessarily, no.

MR. MICHELSON: Okay.

MR. SIEGEL: It would have to do with all the systems that are involved.

MR. MICHELSON: So that's what you mean by determining the effects. You are going to look for the safety implications of whatever changes they wish to make.

MR. SIEGEL: Exactly.

MR. MICHELSON: Okay.

MR. SIEGEL: The SPIP concern was the catastrophic reactor pressure vessel failure resulting from an overcooling transient assuming one control rod stuck out and it returned to criticality. The conclusion on this was the reactor ing temperature requires the reactor return to criticality was too low. It was approximately 35 degrees F for it to be considered a probable event, so as a result we didn't consider it any further.

MR. WARD: I guess I don't understand that about the rod, but the overcooling transients in general--I mean Brookhaven--the reason Brookhaven came to the conclusion they did about their not--that these transients don't introduce a bunch of core melt risks was because the bulk of transients are overcooling transients.

MR. SIEGEL: That's right.

MR. WARD: And so they must be concluding in there somewhere that these overcooling transients don't lead to PTS problems.

MR. SIEGEL: That's right, yes. This one has to do with--this is something they addressed that's so broad in their analysis. They didn't, did they, Bob?

MR. WYLIE: How did they reach their conclusion?

MR. JONES: The PTS conclusion?

MR. WYLIE: Yes.

MR. JONES: They did it as part of the risk

evaluations. They did look at PTS where it's associated with these transients. They estimated the temperature you can get to. And using some of the similar type of vessel failure probabilities based on those temperatures that were under the PTS, used as part of the PTS, and came up with a numerical value, more a core damage status associated with PTS risk, like $10^{-7}$, $10^{-8}$ type numbers. If I remember right.

MR. SIEGEL: This was looked at without a stuck rod and no bore and injection, and then with a stuck rod and bore and injection, and the temperatures for both cases were so low that you'd never get there on the cooldown.

The sixth item was operator burden study, does not address operator errors. The operator burden study did include those and those are addressed in our human factor section, Section 7 of the report.

The seventh item is B&W plants violate off-site dose limits under the condition of steam generators tube rupture design basis accident.

MR. WYLIE: I'm sorry, Byron. But sixth you wrote off pretty easily.

MR. SIEGEL: We did address it.

MR. WYLIE: Well, I bet I could think of errors of commission that you didn't address. I mean I hate to see you write that one off. How do you decide what errors of commission should be analyzed and what one shouldn't?

MR. SIEGEL: I don't have the human factors--

MR. WYLIE: Maybe I can't think of them, but Carl can think of them, I'll tell you that.

MR. SIEGEL: I don't think we addressed all of them. We addressed some of them.

MR. WYLIE: And that's what I'm wondering. How was that defined? I think you have to do that in some way but I--

MR. SIEGEL: I guess I can't answer that question. The Human Factors people aren't here and I'm not sure--Bob, do you know the answer to that?

MR. JONES: No, I don't remember.

MR. DAVIS: There's a reference to SER Section 7.2.

MR. JONES: Yes. But what it identifies specifically--what's in there is pretty general in nature. It won't address what you are asking. I think it's pretty broad.

MR. WARD: Okay. All right.

MR. SIEGEL: Item 7, the B&W plants violate on-site dose limits under the condition of the steam generator tube rupture design basis accident. We didn't address this because it was being addressed by Generic Issue 67.

On Item 8, the main steam line break in steam generator tube ruptures when they are created as one design basis accident for all PWRs. Again, this is under consideration as part of USIA 3, 4 and 5 regarding steam generator

tube integrity, so we didn't address that item.

Item 9 was certain failures in the turbine control. To delay turbine trip after reactor trip can result in a reactor trip without a turbine generator trip.

This was generic to all the PWRs. There was a memo sent to Research suggesting that this be proposed as a generic issue by the originating staff member. This in fact has been done and he has sent it over to the Generic Issues Branch to prioritize it and determine the risk associated with it.

That's all I've got. Does anybody have any questions?

DR. REED: In my background I'm just a bit surprised on Item 9 that that is generic. In my experience I don't know of a trip situation where reactor trip is not accompanied by a turbine generator trip unless there's a failure in the circuit. It's designed in in all those that I know of.

MR. SIEGEL: There was a study that was made--let me see if I can read my scribbling--it apparently is valid for all PWRs at the end of -- or the end of the fuel cycle. There was an I&EL study that just came out April of '83 and the study indicates that you can have recriticality both with or without a--

DR. REED: Well, that's a trip.

MR. SIEGEL: That's a trip. I'm sorry. That's a trip. You're right.

MR. JONES: What's the question again?

DR. REED: Well, I was just wondering--in my experience I didn't realize that it would be generic because I just don't know that--my reactors--reactors that I've been familiar with, the turbine always gets trip signals if the reactor trips.

MR. JONES: Oh, right. And the question is what happens if it fails. And--

DR. REED: You are just saying automatically the circuitry fails, is that it?

MR. JONES: Yes. We had an experience just recently at Crystal River wherein that trip signal failed. The trip signal got there but the solenoid failed and Crystal River's turbine didn't trip. It was the consequences of that failure. Similarly on the Westinghouse plants, there is a delay in the turbine for about thirty seconds.

DR. REED: Not on Westinghouse plants I'm familiar with.

MR. JONES: Well, there are some that have them. Either Sanofre or Diablo, one of those have it.

DR. REED: A couple of weirdos, huh?

MR. JONES: There are some that do have that system.

MR. SIEGEL: That study that I was mentioning was related to this. And it was to the return of recriticality because you don't get the turbine trip and you get a cooldown.

And as a result it indicated that the problem was existent both for Westinghouse and CEN and B&W plants, and for all three types of plants. And with or without--they addressed it both with and without a stuck rod.

MR. DAVIS: But Item 5 says you have to get clear down to 35F for the stuck rod to get recriticality.

MR. JONES: Yes, sir. And this is something that just came in--this INL report came in--either Monday or Tuesday I got it and I saw that they had gotten it and I called up the Research guy--there was a note on the copy that says, "What's going on here?" Are they using different numbers than the staff used when they did the calculations? And one or both of these are in error.

The information we had when we wrote the SER with respect to the recriticality issue was that you had to get down to about 35 degrees with a stuck rod--

MR. DAVIS: That's with no bore on injection in the blind.

MR. JONES: The 35 degrees with a stuck rod included the bore on injection. Without the bore on injection you had to be, I think it was around 300 degrees.

MR. DAVIS: Okay. That makes more sense.

MR. JONES: But because the issue of the catastrophic failure was related to also filling back up the pressurizer, getting cold, and then going back. And it may be

the amount of bore on was different between that study that we referenced in our resolution of Item 5 and what's coming up out of this recent study on the turbine trip on the re-criticality issue.

So I want to try to focus that anyway. I don't want him to bring it up because I wasn't sure whether the numbers were right, so I wanted to delay it. I didn't understand where they came up from. I just glanced at it and noticed the inconsistency.

MR. SIEGEL: But it may be due, you said before, to the reactivity margins, the differences they are getting in reactivity margins--

MR. JONES: It's just not clear.

MR. SIEGEL: Because there's probably several hundred degrees difference between this number and what this INL report--

DR. REED: And as you do your investigation, recognize that many plants have main steamline stop valves that may also be tied into the turbine trip circuit breakers. So if the turbine doesn't trip, the throttle wells don't go down or something, the main steamline stops may close.

MR. JONES: The INL study includes basically three cases. It's only done for the B&W plant. It includes three cases. Basically one where you don't trip the turbine and the line stays wide open. Another case where they modulate

the control valves to determine shut with the ICS runback at 20 percent a minute. Another one where we looked at controlling the control valves to maintain pressure in the steam generator.

In the ICS functions, these things are not near as severe an event, and so really the turbine trip or the reactor trip without turbine sequence, it gets the worse temperatures, appear to be $10^{-7}$ sequence. $10^{-7}$ to $10^{-8}$ sequence, if I remember the numbers correctly.

So they looked at several cases and they tried to account for closure of the MSIBs, also result in some of the quick studies that have been done.

This was just information to be used to help prioritize the issues to determine whether further study is warranted from a safety standpoint.

MR. SIEGEL: Yes, that report was sent over along with the request to prioritize--

MR. WYLIE: Okay. Any other questions?

MR. JONES: We'd like to make a couple of closing remarks.

MR. WYLIE: Okay.

MR. JONES: Over the last two days, and they've been a long two days for everybody--there's been a lot of comments with respect to the scope and the overall reassessment program. And some of my comments may be redundant to

what I've said earlier, but we would like to offer the overall staff view of this whole project.

First of all, the staff developed its plan in about March of '86 in response to the EDO letter to try to address all the issues that Mr. Stello identified. These were provided both to the EEO staff and the NRR management and to the best of our knowledge did indeed address all the issues that we were told to address.

In addition, we did discuss the plan with you in the June '86 subcommittee meeting which provided some comments on--we incorporated your comments with the exception of the management-related issue items we discussed earlier today.

The primary focus of the program was B&W design specific issues. As such, we didn't review external events. We think that is a very plant-specific issue that is not an NSS design specific issue. It's just as valid for any given plant out there and there would be no way to do it on a generic basis for the B&W plants and the NSS design itself does not have a substantial influence on that.

Although I don't think this comment was made earlier, there was some comments made by Mr. Tackie about whether or not we looked at two-phase design characteristics and transient response to accidents of these plants. We did look at it. It was one of the things we did as part of the program was going back and looking at the old NUREG documents.

And looked at the old discussions on two-phase flow issues and decided whether or not that had to be reresurrected as part of this overall process. And as is discussed at least the section on the small break LOCA, in the Section 5 of the report, we did look at the two-phase natural circulation and identified it as a unique characteristic of the plant, but did not see that as a safety problem that needed to be addressed additionally at this time.

So that in general we looked at it. We didn't think that it had to be resurrected. It wasn't the problem that we received today with the plant.

The emphasis of the program was indeed placed under the operating history. That's what led to this whole letter. And in light of the operating history since the TMI modes, which we thought it would have affected the behavior of these plants, that it more than appeared that it has. As well as rereviewing sensitivity in light of some of those TMI modes. And looking at the risk where we had on board to determine to some extent the overall state of the B&W plants versus other PWRs.

In summary, the conclusion we come up with is the program was responsive to Mr. Stello's letter. We think the program has indeed examined the B&W unique design characteristics. We think in review of the operating history and the sensitivity study and the risk work that was performed, we

believe that the Owners Group program and the extensions that the staff has performed that we felt necessary have confirmed that the proper systems were examined and dealt with as part of the program.

We've also we beleive have confirmed that the overall safety of the B&W design at least as related to the NSS-specific design characteristic has been reexamined and is not significantly different than that of other PWRs.

Finally, we believe that the implementation of the recommendations will indeed result in improved operational performance and safety for the B&W plants.

We thank you for the review that you've done today and yesterday and we understand some of your concerns on the scope.

What we would like you to consider when you deliberate any letter or recommendations you make to the full committee is try to keep them like the operating experience which brought to light this program and whether you think we have done an adequate job in responding to that operating experience.

(Go to next page.)

What we would like you to consider now is any recommendations to be made to the full committee and to try and keep in mind the operating experiences which brought to light this program and questions as to whether you thing we have done an adequate job in responding to that operationg experience.

MR. WYLIE: I would like to thank the staff and the B&W Owners Group for their participation and suppory in this meeting and I think we can close the record at this time and consider a couple of items.

The services of the reporter will no longer be required.

(Whereupon at 5:00 o'clock p.m., the subcommittee record was closed.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name: Babcock & Wilcox Reactor Plants

Docket Number:

Place: Washington DC

Date: May 4, 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/ Irwin J. Coffenberry

(Signature typed): Irwin Coffenberry

Official Reporter

Heritage Reporting Corporation

# NRR STAFF PRESENTATION TO THE ACRS

SUBJECT: SYSTEMS REVIEW, MECHANICAL ASPECTS OF MFW, AFW/EFW, SECONDARY PLANT RELIEF, INSTRUMENT AIR

DATE: May 3, 1988

PRESENTER: William LeFave

PRESENTER'S TITLE/BRANCH/DIV:

Senior Reactor Engineer (Nuclear)
Plant Systems Branch
Division of Engineering and Systems Technology

PRESENTER'S NRC TEL. NO.: 492-0862

SUBCOMMITTEE: B&W Reactor Plants

MFW SYSTEM

- STAFF CONCURS THAT PROPER IMPLEMENTATION OF RECOMMENDATIONS WILL REDUCE FREQ OF MFW/CONDENSATE INDUCED REACTOR TRIPS AND SEVERITY OF TRANSIENTS
- RECOMMENDATIONS ADDRESS DESIGN, MAINTENANCE AND TESTING ASPECTS AIMED AT IMPROVING RELIABILITY
- STAFF RECOMMENDS ENTERING INTO THE RTS THE REMAINING UNPROCESSED RECOMMENDATIONS (MFW) FROM THE TRIP INITIATING EVENTS
- THE BWOG RECOMMENDATIONS ARE RESPONSIVE TO THE MPR SENSITIVITY STUDY (APP.P)
- COMMENTS IN BWOG OPERATOR BURDEN REPORT (APP.S) SHOULD BE CONSIDERED DURING IMPLEMENTATION
- RECOMMENDATION FOR ENHANCING RELIABILITY OF MFW/CONDENSATE SYSTEMS AND CONTROLS SHOULD BE ADDED TO KEYLIST

# BOP IMPORTANCE

- o POOR BOP PERFORMANCE INCREASES RISK
- o MFW/TURBINE CONTROL PROBLEMS ARE MAJOR CAUSE OF BOP RELATED-TRIPS/PLANT TRIPS
- o LICENSEE's PRACTICES/PERFORMANCE VARY CONSIDERABLY IN BOP AREA
- o PLANTS WITH AGRESSIVE BOP PROGRAMS WILL HAVE HIGHER PLANT AVAILABILITY
- o ECONOMIC INCENTIVES FOR RELIABLE BOP OPERATION HAVE POSITIVE AFFECT ON SAFETY

# BOP REGULATIONS

- o POLICY ISSUE, SECY-86-349, NOV 21, 1986 DESCRIBES BOP PROGRAMS/SAFETY SIGNIFICANCE OF BOP ITEMS
  - FREQUENCY OF CHALLENGES
  - EFFECTS ON SAFETY RELATED SYSTEMS/OPERATOR CONTROL
- o STAFF REVIEW IN PAST FOCUS ON IMPACT ON SAFETY-RELATED SYSTEMS
- o TODAYS FOCUS IS ON FREQUENCY OF BOP CHALLENGES/OPERATOR CONTROL
- o TEMPORARY INSTRUCTION 2515/83 BOP TRIAL INSPECTION PROGRAM COMPLETE
  - o TI EXTENDED WHILE INSPECTION PROCEDURE ISSUED FOR COMMENT
- o RESULTS OF TI SHOWED UTILITIES ARE CONCERNED WITH BOP
- o TAP TO ASSESS SAFETY SIGNIFICANCE OF BOP AND DEVELOP RULES, REG, OR GUIDANCE IF NEEDED
  - CONTRACT IN PLACE WITH SAIC TO PERFORM STUDY OF PROGRAMS
  - MAINTENANCE POLICY/RULE EFFECTS ON BOP

AFW SYSTEM

- VERIFICATION THAT RECOMMENDATIONS DO NOT CONFLICT WITH NRC RULES, REGS, OR GUIDELINES
- MANY RECOMMENDATIONS CALL FOR ANALYSES/EVALUATION BY UTILITIES, STAFF CANNOT ASSESS ACTUAL BENEFIT UNTIL IMPLEMENTATION NO IMMEDIATE IMPACT
- STEERING COMMITTEE HAD NOT ACTED ON MANY OF RECOMMENDATIONS IN APP.Q RELATED TO DESIGN/TESTING OBJECTIVES
- BWOG EFFORT DID NOT ADDRESS THE ADDITION OF A THIRD AFW PUMP. STAFF IS PURSUING THIS VIA GI-124
- IF PROPERLY IMPLEMENTED RELIABILITY/AVAILABILITY OF AFW SYSTEM SHOULD BE ENHANCED TO VARYING DEGREES
- STAFF RECOMMENDED KEEP IN MIND REJECTED BWOG RECOMMENDATION RELATED TO RESEARCH PROGRAM FOR TURBINE CONTROLS SHOULD DESIRED AFW PERFORMANCE NOT BE ACHIEVED

## SECONDARY PLANT RELIEF SYSTEM

- CONSISTED OF MAIN STEAM PRESSURE CONTROL REVIEW TO REDUCE MSSV ACTUATIONS FOLLOWING Rx/TURB TRIPS
- TESTING/MAINTENANCE/PERFORMANCE OF MSSVS RELATED TO VALVE TASK FORCE EVALUATION
- RAISING MSSV SET POINTS CONSIDERED PART OF VALVE TASK FORCE EVALUATION, NOT ENCOURAGED BY STAFF
- AFW RECOMMENDATIONS ARE RESPONSIVE TO CONCERNS IDENTIFIED DURING PRESSURE CONTROL REVIEW
- THE STAFF BASICALLY AGREES WITH PHASED APPROACH
- STAFF RECOMMENDS BWOG CONTINUE TO INVESTIGATE PLANT MODIFICATIONS, ESCALATE ANALYSES IF NECESSARY
- PROPER IMPLEMENTATION WILL IMPROVE PERFORMANCE OF RELIEF SYSTEM, POST-TRIP PRESSURE CONTROL AND OPERATOR BURDEN, AND ENHANCE PLANT SAFETY

## INSTRUMENT AIR SYSTEM

- AIR SYSTEM INCLUDED BECAUSE FAILURE SIMILAR IN EXTENT AND CHARACTER TO LOSS OF ICS POWER
- STAFF COMPAPED BWOG RECOMMENDATIONS WITH AEOD REPORT - FAVORABLE RESULTS
- STAFF AGREES WITH CONCLUSIONS AND RECOMMENDATIONS
- RECOMMENDATIONS FOR AIR SYSTEMS DO NOT REQUIRE EXTENSIVE EVALUATION/ANALYSES BEFORE IMPLEMENTATION
- RECOMMENDATIONS ADDRESS RECENT STAFF CONCERNS
  - CLEANLINESS
  - EMERGENCY PROCEDURES
  - TESTING
  - OVERALL IMPORTANCE OF IA SYSTEM
- BWOG SHOULD CONSIDER RECOMMENDATION FOR GRADUAL LOSS OF AIR SYSTEM TEST (AEOD REPORT)
- BWOG SHOULD CONSIDER ANALYSIS TO ASSESS IMPACT ON SAFETY ON LOSS OF IA DUE TO LOOP EVENT
- ADD FOUR OF IA RECOMMENDATIONS TO KEY LIST
  - INSPECTION FOR LEAKS
  - TRAINING AND LOSS OF IA RESPONSE PROCEDURES
  - INSPECT ACCUMULATORS/CHECK VALVES
  - DEVELOP/UPGRADE LOSS OF IA PROCEDURES (3 PLANTS)

# NRR STAFF PRESENTATION TO THE ACRS

SUBJECT: B & W REASSESSMENT - VALVE RELIABILITY IMPROVEMENT RECOMMENDATIONS

DATE: May 3, 1988

PRESENTER: Gary Hammer

PRESENTER'S TITLE/BRANCH/DIV: Mechanical Engineer, EMEB, DEST

PRESENTER'S NRC TEL. NO.: 492-0919

SUBCOMMITTEE: B&W Reactor Plants

# B & W REASSESSMENT - VALVE RELIABILITY IMPROVEMENT RECOMMENDATIONS

MAIN STEAM SAFETY VALVES

- IMPROVE PERFORMANCE BY BETTER SETPOINT PROCEDURES, BETTER RING ADJUSTMENT PROCEDURES AND BETTER MAINTENANCE

- MAY REDUCE CHALLENGES BY ENHANCING TURBINE BY-PASS VALVE AND ATMOSPHERIC VENT VALVE PERFORMANCE

- MAY REDUCE CHALLENGES BY INCREASING MSSV SETPONTS - NOT ENCOURAGED BY THE STAFF

- FURTHER STUDY BY VALVE TASK FORCE (VTF) TO BE DONE - NO REPORT TO DATE

MOTOR OPERATED VALVES (MOVS) AND OTHER POWER OPERATED VALVES (POVS)

- IMPROVE PERFORMANCE OF ALL SAFETY-RELATED VALVES BY ENHANCED TESTING CONSISTENT WITH BULLETIN 85-03

409/451

- FURTHER STUDY BY VTF

POWER OPERATED RELIEF VALVES AND BLOCK VALVES

- IMPROVE RELIABILITY OF PORVS AND BLOCK VALVES BY TESTING CONSISTENT WITH DRAFT ASME STANDARD OM-13

CHECK VALVES

- IMPROVE PERFORMANCE OF CHECK VALVES THROUGH USE OF INPO SOER 86-03 GUIDELINES WHICH ADDRESS DESIGN, OPERATION AND MAINTENANCE

- FURTHER STUDY BY VTF

# Human Factors Evaluation of B&W Plant Reassessment Program

Prepared for:

ACRS Subcommittee on
B&W - Reassessment Program

May 3, 1988

Prepared by:

Joseph DeBor
Science Applications
International Corporation

# Background

- Human Factors-Related Elements of Reassessment Program Included:

  - Task 1 - Operator/Maintenance Personnel Interview Project
  - Task 2 - Operating Experience Reviews
  - Task 3 - Procedures Review
  - Task 4 - Operator Burden Project/Sensitivity Study

- Review Conducted on Behalf of NRC by:

  - SAIC
  - COMEX Corporation
  - Carlow Associates

# Task 1: Operator/Maintenance Personnel Interview Project

- B&W identified 11 hardware problems and identified concrete recommendations.

- B&W also identified 6 human engineering problems, but no concrete recommendations or follow-up actions were developed. Examples of problems included:

  - ICS' feedwater control of T-Ave is poor.

  - Difficult to tune secondary system at less than 100% power.

  - Delayed subcooling margin potentially confusing.

# Task 2: Operating Experience Reviews

- o B&W review was comprehensive.
- o Human engineering issues were summarized and characterized:
  - Human Interface
    - -- Operations and Operating Procedures
    - -- Surveillance and Testing
    - -- Maintenance
  - Training
  - Displays

## Task 3: Procedures Review

- Significant human engineering concerns involving components and displays on loss of ICS/NNI were addressed by each plant.

- B&W general recommendations for labeling and component modifications are appropriate, but not plant specific.

# Task 4: Operator Burden

The operator burden study findings are valid human engineering issues, and the B&W recommendations are appropriate, e.g.,

- Control of steam and feed flow on loss of automatic control.
- Drastic operator actions.
- Overcooling mitigation strategy.

# Task 4: Sensitivity Study

- The B&W sensitivity study was comprehensive.
- The B&W recommendations imply far reaching man-machine interface changes in the control room, e.g.,
  - Eliminate anticipatory reactor trip on turbine trip.
  - Reduce probability of overcooling on turbine trip.

## Overall Assessment of B&W Findings

- The B&W studies resulted in valid human engineering concerns. However, because human factors professionals were not involved in the reassessment effort, the completeness of the effort in identifying human factors concerns is uncertain.

- The proposed corrective actions imply very significant changes in the man-machine interface environment in control rooms; but they are general, and not plant specific.

- The proposed corrective actions do not include implementation dates.

## Recommendation

Include human engineering experts, such as those who participated in the development of modifications resulting from the recent control room design reviews as members of modification teams.

# NRR STAFF PRESENTATION TO THE ACRS

SUBJECT: RISK ASSESSMENT

DATE: May 3, 1988

PRESENTER: R. YOUNGBLOOD

PRESENTER'S TITLE/BRANCH/DIV:
GROUP LEADER / BNL

PRESENTER'S NRC TEL. NO.:
FTS 6662363

SUBCOMMITTEE: B&W Reactor Plants

Bob Fitzpatrick
Charlie Soo
Amico

# RISK SIGNIFICANCE OF COMPLEX TRANSIENTS AT B&W PLANTS

PRESENTED BY

R. YOUNGBLOOD
SAFETY AND RISK EVALUATION DIVISION
DEPARTMENT OF NUCLEAR ENERGY
BROOKHAVEN NATIONAL LABORATORY

# PERCEPTIONS

B&W PLANTS ARE NOT ASSESSED TO HAVE SIGNIFICANTLY HIGHER CORE DAMAGE FREQUENCY THAN OTHER PLANT TYPES

YET

B&W PLANTS SEEM TO EXPERIENCE COMPLEX TRANSIENTS MORE FREQUENTLY

# ISSUES

IS PRA MISSING SOMETHING IMPORTANT ?

IS B&W CORE DAMAGE FREQUENCY HIGHER THAN THAT OF OTHER CLASSES OF PLANTS ?

# BWOG SUBMITTALS

BWOG SUBMITTAL ARGUES EVENTS OCCURRING IN COMPLEX TRANSIENTS ARE

WITHIN SCOPE OF EXISTING PRA MODELS

PROPERLY TREATED

SO NO REASON TO DOUBT PREVIOUS PRA CONCLUSIONS

ALSO ARGUE SUPPORT SYSTEM FAULTS STILL MOST LIKELY CAUSE OF CORE DAMAGE

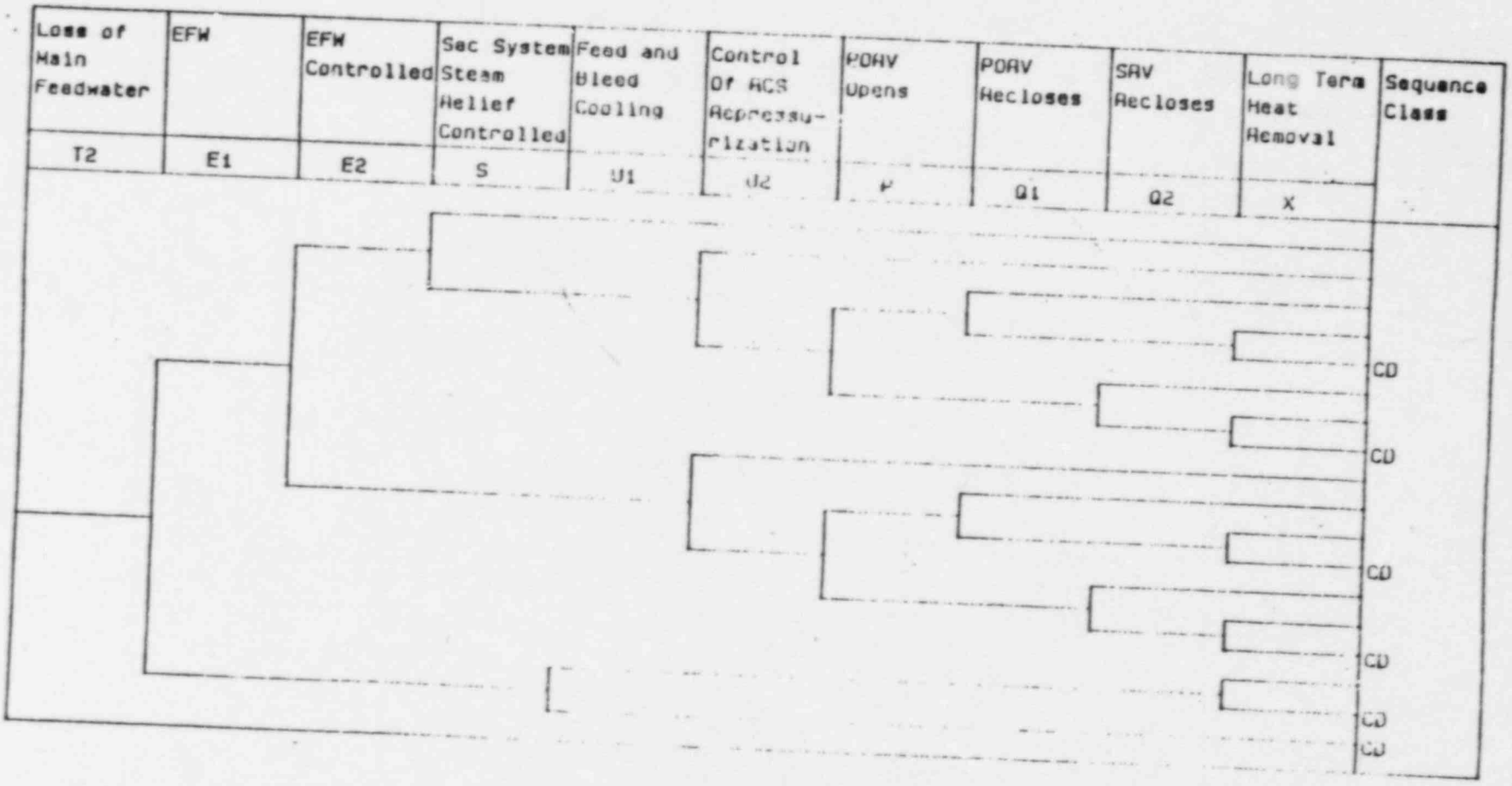


Figure 3-2. Loss of Main Feedwater Event Tree

# BWOG SUBMITTALS

(CON'T )

THIS LINE OF ARGUMENT DOES NOT ADDRESS THE QUESTION OF FREQUENCY OF COMPLEX TRANSIENTS

- BWOG EVENT TREE DISCUSSION VERY SIMPLIFIED

  EFW FAILS TOTALLY OR SUCCEEDS TOTALLY

  VS

  EFW FAILS INITIALLY BUT IS RECOVERED

THERE IS A NEED TO ENSURE CONSISTENCY OF THE CORE DAMAGE MODEL WITH THE OBSERVED EXPERIENCE

# BNL APPROACH

CONSTRUCT AN EVENT TREE MODEL WHICH

PREDICTS CORE DAMAGE FREQUENCY FOR SPECIFIED SEQUENCE TYPES

PREDICTS FREQUENCY OF COMPLEX TRANSIENTS FOR SPECIFIED TRANSIENT TYPES

LINKS THESE PREDICTIONS

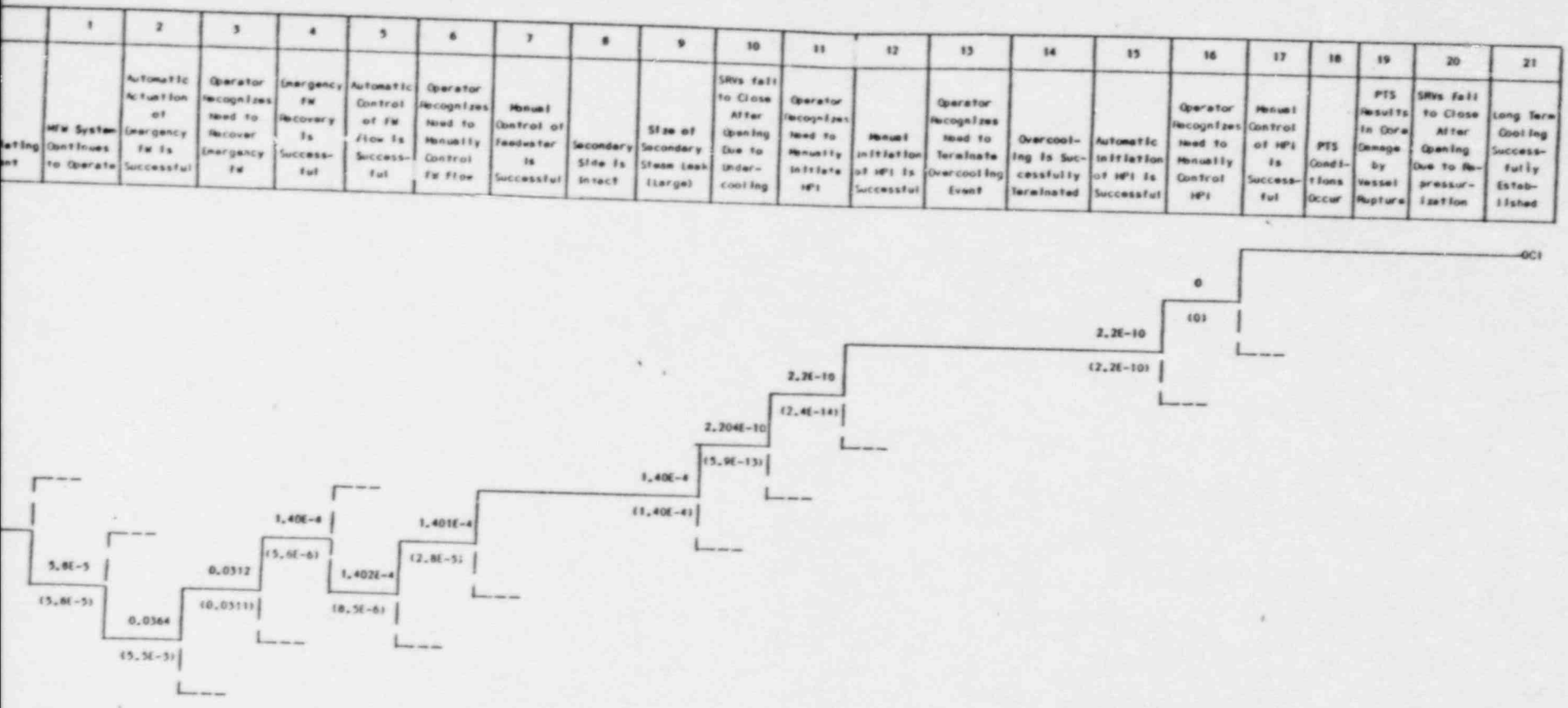


Figure 4.20. Davis-Besse 6/9/85.

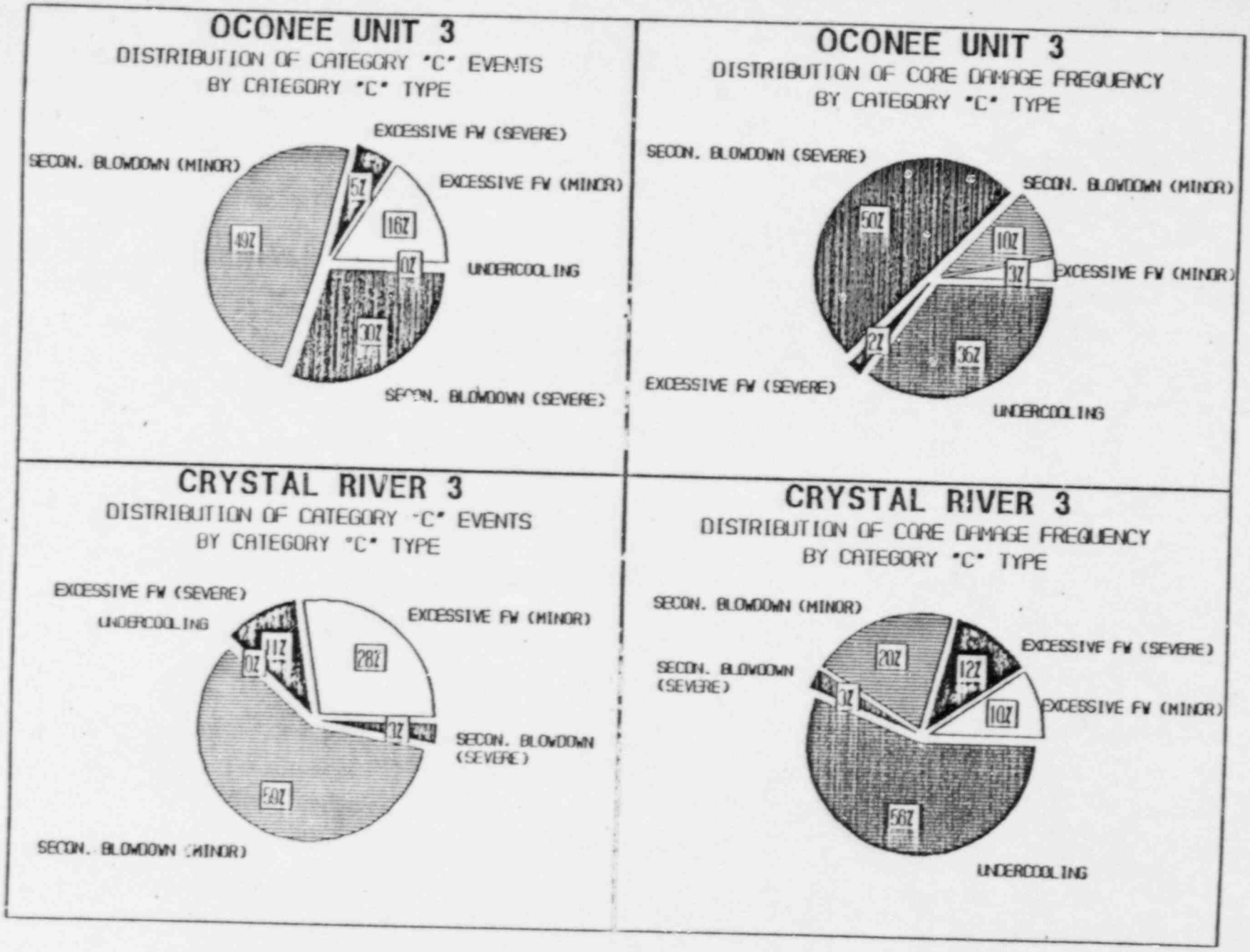
OCONEE UNIT 3
DISTRIBUTION OF CATEGORY "C" EVENTS
BY CATEGORY "C" TYPE
EXCESSIVE FW (SEVERE)
SECON. BLOWDOWN (MINOR)
EXCESSIVE FW (MINOR)
5%
16%
49%
10%
UNDERCOOLING
30%
SECON. BLOWDOWN (SEVERE)
OCONEE UNIT 3
DISTRIBUTION OF CORE DAMAGE FREQUENCY
BY CATEGORY "C" TYPE
SECON. BLOWDOWN (SEVERE)
SECON. BLOWDOWN (MINOR)
50%
10%
3%
EXCESSIVE FW (MINOR)
2%
36%
EXCESSIVE FW (SEVERE)
UNDERCOOLING
CRYSTAL RIVER 3
DISTRIBUTION OF CATEGORY "C" EVENTS
BY CATEGORY "C" TYPE
EXCESSIVE FW (SEVERE)
UNDERCOOLING
EXCESSIVE FW (MINOR)
11%
0%
28%
3%
SECON. BLOWDOWN
(SEVERE)
58%
SECON. BLOWDOWN (MINOR)
CRYSTAL RIVER 3
DISTRIBUTION OF CORE DAMAGE FREQUENCY
BY CATEGORY "C" TYPE
SECON. BLOWDOWN (MINOR)
20%
EXCESSIVE FW (SEVERE)
12%
SECON. BLOWDOWN
(SEVERE)
3%
10%
EXCESSIVE FW (MINOR)
56%
UNDERCOOLING

Figure 4.8.

# SIGNIFICANCE OF OBSERVED EVENTS

EACH OF 12 COMPLEX TRANSIENTS EXPERIENCED AT B&W PLANTS WAS ASSESSED

TWO EVENTS (DAVIS-BESSE - SEPT 1977 AND RANCHO SECO - MARCH 1978) ARE MUCH MORE SIGNIFICANT THAN THE REST

THESE TWO INVOLVED UNDERCOOLING

THE REST INVOLVED OVERCOOLING

UNDERCOOLING HAS HIGHER CONDITIONAL PROBABILITY OF GOING TO CORE DAMAGE

# CONCLUSIONS

AS A CLASS, B&W PLANTS CANNOT PRESENTLY BE SAID TO HAVE A CORE DAMAGE FREQUENCY SIGNIFICANTLY GREATER THAN THAT OF OTHER PLANT TYPES

OVERCOOLING EVENTS DOMINATE CATEGORY C FREQUENCY, BUT ARE MINOR CONTRIBUTIONS TO CORE DAMAGE FREQUENCY AT ALL PLANT TYPES

OF THOSE CATEGORY C EVENTS WHICH ARE EXPERIENCED, UNDERCOOLING IS THE EVENT MOST LIKELY TO LEAD TO CORE CAMAGE

OF THOSE CATEGORY C EVENTS WHICH ARE EXPERIENCED, LOSS OF ICS FUNCTION IS CONSIDERED TO BE THE MOST SIGNIFICANT INITIATING EVENT

## RISK ASSESSMENT REVIEW

- o CATEGORY C SEQUENCES MODELED IN THE CR-3 AND OCONEE PRAs. ACTUAL B&W TRANSIENT HISTORY ADEQUATELY REPRESENTED IN BOTH PRAs.

- o CR-3 AND OCONEE PRAs INDICATED MINIMAL CORE DAMAGE RISK DUE TO CATEGORY C EVENTS AT THESE UNITS.

- o FEED-AND-BLEED (HPI) COOLING CAPABILITY IS AN IMPORTANT ACCIDENT MITIGATOR FOR B&W UNITS.

- o SUPPORT SYSTEMS (SERVICE WATER AND AC POWER) WERE FOUND TO BE RELATIVELY RISK-IMPORTANT IN BOTH ACCIDENT INITIATION AND MITIGATION.

- o GENERALIZATION OF THE CR-3 AND OCONEE PRA RESULTS INDICATED THAT CATEGORY C EVENTS ARE NOT LIKELY TO BE CONSIDERED AS DOMINANT CONTRIBUTORS TO CORE DAMAGE RISK FOR MOST B&W UNITS. DAVIS-BESSE AND TMI WERE FOUND TO HAVE A NON-NEGLIGIBLE CONTRIBUTION TO CORE DAMAGE RISK FROM CATEGORY C EVENTS - DAVIS-BESSE, DUE TO DB'S UNIQUE REQUIREMENTS FOR HPI COOLING; AND TMI, DUE TO DIFFERENCES IN THE TMI PRA ANALYSIS.

- o WHILE THE B&WOG INTENDS TO REDUCE THE FREQUENCY OF OR ELIMINATE ALTHOGETHER THE CATEGORY C EVENTS, FROM A PURE PRA PERSPECTIVE, THE RISK ASSESSMENT REVIEW INDICATES THAT B&W CATEGORY C EVENTS ARE RECEIVING MORE ATTENTION THAN THEIR CORE DAMAGE RISK-IMPORTANCE INDICATES IS WARRANTED.

# B&W PLANT REASSESSMENT
# NUREG–1231

# REACTOR TRIP INITIATING EVENTS REVIEW

PRESENTED TO
ACRS SUBCOMMITTEE
ON B&W REACTORS
MAY 3–4, 1978

PRESENTED BY

R.C.JONES
NRR/DEST/SRXB

BWACRS5

# STAFF FINDINGS

- BWOG REVIEWED REACTOR TRIPS FOR 1980 – 1986

- ADDITIONAL RECOMMENDATIONS DEVELOPED TO REDUCE REACTOR TRIP FREQUENCY
  - TURBINE TRIP SYSTEMS (8)
  - MAIN FEEDWATER SYSTEMS (11)
  - ICS (5)
  - CONTROL ROD DRIVE SYSTEM (5)
  - IMPROVE TRANSIENT RESPONSE (7)

- STAFF REVIEW CONCENTRATED ON POSSIBLE NEGATIVE IMPACTS OF RECOMMENDATIONS

- STAFF GENERALLY FINDS RECOMMENDATIONS ACCEPTABLE
  - BWOG RECONSIDER RECOMMENDATION TO PROPERLY CHECK OUT REPLACEMENT COMPONENTS
  - PLANT SPECIFIC SAFETY EVALUATIONS NEEDED TO IMPLEMENT TRANSIENT IMPROVEMENT RECOMMENDATIONS

BWACRS23

# B&W PLANT REASSESSMENT
# NUREG–1231

# EVALUATION OF OTHER
# BWOG REPORTS

PRESENTED TO
ACRS SUBCOMMITTEE
ON B&W REACTORS
MAY 3–4, 1978

PRESENTED BY

R.C.JONES
NRR/DEST/SRXB

BWACRS4

# STAFF FINDINGS

- STAFF PREVIOUSLY APPROVED TOPICALS FOR RAISING HIGH PRESSURE TRIP SETPOINT AND ARMING THRESHOLD FOR ARTS ON TURBINE TRIP
  - EXPECTED TO REDUCE REACTOR TRIP FREQUENCY
  - DOES NOT SIGNIFICANTLY INCREASE PORV OPENINGS
  - PLANT TECH SPEC CHANGES APPROVED OR UNDER REVIEW FOR OPERATING B&W PLANTS

- TURBINE SYSTEM RECOMMENDATIONS EXPECTED TO DECREASE UNNECESSARY TURBINE TRIPS

- 1154 TASK FORCE REPORT RECOMMENDATIONS EXPECTED TO IMPROVE RELIABILITY OF MOVs, PORV, PORV BLOCK VALVE AND CHECK VALVES

BWACRS22

# NRR STAFF PRESENTATION TO THE ACRS

**SUBJECT:** B&W Owners Group Plant Reassessment Program - BWOG Programmatic and Managment Actions

**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

BWOG PROGRAMMATIC AND MANAGEMENT ACTIONS

ROOT CAUSE PROCESS

GENERIC PROGRAM TO SERVE AS MODEL TO UTILITIES TO DEVELOP THEIR OWN PROGRAMS

- o EVALUATION METHODS
- o INITIATING CONDITIONS
- o GUIDELINES FOR EVALUATION

THIS PROCESS SHOULD IMPROVE THE WAY OWNERS EVALUATE TRANSIENTS IDENTIFY CAUSES OF EQUIPMENT FAILURES.

TRANSIENT ASSESSMENT PROGRAM REPORT UPGRADES

SEVERAL IMPROVEMENTS TO TAP HAVE BEEN IMPLEMENTED. IN ADDITION BWOG HAS STATED THAT HUMAN FACTORS CONCERNS WILL BE ADDRESSED FOR FUTURE EVENTS.

IMPROVEMENTS MADE SHOULD IMPROVE USEFULNESS OF TAP IN ASSESSING TRANSIENTS.

ADVISORY BOARD & SAFETY AND PERFORMANCE RECOMMENDATION INTEGRATION GROUP (SPRIG)

BOARD PROVIDED ADDED ASSURANCE ALL IMPORTANT ASPECTS ADDRESSED TO ACHIEVE PROGRAM OBJECTIVES, PROVIDED RECOMMENDATIONS FOR PROGRAM IMPROVEMENT AND IMPLEMENTATION OF RECOMMENDATIONS.

PROCESSES UTILIZED BY SPRIG FOR PRIORITIZING, GROUPING RECOMMENDATIONS AND ASSESSING TEST FOR HIGH PRIORITY RECOMMENDATIONS FOR COMPLETENESS ACCEPTABLE.

STAFF DURING ITS AUDIT OF BWOG AT B&W DETERMINED THAT NEITHER GROUP FUNCTIONED IN A MANNER THAT DILUTED THE EFFECTIVENESS OF THE RECOMMENDATIONS PROPOSED BY THE VARIOUS SUBCOMMITTEES.

THE STAFF IDENTIFIED IN THE SSER 11 ADDITIONAL RECOMMENDATIONS THAT HAVE SUFFICIENT SAFETY SIGNIFICANCE TO BE IDENTIFIED AS HIGH PRIORITY AND SHOULD BE GIVEN ADDITIONAL ATTENTION DURING PLANT AUDITS.

BWOG EVALUATION PROGRAM

PROGRAM IN PLACE TO EVALUATE EACH UTILITY.

- o PROGRAM FOR MANAGING SPIP RECOMMENDATIONS
- o ASSESS ADEQUACY OF IMPLEMENTATION INTERPRETATION
- o MONITOR SPIP GOALS

STAFF HAS SIMILAR PROGRAM TO AUDIT UTILITIES

# NRR STAFF PRESENTATION TO THE ACRS

**SUBJECT:** B&W Owners Group Plant Reassessment Program - Additional Concerns Identified by the Staff

**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 MEMBER CONCERNS

1) POTENTIAL LACK OF INDEPENDENCE IN MPR ASSOCIATES PERFORMING A SENSITIVITY STUDY FOR THE BWOG AND RELATED WORK FOR A B&W PLANT OWNER (SER, SECTION 5.1).

   THE STAFF DID NOT REQUEST, NOR DID IT BELIEVE IT NECESSARY, THAT THE STUDY BE PERFORMED BY AN INDEPENDENT ORGANIZATION.

2) POTENTIAL LACK OF INDEPENDENCE IN SCIENCE APPLICATIONS INTERNATIONAL CORPORATION PERFORMING SIMILAR WORK AS A SUBCONTRACTOR FOR THE NRC AND FOR B&W PLANT OWNERS.

   OGC REVIEWED ISSUE AND DETERMINED NO CONFICT SINCE WORK WITH NRC ESSENTIALLY COMPLETE.

3) A PREMATURE FINDING BY THE BWOG OF THE ADEQUACY OF ICS/NNI (SSER, SECTION 6.1.1).

   BWOG ASSUMED SYSTEM CAN BE MODIFIED AND THEREFORE DID NOT CONSIDER REPLACEMENT AT THIS TIME, STAFF BELIEVES EXISTING SYSTEM CAN BE MODIFIED TO RESOLVE CONCERNS.

4) THE BWOG OR UTILITIES HAVE NOT ANALYZED EFFECTIVELY THE PROPOSED SPIP RECOMMENDATIONS TO DETERMINE THE EFFECTS ON THE OTHER PARTS OF THE PLANT (SSER, SECTION 11.5).

   BWOG HAS PERFORMED SOME SYSTEMS INTERACTIONS STUDIES, HOWEVER, MANY OF THE RECOMMENDATIONS ARE GENERAL IN NATURE AND REQUIRE PLANT SPECIFIC EVALUATIONS. BOTH THE BWOG AND STAFF INTEND TO EVALUATE THIS ASPECT DURING THEIR AUDITS.

5) CATASTROPHIC REACTOR PRESSURE VESSEL FAILURE RESULTING FROM AN OVERCOOLING TRANSIENT ASSUMING ONE CONTROL ROD STUCK OUT AND A RETURN TO CRITICALITY (SSER SECTION 5.5.3).

SIEGEL 5/3/88

THE REACTOR COOLANT TEMPERATURE REQUIRED FOR REACTOR TO RETURN TO CRITICALITY IS TOO LOW (35°F) FOR THIS TO BE CONSIDERED A PROBABLE EVENT.

6) OPERATOR BURDEN STUDY DOES NOT ADDRESS OPERATOR ERRORS OF COMMISSION (SER, SECTION 7.5.2).

OPERATOR BURDEN STUDY DI[illegible]LUDE ERRORS OF COMMISSION.

7) THE B&W PLANTS VIOLATE OFFSITE DOSE LIMITS UNDER THE CONDITIONS OF A STEAM GENERATOR TUBE RUPTURE DESIGN-BASIS ACCIDENT.

THIS IS BEING ADDRESSED BY GENERIC ISSUE 67.

( ) THE MAIN STEAM LINE BREAK AND STEAM GENERATOR TUBE RUPTURE SHOULD BE TREATED AS ONE DESIGN-BASIS ACCIDENT FOR ALL PWRs.

UNDER CONSIDERATION AS PART OF USI A-3, A-4 & A-5 REGARDING STEAM GENERATOR TUBE INTEGRITY.

9) CERTAIN FAILURES IN THE TURBINE CONTROL OR TRIP SYSTEMS DUE TO A DESIGN FEATURE TO DELAY TURBINE TRIP AFTER THE REACTOR TRIP CAN RESULT IN A REACTOR TRIP WITHOUT A TURBINE/GENERATOR TRIP.

GENERIC TO ALL PWRs - MEMO SENT TO RES SUGGESTING THIS ISSUE BE PROPOSED AS A GENERIC ISSUE BY ORIGINATING STAFF MEMBER.

# NRR STAFF PRESENTATION TO THE ACRS

**SUBJECT:** B&W Owners Group Plant Reassessment Program - Implementation

**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

# SPIP RECOMMENDATIONS

SPIP PROGRAM GENERATED 375 RECOMMENDATIONS

75 DUPLICATES
20 REJECTED
215 APPROVED BY BWOG TO DATE
65 STILL IN APPROVAL PROCESS

SER & SSER ADDRESSES ALL RECOMMENDATIONS IN PROGRAM EXCEPT THOSE THAT WERE DUPLICATES

SPIP HAS IDENTIFIED 70 RECOMMENDATIONS AS KEY - (REDUCE COMPLEX TRANSIENTS, TRIPS, OPERATOR BURDEN ETC.) STAFF HAS IDENTIFIED 11 ADDITIONAL RECOMMENDATIONS AS HIGH PRICRITY (ENHANCE SAFETY)

BWOG IS TRACKING PROGRESS IN IMPLEMENTATION OF RECOMMENDATIONS THRU RECOMMENDATION TRACKING SYSTEM, WHICH IS UPDATED BI-MONTHLY

UTILITIES HAVE AGREED TO IMPLEMENT ALL APPLICABLE RECOMMENDATIONS, BWOG OVERSEEING PROGRAM TO ASSURE IMPLEMENTATION - STAFF INTENDS TO MONITOR, AUDIT & INSPECT PROGRAM

# BWOG PLANT REASSESSMENT PROGRAM

## STAFF VERIFICATION OF IMPLEMENTATION OF BWOG RECOMMENDATIONS BY UTILITIES

STAFF EVALUATED BWOG RECOMMENDATION APPROVAL PROCESS AT B&W IN OCTOBER 1987

STAFF WILL AUDIT THE IMPLEMENTATION PROGRAM UTILITIES HAVE IN PLACE TO EVALUATE THE BWOG RECOMMENDATIONS

STAFF WILL AUDIT THE IMPLEMENTATION PROCESS AT UTILITIES TO ASSURE RECOMMENDATIONS ARE BEING PROPERLY IMPLEMENTED

STAFF WILL VERIFY RECOMMENDATIONS HAVE BEEN IMPLEMENTED BY UTILITIES

STAFF WILL TRACK PROGRESS OF IMPLEMENTATION OF RECOMMENDATIONS BY UTILITIES THROUGH BWOG RECOMMENDATION TRACKING SYSTEM AND PROJECT MANAGERS INTERACTIONS WITH UTILITIES

SIEGEL 5/3/88

BWOG PLANT REASSESSMENT PROGRAM

OVERALL UTILITY PROGRESS IN IMPLEMENTING BWOG APPROVED RECOMMENDATIONS

| | PERCENT |
|---|---|
| EVALUATING | 45 |
| IMPLEMENTING | 12 |
| CLOSED OPERABLE | 20 |
| CLOSED N/A | 18 |
| CLOSED REJECTED | 1 |
| NOT STARTED | 4 |

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