ACRST-1733

UNITED STATES
NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In the Matter of:

SUBCOMMITTEE ON INSTRUMENTATION)
AND CONTROL SYSTEMS)
)

Pages: 1 through 135

Place: Bethesda, Maryland

Date: April 21, 1989

HERITAGE REPORTING CORPORATION
Official Reporters
1220 L Street, N.W., Suite 600
Washington, D.C. 20005
(202) 628-4888

PUBLIC NOTICE BY THE

UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

The contents of this stenographic transcript of the proceedings of the United States Nuclear Regulatory Commission's Advisory Committee on Reactor Safeguards (ACRS), as reported herein, is an uncorrected record of the discussions recorded at the meeting held on the above date.

No member of the ACRS Staff and no participant at this meeting accepts any responsibility for errors or inaccuracies of statement or data contained in this transcript.

UNITED STATES NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In the Matter of:)
)
SUBCOMMITTEE ON INSTRUMENTATION)
AND CONTROL SYSTEMS)

Friday,
April 21, 1989

Room P-110, Phillips Building
7920 Norfolk Avenue
Bethesda, Maryland

The meeting convened, pursuant to notice, at 8:30 a.m.

ACRS MEMBERS PRESENT;

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

MR. JAMES CARROLL
Retired Manager, Nuclear Operations
Support
Pacific Gas & Electric Company
San Francisco, California

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

DR. HAROLKD W. LEWIS
Professor of Physics,
Department of P'ysics
University of California
Los Alamos, California

ACRS COGNIZANT STAFF MEMBER:

M. EL-ZEFTAWY

ACRS CONSULTANTS;

PAUL DAVIS
LESTER OAKES
WALTER LIPINSKI

PRESENTERS; (BWR OWNER'S GROUP) & others

DAN WILLIAMS
RICHARD BARNES
STEVE FLOYD
ROGER NEWTON
MELITA OSBORNE (W)
BILL SULLIVAN
W. STALTER

PRESENTER'S; (NRR STAFF)

H. LEE
F. FIENO
Z. MAUCK
H. LYNCH

P R O C E E D I N G S

DR. KERR: The meeting will come to order.

This is a meeting of the Advisory Committee on Reactor Safe Guards, the Subcommittee on Instrumentation and Control Systems.

My name is Kerr. I am Subcommittee Chairman. Other committee members present today are Messrs Lewis and Wylie. We expect Mr. Carroll and as consultants, we have Messrs Davis, Lipinski and Oakes.

The purpose of the meeting today is to review the implementation and status of the ATWS Rule. I must emphasize that this is not a meeting to discuss ATWS. ATWS has been resolved. What we are discussing is the reliability of the shutdown system.

Mr. Medhat El-Zeftawy is the Cognizant ACRS Staff Member for this meeting.

Rules for participation at todays meeting were announced as part of the notice of the meting published in the Federal Register of Monday, April 3d, 1989.

A transcript of the meeting is being kept and will be available as stated in the Federal Register notice.

I ask that each speaker identify himself or herself and use a microphone so that your words can be recorded accurately.

We will proceed with the meeting, but before going to the representatives of the NRC staff, I would ask if there are any comments or items in which any of you would like special emphasis?

(No response)

To paraphrase Mr. Churchill, never have so many depended upon so little for so much as is the case with the reliability, or lack of availability, I should say, that we demand for the automatic shutdown system, sometimes known as the SCRAM system for reactors.

The resultant core damage probability, for example, depends upon this very low lack of availability and it therefore behooves us to, I think, continually follow experience and our best judgment to ascertain, insofar as we can determine that we are achieving the reliabilities that are generally assumed.

So today, specifically, we want to explore the changes that have recurred as a result of the ATWS Rule adopted some years ago and to acquire any additional information that may bear upon this important system in operating reactors.

I believe that Mr. Lynch is going to open things.

MR. LYNCH: That's correct, Dr. Kerr.

DR. KERR: Okay.

MR. LYNCH: I'm Dave Lynch, I am lead Project

Manager on this particular issue and I would like to just mention a few administrative details.

There are copies of the staff's slides available up front. They come in three separate sets. If anybody does not get a copy, I do have a few extras here with me and, if need be, I can duplicate some more. I have the masters also.

I would like to make a slight editorial correction to the agenda, as passed out. For Roman III, Scott Newberry will not be making that presentation, Dan Fieno will be doing Roman III (a), the effect of BWR instability on the ATWS fix--I'm sorry, Harry Richings will be and for Roman III(b), Dan Fieno, who will be doing the effect of the impact of high core burn up on the ATWS situation.

Now with respect to the staff's presentation, we will be going in three separate groups, consistent with the three packages of slides I have laid out on the chairs.

The first person to start off for the staff is Scott Newberry, who will introduce the general background and then turn it over to members of his staff.

DR. KERR: Thank you, Mr. Lynch.

MR. NEWBERRY: Thank you Dave.

My name is Scott Newberry. I am Chief of the Instrumentation and Control Systems Branch in NRR.

We're glad to be here, Dr. Kerr, to discuss the status of ATWS implementation with you. We share your views on the importance of this issue.

Since NRR reorganized in the Spring of '87, we have placed considerable resources, resolution of issues remaining to implement the ATWS Rule systems, to review each of the plant specific designs with respect to their implementation and I would estimate, that on the order of a third of my branch, at one time or the other, is working on ATWS, out of the approximately 9 or 10 engineers in the Instrumentation and Control Systems Branch in NRR.

We are prepared to go through the agenda item by item. Hulbert Lee, from my branch, will be making the presentation.

I would comment that the last item, under Roman Numeral II, on BWR resert pump trip failures, that appears to be a new item on the agenda to us. We aren't formally prepared to discuss that, but we are certainly familiar with, what I expect is your concern, and would be glad to talk about that and answer any questions that you might have.

I have several members of my branch here today. As I said, Hulbert Lee would be making the presentation. Jerry Mauck, Vince Thomas and Lynn Tran. who are also working on ATWS are here today to answer any questions. Hulbert.

MR. LEE: Good morning. My name is Hulbert Lee, from the Instrumentation Control Branch. I am one of the reviewer on ATWS design review and implementation.

First let me go through, briefly, the chronological background since the ATWS Rule was published in 1984.

In 1985, April, NRR issued QA guidance to go through Genetic Letter 85-06, basically telling industry the guidance on the ATWS related to component because it was non safety related, so we had specific guidance how to deal with the QA requirements.

In May, 1985, N>RR established at Multi-Plant Action that basically started the review effort. Each different vender-owners group submit their genetic design package.

September Owners Group submit report CEN 315. B&W Owners Groups submitted their genetic report October and Westinghouse submit in October and the Boiling Water Reactor Owners Group submitting in January.

DR. KERR: Mr. Lee, unless there is something unusual about this schedule that you want to point to, why don't we just assume that we can read the schedule and you go on to your next slide.

MR. LEE: Okay. The only thing I want to point to is the B&W Owners Group Report Review, a little bit delayed because the staff resource work on the B&W Reassessment

Program and the Rancho Seco restart, so the acceptance of the genetic design review, there was a little bit delay on that.

Another point I want to point out is so far the status, we have 82 SER complete and 30 plants have been inspected. That is based on our telephone survey through 5 different regions. It may change from month to month if you do progress.

DR. KERR: Inspected means that somebody inspected them.

MR. LEE: Yes.

DR. KERR: Who does the inspecting?

MR. LEE: The region inspector. Each region set up special task force effort to go through each plant specific implementation.

DR. KERR: What do they inspect?

MR. LEE: We have guidance issued, TI 25---

DR. KERR: My question is: Do they inspect documents or do they go and look at equipment?

MR. LEE: Both all the procedures, documents and the equipment itself.

MR. NEWBERRY: I think that we could clarify a little bit further there that each plant specific design is looked at closely by headquarters and the results of that review are documented.

In the Safety Evaluation, as Hulbert has indicated there, we're just about completed with our review of each plant specific design. After we complete our review, especially in areas like diversity, getting right down to the specific details of the hardware, the inspectors in the regions, supported by headquarters will go out and look at both the equipment, maintenance procedures and any open issues that the utility was supposed to take care of after we had performed our review and every plant will be inspected.

MR. LIPINSKI: What about the issue of simulators, is that included in terms of whether the operators are being trained?

MR. LEE: To my knowledge, probably is not.

MR. NEWBERRY: Well, Mr. Lipinski, not really in the scope of this program. Within the scope of EOPs and how these systems would, you know, after their installed in the plant, I would expect that the answer to your question is yes. I don't think we're the group to--

MR. LIPINSKI: Who closes that loop?

MR. NEWBERRY: I believe tha operator licensing people who do the EOP inspections, the simulator inspectors, would close that loop. That is--

MR. LYNCH: We can get back to you on that specifically, but I think, as Scott has indicated, that will be the normal practice. We would not take ATWS simulation and training and break that out as a separate subject. We would rather keep the operator licensing qualifications and all the other human factors considerations with respect to the plant, including the simulator in one package.

DR. LEWIS: I wonder if I could raise a different question, when this one is over?

At some point, during the day, I want to ask a question about diversification or diversity and you use the term. I wonder if you'll tell me a good time. Is this a good time to raise it?

MR. LYNCH: We have a specific slide on that subject and that would be an appropriate time. It's coming up if you look at the package.

DR. LEWIS: Soon?

MR. LYNCH: Yes.

DR. LEWIS: I can hold myself.

MR. LEE: This table provides a summary of the implementation status for boiling water reactor and most of the plan is already implemented with few coming to be implemented this year and this too is basically the Browns Ferry type of restart.

For the Westinghouse plant, we have other 55 plants, 20 already complete implementation and 16, a good portion will be completed by the end of this year.

The OE plant, start a little bit late, but we tried to improve the schedule on the implementation.

The B&W plant, although this shows there is no implementation complete so far, some of the equipment related to the DSS and AMSAC are already installed. They just have not totally completed review and the procedures to utilize those systems has not been ut into the plan, so we cannot declare implement.

So this table basically is from the record of each project that they are completed implementation and actual equipment is installed better than this table shows.

Another point I would like to point out is that for Boiling Water Reactor we take the first implementation review, so most of the Boiling Water Reactors, they install equipment much earlier than the PWRs.

MR. LYNCH: If I may interrupt for a moment to expand on something that Hulbert said.

We hold a fairly rigid standard on what implementation means and as Hulbert says, the hardware may be in, but we don't give credit for implementation until the procedures have been revised and the operators have been trained on those revised procedures.

So you might have the situation where every piece of hardware is there, but if the operators haven't completed their training, we don't give credit for implementation.

MR. DAVIS: Excuse me. Mr. Lee, can you tell me which BWR was exempted from the resert pump trip and what the basis was, briefly, for the exemption?

MR. LEE: It's a very good point. Because the size and their unique design and the location, , there was new guidance.

MR. NEWBERRY: I think that exemption is a proposed exemption. Correct Hulbert? I don't think we have quite finished our review.

MR. LEE: Yes. The resert pump trip is already approved, yes. The ARI is still under review.

The open issues and NRC staff positions, the first one I am going to discuss is the BWR plants instrument diversity.

The background, as mentioned earlier, for BWR, we take post instrumentation review. We give a check list to each utility, ask them to verify the conformance to each individual design criteria and then during the inspection, stage, we verify each items.

This issue was discovered during a test spec updating review for Brunswick. In their original submittal, they declared all diverse and when we review the test spec modification, we found out same model, the analog transmitter trip unit was utilized at both the execute system and ARS system.

DR. KERR: I'm sorry, what you're saying is that they didn't install what they had proposed to install?

MR. LEE: They already--At Brunswick, it's in the process. They're installed and--

DR. KERR: No. I thought you said they originally proposed diverse systems, but when you inspected you discovered they had not installed diverse systems. Did I misunderstand?

MR. LEE: In their submittal for the compliance with ATWS new guidance, they identified what is diverse and then when we reviewed the tech specs and during the inspection, we found out they're not the same model of the ATTU utilized on both systems.

MR. NEWBERRY: It was the view of the plant that the equipment they had installed, although they're the same model, HETU, was diverse and Hulbert will describe that. It's primarily because of in ARI, they are energized to actuate inter active trip system, deenergized to actuate. They viewed that the diversity of function was sufficient to meet the rule. We disagree.

DR. KERR: So that is a judgment call?

MR. NEWBERRY: Yes, sir.

DR. KERR: And you're convinced by having them install something different, it will be significantly more reliable?

MR. LYNCH: I don't know that we can say that, sir, so much as we're saying that the overall philosophy of the ATWS Rule is to minimize common mode failure by implementing diversity and by having an exactly the same model component, sub component for sub component in that trip unit, we believe it somewhat tends to short circuit the concept of diversity of components.

DR. KERR: But if that is the overall philosophy, then I don't understand it because it seems to me that the overall philosophy should be one which tries to have low risk and high reliability and I don't understand a philosophy that ignores reliability and risk and instead seeks to talk about something like diversity and NRC philosophy.

DR. LEWIS: This is what I was going to bring up at a certain point because as I looked ahead to the view graph, it simply states flatly what you have just said, namely that to minimize the probability of commo mode failures, one insists on complete diversity and it is easy to conclude from that, and this has, in fact, strengthened the conclusion, that if one had a really very fine component and used it in two places, you would require that it be replaced in one of those locations with an inferior component, just to satisfy the blind thrust toward diversity.

Where as, what I think our chairman is saying is that one ought to look somehow at the probability of common mode failures and make an effort to improve the overall reliability of the system, which is sort of the way I would go.

And I wondered, just how far you would take this. You know, there are resistors that are replicated through the system. There are screws that are replicated through the system that come from suppliers.

If you're really blind about a requirement for diversity, you would go crazy.

MR. NEWBERRY: That's true. The regulation does require independent and diverse components in the reactor trip system and alternate route interjection or diverse SCRAM systems to a reasonable and practical level.

So there is a judgment call that needs to be made and--

DR. LEWIS: But the view graph that we are coming to, when I am supposed to bring this subject up, doesn't say anything about reasonable.

MR. NEWBERRY: Well the guidance that was published with the rule does and this has been a point of contention between he staff and the BWR Owners Group since, I guess, the middle of last year and we can go into it in more detail here, if you would like, but it was our view that, not only because of these components being virtually identical, but also because there was a ready replacement from a different manufacturer, that it was reasonable to replace these ATTUs.

DR. KERR: But it had nothing to do with reliability, it just had something to do with diversity?

MR. NEWBERRY: No, I wouldn't say that. I think it does have something to do with the reliability but I don't know that I could quantify for you, in really a rigorous way, what the significance of that change in reliability would be.

DR. LEWIS: Nobody, I think, is looking for rigor here, we're looking for plant safety and it may have been a point of contention between you and the owners groups last year, whatever you just said, but I remember raising the question 5 years ago or whenever the ATWS Rule first came out and the example I used, I remember at the time, was that one would make that argument to say that every airplane should have--twin engine airplane should have one jet engine and one propeller engine for diversity because you could fly on either engine and that way you're certainly avoiding common failure to the two engines and that is dumb, of course. Nobody does that because there are certain advantages in duplicating components. The maintenance problems become easier, the parts problems become easier, the experience accumulates at twice the rate, all sorts of things like that and they have to be quantified if you're really interested in plant safety.

MR. LYNCH: You're absolutely right, sir. But I would like to throw a different point of view on the table for your consideration.

What we're talking about--

DR. LEWIS: Go ahead.

MR. LYNCH: What we're talking about is plants that have a 40 year life time and, as you know, industry and the NRC is presently reviewing the concept of a 20 year extension, so we're potentially talking about plants with very very long lives.

The concern that the staff has is: Will identical units, down for the serial number, be such that during their, say as much 40 to 60 year life time, have a failure due to an aging process that nobody can identify at this point? And the thought was, the particular ATTU unit, if that is replicated in the ARI circuitry as well as the RPS circuitry, is not the only reliable component available to industry, but the other components, which are used, in ATWS circuitry in other plants are considered just as reliable so we don't want to get into a discussion about which vender's model is more reliable.

We won't take a position that this particular ATTU unit is the highest reliability unit. OUr concern is for mechanisms which we cannot identify and the scenario is aging of a particular component such that we would have a fuel run, say of an 18 month duration, and in between a surveillance test, that they both come to the end of their operating life due to aging, we don't really wish to address that question and by getting diversity between venders, we hope that we can minimize that probability and that is what we are really looking for in terms of the diversity of the component level.

Certainly not down at the resister or the screw level, but certainly for a black box package.

DR. LEWIS: I don't want to belabor the point, but I must say that I am not convinced because what you have described is a perfectly reasonable quantitative approach to the diversity question, mainly that you have to ask yourself what are the afflictions that are common to a particular thing and see whether the overall contribution to risk is larger because you have identical components.

But that doesn't seem to be what is happening. What is happening is a fairly, as I understand it, is fairly blinded here as to the requirement that, by golly, there shall be different suppliers and different units.

MR. LYNCH: Well sir, there is more than one vender and we don't believe we're pushing industry unreasonably hard by requiring that two reliable units from separate vendors be installed. There is more than one car manufacture, there is more than one airplane manufacturer and there is more than one ATTU manufacturer and they're off the shelf components.

DR. KERR: Mr. Lynch, it does not seem to me that you should worry about from what vender a purchase is made. That is irrelevant to reliability.

What we're trying to achieve is reliability and to try to force a utility to buy from two separate vendors just because there are two separate vendors in the market, it seems to me, is irrelevant to what we ought to be talking about. I don't understand that argument.

MR. NEWBERRY: The argument is not necessarily the vendor. I believe the argument is--

DR. KERR: I'm listening to the argument that I heard.

MR. NEWBERRY: Yes, sir. Just clarifying what Mr. Lynch said, the argument is to reduce or minimize the chance of an equipment failure due to a defect in the manufacturing process or the design process of like components in analog transmitter trip units.

These trip units are used in all pressure and level channels in the entire reactor trip system and alternate route injection systems. And what we were looking for and it seemed to be reasonable, were different trip units in the ARI system.

MR. LIPINSKI: But what we're not hearing is the fact that you have compared these in any way to show that they have, at least, equivalent reliability. You may have another manufacturer, but his unit may have a failure rate 10 or a 100 times higher than the one he is using.

MR. NEWBERRY: That's true.

MR. LIPINSKI: The question is how do you establish that?

MR. NEWBERRY: That's true, sir, but the rule itself, for example, has the no requirement on safety related components, but it does say that the components should be reliable and we're depending upon industry to properly interpret what reliable means.

We're not really--and, Dr. Kerr, you're quite right. I am not trying to force--we're not trying to force industry to purchase from two different vendors. If a vender had two or three models that were sufficiently diverse between models, we would certainly accept that. The concern is, again, to go back to the aging problem, a particular design of a unit, both of which are identical, what we're saying is that we could not address the probability of them not having a common mode failure mechanism sometime in the distant future, which we have no way at all of identifying, until they accumulate the service life that would give us those statistics.

DR. LEWIS: There is a battle in the super market business to provide as much diversity as possible in packaged dry cereals in order to fill up shelf space at super markets and to do that, manufacturers put things in different size boxes, you know, pound to pound and a quarter, pound and an eighth, different colors to occupy shelf space.

The manufacturer, once he gets on to this game can do that with different models, you know. You can make minor changes, give them different names, give them different outside covers, you know.

At what point do you decide that something is functionally sufficiently diverse to provide an enhancement in safety compared to the real advantages of standardization.

You know, the agency at another level is pushing toward standardization of nuclear plants and here you have a rule that is pushing against it because of safety reasons, you know. Where are we?

MR. LYNCH: Maybe we should go ahead. I share your concern, but I don't know what else we can say.

DR. LEWIS: No. It's been going on for a long time.

MR. LIPINSKI: Let me inject one last comment.

The holy grail of diversity cannot be quantified. So far I have yet to see some systematic process that tells you what the benefits are statistically or any other way, whereas, if we look at reliability of individual components, we can quantify those numbers by collecting data on sufficient number of units.

But when we say we're going to have diversity, I have yet to see some way to quantify what the benefit is. We think we're getting something, but there is no way to demonstrate what that something is.

DR. LEWIS: I agree with that. As Bill says, we've been saying this for years, with no apparent affect.

DR. KERR: Please continue, Mr. Lee.

MR. NEWBERRY: One further comment. I think the subject of diversity in our reviews has been a difficult one for us. The judgments largely have led us to this point where we're down to a couple of issues of disagreement. This is one and there is going to be another one.

I think, getting back to one of Mr. Lipinski's questions on reliability, I believe that everything that we have seen so far would indicate that Rosemont Analog Transmitter Trip Units are, indeed, reliable. They're widely used in the industry and have a very good record, but the rule is rather prescriptive and--

DR. KERR: I thought that it had some language in it that indicating reasonableness, from what I heard otherwise, and you did indicate that there was a diversity of function and it is function, after all, that we're looking for from these components, not just being there.

MR. NEWBERRY: Diversity of function, from the standpoint of movement of the switch position, which changed the function from energize to de-energize, other than that, the boards are identical, yes, sir, that is correct.

And I think what you see here is the results of our judgment and maybe we ought to move on.

MR. LEE: The second issue also relates to the diversity of requirements on the newer CE plants.

Again we comment on the implementation aspect that followed the rule guidance, so we found some of the components which were used in the reactor trip system and used for the AMSAC System and that, in our mind, that does not satisfy the ATWS Rule diversity requirement.

The CE Owner's Group argument basically say those are not cost effective. The benefit is marginal, but our position is that the cost benefit argument, has already been considered during the rule making process.

In the first case, we just followed the rule guidance to make sure the implementation is following the guidance published in the ATWS Rule Guidance.

MR. LYNCH: If I may interrupt for a moment. The slide doesn't say it, but those exemption requests were denied a few weeks back, officially on the dockets.

DR. KERR: Would you say that the diversity that is being required will make the system more or less complicated than otherwise would be the case?

MR. NEWBERRY: Anytime you add something to a plant, I think you may have the tendency to make it a bit more complicated. That appears to be the case here.

Certainly the view of the owners and the vender is something that we are looking at closely now. There is a continuing need here, with respect to providing water to the steam generator or, in some cases, for line breaks, isolating water to a steam generator and that tends to lead you to some complexity in the design, yes.

DR. KERR: This is for what we might call an emergency or auxiliary feed water?

MR. NEWBERRY: Yes, sir. This would be for the actuation of the emergency or auxiliary feed water.

DR. KERR: And this is automatic actuation--

MR. NEWBERRY: Automatic.

DR. KERR: --as contrasted with--

MR. NEWBERRY: That's correct.

DR. KERR: Manual actuation is still available but is not credited or is that--I mean credited in the sense that if one does an analysis does an analysis to determine what risk exists on a qualitative basis, one does not take into account the possibility of manual actuation.

MR. LYNCH: There is always a time delay that is factored in to an analysis of manual actuation and to the extent that you increase the manual action to a 5, 10 or 15 minute period, you may be beyond the scope of the transient by--

DR. KERR: But with it manually actuated a few seconds, it would probably work?

MR. LYNCH: Yes, sir.

MR. NEWBERRY: Oh yes.

DR. KERR: Thank you.

MR. WYLIE: Let me ask a question. These non diverse components that are being used, are they performing essentially the same functions in the several trains?

MR. LEE: Yes. Most relays, the relay matches.

MR. WYLIE: Okay.

MR. LEE: The next slide I am going to discuss is the--

MR. NEWBERRY: Hulbert, before you proceed, just to put where we are in perspective with the agenda, the committee had asked to us talk about open issues on our reviews. The issue of ATTU diversity and the issue, on a few of the newer CE plants, on diversity of the AMSAC feature are really the only two generic issues that are in front of us right now. Everything else is pretty much status of plant specific implementation.

So unless you have any other questions, Hulbert is going to get into the next agenda item on the meaning of independence and diversity.

DR. KERR: Thank you, sir.

MR. LEE: The meaning of independence from ATWS Rule guidance states, "Logic and actuation device power must be from an instrument power supply independent from the power supplies for the existing reactor trip system."

The guidance also provides another provision, "Existing reactor trip system sensor and instrument panel power may be used provided the possibility of a common mode failure is prevented."

But the staff position is--

DR. KERR: Excuse me, do you understand what that last statement means because I don't.

MR. LEE: The next slide, I try to show what we interpreted from this guidance.

DR. KERR: So you do understand what it means. Okay.

MR. LEE: But based on this guidance, we have two methods of compliance.

The first is--

DR. KERR: I want to know what you think you're complying with. This says that you're going to make this such that the possibility of common mode failure is prevented which, I assume, means that the probability is zero, is that what that means?

MR. LEE: Yes, it's just that you advance--it could mean minimize.

DR. KERR: Okay. And what does minimize mean?

MR. LEE: Well, due to engineering best judgment to reduce that probability from--

DR. KERR: So it means use good engineering judgment?

MR. LEE: Yes.

DR. KERR: Okay.

MR. LEE: So the first one is preferred method of design. Use of total independent non 1-E power and if they have to share the power from 1-E power source, then the acceptable level is the DSS and AMSAC should be Class 1-E system and also provide a failure mode effect analysis to demonstrate the possibility of common mode failure is prevented.

We are illustrating with two simplified diagrams.

DR. KERR: And again, when prevented is used here, it doesn't mean prevented, it just means made reasonably small.

MR. LEE: Yes.

DR. KERR: And what is reasonably small, engineering judgment?

MR. LEE: Yes. Our branch--

DR. KERR: Whose engineering judgment, the designers or the NRCs?

MR. LYNCH: Well obviously, there are two points of view, industry has theirs and we have ours. But basically what we are stating is our position today.

DR. KERR: So a licensee, from this, does not have any idea whether something that he presents will be acceptable to NRC because he doesn't have any guidance as to what is meant by "prevented."

Only when he submits it and a reviewer goes over and the reviewer doesn't have any guidance either because he's told to prevent it.

MR. NEWBERRY: The guidance is primarily not in the terms of definitions of "prevent" or "minimize". The guidance is primarily in the terms of design concepts, in terms of whether the system is a non 1-E or 1-E or whether the power supply should be independent or not independent from the reactor trip system power supplies.

The question comes up, for the designer, should I use the instrumentation buses that are used for my reactor trip system to power the AMSAC or DSS or should I power that system from another bus and so, from a practical design point of view, what Hulbert is going to show you here is our view of what independence means when it comes to where you would get the power these systems.

DR. LEWIS: But what it says on the view graph, the previous one, is that an FMEA is required to demonstrate the possibility of common mode failure is prevented and we assume that means minimized.

Now an FMEA is not a particularly great way to discover common mode failures and therefore, what is--this is, as a practical matter saying that you do an FMEA and if you don't put in common mode failures, you won't get them out, of course and that will be sufficient to comply with the rule, as I see it on the previous slide.

MR. NEWBERRY: This is one place where, I guess, our judgment will end up with the arguments opposed to us by the industry.

DR. LEWIS: You have used that term very often, as if this is simply a two person contest between you and the industry and presumably everyone, including even ACRS, is on the same side in that we are trying to, you know, make these plants as safe as is reasonable.

So it's not a contest. We're trying to get at what the basis--

MR. NEWBERRY: I use the term "industry," and perhaps that's not the best term. In this case, it was a specific design proposed at one of the plants, one of the first CE plants that we looked at and what they had proposed was a power supply designed from the same instrument buses as the reactor trip system.

DR. LEWIS: Why do you specify an FMEA to uncover common mode failures?

MR. NEWBERRY: Well, the--

MR. LEE: For the power source, we usually use the primary loss of power, you have over voltage or under voltage, those three conditions and it is based on those three conditions, how the plant can cope with those type of failures.

And this is one of the designs that we accepted. They have Class I-E, DSS and AMSAC that provides--the power is provided from 120 volt safety bus. Those bus also provide power to the reactor trip system and they give us the same effect--analysis on the power failure and we're satisfied with their analysis, and we accepted the design.

But our preferred design, from the first one, is totally separate.

DR. KERR: Am I correct, this represents 2 designs that were submitted to the NRC and were considered appropriate?

MR. NEWBERRY: Yes, sir, that is correct.

Hulbert, why don't you go ahead and describe this?

But the answer to your question, Dr. Kerr, is that is correct, these are two designs submitted to us that we found acceptable.

DR. KERR: Okay, thank you.

MR. LEE: The next item is the staff's view of the meaning of "diversity".

"The basic premise behind the ATWS rule is to prevent or minimize the common mode failures which simultaneously disable the redundant reactor trip circuitries."

Our view is that the reactor trip system is a very reliable system. The only reason for the ATWS rule was mitigation system, is to prevent a common mode failure.

So the whole emphasis on the ATWS Rule is the diversity. And, our interpretation is that the diversity requirement by the ATWS Rule is a hardware of component diversity and the method to achieve these, either by component from different manufacturers or the function of capabilities.

The function of capability could be the digital system versus analog system or AC power source versus DC and energize the energize status.

DR. KERR: Does that then mean the same thing as functional diversity or when you say functional capability because that seems to be different from what I was hearing earlier in which case, the functional diversity was not considered acceptable.

MR. MAUCK: This is Jerry Mauck of the staff.

Are you referring to the ATTU card, is that what you're referring to?

DR. KERR: Yes.

MR. MAUCK: Have you seen the ATTU card?

DR. KERR: I can truthfully say that I never heard of an ATTU card before this morning.

MR. MAUCK: Well Dr. Kerr if you take a look at the proposed GE ATTU cards, one in your left hand and one in your right hand, they will be identical cards.

DR. KERR: Well, my question was: Does functional diversity qualify--I'm trying to understand what is meant byu functional capability.

MR. MAUCK: True functional diversity qualifies, yes.

DR. KERR: True functional diversity.

MR. MAUCK: And the answer to your next question is going to be: What is true functional diversity.

DR. KERR: I was going to be more specific than that, but that probably was the question I should have asked.

But what you're saying is that if I use two identical cards, and have one of them doing one thing, and one doing another thing and one doing another thing, that is not diversity.

MR. MAUCK: When you say one is doing one thing and one is doing another thing, you mean that one is taking a different process signal and working on that process signal?

DR. KERR: They're just doing different things.

MR. MAUCK: Doing different things, what do you mean? I don't understand.

DR. KERR: I don't know what I mean except that they are performing different functions. One is opening a switch, one is closing a switch, for example.

MR. MAUCK: No. If the cards are, in fact, taking two different process signals and it's not the same process signal over in the trip system and the ATWS system, then that is functional diversity.

DR. KERR: So it would be possible to achieve partial diversity and that would be acceptable with two identical units?

MR. MAUCK: As long as one unit, the same units in both systems weren't processing the same signal, yes. But I think that you'll find that GE is using our level in pressure for ATWS or actuation and in all cases, the GE plants that have this diversity problem are using the same level--

DR. KERR: So the problem is that they are not identical but that they are using the same signal?

MR. MAUCK: That's a two fold problem. You wouldn't have one problem without the other. You cannot have the diversity problem if they are not identical or and if they are not processing the same signal, true.

DR. KERR: Okay. That's clear to you. It isn't clear to me yet, but let me think about it.

MR. MAUCK: I guess it's more clear to the staff than it would have been down in the trenches looking at these things since 1985.

DR. KERR: Well, one can get so far down in the trench that one can't see daylight.

MR. MAUCK: That's true and I guess we're not trying to get that far down in the trenches and we don't believe that we have on this particular issue.

MR. LYNCH: Doctor Kerr, diversity is not a new phrase in the regulations. It's there in Appendix A and the classic interpretation of it, since Appendix A has been around, is diversity in principal which, I think, would cover your approach, in terms of functional diversity.

Our concern, as Jerry has, I think, correctly put it, is the two, the identical components and the function are, in this case, both identical. The same signal, same electronic circuitry, same output. We believe that is just a little bit too common.

DR. KERR: So that any reasonable person would probably agree with you?

MR. LYNCH: Hopefully.

MR. LIPINSKI: There is one other aspect. They're talking about energize to achieve function. Another function is fail safe design such as in a loss of power, your function takes place, failure of a component, your function takes place.

But if you say you want to close a contact to get a function, this is contrary to the fail safe design, so now you're giving up some of your reliability.

MR. LEE: The reactor trip system is fail safe design. Again, emphasized on ATWS rule is not the reliability. It deals with some common mode failure type scenario.

MR. LIPINSKI: If you could quantify your common mode failure and tell me what it is you're concerned about, generally you can design for it. Right now you're saying you're going to examine the designs, look for common mode failures and hopefully see none.

But you think there are some residual common mode failures that you can't identify and that is why you want your diversity.

MR. LEE: Right.

MR. LIPINSKI: Having that, when you ask for a contact to close, rather than to fail open, you have given up some of your reliability, by having gone in that direction of diversity.

MR. MAUCK: Well that contact to close is just in conjunction with the other two arguments. Also what you're trying to look at on the ATWS System, is to not have an ATWS System that is inadvertently putting the rods or causing the resert pump trips to trip so one of the--I think one of the goals is to avoid these spurious trips and a fail safe system is more prone to spurious trips.

MR. LIPINSKI: But that is when you start going into multiple logics where not a single train causes a function to take place, you have to have combinations of failures.

MR. MAUCK: Right. The ATWS Rule doesn't require redundancy and if you have a single train and a single channel that is energized, that is de-energized to actuate, then you're very prone to trips.

MR. LIPINSKI: This is the entire question then in terms of the reliability. If you're going to insist on something being diverse, hopefully it has equal reliability to what you could have in there in the first place and if it doesn't, then you're giving something up. Take a close look at that reliability.

MR. MAUCK: It's very hard to quantify reliability on these electrical units. The trip system reliability is quite high and I guess we anticipate that the ATWS systems that they are putting in, at this time, are not quite as high, but we feel that that failure in the reliability is more due to the lack of industry's cooperation with the technical specifications and we believe that our power testing will greatly increase reliability of ATWS, not going to identical components such as the ATTUs.

There are a lot of other components that are probably as reliable and I would guess, more reliability than that ATTUs.

MR. LIPINSKI: But what you're saying is--I can appreciate the fact that you might go to a different manufacturer but hopefully you ought to be able to ressurrect the data that goes with the component that you think is good enough to do the job. That they will select the component not known numerically, but its reliability is.

MR. LEE: But the ATWS System does create a back up from any failure on the reactor trip system. We have not tried to build an ATWS System as reliable as the reactor trip system.

MR. LIPINSKI: I'm talking about the individual replacement of sensor for sensor that you're talking about.

MR. MAUCK: Not sensor--not sensor. The sensors are the same.

MR. LIPINSKI: What was the name of the device you were using?

MR. MAUCK: This is a transmitter trip unit, but it's the signal conditioning device, is stable.

MR. LIPINSKI: But if you're going to replace one with another, you ought to know what the date is on the first one and what the date is on the second one in order to make a judgment on the acceptability of the replacement.

MR. MAUCK: Well, we don't even do that when we look at the trip system for a plant that is coming through the licensing stage.

We don't get down, as you say. If we did that, we would be way down in the trenches and we would never see daylight.

If you expect the staff to get down into component level reliability for each piece of instrumentation that they have got that is safety related in a power plant, we would never get a plant license.

I think that we have to assume that industry knows that there is a reliability goal and that they are out there purchasing things that have the required reliability.

DR. KERR: Let's assume that industry does know that. Apparently you have concluded that this particular segment of industry that is proposing this doesn't know that or they wouldn't be proposing--

MR. MAUCK: No, no. GE has proposed a reliable--as reliable as a trip system, by using the ATTUs because it's he same device, but what they haven't proposed is something to prevent the common mode failure and their justification was that this switch that changed the final output relay on the ATTU card and I think that is the only difference is that the relay and the trip system is energized and the final relay which is, I would guess, about two percent of all the components on the card is the only different component that is in a different state and that judge doesn't cut it.

DR. LEWIS: Doesn't cut it in what sense?

MR. MAUCK: That doesn't meet out diversity, having one component on the whole card in a different state.

DR. LEWIS: It doesn't meet it in terms of the straight reading, not in terms--in terms of reliability or in terms of straight reading?

MR. MAUCK: No, not reliability. We're not discussing reliability.

DR. LEWIS: Just the straight, the straight meaning--

MR. MAUCK: It doesn't meet--that was their interpretation of being able to have diverse ATTUs, that one component on this card that has hundreds of components on it is in a different state.

DR. KERR: Would 2 be enough?

MR. MAUCK: No.

DR. KERR: Three?

MR. MAUCK: Well, you have to look at how many components are on the card.

DR. KERR: That's what I'm looking at and you told me there were about a 100 components and I'm trying to find out how many would have to be different in order that it would be diverse.

MR. MAUCK: Well, not all the components on the card have any state definition with them. There are a lot of passive components on the card and so you wouldn't expect passive components to be in a different state.

DR. KERR: So your answer is, I don't know?

MR. MAUCK: My answer is I would expect all active components on the card to be in a different state.

MR. LIPINSKI: I would venture to say that if you take that same card, and the first one is one that is really energized and failure of the relay causes action from the card, when you go to the reverse state and you have a relay that is de-energized and do a reliability analysis on both cards, you will find that your second diverse card has less reliability than the first card, which relay is normally energized, in terms of being fail safe.

MR. MAUCK: True.

MR. LIPINSKI: And since you're diversity, you have gone for something that has less reliability.

MR. MAUCK: But I would argue that that change in individual component or board reliability is not significant in terms of the overall objective of minimizing the likelihood of a common mode failure between the reactor trip system and the ARI.

DR. KERR: Is it valid to assume, from what I have heard so far, that the staff is not concerned or does not look at overall reliability.

What you do look for is a system that will minimize common mode failure in so far as engineering judgment and practicality is concerned?

MR. LEE: Yes.

MR. MAUCK: I guess that's true up to a point, but as I stated previously, to actually get down and find out to the nearest tenth of a percent of hundredth of percent whether some particular black box is 99.9 98 percent reliable is very difficult and I don't know--

If you've got a way that the staff can take an applicant's drawing or licensee's drawing and look at his reliability analysis and prove that that is correct in the time frame that we're allowed to work on these things, we'll be willing to listen.

DR. KERR: I am unreasonable, but I hope I'm not that unreasonable.

MR. MAUCK: I don't think so. I think it's very--

DR. KERR: The point I am trying to make is that diversity is receiving a lot of emphasis and rightly so, because of the ATWS Rules talks about diversity.

MR. MAUCK: Right.

DR. KERR: And to some extent you're slaves of the rules that exist.

MR. MAUCK: Trues.

DR. KERR: But you have said and I agree with you, you can't quantify this.

MR. MAUCK: True.

DR. KERR: So you really don't know how much you are adding to the reliability by insisting on diversity.

It may be a very small quantum or it may be something very large. You are forced, I think, to be very quantitative about something--quantitative in the sense you insist on it, which you can't quantity.

And therefore, you don't really know whether you are adding to existing reliability very much or not or as Mr. Lewis suggested, maybe you're making it less. And, it is that part of the process about which I have some concern.

I don't see how you could analyze every circuit, I agree, but it does seem to me that we all have an obligation to try to determine, as best we can, even if the rule exists, it is accomplishing the ultimate purpose and the ultimate purpose of the ATWS Rule certainly wasn't diversity, it was an increase in the reliability of the trip system.

MR. LYNCH: I would like to throw something in, sir, to help clarify the picture about reliability.

Let's go back to safety related components. The staff recognized long ago, when it created Appendix A, that indeed it could not get down to the nitty gritty of being able to quantify reliability of individual components or systems of components.

As a result it took a basic three pronged approach to try to avoid the problem of not being able to accurately quantify the components. The first approach was redundancy, single failure, board analysis required.

The second thing was physical separation. The third thing was tech spec surveillance.

Now what we're faced with, as of now, going back to the non safety components which is what ATWS is really composed about, is we don't have, as of this moment in time, tech spec requirements on surveillance. Theoretically a component can be put in a plant and run for 40 years and never be tested because there's no tech spec requirement on it and it's not safety related.

It's not quite true. I'm stretching to make a point. But what we're saying is the staff has never been given the task nor has it assumed the task of trying to quantify reliability on components or systems.

DR. LEWIS: Can I just interject two things, if I may.

One is that I think we have to start with the presumption that everyone is on the same side in trying to assure the reliability of the SCRAM system. What Bill said is absolutely right, the issue was not, at the beginning, not the ways to do it, but the assurance itself and the way common mode failures became important was that when one did the standard probabalistic risk assessments of the SCRAM system, the likelihood of failure turned out to be very small because there really was so much redundancy built into the system and whenever that happens then the primary threat does become common mode failures and most of them are not predictable. There are plenty of antidotes that tell us that they happen even though we don't foresee them.

So I have no problem with a concern about common mode failures.

The problem I have is with the sort of knee jerk response to the problem of common mode failures in there is a set of rules which, as we have learned this morning are very ambiguous and depend very much on conflicts in judgment between he staff and the vendors and the owners and what have you.

And whenever one has rules which cannot be stated clearly and I think it really has come through that these rules are not stated clearly now because they come to you and you have judgments which are different.

Whenever that happens, it's very similar to having laws which are fuzzy and then it's up to the policemen to decide whether you broke the law or not.

We have speed limits just to avoid that because the real law on speed limits is that you shouldn't drive carelessly ore recklessly but it turns you that you can't leave that to the judgment of the policeman and therefore, we have a speed limit and even at that, we have such slop.

When we depend on the comparison of judgment between the staff and the vendors and industry, we're depending very heavily, and I got to say it, on the fact that you're better ngineers than they are, unless you believe that they're not interested in the reliability of the system and I don't believe you're prepared to say that in public. I don't think you're even willing to say it in private.

And therefore, we are depending a great deal on your being better than they are. Why should I depend on that? Don't answer that question.

MR. LEE: Well this--

DR. KERR: I hope you find this discussion interesting, Mr. Lee.

MR. LEE: This pretty much concludes my portion of the presentation.

The detailed status is shown in the handout. The next item is exemption request process and it will be addressed by Mr. Lynch.

MR. NEWBERRY: While Hulbert is there and before we get into the exemption discussion which Mr. Lynch is prepared to discuss.

As Hulbert said, there is an attachment to your view graphs, I believe, which lists our understanding of where each plant is with respect to their implementation. You can see the system abbreviations for each part of the ATWS Rule heading each column and a date or a yes which describes our understanding of when he would implement that part of the system or has already implemented it.

So we would be happy to respond to any questions you have on those tables.

DR. KERR: I appreciate the tables and I don't have any questions at this point, but if questions do come up, we can get them I am sure.

But thank you for providing those.

MR. LYNCH: I'm an engineer, so I hope I don't sound like an attorney as I start down this path because I don't have a license to practice law.

But with respect to the exemption process, there are a number of avenues that industry can go and Dr. Lewis is quite correct, when the staff takes a position, it is the staff's position and not truth handed down from on high. And as a result, it is subject to an appeal process.

The basic process of appeal is administrative and legal in nature. I am going to just describe the administrative procedure.

Any utility has the right to come in through our administrative formal process and go through an appeal process, basically at the branch chief level, the AD level, the division director level, the office director level, as high as they wish to go pursuing that. And, it is a fairly formal process. We do have procedures governing it and it isn't very legal in nature so much as it gives the industry appealing the--the licensee appealing a particular staff position, an opportunity to assure itself that each level of management in the chain of command has had a chance to hear their best case.

This process has been used on many other issues and it has cut both ways. Sometimes the licensee has prevailed and sometimes the staff position has prevailed, but we are not arbitrary, at the working level reviewer or branch chief may take a position and that is the end of it. That administrative process does exist and has been used quite frequently by industry.

There is another formal process which is more legalistic in nature and that is 10 CFR 50.12, allows the licensee to basically request that exemption provided they meet one of 6 individual criteria and without reading the whole section 50.12 and, without reading the whole section of 50.12, one of the issues there would be financial hardship.

Another criteria that could be met and would satisfy the requirement for the exemption would be that the licensee approach meets the intent of a rule.

This process was used by Louisiana Power, it's Waterford unit, at Arkansas and at San Onofre 2 and 3. We did consider this, both internal review. We did consider this at meetings. We did send out, as I said earlier, letters denying those exemptions, detailing our reasons why.

For example, on the BWR, those are CE plans. On the BWRs, as recently as last January, we had a meeting with the owners group, where we thrashed out thoroughly the question of reasonable and practical. Industry did take the position that the rule itself did include an exemption process within the rule by quoting the words in the statement of consideration or issue with the rule, namely the concept that diversity is required to the extent reasonable and practical.

To help put your minds at ease, that I'm not an attorney, we would first look at reasonable and practical from the point of view of technical feasibility and what we are really talking about is a relatively low level of technology. We're talking about circuit breakers. We're talking about wires.

I think a very bright junior high school student could design such a system, assemble it and test it, so we're not talking about what the staff is looking for is something that is pushing the limit of technology, we're really talking about very basic wiring logic and hard wire logic. So we have always addressed it from that particular point of view.

Just as a footnote, if it was not technically feasible, the dollars involved would sky rocket. If it is technically feasible and is the low level of technology that I am talking about, the cross would be relatively minimal.

Now, on a personal level, if somebody were to tell me a $100,000, if I am pay for it myself, that's a large dollar amount, but if I am looking at a $4 billion power plant and I am advertising that cost over a 40 year life time, I would have to say, from an accountant's point of view, that's not very much.

Basically, the staff stands ready, so as not to have the reviewers at the branch chief level or at the AD level or the division director level view--be the last word on it.

We always stand ready, by law, to entertain any exemption request per 50.12.

I don't know if that is the level of detail you wanted, but that's a compromise between a 2 second and a 5 hour presentation.

DR. KERR: Mr. Lewis.

DR. LEWIS: If I might just say a couple of words.

One is that somehow the appear process doesn't give me a great deal of comfort because it's an administrative appeal process and normally when there are technical conflicts and we are talking about technical conflicts here, I would like to see them appeal to better and better and more competent engineers rather than higher and higher level people within the system.

Unfortunately I recognize that in the nuclear safety business. In the end you end up in the courts which are singularly incapable of judging these technical questions, so I would rather not see them appealed up the line, but resolved at the best possible technical level, whatever that is.

The second point I would like to just say is that, whereas the implementation of these issues may be at a low tech level, involving wires, relays and so forth, the issues of reliability of very complex systems are far from simplistic. They challenge the hardest part of reliability analysis and we have been harping all morning on the issues of reliability analysis and I don't agree at all that those are trivial, when you deal with these questions. Even if the implementation may be in terms of relays and wires.

MR. LYNCH: I fully agree with you, sir, and as I mentioned earlier, just a few moments ago, the staff has great difficulty with reliability and I would call to your attention with the concept of PRA was first brought before the ACRS, the ACRS did indicate, as I recall, that it was an interesting concept, but they were concerned that with the limited number of plants, that there was an insufficient data base to have a fairly reliable set of statistics to plug into a fault free analysis process and I think we have not, as a staff, yet been able to solve that problem.

DR. LEWIS: Well, you know, all I can say is that I wasn't on ACRS at that time, but I will agree with you that ACRS did not understand PRA very well.

DR. KERR: However, there is a difference between PRA and reliability of fairly simply, well understood components with which there is a lot of experience, and I don't think that even the ACRS had difficulty with that particular part of the total PRA process. And, indeed, one of the problems with the reactor trip system, as you recognize after all these years, somewhat better than I, probably is that we are requiring that it be extremely reliable, more so than any other component or system in a power plant, so far as I can determine.

And, it's for this reason that I keep harping on reliability rather than diversity or redundancy or whatever. What we are trying to achieve in this system is reliability and it is such an important system that it behooves those of us, not in the trenches and those of us in the trenches, to use whatever tools are available, insofar as we can, to try to achieve that.

MR. NEWBERRY:I think we certainly agree with that objective. After going through our part of the agenda here, I would make just one observation.

Most of our discussion was focusing on the places where we have disagreed with proposed designs from the different utilities. We didn't say too much about where plants that proposed acceptable designs have implemented acceptable designs and I would only say that I think all of our objectives are to improve the reliability of the SCRAM function and improve safety at all the nuclear power plants.

I think that the systems that have been installed and will be installed would do that. I would hope, as the owners groups go through their part of the agenda, you would get a broader picture of the progress that has been made and should be made and continue to be made in the next couple of years.

The ATTU issue, the issue of insufficient diversity in a few CE plants are really, as I said, the two remaining issues--there has been a lot of work done by the industry. Where we have looked at it, it's been good work and we have accepted it and are proceeding with implementation.

So, I don't know that it's a fair picture of the overall ATWS implementation project to just use those two open issues as an example of where we are.

MR. LYNCH: I would like to address your last comment, sir, and specifically Mr. Lipinski has raised this point also, as Dr. Lewis has.

We don't disagree with you, that reliability is an important factor. And to show you where I stand, if industry were to come in and make the point that there was a significant degradation in reliability to go to a diverse component we would, of necessity, be forced to accept their position almost instantaneously, but nobody has made such a case that if a different component, as diverse component is used, whether from the same vender or a different vender, that there is any quantifiable reduction in reliability.

Since that argument has not been made, we're not free then to say that requiring diversity in components is reduction in reliability.

If, indeed, industry can come in and make that case, very succinctly, we would immediately, I think, agree with them. I can't speak for the whole staff, but if they were to say that is the most reliable unit and there is a factor of 2 or a factor of 10 reduction in reliability going to a different component, the staff would give that great weight in this decision making process.

But that--I am emphasizing for the third time, that position, that presentation, has not been made by industry.

DR. KERR: Thank you, Mr. Lynch. Anything else on this subject?

I assume that we covered the detailed status on selected plants with the chart to which you referred us?

MR. NEWBERRY: Yes, sir.

DR. KERR: I'm not sure how that last item--how did the last item on the agenda? Did I suggest it be put there and then forget it?

MR. NEWBERRY: Well we thought that--

DR. KERR: This was regarding some resert pump trip failures? Maybe you should just tell us about it, if you can, without an exhaustive analysis.

MR. NEWBERRY: There is certainly one recent one of interest to us. Some of the boiling water reactors use a trip design that opens the fuel breaker to the MG set for the recirculation pumps. There was an event that occurred at Fermi, a few months ago, where a breaker failed to open when it should have and investigation led to what I believe was the route cause of inadequate maintenance of that breaker.

There had been problems with that type of breaker over the past few years, but reviewing the record, the plants that have been maintaining them seem to not be having problems since the service information letters and other maintenance information were provided by the vender to those plants.

So, as a result of that event, we have a few other activities on going, I believe, there still may be a better way, a more reliable way to trip the resert pumps.

As some plants have, there is an in line breaker going to the MG set that appears to be doing a better job. I have talked to the GE owners group about looking at what it would take to modify plants along those lines, to change the design and also there is a recent memo that I saw where the staff has proposed this as a potentially new generic issue to look at the reliability of resert pump trips, so it's going to be an ongoing issue.

DR. KERR: Was there some reason why the maintenance eon the unit at Fermi was not correct or maybe they didn't know that the breaker was there.

MR. NEWBERRY: I believe there was a programmatic breakdown in taking the information that came to the plant, the correct maintenance information, such that it did not make is way into the plant procedure.

DR. KERR: Okay, thank you.

MR. LYNCH: If there are no further questions on this issue of ATWS, we would then move on to the next agenda item.

DR. KERR: Okay, let's do it.

MR. LYNCH: Okay. That falls into the bailiwick of the Reactor Systems Branch and we have Wayne Hodges here who is branch chief and we have two individuals who will be making the presentation. As I mentioned earlier, Dan Fieno and Howie Richings and I am now going to turn the microphone to them.

DR. KERR: Thank you, Mr. Lynch.

MR. RICHINGS: I am Howard Richings, the Reactor Systems Branch. I am going to discuss the inner actions of BWR and some hydraulic stability oscillations with the ATWS.

Ever since the LaSalle event, the interest in oscillations that has basically divided off into areas, one dealing with asymmetric oscillations. First mode harmonic primarily in which the oscillations occur across the core, but in which the average power of the reactor doesn't change very much.

A good deal of the effort on the part of owners groups calculations and staff consultant calculations has been devoted to this area, but I am not going to discuss this areas since it isn't evidently directly relevant to ATWS, but only the second area in which there are symmetric oscillations in which, at least, in the course of the oscillations , the power does change significantly over the entire reactor and those become the areas of interest.

The basic question is will the oscillations in and of themselves or via some other process, inter action process, increase the average power of the reactor so that, in the course of those events in which energy is being dumped into the suppression pool, that the average power will increase that suppression, pool temperature beyond limits which are deemed desirable for the prevent.

The events, of course, are primarily those isolation events in which this suppression pool action occurs.

The other associated problem is, will these large oscillations affect what the operator does or what the system does in some way which will also accomplish the same undesirable affects, average power, increase in the reactor, increased temperature in the suppression pool.

There has been a good deal of effort by the BWR owners group in this area with thus far calculations primarily by GE although EPRI is now beginning to get into the calc8ulational area also.

But in the area of the large symmetric oscillations, GE has maintained, from the beginning, that they did not believe that large oscillations in and of themselves would increase the average power, that as long as the primary system parameters like inlet flow and so on remained as they should be in the system, that they would not affect the power.

They have done, with their TRAC code and its three dimensional calculations, a calculation of large oscillations and it is their contention, from this calculation, in particular, that they have demonstrated that there is no significant power increase at any variation seen in the course of these calculations or residual system effects occurring as affects of changes in the initial conditions.

DR. KERR: Is there any reason to believe that TRACT is capable of handling this problem? I guess there is or GE wouldn't be using it, but certainly it wasn't reasonably intended to handle this problem necessarily.

MR. RICHINGS: They are doing benchmark calculations, at least the LaSalle event, to see that it can produce as a type of results that were seem in LaSalle and perhaps others.

We have not, as yet, seen their complete program. We are still awaiting their report on this subject, so we haven't done an official review in this area. But they have and or will do bench mark calculations, as is going to be true throughout the calculational program, both of our consultants and of GE and EPRI.

As of this point, the general consensus appears to be, yes, it's perfectly capable of handling this type of problem. That includes our consultants too from, for instance from INEL, which you is also going to be using TRAC in this area.

So, as far as we know, at the moment, there is no reason to doubt that it can handle this reasonably well.

MR. HODGES: Is the major obstacle to using TRAC for a problem like this, is the pocketbook. It's a very expensive analysis.

DR. KERR: And this is also a problem that is not well analyzed as TRAC and other codes have been demonstrated to work well if one has sufficient data so that they can be tuned to deal with the problem, as you know better than I and I guess I would--go ahead.

MR. RICHINGS: Our ultimate, of course, decision will be based, not only on TRAC, but on our consultant's codes and a number of calculational areas, all of which will be bench marked as much as possible with experimental or observed data from plants and there have been a number of cases in which there have been relevant oscillations of reasonably large magnitude, at least up to a 100 percent type power oscillations.

There has been, thus far, peer review of the GE calculations by EPRI. We have had several meetings with GE in which these calculations have been discussed, but as I say, we have not yet received the first report on the subject, which is due about now. It was due sometime in April, so we expect to see it almost anytime now.

But GE, at least, and the owners group and presumably EPRI, since I have heard no adverse comments coming out of EPRI thus far. Their basic conclusion is that there is no evident problem in this area. They have not yet explored the subject of oscillation inner actions with the system and with the operators. This is now being done by EPRI. EPRI recently started in this area. We have no results from them yet in this area.

DR. KERR: Okay. Now let me see if I understand your first statement that there are no problem. This implies if one did not shut the reactor down with the trip system, but presumably did get pump trip or--

MR. RICHINGS: Yes. The situation is just after the initial isolation event, the reactor has gone to part power because of the pump trip. It is sitting there at some 30 percent power or so and presumably now oscillating, as differing from the previous calculations, although GE did include oscillation type calculations in their previous ATWS work in this area. The only question is, at that time, they were introduced somewhat artificially and were they done appropriately at that time, which is why it is being examined at this time.

DR. KERR: Now when they say there would be no problem, that means that the average power would not be any greater than--

MR. RICHINGS: Right, the average power would remain the same and the suppression pool increase in temperature would be as already approved in the previous ATWS calculations.

DR. KERR: Okay, thank you. Just try to state a little bit of the basis for why there is even a question. If you try to say from a first principal's view point, well I've got a certain amount of feed water going in with a certain amount of sub cooling, and the water level is going address itself to support whatever average power you're putting in there, you can make a relatively simplistic argument that it shouldn't change, but the power shape is such that the--it is not symmetric if you pool an average power. The top half is not the same shape as the bottom half of the oscillatory curve and the fact that the LaSalle, although it was thought that it was due to a decrease on the feed water temperature, there was an observed increase in power and so those two together, at least, raised a question that needed to be looked at, but from a simplistic standpoint, you would not expect to have the power to go out.

DR. KERR: But I don't think this is a simplistic process or a simplistic argument is not going to tell you much about it.

MR. HODGES: It's not a simplistic process and that's why we're going through all of this.

DR. KERR: I just wanted to say, this is your gut reaction based upon a simple look at it says it should not increase, but the power shape is not symmetrical--the oscillation is not symmetrical, about an average and therefore, you want to look.

MR. RICHINGS: As of this point, GE and the owner's group have indicate there is no further need to do these large oscillation calculations and we have asked them to do more.

As of the moment, this is on hold until we do, indeed, review the written report on the subject and come to a more formal decision in this area.

So there still may be more or there may not be more need for further large calculations.

The EPRI work on inner actions, however, will be going on.

DR. KERR: The EPRI work on the inner actions--

MR. RICHINGS: On the inner actions of the operator and the system because of the existence of large oscillations.

DR. KERR: Thank you.

MR. RICHINGS: Now for our consultants work in this area that has been going on, B&L has been using RAMONA and the EPA, which is Engineering Plant Analyzer, which is also called by various other initials at various times like HIPA and so on. I'll call it EPA here.

That is incidentally a point kinetics with neutronics in it whereas RAMONA is running full 3-D, very much like the TRAC is except in its form as its used at Brookhaven, it is much more rapidly operating codes and TRACT and therefore, can be used a little bit more freely than TRAC 3-D can.

The problem with RAMONA, however, that was oscillations where the primary interest is one of just looking at the large oscillations and seeing what they do in and of themselves is that RAMONA has numerical problems in thermal hydraulics, has thus far these problems and it basically breaks down for doing these calculations when you get to large oscillations. The primary effect is that it takes forever to runt he calculations once you begin to see this, particularly when you get to reverse flow with the inlets, the system just breaks down.

New thermal hydraulics is being introduced into the system. That's going on now, but that has halted work that has been going on with RAMONA and therefore there is from RAMONA no significant output in this area other than the large calculations which did occur. They weren't nearly as large as we would like to have them, on the order of 100 percent oscillation, showed no particular signs outside of the system affects, once again, of intrinsically causing problem areas.

But, we have not reach any conclusion in that area yet because of RAMONA.

The EPA calculations have explored a number of ATWS scenarios. They have begun to get into this area of looking at a number of scenarios, seeing what the oscillations themselves, we haven't gotten into any questions of operator action here, but seeing what the system is doing and seeing what the large oscillations are doing to it.

There is tendency on the part of those at Brookhaven running the EPA to believe that there are, indeed, power increasing affects from oscillation, but thus far, the calculations which have been one, do not give any clear separation of effects or any quantification of w' 1t might be going on there. So we are continuing to explore the types of calculations which might be necessary to further examine this question.

We are right now in a state therefore in which we have some slight indications that there may be a problem here, but we are no where near yet ready to quantify it and say that there is.

DR. KERR: Remind me again, what is EPA?

MR. RICHINGS: Engineering Plant Analyzer. ABWR for handling the entire system primarily, with point kinetics in the core, so it can handle symmetric oscillations, but not asymmetric oscillations.

DR. KERR: Thank you.

MR. RICHINGS: And the last slide. The future plans are, as I said, to improve RAMONA to get the thermal hydraulics improved so that those types of calculations can be done. We intend to bench mark RAMONA against, at least, LaSalle and hopefully Ostrisham--Ostrisham because it is an asymmetric one and its interest to the other side of the problems which I am not discussing.

And then we will go on to a--once that is accomplished, we will go on to explore these large oscillations again with RAMONA.

The EPA, as I said, further scenarios are going on to attempt to quantify what those calculations or to what the people doing those calculations believe are indications of a average power increase.

Also, we're beginning work with INEL using TRAC in a 1-D mode for these calculations. They too will be examining scenarios as a separate code in this area, sort of as a supplement to the EPA. In the 1-D mode, it is, of course, capable of operating much more quickly than the 3-D mode so we can do a number of calculations there.

TRAC 2 will be bench marked against some of these events and RES has set up a review team, including knowledgeable members throughout the NRC staff and through consultant's areas and we are, in this group, setting up an examination of the whole problem and seeing what calculations should be done, need to be done, what the explanation of the calculations results are and so on.

This has been in effect for about a month now and will continue on for the next year or so. The basic program--calculational program in this area is expected to continue on the order of another year or so before everything is settled. A good deal of the work, of course, has to do with the Asymmetric calculations. All the bulletins we put out thus far have to do with the asymmetric calculations, not with the ATWS problem.

And that is all I intend to say to day.

DR. KERR: Who is responsible for the RES review team

MR. RICHINGS: RES is running it. You mean a name or what?

DR. KERR: If there is a name.

MR. RICHINGS: Harold Scott is the person in charge of setting up that review team. I'm not quite sure--

DR. KERR: Does it have a chairman or is it a 3 or 4 person committee with no head, how does it operate?

MR. RICHINGS: The chairman is basically either Dave Visette or Harold Scott of RES. It has about--

DR. KERR: They haven't decided which one or you mean it rotates from day to day.

MR. RICHINGS: Well, I'm not really sure. They're both there in the meeting and I'm not precisely sure--

DR. KERR: Harold Scott works for Dave Visette and so it probably depends on which one is there.

MR. RICHINGS: And if you would like to know who is on it, I can tell you who is on the committee.

DR. KERR: That's enough. Any questions or

*PRESENTATION MADE MY MR. D. FIENO (NRR STAFF) IS MISSING comments from any of the subcommittee?

There being none, thank you. Mr. Richings.

* MR. NEWTON: I'm Roger Newton. I am Chairman of he Westinghouse Owners Group, also from Wisconsin Electric Power, Point Beach Nuclear Plant.

I would like to be optimistic and hope that this is our last presentation on ATWS before the ACRS, but I always get surprised in that area as well.

DR. KERR: Well, you didn't want to feel neglected.

MR. NEWTON: Right.

But, on behalf of the owners group, Dr. Kerr, I think we can provide you a gooc update. In a similar manner, I think we have the statement, similar to what the B&W group said, we don't think we have an issues remaining. That's a brief history. You have a slide of that in the handout.

The key items, I think, are when we submitted the generic designs to the NRC in response to the rule, and we'll cover that in a little bit more detail, but quite briefly. Somewhere in this time period, probably right in this range, plants started submitting their plant specific designs for approval by the NRC.

We have two main products that address ATWS, the generic AMSAC design and a more recent one, that is a response to the NRC questions on moderator temperature coefficient, we interpret that really to be how do we address the rule. So those are the two main products which we will cover in a little bit more detail.

The Owners Group ATWS Rule Programs have a couple of goals. The main one is to provide a generic means of addressing the ATWS Rule and that was to benefit the utilities and to benefit the NRC in their review process and to provide uniformity in addressing it.

We also were looking for flexibility in how to address the rule, but this is more in now we can implement it that best allows the plants to pick different systems for the AMSAC design.

Again the two main products are the W Cap that addresses the generic design with a rev to it and the W Cap that addresses the ATWS Rule basis. So those are the two main products.

A couple of comments that I would like to make that we didn't have slides for, was the question of reliability that was asked previously.

There are really two forms of reliability, just listening to the discussion that took place. One form of reliability is reliability of the system to function when needed to function and the second one is the reliability of the system not to function when needed not to function and both of those reliabilities are important.

The NRC tends to be more concerned about the first reliability and I think the industry, outside of the NRC and the utilities, are concerned about both of them and just as important the not to function when not needed because that means our plants will stay up and we won't challenge other systems.

The comment was also made by the NRC that we have not made reliability arguments to the NRC an I think we have, in that when we approach some of the designs--generic design aspects, we specifically did look at reliability and the NRC recognized that.

An example of that is that for the AMSAC design, it is not a system that will actuate when you lose power. It's an active system, so that if you do lose power to it, it will not trip the plant off line. So it is not adding to the unreliability of the plant in that regard. And that was a reliability issue that we showed that reliability was important.

DR. KERR: And when you presented that issue, you received sympathy and understanding?

MR. NEWTON: Excuse me. I was looking at the next slide.

DR. KERR: When you made that presentation, you received sympathy and understanding?

MR. NEWTON: Yes. And they accept it, so we must have, right.

The next area that we will be getting into and Melita Osborne, the Manager of Transient Analysis will cover the specifics of the two areas that the owners group has had programs in.

MS. OSBORNE: What I would like to do is address the two main owners group programs that we did to address ATWS, AMSAC, the ATWS Rule and what not.

The first one is the development of the AMSAC functional design which, as Mr. Newton mentioned already, has been approved by the NRC.

This was a joint effort between Westinghouse and the utilities and the goal was to allow utilities to select a design that would be best suited for them when it actually came time to implement it.

The utilities actually met with Westinghouse in our offices in Pittsburgh and hammered out three different designs which are at the bottom and each one of these designs meets the requirements of the rule and they have been approved by the NRC.

Basically they are all indicative of a loss of heat sync. You can choose any one of the three designs, but the NRC in their SER on the generic topical report, also stated that the plant specific aspects would have to be reviewed separately. A lot of the issues associated with implementation are really more plant specific than can be addressed WOG topical.

So, as I already mentioned, the generic part has been approved. There were two key elements addressed--identified by the staff which the WOG addressed generically. One of them had to do with the power levels below which AMSAC is not required and the other one was a question whether or not tech specs were required.

The other elements were required for the utilities to address in their individual submittals.

I would like to shift gears now, for a moment, and talk about the second program that--

DR. KERR: Excuse me. What was the decision on the tech specs?

MS. OSBORNE: That's still open.

DR. KERR: Okay. That is not regarded as a serious issue since we earlier heard that no serious issues still existed?

MS. OSBORNE: It's not an issue that is serious in terms of implementation. Tech specs themselves, are not pieces of hardware.

DR. KERR: Okay.

MS. OSBORNE: No one would say that they want more tech specs, however.

Switching gears now to the second program which the owners group worked on with Westinghouse. As Dan Fieno mentioned earlier this morning, the NRC issued a letter to all the owners groups asking about the effects of changes in fuel management style.

And the purpose of this program was to answer that question, but also to answer it in the context of all the integrative affects of an ATWS because MTC is not the only thing that can affect a plant response to an ATWS event. It's the total core and it's the total plant configuration.

What this program did was to review the basis of the ATWS rule and history leading up to it and I won't go into all of that, you know it.

Most of the basis for the rule is contained in SECY 83-293 and there was a PRA model in that document that was used to come up with the conclusions that AMSAC was required. And we used that as a basis to construct our own event tree.

It was consistent with the rule basis. We were still trying to meet the target of 10 -5 that was in SECY 83-293. We still treated all the ATWS events as loss of heat sync events. It was a little bit more specific to Westinghouse PWRs and it did include the fact that AMSAC would be installed.

At the time the IPE letter had not bee issued but we wanted this program to be compatible with the severe accident policy statement so that when the IPE letter was issued, the utilities could take this ATWS portion of it and then integrate it into their IPE.

Our conclusions and this topical report was given to the NRC for information a month ago showed that we are still meeting the target of 1 x 10 -5 and that is presented in terms of a core damage frequency for the Westinghouse plants.

DR. KERR: That core damage is defined as?

MS. OSBORNE: Well, in this case, core damage was actually equated with public risk and that is not normally the case. It was conservatively assumed that--

DR. KERR: I didn't ask my question very well. There is a spectrum of definitions of core damage from water 10 inches below the top of the core to the core on the floor and I am wondering which of these or maybe none of them.

MS. OSBORNE: Well, for a detailed definition, I will ask Mike Hitchler to give that.

MR. HITCHLER: For the purpose of this analysis, we assume exceeding stress level C conditions was the equivalent of leading to severe core damage.

DR. KERR: Okay.

MS. OSBORNE: That was also what SECY 83-293 assumed.

DR. KERR: Thank you.

MS. OSBORNE: A couple of other conclusions in our NR W-11993 is that although AMSAC is required to meet the target, it's unavailability is not of significance in contributing to the core damage frequency and that is because there is really no one factor that affects risk and there were other things as well.

The MPC, obviously is one that the NRC questioned us about and got review of this program, the eligibility of pressure release, the number of initiating events that you have, obviously affect the core damage frequency.

The fuel management question, specifically that the staff asked, had a small to insignificant affect on the core damage frequency and that was really depending upon whether you had adequate pressure release capability or not. Not so much whether or not it was an 18 month cycle or a 24 month cycle or a 12 month cycle, but whether or not your PORVs were gagged.

And finally, now that the IPE letter has been issued, we can say it is compatible with--

DR. KERR: Excuse me. Maybe you could back to the 10 -5. Is this 10 -5 the contribution to core damage due to ATWS or contribution due to all causes?

MS. OSBORNE: Mike.

MR. HITCHLER: Yes. The 10 -5 is strictly due to

ATWS.

DR. KERR: Okay. And this is in the context of generic analysis or analysis of some class of plants or--

MR. HITCHLER: Well the analysis is very Westingho ise specific in terms of standard design practices for core reloads and we chose abounding set of conditions, in terms of numbers of steam generators, transients, also a very important part of the W caps, the middle, was a large number of sensitivity studies, and we thought there ay be some variations, that we didn't want to unnecessarily penalize the entire Westinghouse class of plants with.

And so it is a bounding analysis and it has also taken into account what I would call outlyers.

DR. KERR: I'm trying to understand what is being contributed to. Is this in the context of a total core damage frequency of something. This is 10 -5 contributing to 10 -4, 10 -3 or--

MR. HITCHLER: It could be 10 -5 contributions to overall core melt from all events.

DR. KERR: And which would have been how much if you had analyzed the plant for the total? You didn't do that, you just--

MR. HITCHLER: We didn't do that, no. The view has been traditionally that current generations of plants have a total core melt frequency from all events on the order of

5 x 10 -5 to 10 -4. We felt that the targets apportioning ATWS to being less than 10 -5 would assure that we wouldn't change any of the overall conclusions or goals that ATWS set for overall core melt risk.

DR. KERR: So the 10 -5 then was an upper limit in your view and not necessarily what the contribution would be?

MR. HITCHLER: Right. We feel that that is an upper limit and that is consistent with the basis that was set forth in SECY 83.293.

DR. KERR: Thank you.

MS. OSBORNE: In summary, the owners group has done two programs to show that we complied with he ATWS Rule. We have developed an AMPAC design and then we have looked at the basis of the ATWS rule to see that we we're still meeting the basis of the ATWS rule as well.

I'll turn it back over to Roger Newton who will now talk about the status of implementation.

MR. NEWTON: In anticipation of the meeting, we sent out a questionnaire to the members of the Westinghouse Owners Group asking them certain questions with respect to implementation.

Within the owners group, we usually do not act as an enforcement agency with respect to once a product is produced, it is up to the utility to use it and in many cases, the NRC to work with the utilities on implementing that, consistent with the regulatory process.

So we sent out questionnaires asking how many--we got answers back, in a short time from 26 sites, 43 units and we just asked which ones already had NRC approval and for those 26, 22 had been approved by the NRC, 3 were pending and one indicated they had not yet submitted a specific plan.

Looking at the list that the NRC provided, in their attachment, we seemed to match up fairly close to that. In the installation , 22 were installed, 7 were to be installed shortly or at the next refueling, probably during '89 is how that was answered and 14 were yet to be installed.

Our actual operating experience with the AMSAC system is very little at this time. On the average, it's just 4 to 6 months, with a range of 0 to 18 months.

So we don't have a lot of operating experience with AMSAC yet. We have had no indications that there have been problems with respect to the design or how it was designed and implemented that are causing problems. It may be a little to soon to tell.

I know that from my utility standpoint, we have approached the reliability aspect of inadvertent trips at the plant very carefully in our design because we had to make sure we weren't adding more risk to the plants by causing trips than we were trying to protect from the AMSAC part of the system.

MR. DAVIS: Excuse me, Mr. Newton, a question.

MR. NEWTON: Yes.

MR. DAVIS: How often do you test that system?

MR. NEWTON: That was an issue that was asked by the NRC and we had to provide the design to have it testable, so pretty much, all AMSAC designs are testable.

In the questionnaire, we asked the utilities what are they planning to do with respect to testing their system and there was a whole range of answers from almost every week to every refueling. So obviously we didn't ask the question completely correct because testing of the plant may be testing the alarms versus testing the system from one end to the other.

MR. DAVIS: Does that mean there are no tech specs for testing the systems?

MR. NEWTON: That's one of the issues that we--and when I come to the end, tech specs is an open item, so I can cover that at that time, if you want.

MR. DAVIS: Thank you.

MR. LIPINSKI: Another question. What about the reporting requirements? This is not a safety system, so it falls outside the reporting requirements of safety equipment.

MR. NEWTON: That is correct.

MR. LIPINSKI: If you have failures in the system, will the NRC ever know about them or will that just be internal?

MR. NEWTON: It woul~ be--we're proposing that it would be internal, that it would just go into a reliability type data base that is generally available to the industry and I think to the NRC too, but if we don't have tech specs that call that a safety system, which it is not, it would probably not be reportable.

So we would be looking at and we have asked targets on what is the reliability of your system and we just haven't had enough operating experience to answer that.

DR. KERR: You haven't done any--made any effort to analyze the reliability of the systems?

MR. NEWTON: The basic design that was proposed and the generic looked at the reliability very carefully from both aspects of performing the function and for not performing the function. So there was redundancy involved in the design. In our particular plant we made sure we had kind of a redundancy on redundancy so that it functioned when it needed to and it didn't function, so we feel that they are very reliable systems for both of those reasons.

DR. KERR: That's a very quantitative answer.

MR. NEWTON: My next slide will show why that is difficult to answer.

As Melita indicated, there are three different choices of systems that can be used and we asked what particular choice did you make and we found that the steam generator low level seemed to be the dominant one. Low main feed water flow was next and tripping of feedwater pumps and valve closure was the third. They all were indicators of loss of main feed water flow.

Each of these systems do have different designs and how they were specifically implemented at the utility was pretty much plant specific and the NRC had to review each one of these and approve them.

This also comes up at--since we proposed systems that were generically designed, we could do a number of things on who we bought them from. Eleven were bought from Westinghouse, 5 were utility design systems and 8 were other suppliers.

So there is a lot of different hardware out there that utilities could implement in a manner they felt best suited their design, their budget of whatever reasons they wanted to use. But the WOG design is generic and the design targets they met were consistent with what was submitted and it met the reliability goals that were in the owners group report as well as what the NRC was looking for.

And the NRC has been approving these and I am sure, speaking for my own utility, we went through a number of items as to the reliability of the power supply and independence and things like that, that they had asked that we address in our plant specific proposals and we were able to reach agreement mon all of those and, as indicated by the status, a large number of utilities are also reaching an agreement with the NRC on exactly how to implement it.

How reliable those systems are, in a specific number sense, I don't have a number that we can give you and I think it will be a period of time before we can answer that and I am saying reliability from the standpoint of both aspects.

There won't be too many demands on the system to operate, but there will be a lot of demands on it to not operate and to be available to operate, so those are the two categories of reliability we will be able to keep track of in the future.

MR. HITCHLER: Roger, can I say something quickly?

MR. NEWTON: Sure.

MR. HITCHLER: In terms of the design, we assessed that we wanted to have a reliability of at least 10 -2 with the kind of goal that we had in terms of specifying configuration.

The configurations that were specified, if you go to like plants because we haven't done reliability test for every plant, but for the configurations that we have seen, the reliability has been between 2 x 10 -3 to 5 x 10 -3. We have to get into specific hardware.

So we don't feel that, in terms of when we go out to the individual suppliers of components or whatever, that we are right up against the wall in terms of having a 9.99 10 -3 reliability in safety design.

What we have also done though is, in terms of sensitivity, in terms of the design, to meeting the ATWS rules requirements, whereas we looked at the impact in terms of changes in the reliability of AMSAC. In other words, the base line analysis says, we're going to have a reliability or a non reliability of 10 -2 for demand.

We look at the sensitivity of what happens if that changes by half an order of magnitude, up to 5 x 10 -2 and we saw a very small change in terms. In other words, we're still way below the 10 -5 goal that we set for ourselves in terms of ATWS risk.

So we don't feel we're sensitive, either from the standpoint of variations in terms of fine detail in the AMSAC configurations or in terms of--even in terms of changes in terms of testing requirements, whether you have a tech spec for it or you just use good practice for testing.

MR. NEWTON: We also asked the utilities, are there any open items that kind of still remain with respect to AMSAC implementation and only two came out. Tech specs, our generic one that we have been aware of with the NRC, we have submitted a couple of letters identifying why we don't think tech spec on AMSAC is a requirement. Obviously, somewhere in our administrative controls of the plant, you do have to have some requirement for testing and maintaining it. But does that belong in tech specs, we don't feel that it does.

The second one that has occurred in the control room human factors review. Generally the NRC was asking how does this fit into the control room and each utility had to look at that and that may be an open item with the NRC for when they come out and inspect, that will be an item they will probably be looking for, as did you put this into the control room in a place, that form a human factors standpoint, it fits well into the control room.

As an example, in our particular plant, the engineer wanted to call this an AMSAC turbine trip. We went to the operators. The operator had no idea what AMSAC was and the more we thought about it, he probably would never know what AMSAC was or meant. It was a foreign term to the operator.

So we went back and sat down with the operators at the plant and said, what is this trip really doing and we had to come up with a name that represented what was occurring and it was a loss of feed water, a trip of a turbine and start of off speed water pump. So we had to name it by the functionality of what it did for the operator. And it is likely that we'll never use the word AMSAC in the plant.

That is just a human factor type thing and what do you call--how do you label alarms of by pass and trips, so those are all items that each plant is having to look at. It has not been signed off.

In your plant, prior to this installation of this system, what would the operators have done with the off feed water manually or whatever in case of a ATWS, maybe it was automatic before.

MR. NEWTON: They would have--before meaning--

DR. KERR: Before implementation.

MR. NEWTON: Of this.

DR. KERR: Yes.

MR. NEWTON: I would say after the new emergency response guidelines.

DR. KERR: Okay.

MR.NEWTON: Because the new emergency response guidelines really address ATWS from an operator response as well and they do a number of things when they obviously--immediately you go to manual trip on the reactor SCRAM system. If that doesn't work, drive the rods in and if that doesn't work, in our plant you can do and do other electrical trips of the motor generator sets and so on.

If [illegible] speed is not running, you manually start [illegible] speed. If the turbine is not tripped, you manually trip the turbine. So you do, in procedure space, all of the things that AMSAC would do too. So you have got the operator, as a back up, to the hardware, both in the reactor protection system and in AMSAC.

That's pretty well imbedded in the procedures in the training of the operator right now.

DR. KERR: Thank you.

MR. NEWTON: As I indicated, we have made generic responses on tech specs.

This just provides a summary of what we have presented thus far. The rule requires AMSAC, the NRC has approved it. Utilities are implementing it. The NRC has been reviewing or approving those and that is being actually installed in plants and we have the added basis for our continuing safety awareness of the ATWS rule.

The bottom line of all of this is that the Westinghouse plants are successfully implementing the requirements of the ATWS Rule.

Are there any questions?

DR. KERR: I see none.

MR. NEWTON: Thank you.

DR. KERR: Thank you, sir.

We originally had scheduled lunch from 12:30 to 1:30, between the Westinghouse and GE presentations.

Since we are somewhat ahead of schedule,I would propose to schedule lunch from about a quarter of 12:00 to a quarter of 1:00.

Is that going to cause anyone serious inconvenience?

I see no objections.

So we will recess until 1245.

(Whereupon, at 11:45 a.m., the subcommittee recessed for lunch to reconvene at 1:45 p.m.)

A F T E R N O O N   S E S S I O N

DR. KERR: We will continue with the presentation by the representative of the G.E. Owners Group, Mr. Floyd.

MR. FLOYD: Thank you. My name is Steve Floyd. I'm Vice Chairman of the BWR Owners Group and I come from Carolina Power and Light Company.

We've been asked by the ACRS and the staff to make a presentation on a number of ATWS-related issues regarding implementation. And these are the topics that we will be covering today which are very similar to the topics that the other NSSS Owners Groups have covered.

The first item to cover is the status of the generic reports. The BWR Owners Group submitted the Licensing Topical Report to the NRC in December of 1985. The SER was issued in October of '86. And the approved Licensing Topical Report was issued to the industry in February of 1987.

We've had two implementation problems. The first one is one that received a fair amount of discussion this morning and that was the diversity issue related to the transmitter trip units and we'd like to spend a few moments a little bit later in the presentation talking about that in more detail.

Another--not a major problem, but another slight change we had to make in some of the designs was providing some added testing capability to provide more complete testing of some of the circuitry while at power. Some of the initial designs did not have full testing capability. It's not a point of contention with those utilities and they are proceeding with those modifications.

DR. KERR: You are simply asked to provide the capability without discussing how frequently you would test?

MR. FLOYD: Yes, sir. That's correct.

DR. KERR: The implication I guess therefore is that you should test more frequently than each time you reload, for example?

MR. FLOYD: That would be our interpretation as well.

DR. KERR: Okay.

MR. FLOYD: As the Westinghouse Owners Group did, we sent out a survey within the last week or two and these are the results that we have received.

We have thirty-seven reactors which are subject to the ATWS rule. Thirty units are essentially complete. Of those thirty, seventeen are totally completed with implementation. Eleven units would be complete except for the recent diversity issue on the analog trip units which has arisen. And two units would be complete with the exception of both the diversity issue and the RPT logic testability issue which I just mentioned.

DR. KERR: What does "complete" mean? Does that mean it's installed?

MR. FLOYD: "Complete" means installed, with procedures and training in place.

DR. KERR: So you install these with the ATTU and if your efforts do not prevail, you'll have to take those out and replace them by something else?

MR. FLOYD: Yes, sir. That's correct.

We have seven units--

DR. KERR: Why were you so impetuous?

MR. FLOYD: Well, I think we'll get to that in just a minute.

DR. KERR: Oh, okay. I won't be impetuous then.

MR. FLOYD: Okay. We have seven units that are incomplete, and by incomplete I mean they have not completed implementation, training or procedures of the baseline requirements of RPS, SLC and ARI without the issue of diversity of testability coming into play.

They would not be complete even if those were not issues. Of those seven, six of those reactors also have the diversity issue to resolve.

That gives us a total of nineteen units that do need resolution of this diversity issue on the analog trip units.

I think the point here is to show that it was not one of two reactors that had difficulty in interpreting the diversity requirements of the ATWS rule as it related to the sensor device. But that nineteen units have.

Another item to point out here is that most of these units ran into this difficulty because many of us had the Barton transmitters or the level trips previously and the reactor protective system, there were a fair number of reliability problems with the Barton level switches. Utilities replaced those with the Rosemount which was a much more reliable device.

Of the units that are currently in compliance with the ATWS rule and don't have to deal with the diversity issue, the major reason there is that they had not yet switched from the Barton level switches to the Rosemount devices.

And a number of those utilities are now very hesitant to make that switch because they'd like to have common equipment in both their RPS and ARI for maintenance and procurement concerns and are now hesitant to do so.

As you'll see from our later discussion, the Barton level trip is an acceptable device to have in both the RPS and the ARI system and meet the diversity requirements of the ATWS rule.

DR. KERR: Now, wait a minute. It meets the diversity--you don't mean, these units are diverse from each other but rather--

MR. FLOYD: The staff interprets the Barton level trip device as being part of the sensor and they do not consider that the likelihood of having a problem with a sensor in a common mode sense is sufficiently large enough such that you need a diverse sensor. They have a slightly different interpretation.

We'll go into this in more detail and I think make it clear, the distinction.

DR. KERR: I'm sure it's all logical, so I'll just wait.

MR. FLOYD: Exemptions on the ATWS rule. We've had one exemption to date which was requested and granted. The original ATWS rule did not take into account, under the SLC portion, the fact that there are different diameter boiler water reactor vessels and therefore different capacity requirements for SLC.

One utility filed an exemption request and that was granted. The staff has since revised the final ATWS rule to take into account the difference in diameters of the vessel so that is not an issue anymore.

We do have the potential for additional exemption requests in the area of diversity for the analog trip units.

I'd like to turn our attention now to the ATWS diversity issue. The staff position, as I mentioned a minute ago, is that--well, in the case of the Rosemount analog trip unit, the trip unit is not part of the sensor and therefore requires diversity under the ATWS rule.

They therefore have concluded that our ARI system lacks diversity and does not comply with the ATWS rule since we are using the same Rosemount analog trip unit in both the ARI and RPS systems.

The proposed resolution that has been recommended to us, largely at our urging, seeking a solution on this, was to replace the Rosemount circuit board, which is the trip unit portion of it, with an equivalent board that's manufactured by a different vendor, in this case, General Electric has come up with a design that is a one-for-one replacement with the Rosemount board.

The position of the BWR Owners Group is that the trip unit is part of the sensor and therefore it is not required to be diversed by the rule since it performs the same function that the Barton level trip performs. And we'll go into the details on this in just a minute.

Our second position is that the ARI system therefore meets the diversor requirement of the rule and does minimize the potential for common mode failure.

The staff's proposed resolution we do not believe is necessary to meet the rule and we further believe that it offers little or no improvement in core damage frequency.

I'd like to turn the presentation now over to Bill Sullivan who will give you the basis for these three positions that we have.

DR. LEWIS: Could I just--I don't want to ask you to interpret the staff's position, but what did they say to you as the basis for their position? And then we'll hear later what it really is.

MR. FLOYD: Basically their position was that the statements of consideration in the rule require equipment diversity from sensor output, the final actuation device.

DR. LEWIS: I understand that.

MR. FLOYD: And they consider that the trip unit portion of the Rosemount analog trip unit is not part of the sensing device but is part of the signal processing and therefore needs to be diverse.

DR. LEWIS: And they said to you that getting the same board manufactured by somebody else meets that objective?

MR. FLOYD: Yes, sir. It would, in their opinion--please help me, God, if I'm mischaracterizing anything but their statement was that it would at least address one sub-set of potential common mode failure in the area of manufacturing error.

DR. LEWIS: Okay. Thank you.

MR. LIPINSKI: But the sensor itself was not required to be diverse.

MR. FLOYD: That's correct, sir.

DR. KERR: Well, you understand the rule says that.

MR. LIPINSKI: I know that.

DR. KERR: Yeah, okay.

MR. SULLIVAN: My name is Bill Sullivan. I am from G.E. I am a Principal Engineer in our Reliability Engineering organization.

Before I get started, let me kind of set the stage here. First of all, I'm going to be only talking about the diversity in the analog trip unit. The question of overall diversity in the other equipment in RPS and the ARI and the associated reliability and common cause failure reduction is really not an issue here and I think we're in agreement with the staff on that.

What I plan to present is basically three points. Steve mentioned one of them. The first point, just from a legalistic point of view, we feel the analog trip unit meets the rule in the sense that the rule does not require design and manufacturing diversity between the RPS and the ARI.

Secondly, looking at it in another light, you can say functional diversity and equipment diversity, and I will go into that in a little bit more detail, of the analog trip units within the RPS currently exist.

We had identified one case, and that's a loss of feedwater transient, here the automatic scram depends basically on one scr a parameters. And that's level. And I'd like to share with you some of our results of that assessment.

I don't plan to read this. I think you can take a quick stand. This is an excerpt from the ATWS Task Force recommendation. Basically what it's saying is the vulnerability of scram system, the bistable calibration errors and common cause failure errors is recognized.

It also recognized that monitoring of sensor output and frequent testing of the trip value ensures common cause failures can be detected.

The final rule, as given in the statement of consideration, the bottom line says the sensors need not be of diverse or of manufacturer.

Now, the real issue I think, as Steve pointed out, is the fact that we have with the staff is what is included in the sensor.

What I have here--

DR. KERR: You've tried this argument on the staff and they didn't accept it, I take it?

MR. SULLIVAN: That's right.

DR. KERR: That didn't make you wonder about the logic of forcefulness or persuasiveness of your argument?

MR. SULLIVAN: I haven't been persuaded. And I'm having a hard time--you know, I can understand the arguments that we've laid out here and I think it's a pretty strong case that we have. I'm not too sure that I really understand some of the overlying objections the staff has for this particular issue.

DR. KERR: Okay.

MR. SULLIVAN: What I have here is the two types of level sensors that we normally have in a BWR. The first type is a level switch. This is usually a Barton or Yarway. This is the one that Steve had referenced before.

The other type is a transmitter trip unit which includes a transmitter and, of course, a trip unit here.

The key thing here is both of these devices provide a bistable output here and here to the RPS. Some plants have level switches. Some plants have gone to the more reliable analog trip units. But basically both of these sensors are accomplishing the same function. We feel this is a little bit more reliable and reflects the current state-of-the-art.

DR. LEWIS: Forgive my ignorance. What's an LT in that--

MR. SULLIVAN: LT is level transmitter.

DR. LEWIS: I see. Okay, fine. So it's a level transmitter with a bistable interpreter.

MR. SULLIVAN: Right.

And the key thing also here is both of them have a bistable trip device. Right here and right here. Which is supplying inputs to your logic. And this logic could either be RPS or ARI.

DR. LEWIS: I'm trying to understand whether they measure different things. A level switch is also--

MR. SULLIVAN: They measure the same thing.

DR. LEWIS: Okay. Thank you.

MR. SULLIVAN: Yes.

MR. LIPINSKI: Would you discuss the testability of each of these devices and which one is more amenable to testing?

MR. SULLIVAN: Well, this s currently right now per tech spec. This is calibrated on an eighteen month--or every quarter, and you do functional testing every month. This is calibrated every month and along with doing functional testing every month. This calibration is a relatively simple calibration. This right here requires you to hook up a source and provide a trip of that particular switch.

MR. LIPINSKI: That's why I asked the question.

MR. OAKES: Do you have any data on the relative reliability of these two devices?

MR. SULLIVAN: We have--on the reliability we have, of course, done a study of this module here and it's documented in one of our reports where we've used the feest part type reliability and came up with the overall reliability of the boards in the various trip units.

As far as the level switch, there's a lot of level switches out of there and we have experience there. I don't have an exact difference in those two reliabilities. I would offer opinion. I'd say you were talking about in the order of a factor of 3 difference.

MR. LIPINSKI: But if you take into account the test interval, the beta rates were same. You've got a shorter test interval on the transmitter unit, you would have a higher reliability.

MR. SULLIVAN: Availability.

MR. LIPINSKI: Availability, right.

MR. SULLIVAN: Availability would get into your test interval, incorporating test interval, right.

So argument number one. We are saying that whether it's a level switch or whether it's a transmitter trip unit, we are talking about a sensor, the rule legalistically states that the sensor does not require it to be of diverse design and manufacturer.

DR. KERR: Well, now, what would happen if you put the transmitter slash ATU in a box, painted in black, and you just had two output terminals and you put a label on it that said "sensor."

MR. LIPINSKI: Well, that's what he's arguing about.

DR. KERR: Would the staff accept that then? Because they don't look at details. They said this morning. And they might not ever open that box.

MR. SULLIVAN: This is the box that we would like to blacken out--

DR. KERR: I mean did you try that? Did you take them this box and--

MR. SULLIVAN: Yes.

DR. KERR: And they didn't--

MR. SULLIVAN: I wasn't at that particular presentation. One of our electronics people was there.

DR. KERR: You see, an electronics guy will always open it up and show them the internals.

MR. SULLIVAN: Yeah.

DR. KERR: That's the mistake you made.

MR. SULLIVAN: Okay. We should have shown this box here and this box here.

DR. KERR: That's right.

MR. SULLIVAN: Okay.

DR. LEWIS: Are you selling black boxes?

MR. SULLIVAN: I'm selling sensors.

I'd just like to point out that I think that's the answer to the question that you asked me earlier about why could nineteen reactors select apparently the wrong device. When we read the ATWS Task Force recommendations, it did talk about the reliability of a bistable, the fact that you frequently calibrated and tested them.

And the wording that's in there certainly does suggest that that entire bistable feature is considered to be part of the sensor. Therefore, when the staff stated their position, that because there is some signal conditioning going on there, that that is not part of the sensor, we were surprised by that.

DR. KERR: Okay.

MR. SULLIVAN: Let me also go back here because I think one question was brought up this morning about reliability. And if we were to state, and I'll take your suggestion, Dr. Kerr, of calling this a box here, and say if this box was a Rosemount or a Brand X, which I think the staff has recommended, how would the two reliabilities compare?

From a reliability point of view, there are--I mean from a configuration point of view, there are differences. From a reliability point of view, there really is no basic difference because you have the same basic number of components on the card. The same basic major contributors to the overall card unreliability.

So I don't see any real difference in the reliability of whether you put a Rosemount here or some Brand X which is of similar design that you could plug right in as your sensor output real conveniently.

Now, second point. The other was more legalistically. This is what I consider more technically. Well, what about the sensors themselves? When you look at the RPS for BWR you'll see there's basically three different types of sensors that cause an automatic scram. Flux, position switch, and analog trip units, analog transmitter trip units.

And to demonstrate this, or to show it a little bit in more clearer terms, what I have here, and hopefully this isn't too busy, here again I want to concentrate on sensor diversity. I'm not saying that the logic is going to be different from one transient to the next, only talking about sensor diversity here.

What you have is three different types, which I am going to call functional diversity because they perform three different types of functions. One falls into analog transmitter trip unit category. And that would be your pressure and level. Your other would involve position switches, which is turbine control valve closure, stop valve closure, and MSIV closures, which all cause automatic scram.

The third one are inputs from flux and radiation sensors in terms of APRN and high radiation.

Listed here are the various major transients and major meaning the anticipated transients that we normally look at.

The numbers here refer to the order in which one would expect these sensors to be tripped. For MSIV closure, the first trip would be your closure of the valves would cause a position switch scram. If that didn't work, then you would have flux to pick you up and cause a scram. If that didn't work, then you would have pressure that would also pick up. And level would be your fourth level.

As you see here, there's various ones here. I think the minimum one we have here is for pressure regulator failure primary increase. In here you have flux and pressure so you still have two diverse ways of shutting down the reactor. Remember, this is the place where your transmitter trip units are. These right here are diverse from the transmitter trip units.

However, we've identified one case where the level here are the MSIV closure and pressure is dependent on the level sensor. Otherwise in order to get MSIV closure for loss of feedwater event, you must have a level trip in order to get an MSIV closure, and then MSIV's will cause the plant to scram. If you get an MSIV closure, then you should get a high reactor pressure level scram. But here again it's all dependent on level.

So looking at that specific event, we performed what I'd consider a mini risk assessment. And like I say, we're only looking at one event here. Loss of feedwater event. And what we have found is basically three separate sets of water level trip units. And by set I mean four sensors. One of these sets happens to be ARI. The other set is the RPS and the other one is the set that causes MSIV closure.

So in total, you are talking about a minimum of at least six individual trip unit failures in order to prevent scram. And this would be automatic scram.

However, when you look at the event itself, and we've looked at basically what happens if you lose Level 3 or the RPS level, ARI level, MSIV level and took it all the way through, what we find is the operator has at least fifteen minutes to initiate manual control rod insertion or manual scram.

He has diverse reactor water level indication. This is provided by the feedwater. It uses the diverse set of sensors. I think in some plants they use what they call a GMAC-5000 which is diversed from the Rosemount analog transmitter trip units.

He also will eventually get an APRN downscale alarm which will also be another indication to him.

Combined with that we have EPG's or Emergency Procedure Guidelines in place which provide adequate or appropriate operator guidelines on what kind of action he should take in response to these indications here.

Now, before you tell me to sit down, because I presented a very low number here, and attempted to quantify a common cause failure, let me characterize this number a little bit, because I think it needs to be put in the proper context.

First of all, it's only for the loss-of-water injection or loss-of-feedwater event. Secondly, it doesn't include other contributors, the scram unreliability, like the trip logic or the scram contactors, which also could be major contributors to overall probability of completing loss of the level indication. We are only looking at the sensors here. And their contribution.

Also, this number includes the probability of the operator taking action. Now, as far as the quantification is concerned, how we quantified this common cause failure potential. We basically used what's out in the current PRA's out there. What other people are using. We used realistic estimates of the probability of an operator taking action, giving the indication, the procedures he has in place and also the timing.

MR. DAVIS: Did you use the beta factor model--

MR. SULLIVAN: Yes.

MR. DAVIS: What did you use for beta?

MR. SULLIVAN: I think it was something like .1 was our beta factor.

MR. DAVIS: No.

MR. SULLIVAN: Okay. So what we are concluding from this with the loss of feedwater event here, we feel it's a minor contributor to the overall ATWS failure frequency and additional diversity in the analog trip unit is really not justified.

With that, I'm going to turn it back over to Steve and he will continue.

DR. LEWIS: If I could just follow up on Pete's question for a moment.

Did you use the beta method because you believe it's a fine method or because the availability possibility?

MR. SULLIVAN: I think we used the beta method because we have been using that method in some of our PRA's out there and we find that, you know--

DR. LEWIS: That just moves the question back in time.

MR. SULLIVAN: The what?

DR. LEWIS: Never mind. I've never heard any rational defense of the beta method.

MR. SULLIVAN: Okay. I don't know if I would be the one to give that--

DR. LEWIS: I won't even ask.

DR. KERR: Have you ever tried to convince the staff that this push toward diversity might make things less reliable, because they said they'd listen to arguments of that kind?

MR. STALTER: Yes, sir. That's our next slide, which I'm about to give to you.

DR. KERR: No, but I mean, have you tried to convince the staff before you try to convince us?

MR. STALTER: Yes, sir. And we were basically told that there was no way to quantify the amount of detriment that we might see from putting in this card.

As you'll see, I don't think they can quantify the amount of benefit that they hope to gain from us putting in this card either. So we really can't talk quantitatively on this issue, I don't believe. Neither side can.

DR. KERR: Well, if you can use beta factors, you can talk quantitatively without it meaning very much, but I don't see why you couldn't--maybe there's a beta factor for maintenance and for stocking a lot of different parts rather than one or two. You need some ingenuity.

MR. STALTER: We have not gone into that, sir.

DR. KERR: Okay.

MR. STALTER: Given the results that we got from

G.E. and the other reviews that we've done of the ATWS rule, we asked ourselves, should this proposed staff resolution be implemented. And one reason--this is rather, the staff's reason that could be a reason for putting it in would be that you would hope to get some reduction in common mode failures that are associated with the fabrication process.

If you look at the two cards though, you are essentially dealing with the essentially identical components. You are just having G.E.'s vendor fabricate them, put them on the card, as opposed to having Rosemount do it. So you really are talking about a manufacturing or fabrication common mode failure concern here.

DR. KERR: By the way, are you sure that G.E. and Rosemount don't get these from the same supplier?

MR. STALTER: We are confident of that. I've asked that question myself.

DR. KERR: Okay.

MR. STALTER: The negative side that we could think of is that although we have no reason to suspect up front that the G.E. card won't be a reliable card, it really doesn't have a proven history behind it. We've had the Rosemount cards out in service for years and they have proven to be reliable and we are somewhat concerned about taking a card which has had a limited amount of field application thus far and putting it in its place.

Another concern we have really counters the pro side that I just talked about and that's the fact that there is no manufacturing facility set up to manufacture the G.E. cards. They are not readily available as is the Rosemount card. In the case of the Rosemount card, we could call Rosemount and get one Federal Expressed out tomorrow if we needed it that quickly.

For G.E., we have about a six-month lead time because these are manufactured in a batch process. They have to contact a vendor who is willing to fabricate these and then he has to set up his manufacturing process before he can start punching these cards out.

The negative side on that that we see is with an in-place manufacturing process as exists with the Rosemount cards, you have a continuous quality assurance, quality control fabrication feedback mechanism that is further supplemented by field experience which can correct manufacturing errors.

If you are going to do that on a batch process and if we do go this route, we are talking nineteen units that need ten cards each, four for pressure, four for level, and a couple of spares, you are looking at a batch process of about two hundred cards. You are just not going to get a lot of quality assurance, quality control feedback loop in place on such a small scale manufacturing process which will take place over a few month's period.

DR. LEWIS: How many cards has Rosemount sold?

MR. STALTER: They have a production line which is a continuous operation.

The third item is we believe that it raises the potential for common mode failure.

--a change out of a card, should a card prove to be defective or whatnot. He's going to be looking, from the outside, at what appears to be two identical Rosemount cabinets. One will have a Rosemount card in it. The other one will have a G.E. card in it, and we are concerned about the possibility of crossing those cards up, and, as a minimum, the complexity that that places on the procurement and the maintenance process in the plant.

I say "high cost." It isn't particularly high. It's going to cost us about $170,000 per reactor to change these cards out. That includes procurement of the cards. The preparation of the design modification and the reviews associated with that as well as changes to the maintenance and procurement procedures.

DR. KERR: And the card itself costs about how much?

MR. STALTER: It's about--it depends on how many we get fabricated on this batch basis. It's going to be somewhere--and the number is around $8,500 to $12,000, depending upon the exact number that we wind up producing. So in round numbers, about $10,000 a card.

But the reason why it does kind of rub us the wrong way is that we really don't see any substantial safety improvement as a result of doing this, and we do see some negatives up here.

Our last concern is that it establishes a diversity definition that we believe is inconsistent with the rule. We think the rule right now does exempt this device in that it is part of the sensor and should be exempted.

The other concern we have, which is somewhat related to this item, is--and it was referred to this morning, that how far do we go with this? Is achieving manufacturing diversity enough to address common mode failure? Or will six months from now the concern be, "Gee, this diode is the same as that diode. This transistor is the same as that transistor."

I was happy to hear from the staff this morning that they do not intend to go down to the passive component level and that the concern rests solely with the active components. Which raises an interesting point. The only active components that are in the analog trip units are the relays. And in the particular case of application we are talking about in the RPS system, the relays are energized to actuate and in the ARI system, they are currently--excuse me. They deenergize to actuate in RPS and they energize to actuate in ARI.

So the only active component that we are concerned about since we are not concerned about passive components, does have a form of diversity in the form of energization state.

Therefore, you would think that there would not be a common mode failure with regards to active components that could result in diverse energization states. If you had a failure that would result in both relays being actuated, you would get a trip from the ARI system. If you had a failure which resulted in both relays from being deactuated, you would get a trip from the reactor protective system.

DR. LEWIS: This is a dumb question, but do Rosemount and G.E. get their relays from the same source?

MR. STALTER: That I don't know the answer to, sir.

MR. DAVIS: You quoted the $10,000 for the G.E. card. What's the cost of a Rosemount card?

MR. STALTER: It's about $2500. And the difference I think being in that the G.E. card was a specially designed card for this issue and is manufactured in a batch process with a lot of set-up costs to get ready to make the runs.

MR. DAVIS: I don't see any discussion of one of the staff's contentions regarding aging. How do you respond to the possibility that the cards may experience aging faults at about the same time?

MR. STALTER: And I don't have an argument for that.

Bill, maybe you do.

MR. SULLIVAN: I know one thing on the relays, for example. When you talk about an energized type relay versus a deenergized type relay, a lot of the aging things that we've seen, like rubber components or some type of material inside the relay could be subject to a higher type wear-out when you are in an energized state. Because you've got heat, you know. A lot of heat there.

This is kind of what happened at the famous event they had where the twelve relays failed and, you know, it was due to the heat which caused the relays to fail in a deenergized condition. Where when you are in a deenergized condition during normal state, you don't have that condition there and you are probably not going to be as subject to as much wear-out as you would.

So you've got some diversity I feel just in the two different types of operations.

MR. DAVIS: That second question. Item No. 3 bothers me a little bit. I had been led to believe in the past that by having diverse components, you actually reduce failures from maintenance because different methods have to be used on the different components.

But you are arguing here that it, in fact, increases maintenance errors.

MR. STALTER: In point of fact, what happens here is that because these cards are a one-for-one replacement for each other, they perform the identical function, there is no change in the calibration procedure required to calibrate either the G.E. card or the Rosemount card. That's how similar these cards are.

MR. DAVIS: Wouldn't it be possible to make them so you couldn't replace them incorrectly?

MR. STALTER: I don't know the answer to that question. I think the design would probably have perhaps, you know, made such that it couldn't be a one-for-one replacement in the cabinet, and now we are talking about ripping out the Rosemount system and putting in some other total new design, which would, of course, be a much higher cost. We're trying to look for a lower cost alternative to that.

MR. DAVIS: Thank you.

MR. LIPINSKI: Let me ask a question of G.E.

Designing of the new card, you can come up with higher reliabilities depending upon what stress factors you assign to the different components.

Rosemount, I assume, used commercial stress factors whereas if you went to MIL-type specs you could design a card with much higher reliability depending on what stress factors you assign to the different passive components.

Do you know if that's been done?

MR. SULLIVAN: I know the study that we did for the--in fact, we were involved in the original Rosemount study where we did the reliability and we were using values out of the MIL standard handbook on various components.

Basically, as I mentioned before I think, it's my feeling that--I'm not familiar with if we've done a specific study for the G.E. card itself. But I think if one was done, you would expect to see basically very identical type results.

MR. LIPINSKI: That's what I was afraid of. Because that would be one of the benefits that if G.E. was doing it they might do it to a higher set of standards. But if it's still commercial grade, they'll come out the same.

MR. SULLIVAN: And I can't verify specifically those two grades, but it is my judgment the two would be pretty close.

MR. STALTER: A quick summary then on the diversity issue. We believe that the trip unit, the analog trip unit is part of the sensor. And therefore does not require diversity for the rule. Diversity is not limited to equipment diversity by the ATWS rule. The body of the rule itself states diversity. The statements of consideration places a requirement that equipment diversity were reasonable and practicable be applied.

The staff position on diversity requirements, which was attached to the Safety Evaluation Reports which they sent to us allows combinations of allowable methods where total hardware diversity is difficult to achieve. Some of those combinations were functional diversity, as well as manufacturing and equipment diversity.

Recent staff decisions--their latest communication to us requires total hardware diversity regardless of difficulty cost or benefit.

Fabrication for diversity for the Rosemount trip units, in our opinion, provides negligible safety improvement. Our conclusion is therefore that our current design does meet the ATWS rule.

DR. KERR: If the staff would prefer not to answer this, they can say so. But do you accept their interpretation that your recent staff decisions require total hardware diversity regardless of difficulty, cost or benefit?

MR. NEWBERRY: No, I don't think I would interpret our last communication that way. I think the last communication, if I could take a crack at summarizing it, is the design as we see it does not meet the regulation. That is, it is not diverse. I think one primary--one of the primary disagreements we have is simply in the definition of sensor, to be begin with. I just cannot accept that a bistable located hundreds of feet from the sensor would be considered part of the sensor itself.

DR. KERR: If it were five feet away could it be?

MR. NEWBERRY: It's not even integral to it. It's a device which I've always heard termed a "comparator." A comparison device. A bistable, part of the signal conditioning. There are many definitions which would disagree with some of the written and published definitions which would disagree with some of the thoughts found in--I guess what Steve put up here, the ATWS Task Force.

DR. LEWIS: I don't understand a criterion based on distance or integration because there's functional integration and I don't know why two feet are okay and one hundred feet would be bad.

One is getting very arbitrary at that level.

MR. MAUCK: Well, I don't think there was ever any distance criteria. I believe that the Barton level switches that they had up there, it was given that since the trip unit, if you want to call it that, was part of the body of the Barton level switch, that that would be counted as part of the sensor, but in this case if the signal conditioning is not part of the actual body of the level switch or some other switch that it is not considered to be part of the sensing unit. The classic definition of a sensing unit is something that's out there sensing a change in parameter and that's not what the trip unit is doing.

DR. LEWIS: But this is really beginning to get into angels dancing on the head of a pin. Because we're beginning to lose sight of the purpose of all this which as has been said many times to ensure the reliability of the system. And when the definition of what is integral depends on whether they are in the same case or not, you have to ask what contribution the casing makes to the reliability of the system, if you are going to be serious about it.

And I worry about the logic. Maybe we made a terrible mistake long ago when we let the rule go through in its present form. But one is making very, very rigid--and maybe you have no choice. Very rigid interpretations of the wording of the rule in the same way that on the Hill one makes rigid interpretations of badly created legislation. But that doesn't make the country a better country as a result of it.

I wonder if I could ask a separate question, Bill, since I have the floor for an instant. Of the staff.

DR. KERR: Well, let me think. Yes.

DR. LEWIS: Thank you, sir.

Long ago, this becoming a life's work, of course, as it is for you too. Long ago--I'm putting on my "boy inventor" hat now. Long ago the question was raised of whether one way to ensure the reliability, and this is independent of the rule, the reliability of systems of this kind, is used in the computer business all the time, and that is self-testing mechanisms. When you turn on your PC it tests itself. When I turn on my printer, it tests itself. It runs through all its functions. It takes a few seconds to do that. And everything responds and says, "I am here. And I'm working."

And for many of these systems, which include a fair amount of electronics, both passive and active, you can test nearly everything in that way. So that you could have a continuous green light which tells you that everything except the few things that would actually trip the system has been tested on a continuous basis.

This was brought up to the staff several years ago and I think Bill was present at the time and the answer came back, "No, we can't permit that, because that would involve adding extra complexity to a system we'd like to keep simple." As I recall, that was the rationale for not taking the idea seriously.

I'm not proposing that we redesign trip systems at this point, but is there any philosophical response to self testing as a road toward reliability? I'll ask anybody that question.

MR. SULLIVAN: There are plants out there, like one of our Clinton plants out there, the solid-state plant, which has self-test features built into it.

Also I want to mention, which I probably kind of sluffed over, is the fact that one of the reasons why we're saying that the analog trip unit is a little bit more reliability than level switches, it has some self-test features in it, in itself. It's not fully self testing.

DR. LEWIS: No, you can't do it.

MR. SULLIVAN: Right. But there are parts of the trip unit which has self-test features built into it.

MR. MAUCK: I guess there are plants that are coming through or have just gone through the licensing train that do have a computerized micro-processor based safety systems, and they have provided self-test systems, and the staff is looking at those closely, and I guess we are favorable towards self-test systems

DR. LEWIS: I see. Well, that's a change of position then, because it was really very negative a few years go.

MR. MAUCK: Yes. But with these computerized programmable safety systems we are insisting that verification and validation of the software be performed by the vendor. So there is that check on the actual software being used for these systems too.

DR. LEWIS: You are insisting on verification of the software?

MR. MAUCK: Yes, sir.

DR. LEWIS: Verification, of course, of the software business has many meanings.

MR. MAUCK: Oh, it does. Right. Yes. We use IEEE-7432 as a guide.

DR. KERR: Excuse me. I want the record to show that I did not authorize that question.

DR. LEWIS: You will not authorize that question?

DR. KERR: I didn't authorize it. I authorized the previous one but not that one.

(Laughter.)

DR. LEWIS: But I didn't ask that. He raised the issue. I appeal.

But verification is a tough business. It's not as simple as the word seems to be.

MR. MAUCK: No, it's an extremely tough business. I'm in agreement with you on that.

DR. KERR: I want to pursue the earlier question of what is a sensor just a little bit to see if I understand the staff's position.

The impression I got, and correct me if I'm wrong, is a pressure sensor should set pressure and should have pressure as an output otherwise it has some signal processing in it.

MR. MAUCK: No. The pressure sensor should be sensing the pressure and in this particular case it has a current as an output. It's the changeover from the physical medium to the electrical medium.

DR. KERR: I thought the problem here was that this had something coming out different than what is being sensed that made it not a sensor. What is it about the input/output that--

MR. MAUCK: Well, you are talking--I guess in the ATTU, if you include that as the sensor, you also have a plus and minus 24 volt power supply as the sensor and then you can take that up to the 120 volt bus into 480 bus. So you have to draw the line and the line drawn on the sensor is the actual device that's converting the physical medium to the electrical medium. And what's within that body of that particular device.

DR. KERR: I'm trying to find out what the device is that you call a sensor. Where is the--

MR. MAUCK: It's the transmitter in this particular case.

DR. LEWIS: Let me make sure I understood you. You did define it. You said it was the object which sensors the parameter of interest and changes it into an electrical signal. Is that your definition of a sensor? I think that's what you said.

MR. MAUCK: That's within that particular case, yes. And it's in the particular body.

DR. LEWIS: And it's within the particular case. In other words, it cannot send a signal out that is not electrical and then convert it into an electrical signal and still be a sensor?

MR. MAUCK: No. I wouldn't think so. There you are either talking a current-to-current converter or an I to V converter or in another case, a V to I converter. You are talking power supplies. You are talking operational amp, bistables relays, and none of that fits the classic definition of a sensor.

DR. LEWIS: I'm talking about fiber optic connections. They are not sensors anymore? Electrical--

MR. MAUCK: Well, yes. In a particular case where they are actually sensing a source of light, they would a sensor.

DR. LEWIS: I think you are in trouble with this definition.

MR. MAUCK: Well, I didn't say that this was coming from any textbook.

DR. LEWIS: I know. You did it on the spur of the moment.

MR. MAUCK: You realize that.

DR. LEWIS: I think the point is being made and I think it's correct. That if you really try to define these things you are going to be in deep trouble.

MR. MAUCK: It's extremely difficult.

DR. LEWIS: But if you made electrical signals, I'll give you fiber optic cables, and if you include fiber optic cables I'll give you acoustic connectors. And I'll give you strings and wires, for that matter, if it comes to that. And there just is no good definition except functional.

MR. MAUCK: True.

MR. LIPINSKI: And then you get into the question of the separation distances. Whether it's five feet away or whether it's in the same case. No single sensor will send out an electrical signal unless it's got a electric crystal in it. Even in his case where he says he has a milli-amp signal, he has to have a power supply to get those milli-amps out.

And also you'll have sensors that are switches. You don't get currents through the switch unless you provide some external circuit to it.

DR. LEWIS: On the other hand, I can do it with an optical lever and not have a power supply in it.

DR. KERR: I must say that what I have seen up to now would lead me to believe that the two parties involved, which I have to assume include a number of competent engineers, could switch sides and argue the other side with equal conviction.

DR. LEWIS: Only lawyers could do that.

DR. KERR: There is so much ambiguity in the way the definition is applied. And we aren't, after all, talking about reliability. That's not part of the problem. We are talking about diversity which is itself ambiguous. And, well--

MR. STALTER: And, Dr. Kerr, I think from our standpoint that really is the bottom line. The only reason we are opposed to putting this device in is because it's a change to our plant that we do not believe adds any reliability to the RPS or ARI system's capability to insert rods.

The last item that we were asked to talk about was what did we see as the ATWS risk improvement. We used the Brunswick plant level 1 PRA for the first part of this. Our pre-ATWS rule risk calculated a total core damage frequency of and about 2 1/2 X E^{-5}. The ATWS contribution to that was roughly 40 percent 1.1 X E^{-5}.

Using our model we calculated the post-ATWS rule risk assuming that we still had a residual unidentified 20 percent common mode failure potential in there and reduced core damage frequency to 2.39 and the ATWS contribution to 1.02, still approximately 40 percent of core damage frequency.

We then looked at it and said, well, what if we could get rid of all common mode failures. And obviously addressing just the Rosemount analog trip unit would not do that. There's lots of other components, primarily the mechanical portion remaining.

But if we could eliminate all the common mode failure, then we would get a total CDF of 237 and our ATWS contribution to drop to 1 X E^{-5}, again, round numbers still about 40 percent.

The conclusion that we reached from this was that we reduced core damage frequency with a system that we have in place by about 3.2 percent, and if we could eliminate all the potential for common mode failure in all systems of the ATWS-required modifications, we would reduce CDF an additional .8 percent.

We asked other plants out there as part of our survey how much reduction they had gotten. The actual numbers varied from plant to plant, as you would expect. But in general, we were seeing a 10 percent or less effect of the ATWS modifications on total core damage frequency numbers.

MR. DAVIS: A couple of questions, Dr. Kerr.

DR. KERR: Certainly.

MR. DAVIS: I think that the real concern here is not so much the ATWS contribution to core damage frequency, but the ATWS contribution to public risk. And that's a totally different number because ATWS events typically produce the highest public consequences because of the threat to the containment.

So I think that's a perspective that's not here that would change maybe some of the conclusions here.

The other thing is I'm familiar with the Brunswick PRA and I don't recognize these numbers unless you are talking only about internal event.

MR. STALTER: That's correct. This is just internal events.

MR. DAVIS: At that particular plant, external events dominate the core damage, and, in fact, there's a seismic ATWS that is a substantial contributor. So that would be a different perspective also.

MR. STALTER: Right. Yes, it would be.

MR. DAVIS: Thank you.

MR. STALTER: That concludes our presentation, unless there are further questions.

DR. KERR: I see no further questions.

Thank you, sir.

That brings us to combustion engineering.

MR. WILLIAMS: I'm Dan Williams. I'm a member of the Steering Committee of the Combustion Engineering Owners Group.

About three years ago, almost three years ago, NRC accepted the diverse scram system, diverse turbine trip designs for CE plants, and the emergency feedwater actuation system designs for pre-Arkansas plants.

Since that time, the CE plant activity in the area of ATWS has been plant specific. That is, non-owners group. One caveat on that is that three of those newer plants have cooperated in the resolution of the diversity issue for the emergency feedwater actuation system.

There's been significant movement in that area the last few months and it looks like it's near resolution within I would say the next two to three months unless there's--

DR. KERR: What was the diversity issue in that situation?

MR. WILLIAMS: The basic unique aspect of the six CE plants that were involved, three of which are cooperating in addressing the issue, has to do with the fact that they share similar or the same equipment in the electronics that trip the plant and the electronics that actuate emergency feedwater.

The same bistable, the same physical bistable, and the same logic matrix--the different physical logic matrix but this same piece of equipment. The same physical bistable that both trips the plant and actuates emergency feedwater. That was not true for the older CE plants.

That has been an exemption request that you heard earlier denied, on the basis of cost benefit and contribution to the reduction of the risk of adding these additional systems. Arguments have been made regarding the increase in risk from, as I think I heard it characterized, hanging non-safety systems on safety equipment. But right now we are trying to find some middle ground and there does appear to be some progress toward that in the last few weeks.

We do not have information--we are not cognizant, we being CE Owners Group, of individual plant implementation status or licensing activity.

And really because it has not been an owners group activity for about three years, I have very little to say. In fact, that's about all I've got to say.

DR. KERR: What is your estimated schedule on the basis of this--for those that are cooperating?

MR. WILLIAMS: Those three plants?

DR. KERR: Yes.

MR. WILLIAMS: I would anticipate that there will either be a resolution or a deadlock that will lead to some formal action in the next two to three months. And at this point it looks more like a resolution. The latest information I have on the diversity issue so that we can proceed with implementation.

DR. KERR: And once you proceeded, at what point would you expect the equipment and training and whatever to be in place and operable?

MR. WILLIAMS: I don't know. That's going to be at three different plants on three different schedules. And it will depend some on what the resolution turns out to be Whether it's a--

DR. KERR: And is it likely to be one year, ten years?

MR. WILLIAMS: Oh, I think closer to the one. That kind of time frame.

MR. BARNES: Excuse me. Dr. Kerr? I can probably answer that, if you would?

DR. KERR: Would you identify yourself please, sir?

MR. BARNES: I'm Richard Barnes. I'm with Arkansas Power and Light. And deal with ANO 2. One of these six units that's having this current difficulty.

We've essentially split the diverse scram system issue in the diverse turbine trip out of--and we are currently resolving--proceeding with designs along that. So we'll have the diverse scram system in place probably--I think the last one to go in is out in California sometime in late '91 I believe. I'm not real sure on that.

MR. WILLIAMS: That assumes the resolution we are anticipating.

MR. BARNES: Well, no. That's on the diverse scram system.

MR. WILLIAMS: Oh, I'm sorry.

MR. BARNES: The issue that we are currently negotiating with the staff deals with the AMSAC issue and that, you know, is highly dependent upon ongoing negotiations right now.

So a certain amount of our analysis we've done shows that about 98 percent of the achievable ATWS risk reduction is accomplished with the reserve scram system. And we are talking about the remaining less than 2 percent of the total risk improvement available.

DR. KERR: Thank you.

Any further questions?

Thank you, Mr. Williams.

That brings us to the end of our planned and formal agenda. And I think for the need of any further recording of this session.

Are there any final comments that the staff would like to make?

MR. NEWBERRY: No, sir. I think you've got a very good feel for the open issues and what the different views are.

DR. KERR: Mr. Lipinski?

MR. LIPINSKI: I have one question for the staff.

If I were on the Owners Group and I went to Rosemount and I said, "Please repackage your product such that the card is in the same case." Would that be acceptable to the staff? As having the required diversity such as the sensor and the card are in the same case?

MR. MAUCK: I guess what do you mean by repackaged?

MR. LIPINSKI: Take that card. Put it in the same case with the sensor, because that pressure sensor meets delayed point. Terminates in a case, those lines go off--

MR. MAUCK: No.

MR. LIPINSKI: Take that card, put it in that same case. Would that be your definition of a sensor then?

MR. MAUCK: The intent of the rule, I believe, for allowing non-diversity among sensors was because of the cost of putting in new sensors and being able to use the same sensors in the trip system.

MR. LIPINSKI: No, you are missing--

MR. MAUCK: So you are trying to cut a fine line here.

MR. LIPINSKI: No, I'm not trying to cut a fine line. I'm trying to decide whether if I were to try to respond to your request, I went to Rosemount and said, "Hey, please repackage this because I've got a problem with the NRC. Put the card in the same package with the sensor output." Would I have satisfied your needs saying that now diverse--

MR. MAUCK: No, it's not diverse.

MR. LIPINSKI: It's not diverse--

MR. MAUCK: It doesn't have to be because it's a sensor.

MR. LIPINSKI: It meets the definition of the rule. The fact that the card is now in that box that's called a sensor output.

MR. MAUCK: Well, I guess it would be very difficult to get Rosemount to repackage that card, to be able to put it in the sensor case.

MR. LIPINSKI: Whatever I offer them, $100,000--they are going to be happy to do--it may cost me $100,000 a unit, but I'll get them from Rosemount. Does that meet your requirements?

MR. MAUCK: Well, if the card was already in the transmitter housing, yes. If that thing is already sitting there and it's working in the plant and it's used in the trip system.

DR. LEWIS: If he wasn't recording, I'd give you the correlation to--

MR. MAUCK: Well--

DR. LEWIS: A story along the same lines.

MR. MAUCK: If you read the ATWS rule, it says you can utilize the same sensors.

DR. LEWIS: Okay. I think I've made my point.

DR. KERR: Any further questions?

Okay. No more recording needed.

(Whereupon, the recorded portion of the proceedings were concluded.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name: ACRS Subcommittee on Instrumentation and Control Systems

Docket Number:

Place: Bethesda, MD

Date: April 21, 1989

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 T. Cofferberry

(Signature typed):

Official Reporter

Heritage Reporting Corporation

WESTINGHOUSE OWNERS GROUP

PRESENTATION TO

ACRS I&C SUBCOMMITTEE

ATWS RULE IMPLEMENTATION

APRIL 21, 1989

ROGER NEWTON, CHAIRMAN
WESTINGHOUSE OWNERS GROUP

MELITA OSBORNE
WESTINGHOUSE NUCLEAR SAFETY

ATWS RULE AND WOG RESPONSE

July 1984	Rule issued.
June 1985	WOG Generic AMSAC designs submitted (WCAP-10858)
July 1986	NRC SER for AMSAC
February 1987	WOG information on one item from SER
June 1987	NRC request for information on Fuel Management
August 1987	WCAP-10858 Rev. 1 AMSAC additional items
March 1989	Response to NRC 6-87 request WCAP-11993

WOG ATWS RULE PROGRAMS

GOALS

- Provide generic means for addressing the ATWS Rule
- Allow utility flexibility in Rule Implementation

1. Develop AMSAC design(s):

   -- WCAP-10858 AMSAC Generic Design Package approved July 1986.

   -- WCAP-10858, Rev. 1 additional items August 1987

2. Response to June 1987 NRC Letter

   -- WCAP-11993 Assessment of compliance with ATWS Rule Basis for Westinghouse PWRs March 1989

WOG ATWS RULE PROGRAM

1. AMSAC FUNCTIONAL DESIGN -- WCAP-10858, REV. 1

- WOG DEVELOPED THREE FUNCTIONAL DESIGNS
  - -- ALLOWS UTILITY TO SELECT DESIGN BEST SUITED FOR PLANT
  - -- EACH DESIGN MEETS THE REQUIREMENTS OF 10CFR50.62
  - -- APPROVED BY THE NRC

- WOG AMSAC ACTUATION LOGICS
  - -- LOGIC 1 - LOW STEAM GENERATOR LEVEL
  - -- LOGIC 2 - LOW FEEDWATER FLOW
  - -- LOGIC 3 - MAIN FEEDWATER PUMP STATUS
OR
MAIN FEEDWATER VALVE CLOSURE

- IMPLEMENTATION OF APPROVED FUNCTIONAL DESIGN ALSO REQUIRES PLANT SPECIFIC NRC APPROVAL

WOG ATWS RULE PROGRAM

AMSAC FUNCTIONAL DESIGN SUMMARY

- WOG GENERIC DESIGN APPROVED

- TWO KEY ELEMENTS GENERICALLY ADDRESSED BY WOG

- 12 KEY ELEMENTS REVIEWED FOR PLANT SPECIFIC IMPLEMENTATION

WOG ATWS RULE PROGRAM

2. ASSESSMENT AND RESPONSE - WCAP-11993

PURPOSE

- ADDRESS FUEL MANAGEMENT QUESTIONS IN CONTEXT OF INTEGRATED EFFECTS ON ATWS RESPONSE

MECHANICS OF THE PROGRAM

- REVIEW RISK BASIS OF ATWS RULE, AND HISTORY LEADING UP TO ATWS RULE

- REVIEW SECY-83-293 MODEL ASSUMPTIONS IN LIGHT OF CURRENT INDUSTRY EXPERIENCE

- CONSTRUCT AN APPROPRIATE CORE DAMAGE FREQUENCY MODEL (EVENT TREE):

  -- CONSISTENT WITH ATWS RULE BASIS

  -- MORE SPECIFIC TO WESTINGHOUSE PWRS AND AMSAC

  -- COMPATIBLE WITH SEVERE ACCIDENT POLICY STATEMENT

WOG ATWS RULE PROGRAM

RESULTS/CONCLUSIONS

ASSESSMENT AND RESPONSE -- WCAP-11993

- PROGRAM SHOWED CONTINUED ACCEPTABILITY OF ATWS CORE DAMAGE FREQUENCY (CDF) FOR WESTINGHOUSE PLANTS AS A CLASS, GIVEN INSTALLATION OF AMSAC - SECY-83-293 TARGET IS MET.

- ALTHOUGH AMSAC IS REQUIRED TO MEET THE TARGET, AMSAC UNAVAILABILITY IS NOT A SIGNIFICANT CONTRIBUTOR TO CDF

- FUEL MANAGEMENT HAS A SMALL TO INSIGNIFICANT EFFECT ON CDF, DEPENDING ON AVAILABILITY OF PRESSURE RELIEF - SECY TARGET IS MET.

- PROGRAM MODEL IS COMPATIBLE WITH IPE

AMSAC IMPLEMENTATION STATUS

- WOG Survey - April 1989
  - -- 26 sites
  - -- 43 units
- Plant Specific NRC Approval
  - -- 22 approved
  - -- 3 pending
  - -- 1 not yet submitted
- Installation
  - -- 22 installed
  - -- 7 to be installed shortly or at next refueling
  - -- 14 not installed yet
- Operating Experience
  - -- 4-6 months per plant average
  - -- 0-18 months range
  - -- No problems to date

AMSAC IMPLEMENTATION STATUS

- Logics Selected
  - -- 23 Low SG Level
  - -- 12 Low Main FW Flow
  - -- 6 Main FW Pump Trip/Valve Closure

- Implementation
  - -- 11 Westinghouse
  - -- 5 Utility Design
  - -- 8 Other Suppliers

- WOG Generic Design allows flexibility in logic and implementation

- NRC has approved utility implementations

AMSAC IMPLEMENTATION STATUS

- Open Items (Based on Survey)
  - -- Tech Specs (Generic)
  - -- Control Room Human Factors Review

- WOG generic response on Tech Specs

ATWS RULE IMPLEMENTATION

SUMMARY/CONCLUSIONS

- RULE REQUIRES AMSAC

- NRC HAS APPROVED GENERIC WOG FUNCTIONAL DESIGNS FOR AMSAC

- UTILITY IMPLEMENTATION REFERENCES THE WOG DESIGN

- NRC HAS APPROVED PLANT SPECIFIC IMPLEMENTATIONS

- WOG ASSESSMENT OF SECY-83-293 BASES SHOWS WESTINGHOUSE CLASS OF PLANTS CONTINUES TO SATISFY BASIS OF RULE WITH AMSAC

WOG/WESTINGHOUSE PLANTS ARE SUCCESSFULLY IMPLEMENTING THE REQUIREMENTS OF THE ATWS RULE.

SEE
#1

ATWS RULE (10 CFR 50.62) IMPLEMENTATION CHRONOLOGICAL BACKGROUND

ATWS RULE PUBLISHED	6/84
QA GUIDANCE FOR ATWS EQUIPMENT (G.L. 85-06)	4/85
NRC REVIEW EFFORT START (MULTI-PLANT ACTION A-20 ESTABLISHED)	5/85
OWNERS GROUP SUBMIT GENERIC DESIGN	
CEOG CEN-315	9/85
BWOG B&W 47-1159091	10/85
WOG WCAP-10858	10/85
BWROG NEDE-31096-P	1/86
NRC STAFF ACCEPTED GENERIC DESIGN	
WOG	7/86
BWROG	10/86
BWOG	6/88
NRC STAFF REJECTED CEOG REPORT, REGARDING DIVERSITY OF AFW ACTUATION	8/86
INSPECTION GUIDANCE ISSUES (TI 2500/20)	2/87
NRC STAFF PLANT SPECIFIC REVIEWS	1/87 -- PRESENT
82 SERS COMPLETED	
30 PLANTS INSPECTED	

IMPLEMENTATION STATUS

	PLANTS IMPL.	PLANTS WILL IMPL. 1989	PLANTS WILL IMPL. 1990	PLANTS WILL IMPL. 1991 OR 1992	PLANTS EXEMPT
BWR (TOTAL 37)					
RECIR PUMP TRIP	36				1
ALTERNATE ROD INJECTION	32	2	2		1
STANDBY LIQ CONTROL	36	1			
WESTINGHOUSE PLANTS (TOTAL 55)					
ATWS MITIGATION ACT CKT (AMSAC)	20	16	10	7	2
CE PLANT (TOTAL 15)					
AMSAC	3	3	4	5	
DIVERSE SCRAM SYSTEM	6	3	3	3	
B&W PLANT (TOTAL 8)					
AMSAC	0		3	5	
DSS	0		3	5	

OPEN ISSUES AND NRC STAFF POSITION

(1) BWR PLANTS INSTRUMENT DIVERSITY

MANY BWR PLANTS HAVE INSTALLED SAME TYPE OF ANALOG TRANSMITTER TRIP UNITS (ATTU) FOR BOTH THE RTS AND THE ARI SYSTEM. THIS DOES NOT SATISFY THE ATWS RULE DIVERSITY REQUIREMENT.

BWROG ARGUMENTS:

(1) THE ATTU IN THE RTS IS DE-ENERGIZED TO FUNCTION WHILE THE ATTU IN THE ARI SYSTEM IS ENERGIZED TO FUNCTION

(2) OTHER PARAMETERS AND MEANS ARE AVAILABLE TO TRIP THE REACTOR THROUGH THE RTS SHOULD THE ATTU FAIL DUE TO COMMON MODE FAILURE

(3) COST/BENEFIT DOES NOT JUSTIFY REPLACING THESE INSTRUMENTS

THE STAFF POSITION:

THE ENERGIZATION IS DEPENDENT ON A SWITCH SETTING ON THE ATTU CIRCUIT BOARD. THE CIRCUIT BOARDS FOR THE RTS AND ARI SYSTEM ARE IDENTICAL. THE STAFF POSITION IS THAT HARDWARE/COMPONENT DIVERSITY IS REQUIRED TO PREVENT COMMON MODE FAILURE WHICH COULD CAUSE SIMULTANEOUS DISABLING OF THE RTS AND THE ARI SYSTEM. THE LICENSEES ARE REQUIRED TO INSTALL DIVERSE HARDWARE.

OPEN ISSUES AND NRC STAFF POSITION

(2) NEWER CE PLANT AFW ACTUATION DIVERSITY

SOME NEWER CE PLANTS AFW ACTUATION USES SAME TYPE OF COMPONENTS WHICH WERE USED IN THE EXISTING RTS. THIS DOES NOT SATISFY THE ATWS RULE DIVERSITY REQUIREMENT

CEOG ARGUMENTS

THREE UTILITIES SUBMITTED EXEMPTION REQUESTS. THE MAIN ARGUMENT IS THAT TO INSTALL A DIVERSE AMSAC WILL ONLY HAVE MARGINAL SAFETY BENEFIT AND IS NOT COST EFFECTIVE.

THE STAFF POSITION:

THE COST/BENEFIT ARGUMENT HAD BEEN CONSIDERED DURING RULE MAKING PROCESS. THE NRC STAFF CONCLUDED THEN THAT THE SAFETY BENEFITS WERE JUSTIFIED TO REQUIRE THE DESIGN OF AMSAC TO BE DIVERSE AND INDEPENDENT FROM THE EXISTING RTS.

MEANING OF "INDEPENDENCE"

ATWS RULE GUIDANCE STATES:

LOGIC AND ACTUATION DEVICE POWER MUST BE FROM AN INSTRUMENT POWER SUPPLY INDEPENDENT FROM THE POWER SUPPLIES FOR THE EXISTING REACTOR TRIP SYSTEM.

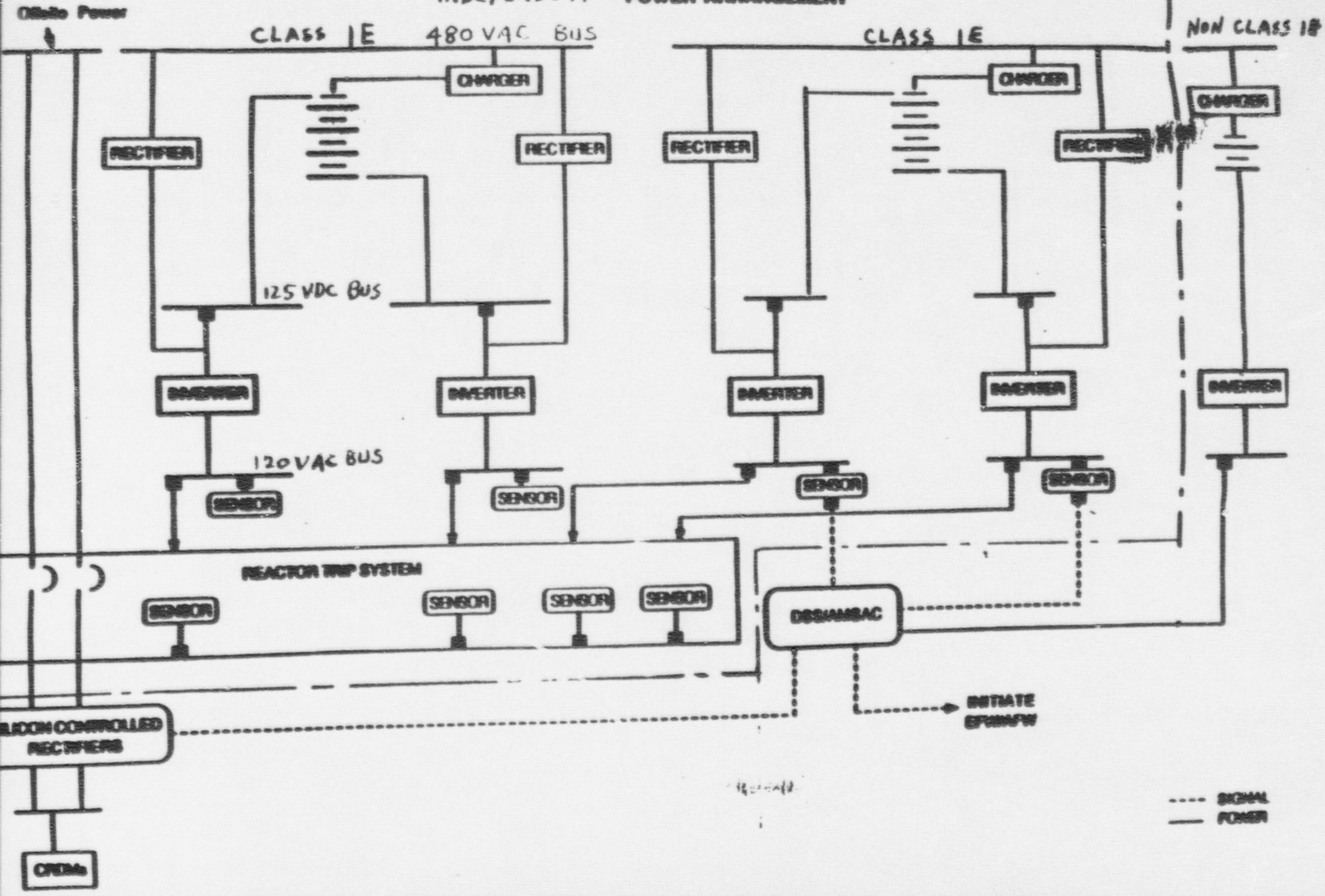
EXISTING RTS SENSOR AND INSTRUMENT CHANNEL POWER MAY BE USED PROVIDED THE POSSIBILITY OF COMMON MODE FAILURE IS PREVENTED

THE STAFF POSITION:

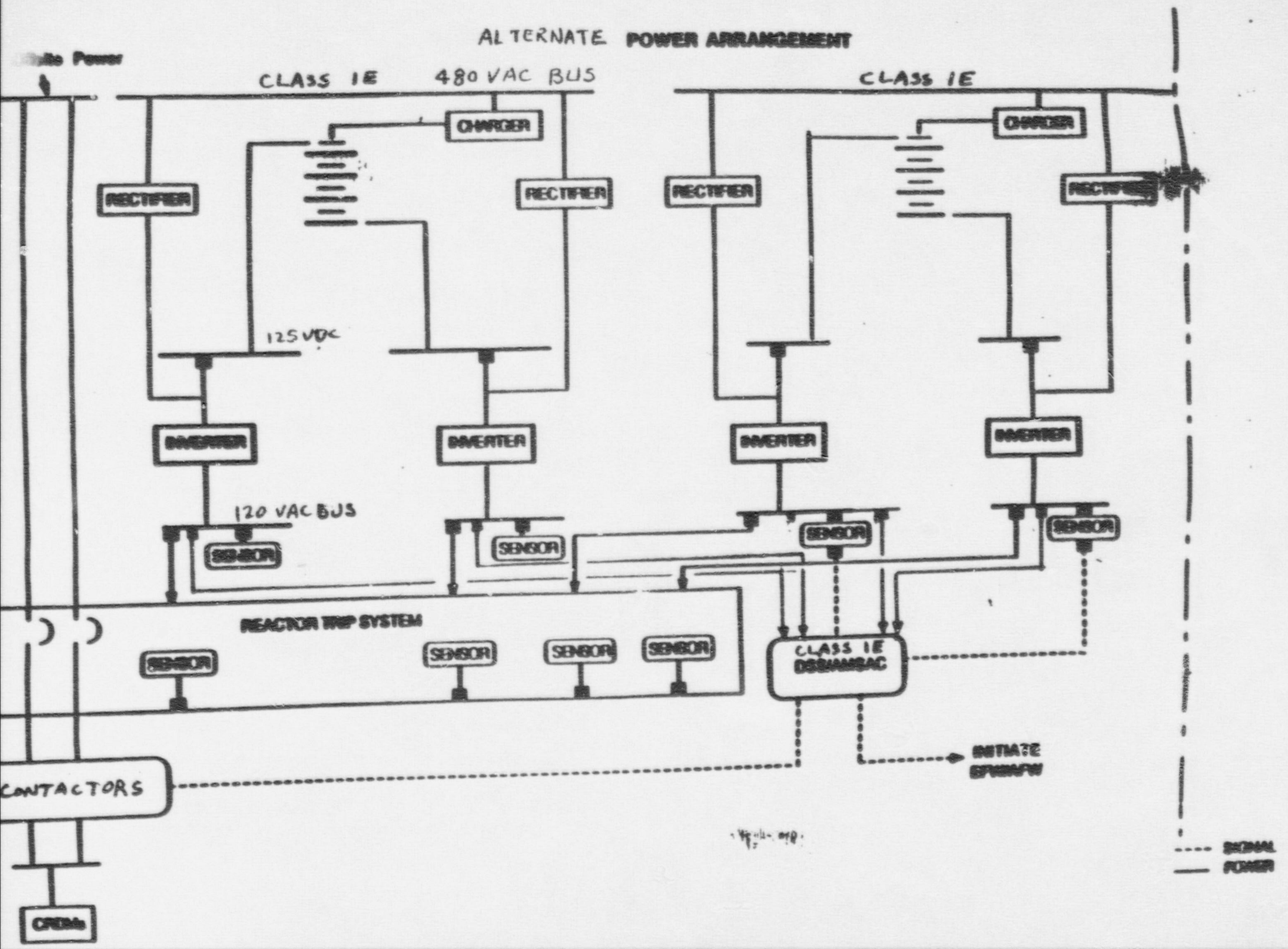
THE INDEPENDENT NON-1E POWER IS THE PREFERRED DESIGN. THE POWER SUPPLIES FOR DSS AND AMSAC ARE FROM NON-CLASS 1E POWER WITH NON-1E BATTERY BACKUP.

THE SHARED 1E POWER IS ACCEPTABLE IF DSS AND AMSAC ARE CLASS 1E SYSTEMS. A FMEA IS REQUIRED TO DEMONSTRATE THAT THE POSSIBILITY OF COMMON MODE FAILURE IS PREVENTED.

"INDEPENDENT" POWER ARRANGEMENT



ALTERNATE POWER ARRANGEMENT



MEANING OF "DIVERSITY"

THE BASIC PREMISE BEHIND THE ATWS RULE IS TO PREVENT OR MINIMIZE THE COMMON MODE FAILURE WHICH SIMULTANEOUSLY DISABLES THE REDUNDANT RTS CIRCUITRIES. THE DIVERSITY REQUIRED BY THE ATWS RULE IS HARDWARE OR COMPONENT DIVERSITY. ACCEPTABLE LEVEL OF COMPONENT DIVERSITY CAN BE ACHIEVED IN ACCORDANCE WITH COMBINATION OF ALLOWABLE METHODS SUCH AS

- THE USE OF COMPONENTS FROM DIFFERENT MANUFACTURERS
- FUNCTIONAL CAPABILITY

THE ATWS RULE GUIDANCE STATES THAT EQUIPMENT DIVERSITY IS REQUIRED FROM SENSOR OUTPUT TO AND INCLUDING THE COMPONENTS USED TO INTERRUPT CONTROL ROD POWER FOR DIVERSE SCRAM SYSTEM, AND FROM SENSOR OUTPUT TO, BUT NOT INCLUDING, THE FINAL ACTUATION DEVICE FOR MITIGATION SYSTEMS.

IDENTICAL COMPONENTS USED IN BOTH THE EXISTING RTS AND THE DIVERSE SCRAM SYSTEM OR MITIGATING SYSTEMS ARE SUBJECT TO POTENTIAL COMMON MODE FAILURES, AND THEREFORE ARE NOT ACCEPTABLE.

(17/89

ATWS RULE IMPLEMENTATION STATUS BY NSSS DESIGN

GENERAL ELECTRIC PLANTS	RPT IMPL	ARI IMPL	SLIC IMPL	REGION	INSP COMP
BIG ROCK POINT 1	EXEMPT	EXEMPT	YES	3	
BROWNS FERRY 1	YES	RESTART	RESTART	2	
BROWNS FERRY 2	YES	06/89	YES	2	
BROWNS FERRY 3	YES	RESTART	RESTART	2	
BRUNSWICK 1	YES	YES	YES	2	YES
BRUNSWICK 2	YES	YES	YES	2	YES
CLINTON 1	YES	YES	YES	3	YES
COOPER 1	YES	YES	YES	4	
DRESDEN 2	YES	YES	YES	3	YES
DRESDEN 3	YES	YES	YES	3	YES
DUANE ARNOLD	YES	YES	YES	3	YES
FERMI 2	YES	YES	09/89	3	YES
FITZPATRICK 1	YES	YES	YES	1	
GRAND GULF 1	YES	YES	YES	2	YES
HATCH 1	YES	YES	YES	2	
HATCH 2	YES	YES	YES	2	
HOPE CREEK 1	YES	YES	YES	1	YES
LA SALLE 1	YES	YES	YES	3	YES
LA SALLE 2	YES	YES	YES	3	YES
LIMERICK 1	YES	YES	YES	1	
MILLSTONE 1	YES	YES	YES	1	YES
MONTICELLO 1	YES	YES	YES	3	
NINE MILE POINT 1	YES	YES	YES	1	YES
NINE MILE POINT 2	YES	YES	YES	1	YES
OYSTER CREEK 1	YES	YES	YES	1	YES
PEACH BOTTOM 2	YES	06/89	YES	1	
PEACH BOTTOM 3	YES	YES	YES	1	
PERRY 1	YES	YES	YES	3	YES
PILGRIM 1	YES	YES	YES	1	
QUAD CITIES 1	YES	YES	YES	3	YES
QUAD CITIES 2	YES	YES	YES	3	YES
RIVER BEND 1	YES	YES	YES	4	YES
SHOREHAM 1	YES	YES	YES	1	
SUSQUEHANNA 1	YES	YES	YES	1	
SUSQUEHANNA 2	YES	YES	YES	1	
VERMONT YANKEE 1	YES	YES	YES	1	
WNP 2	YES	YES	YES	5	YES

ATWS RULE IMPLEMENTATION STATUS BY NSSS DESIGN

WESTINGHOUSE PLANTS	AMSAC IMPL	REGION	INSP COMP
BEAVER VALLEY 1	YES	1	YES
BEAVER VALLEY 2	7/89	1	
BRAIDWOOD 1	12/90	3	
BRAIDWOOD 2	12/91	3	
BYRON 1	4/90	3	
BYRON 2	10/90	3	
CALLAWAY 1	6/89	3	
CATAWBA 1	YES	2	
CATAWBA 2	5/89	2	
COMANCHE PEAK 1	6/89	4	
COMANCHE PEAK 2	F. L.	4	
COOK 1	7/89	3	
COOK 2	12/89	3	
DIABLO CANYON 1	10/89	5	
DIABLO CANYON 2	YES	5	YES
FARLEY 1	YES	2	YES
FARLEY 2	YES	2	YES
GINNA 1	YES	1	
HADDAM NECK 1	EXEMPT	1	
SHEARON HARRIS 1	YES	2	
NDIAN POINT 2	10/89	1	
INDIAN POINT 3	YES	1	
KEWAUNEE 1	YES	3	
MCGUIRE 1	YES	2	
MCGUIRE 2	YES	2	
MILLSTONE 3	6/89	1	
NORTH ANNA 1	5/89	2	
NORTH ANNA 2	YES	2	
POINT BEACH 1	5/90	3	
POINT BEACH 2	10/89	3	
PRAIRIE ISLAND 1	11/89	3	
PRAIRIE ISLAND 2	YES	3	
ROBINSON 2	YES	2	
SALEM 1	YES	1	
SALEM 2	YES	1	
SAN ONOFRE 1	12/89	5	
SEABROOK 1	9/90	1	
SEQUOYAH 1	4/90	2	
SEQUOYAH 2	8/90	2	
SOUTH TEXAS 1	1/90	4	
SOUTH TEXAS 2	F. L.	4	
SUMMER 1	YES	2	
SURRY 1	12/89	2	
SURRY 2	4/90	2	
TROJAN 1	7/89	5	
URKEY POINT 3	10/91	2	
TURKEY POINT 4	11/92	2	
VOGTLE 1	YES	2	YES
VOGTLE 2	YES	2	YES
WATTS BAR 1	F. L.	2	

ATWS RULE IMPLEMENTATION STATUS BY NSSS DESIGN

WESTINGHOUSE PLANTS	AMSAC IMPL	REGION	INSP COMP
WATTS BAR 2	F. L.	2	
WOLF CREEK 1	YES	4	YES
YANKEE ROWE 1	EXEMPT	1	
ZION 1	10/89	3	
ZION 2	3/90	3	

ATWS RULE IMPLEMENTATION STATUS BY NSSS DESIGN

CE PLANTS	AMSAC IMPL.	DSS IMPL.	REGION	INSP COMP
ARKANSAS 2	11/89	11/89	4	
CALVERT CLIFFS 1	YES	YES	1	YES
CALVERT CLIFFS 2	05/89	05/89	1	
FORT CALHOUN 1	YES	YES	4	YES
MAINE YANKEE 1	06/90	06/90	1	
MILLSTONE 2	YES	YES	1	
PALISADES 1	04/90	04/90	3	
PALO VERDE 1	06/90	YES	5	
PALO VERDE 2	04/91	YES	5	
PALO VERDE 3	09/92	YES	5	
SAN ONOFRE 2	05/91	05/91	5	
SAN ONOFRE 3	10/91	10/91	5	
ST. LUCIE 1	10/91	10/91	2	
ST. LUCIE 2	09/90	09/90	2	
WATERFORD 3	12/89	12/89	4	
WNP 3	/	/	5	

ATWS RULE IMPLEMENTATION STATUS BY NSSS DESIGN

B&W PLANTS	AMSAC IMPL	DSS IMPL	REGION	INSP COMP
ARKANSAS 1	04/90	04/90	4	
CRYSTAL RIVER 3	04/90	04/90	2	
DAVIS-BESSE 1	05/90	05/90	3	
OCONEE 1	09/91	09/91	2	
OCONEE 2	01/92	01/92	2	
OCONEE 3	05/91	05/91	2	
RANCHO SECO 1	05/91	05/91	5	
TMI-1	12/91	12/91	1	

Richings
#2

BWR THS INTERACTION WITH ATWS

CONCERNS:

(1) WILL LARGE OSCILLATIONS CAUSE EFFECTIVE POWER INCREASE DURING "LOW FLOW-PART POWER" SLCS INJECTION MODE?

(2) IF SO, WILL SUPPRESSION POOL TEMPERATURE INCREASE SIGNIFICANTLY PRIOR TO SHUTDOWN BY LIQUID CONTROL?

(3) WILL OSCILLATIONS ADVERSELY INTERACT WITH EOP?

BWROG, GE, EPRI CALCULATIONS & CONCLUSIONS

- TRAC-GE-3D LARGE AMPLITUDE SYMMETRIC OSCILLATION CALCULATION
- DISCUSSED IN MEETINGS. REPORT DUE IN APRIL.
- PEAK AMPLITUDE 200 PERCENT POWER
- GE INDICATES NO SIGNIFICANT, OSCILLATION PRODUCED, POWER INCREASE. (SMALL INCREASE FROM SYSTEM EFFECTS.)
- RECENT EPRI PEER REVIEW
- CONCLUDE THERE IS NO NEW PROBLEM
- NO FURTHER LARGE OSCILLATION CALCULATIONS PLANNED
- EPRI IS INVESTIGATING OPERATOR RESPONSE TO ATWS WITH OSCILLATIONS

BNL CALCULATIONS

- RAMONA-3B AND EPA
- RAMONA NOT YET ABLE TO EXPLORE LARGE AMPLITUDE OSCILLATIONS. (T-H CODE BREAKDOWN.)
- EPA HAS BEEN EXPLORING ATWS SCENARIOS
- HAVE NOT QUANTIFIED OR SEPARATED EFFECT OF OSCILLATIONS ON THERMAL POWER

(BNL CONTINUED)

- o FUTURE PLANS (ATWS RELATED)
  - • RAMONA
    - IMPROVE T-H TO HANDLE LARGE OSCILLATIONS
    - BENCHMARK (LASALLE AND OSKARSHAMN)
    - EXPLORE LARGE OSCILLATIONS (PEAK AMPLITUDES, THERMAL EFFECTS)
  - • EPA
    - FURTHER ATWS SCENARIOS AND OTHER CALCULATIONS TO QUANTIFY THERMAL EFFECTS OF LARGE OSCILLATIONS
  - • OTHER
    - INEL (TRAC-ID) ATWS SCENARIOS AND ORNL (LAPUR) SUPPORT CALCULATIONS
    - RES REVIEW TEAM

PWR ATWS MODERATOR TEMPERATURE COEFFICIENTS

STAFF PRESENTATION

TO

ACRS I&C SUBCOMMITTEE MEETING

ON ATWS RULE IMPLEMENTATION

APRIL 21, 1989

- STAFF HAD PREVIOUSLY EXPRESSED CONCERN ON VALIDITY OF EARLIER PWR ATWS ANALYSIS ASSUMPTION ON MODERATOR TEMPERATURE COEFFICIENT BECAUSE OF CHANGES RELATED TO:

    - EXTENDED CYCLES OF 18 AND 24 MONTHS

    - INCREASED DISCHARGE BURNUP

    - LOW LEAKAGE CORE DESIGNS

    - NEW FUEL DESIGNS

    - MODERATOR TEMPERATURE COEFFICIENT (MTC) TECHNICAL SPECIFICATION CHANGE REQUESTS

- CONCERN LED TO LETTER TO PWR OWNERS GROUPS (JUNE 12, 1987)

    - JUSTIFICATION FOR THE CONTINUED APPLICABILITY OR CONSERVATISM IN ATWS BASIS MTCs

    - DIFFERENCES IN CURRENT MTCs WITH ATWS BASIS MTCs

    - PLANT DATA USED

    - ASSUMPTIONS MADE

    - METHODOLOGY USED TO DERIVE ATWS MTCs

- STAFF MEETINGS WITH OWNERS GROUPS

  - WOG/W — OCTOBER 7, 1987; FEBRUARY 11, 1988
  - CEOG/CE — JANUARY 11, 1988
  - BWOG/B&W — FEBRUARY 18, 1988

- MEETING WITH ACRS COMBINED CORE PERFORMANCE AND SCRAM SYSTEMS RELIABILITY SUBCOMMITTEES ON FEBRUARY 19, 1988 o RESULTS FOR ATWS MTCs (10^{-5} ΔK/K/°F)

		ATWS ANALYSIS BASIS	CURRENT VALUES
• WOG/W		-8	-10 (STAFF ESTIMATE)
• CEOG/CE	(2750 MWT)	-2	- 2.6
	(3410 MWT)	-6.3	- 5.0
	(3800 MWT)	-6.8	- 5.7
• BWOG/B&W (177 FA)		-10.5	-11.0 (18 MONTH CYCLE)
			- 4.3 (24 MONTH CYCLE)

o CONCLUSION - THE CURRENT MTC DATA IS CONSISTENT WITH PREVIOUS ATWS MTC ANALYSIS BASIS FOR ALL PWR PLANT TYPES

BWR OWNERS' GROUP

ATWS IMPLEMENTATION STATUS

S. D. FLOYD

CAROLINA POWER & LIGHT

APRIL 21, 1989

BWR OWNERS' GROUP

AGENDA

O INTRODUCTION	S. D. FLOYD
O ATWS GENERIC REPORT STATUS	S. D. FLOYD
O IMPLEMENTATION PROBLEMS	S. D. FLOYD
O IMPLEMENTATION STATUS	S. D. FLOYD
O EXEMPTIONS/SPECIAL DIFFICULTIES	S. D. FLOYD/ W. P. SULLIVAN
O ATWS RISK IMPROVEMENT	S. D. FLOYD

ATWS GENERIC REPORT

STATUS

- O LICENSING TOPICAL REPORT SUBMITTED TO NRC --- DECEMBER 1985

- O SAFETY EVALUATION REPORT ISSUED --- OCTOBER 1986

- O APPROVED LTR ISSUED --- FEBRUARY 1987

IMPLEMENTATION PROBLEMS

- O NRC REQUEST FOR ADDITIONAL DIVERSITY FOR ANALOG TRANSMITTER TRIP UNITS (ATTU's) IN ALTERNATE ROD INSERTION (ARI) SYSTEM

- O NRC REQUEST FOR MODIFICATIONS TO RECIRCULATION PUMP TRIP (RPT) LOGIC

IMPLEMENTATION STATUS

O 37 TOTAL UNITS SUBJECT TO ATWS RULE

O 30 UNITS ESSENTIALLY COMPLETE

- 17 UNITS TOTALLY COMPLETE
- 11 UNITS COMPLETE EXCEPT FOR DIVERSITY ISSUE
- 2 UNITS COMPLETE EXCEPT FOR DIVERSITY ISSUE AND RPT LOGIC/TESTABILITY

O 7 UNITS INCOMPLETE

- 6 HAVE DIVERSITY ISSUE

O TOTAL OF 19 UNITS NEED RESOLUTION OF DIVERSITY ISSUE

EXEMPTIONS TO ATWS RULE

0 REQUESTED

- EQUIVALENCY BASED ON VESSEL DIAMETER
  (1 UTILITY)

0 POTENTIAL

- DIVERSITY OF ARI ATTU's
  (19 UNITS)

ATWS DIVERSITY ISSUE

STAFF POSITION:

0 TRIP UNIT IS NOT PART OF THE SENSOR AND THEREFORE REQUIRES DIVERSITY.

0 ARI SYSTEM LACKS DIVERSITY AND DOES NOT COMPLY WITH ATWS RULE (ARI AND RTS BOTH USE ROSEMOUNT ATTUs).

STAFF PROPOSED RESOLUTION:

0 REPLACE ROSEMOUNT ATTU CIRCUIT BOARD WITH AN EQUIVALENT BOARD MANUFACTURED BY A DIFFERENT VENDOR.

BWROG POSITION

0 THE TRIP UNIT IS PART OF THE "SENSOR" WHICH IS NOT REQUIRED TO BE DIVERSE BY THE RULE.

0 ARI SYSTEM MEETS THE DIVERSITY REQUIREMENT OF THE RULE AND MINIMIZES THE POTENTIAL FOR COMMON MODE FAILURE.

0 STAFF'S PROPOSED RESOLUTION IS NOT NECESSARY TO MEET THE RULE. OFFERS LITTLE OR NO IMPROVEMENT IN CDF.

ALTERNATE ROD INJECTION (ARI)

DIVERSITY ISSUE

W. P. SULLIVAN
GENERAL ELECTRIC

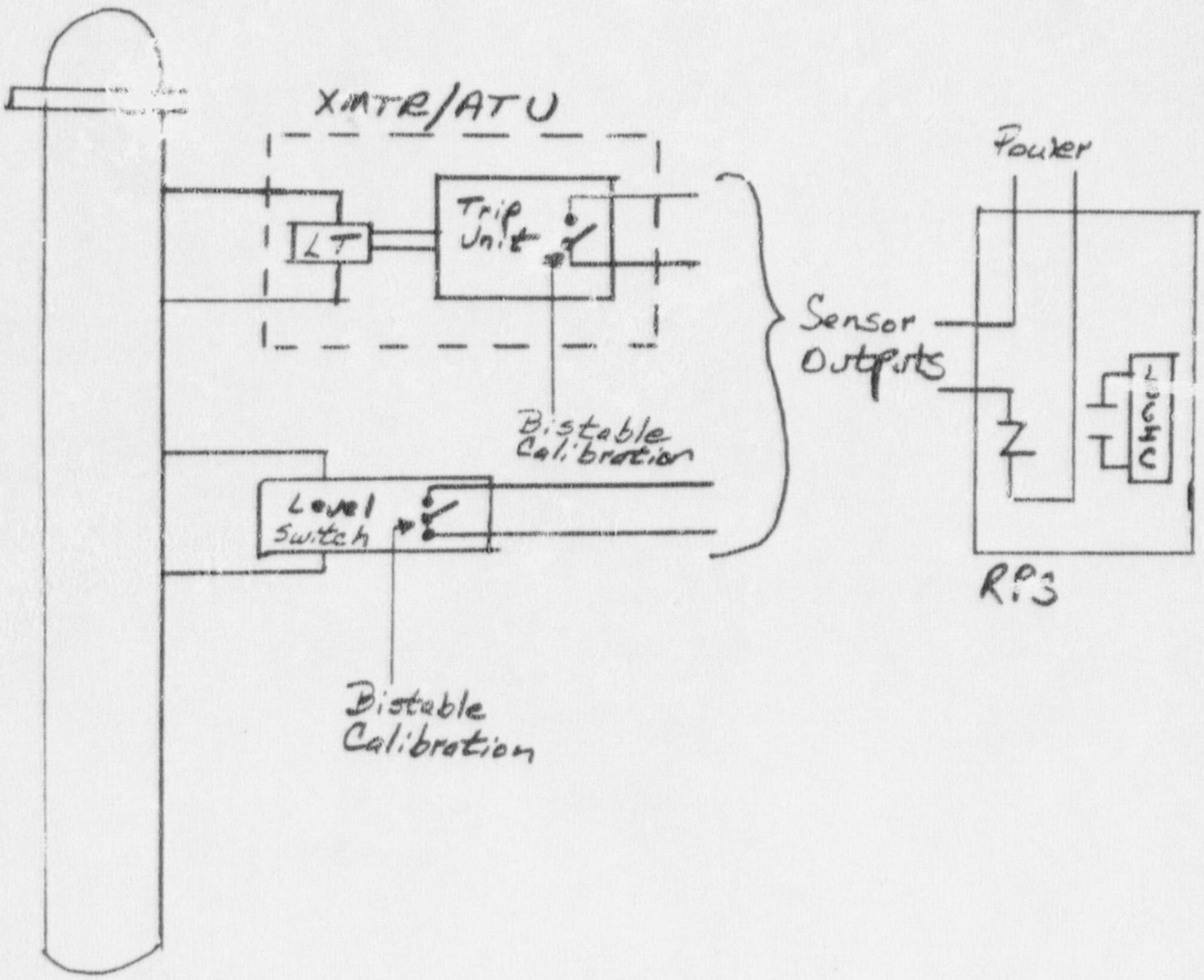
RECOMMENDATION OF THE ATWS TASK FORCE (SECY 83-293 ENCLOSURE "D")

THE TRIP PORTION OF THE SENSOR SYSTEM CONSISTS OF BISTABLES THAT SIGNAL AN OUT-OF-TOLERANCE CONDITION. THIS PORTION OF THE SYSTEM IS VULNERABLE TO BISTABLE CALIBRATION ERRORS AND LIKE COMPONENT COMMON CAUSE FAILURES. HOWEVER, CONTINUOUS MONITORING OF THE SENSOR OUTPUT, AND THE FREQUENT TESTING OF THE TRIP VALUES PROVIDE A GOOD CHANCE OF DISCOVERY OF SUCH COMMON CAUSE PROBLEMS . . . THOUGH DIFFERENCES EXIST IN THE LEVEL OF REDUNDANCY AND LOGIC STRUCTURE, THESE ONLY INFLUENCE THE INDEPENDENT FAILURE CONTRIBUTION WHICH DOES NOT CONTRIBUTE SIGNIFICANTLY TO THE OVERALL RPS UNAVAILABILITY. THEREFORE, FOR THE PURPOSES OF THIS ANALYSIS, THE SENSOR PORTION OF THE RTS WILL BE IGNORED.

"THE SENSORS NEED NOT BE OF A DIVERSE DESIGN OR MANUFACTURER."

- STATEMENT OF CONSIDERATIONS, FINAL ATWS RULE. 49 F.R. 26042

Sensor Comparison



RPS SENSOR DIVERSITY

O FUNCTIONAL AND EQUIPMENT DIVERSITY CURRENTLY EXISTS WITHIN RPS

- NEUTRON FLUX OR RADIATION SENSORS
- POSITION SWITCH SENSORS
- ANALOG TRANSMITTER/TRIP UNIT SENSORS

Sensor Diversity for Major Transients

Transient	Scram Signals - Order of Occurrence							ARI Variables Reached	
	Inputs From Pressure or Differential Pressure Transmitters and Trip Units		Inputs From Position or Micro Switch Contact Opening			Inputs From Radiation Sensors			
	Rx Pressure >1065 PSIG	Rx Level <Level 3	Turb Cont. Valve Oil Pres. <Set Pt.	Turb Stop Valve Pos. <90% Full Open	MSIV Pos. <90% Full Open	APRM >120%	MSIV Hi Rad. >6 x Back	Rx Pressure >1150 PSIG	Rx Level <Level 2
MSIV Closure	3	4			1	2		1	2
Turb Trip (with bypass)	3			1		2		1	M
Generator Trip (with bypass)	3		1			2		1	M
Pres. Regulator Failure (primary pressure decrease)	3	4			1	2		1	2
Pres. Regulator Failure (primary pressure increase)	2					1		1	
F.W. Flow Control, Failure (reactor water inventory increase)	3			1		2		1	
F.W. Flow Control Failure (reactor water inventory decrease)	3	1			2		4	2	1
Loss of Condenser Vacuum	3		4	1	5	2		[illegible]	M
Loss of Normal AC Power	4	5	2	1	6	3		1	M

M = The Trip Value may be reached.

RESULTS FROM RISK ASSESSMENT
LOSS OF FEEDWATER EVENT

O THREE SEPARATE SETS OF WATER LEVEL TRIP UNITS

- MINIMUM OF SIX INDIVIDUAL TRIP UNIT FAILURES

O OPERATOR HAS AT LEAST 15 MINUTES TO INITIATE MANUAL CONTROL ROD INSERTION

- DIVERSE REACTOR WATER LEVEL INDICATION AND APRM DOWNSCALE ALARM PROVIDED

- EPG REV. 4 PROVIDES APPROPRIATE OPERATOR GUIDELINES

O PROBABILITY OF COMPLETE LOSS OF LEVEL INDICATION AND ASSOCIATED SCRAM

- 2.3 E-08/REACTOR-YEAR

SHOULD PROPOSED STAFF RESOLUTION BE IMPLEMENTED?

PROS

1. SOME SMALL REDUCTION IN COMMON MODE FAILURES RESULTING FROM FABRICATION PROCESS.

CONS

1. SUBSTITUTE UNPROVEN EQUIPMENT FOR PROVEN, HIGHLY RELIABLE EQUIPMENT.

2. BATCH PRODUCED EQUIPMENT HAS NO QUALITY HISTORY.

3. RAISES POTENTIAL FOR COMMON MODE FAILURE BY COMPLICATING MAINTENANCE AND PROCUREMENT PROCEDURES.

4. HIGH COST ($170K PER REACTOR) VERSUS NEGLIGIBLE SAFETY IMPROVEMENT.

5. ESTABLISHES A DIVERSITY DEFINITION INCONSISTENT WITH RULE.

DIVERSITY ISSUE SUMMARY

0 TRIP UNIT IS PART OF SENSOR AND DOES NOT REQUIRE DIVERSITY

0 "DIVERSITY" IS NOT LIMITED TO "EQUIPMENT DIVERSITY" BY THE ATWS RULE

- RULE STATES "DIVERSITY"

- STATEMENT OF CONSIDERATIONS STATES EQUIPMENT DIVERSITY WHERE REASONABLE AND PRACTICABLE

- "STAFF POSITION ON DIVERSITY REQUIREMENTS" ALLOWS COMBINATION OF ALLOWABLE METHODS WHERE TOTAL HARDWARE DIVERSITY IS DIFFICULT TO ACHIEVE

- RECENT STAFF DECISIONS REQUIRE TOTAL HARDWARE DIVERSITY REGARDLESS OF DIFFICULTY, COST OR BENEFIT

- FABRICATION DIVERSITY FOR THE ROSEMOUNT ATTUs PROVIDES NEGLIGIBLE SAFETY IMPROVEMENT

0 CURRENT DESIGN MEETS BOTH LANGUAGE AND INTENT OF ATWS RULE

ATWS RISK IMPROVEMENT

BRUNSWICK PLANT PRA

O PRE ATWS RULE RISK

TOTAL CDF	=	2.47 E-5
ATWS CONTRIBUTION	=	1.1 E-5

O POST ATWS RULE RISK (ASSUMES 20% COMMON MODE FAILURE REMAINS)

TOTAL CDF	=	2.39 E-5
ATWS CONTRIBUTION	=	1.02 E-5

O POST ATWS RULE RISK (0% COMMON MODE FAILURE)

TOTAL CDF	=	2.37 E-5
ATWS CONTRIBUTION	=	1.00 E-5

O CONCLUSION

ATWS RULE REDUCED CDF BY 3.2%
TOTAL ELIMINATION OF COMMON MODE FAILURE
WOULD REDUCE CDF AN ADDITIONAL 0.8%

INDUSTRY BWR PRAs

O EFFECT OF ATWS MODs VARIES FROM PLANT TO PLANT

O 10% OR LESS EFFECT OF MODs ON TOTAL CDF