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NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE ON REGULATORY ACTIVITIES

In the Matter of: MEETING TO DISCUSS LIMITED REVISIONS TO 10 CFR PART 50, APPENDIX J, ET AL

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE ON REGULATORY ACTIVITIES

Room 1046
1717 H Street, N. W.
Washington, D. C. 20555
August 6, 1980

The Subcommittee met, pursuant to notice, at 8:45 a.m.

MEMBERS PRESENT:

W. KERR, Presiding
D. W. MOELLER
J. R. RAY
W. MATHIS
S. LAWROSKI
D. OKRENT

ACRS CONSULTANTS PRESENT:

I. CATTON
W. LIPINSKI
Z. ZUDANS

DESIGNATED FEDERAL REPRESENTATIVE:

SAM DURAISWAMY

P R O C E E D I N G S

MR. KERR: The meeting will come to order. This is a meeting of the Advisory Committee on Reactor Safeguards, Subcommittee on Regulatory Activities.

My name is William Kerr; I am acting as subcommittee chairman in the absence of Mr. Siess.

Other ACRS members present are Mr. Ray, Mr. Moeller, and Mr. Mathis.

Consultants Catton, Lipinski, and Zudans are also present.

The meeting is scheduled to discuss limited revisions to 10 CFR Part 50, Appendix J; this is a post comment discussion; a proposed amendment to 10 CFR Part 50, Appendix A to reference 10 CFR 50, Appendix B -- whatever that means. This is a pre comment discussion; a proposed revision to 10 CFR 50, paragraph 54, which has to do with staffing of nuclear power plants; Regulatory Guide 1.97, revision 2, a proposed regulatory guide -- 1.97 is a proposed comment discussion, I should add; Regulatory Guide 1.8, a second revision; and finally, Reg Guide 1.33, a third revision for a pre comment discussion.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act and the government in the Sunshine Act.

Mr. Sam Duraiswamy is the designated federal employee for the meeting. Rules for participation in the meeting have been announced as part of the meeting notice published in the Federal Register of July 22, 1980, as amended in the July 28 issue.

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

I request that each speaker identify himself and use a microphone.

We have received written comments and requests for time to make oral statements on Regulatory Guide 1.97 from six different groups, and I believe there has been some discussion of scheduling of those presentations already.

The schedule looks formidable. We will attempt the proposed coverage, but we may have to regroup and give some thought as to what the schedule is by noon today.

The first item on the agenda, the revision to 10 CFR Part 50, Appendix J, has been distributed, and comments have come in, at least from some members of the committee, indicating no problems with the proposed version from Mr. Ray, Mr. Bender, and Siess also has no problems.

I have no problems with it.

Are there further comments from other members of the subcommittee or consultants on the proposed revision of Appendix J?

The staff under the circumstances probably wants to keep quiet.

MR. MORRISON: That's right.

MR. KERR: Unless I hear anything to the contrary, then, I will assume that the subcommittee reports to the full committee that there are no problems on the part of the subcommittee and that we will recommend approval of the ACRS.

(No resonse)

I hear no disagreement.

This brings us, then, to item two, which is a proposed amendment to Appendix A of 10 CFR 50. And who is the spokesman for this part of the staff presentation?

MR. MORRISON: I don't think this microphone is on.

MR. KERR: I don't think it is either.

MR. MORRISON: The spokesman for this is Mr. Richardson on my left.

MR. KERR: Is Mr. Richardson's microphone on?

MR. RICHARDSON: My name is Richardson.

MR. KERR: It is, how about that.

MR. RICHARDSON: The proposed amendment to Appendix A to Part 50 concerns general design criterion one; this criterion requires that a quality assurance program be established to ensure that the structures, systems, and components covered under Appendix A will satisfactorily perform their safety function.

The proposed amendment is to clarify that the criteria for the quality assurance program are those criteria contained in Appendix B to 10 CFR Part 50.

This was the intended use of the criteria of Appendix B when they were developed back in the late sixties or early seventies. We published a statement of considerations when they went out for public comment and noted that they would supplement criterion one; and this is just to clarify -- a clarifying amendment at this time to pull that down.

It has been sent to the subcommittee for their input prior to going up to the Commission, before going out as a proposed rule for public coment.

MR. KERR: Thank you.

Are there questions or comments from the subcommittee members?

(No response)

I hear none.

The consultants?

(No response)

I shall assume, then, that we approve this for relese for public comment.

That brings us to a proposed revision to 10 CFR 50.54.

MR. MORRISON: This proposed rule spokesman is Mr. Guppy.

MR. GUPPY: Good morning. My name is Mr. Guppy. The proposed amendment deals with two parts of Part 50, part 54 concerning staffing and also part 36, an amendment to the administrative specifications that call for utilities to establish wowrking hour limitations for overtime consideration.

Power plant staffing has been subject to scrutiny as a result of TMI and as a result of the various reports; NUREG-0660 was developed, and it contained specific recommendations for working hours and also contained specific staffing recommendations.

Certain of these have been approved by the Commission to be applied to near term operating licenses. And I believe that those have been applied to North Anna, Sequoyah, and Salem.

And in these are the recommendations contained by -- concering staffing recommendations. I would like to put up a slide concerning that.

(Slide)

Before I get started with this, the first thing I would like to say is the bases for the proposed staffing are two things.

One is to take into consideration that we must have enough people available to handle an off-normal event or casualty. The second thing is that as a basis, if you notice the shutdown condition is not -- is considerably different than the operating condition for 694 as opposed to proposed.

And that takes into consideration the fact that the maintenance or shutdown condition is probably a very dangerous situation from three aspects; first of all, when you are shut down most systems are in an abnormal lineup.

Second, there is usually heavy maintenance underway, and last, there is usually a great deal of administrative activity taking up the time of the senior people, such as tag-out, system lineup verifications, and just4 taking care of that which takes away the shift supervisor's attenton from the overall plant.

Does anybody have any questions concerning the proposed amendments?

I might note there is one correction. A one unit, one control shutdown, I have one SRO listed which is not contained in th table that you have.

MR. ZUDANS: I noticed that.

MR. CATTON: I have a question: is a commercial power plant that much easier to run than a Navy submarine?

MR. GUPPY: Under operating conditions, by the nature of the size, apparently the automatic control allows them to run with fewer operators. In the Navy, as you know, most -- all of the controls are not contained in the maneuvering room, if you will.

And therefore extra operators are needed to monitor both the gauges and to do functions which cannot be automatically done from the control room. Part of that is due to Admiral Rickover's design idea of simplicity and part of it was due to physical size of the submarine and the capability of putting everything within the reach of the EL and the central panel operators.

So I believe with the proposals -- and again, I reiterate that these are minimum -- these have also been verified with people in I & E who hold SRO licenses, and they have concurred in the numbers that are proposed.

They also indicated that they felt that the shutdown numbers were absolute minimums that they could live with and that their feelings were -- there were seven SROs who represented six different plants from their previous experience, and they indicated that normally they doubled their shift when they shut down.

In other words, they went from a three shift to a two shift situation and essentially doubled their shift staffing during shutdown to handle all the maintenance.

MR. CATTON: So the Navy uses 11 as contrasted to four?

MR. GUPPY: That is correct.

MR. CATTON: Thank you.

MR. ZUDANS: It appears that you have in accordance with the proposed number the same number of operators under all conditions.

MR. GUPPY: That is correct. I did not allow credit for common control rooms based on the fact that under operating conditions, one, if you have an accident in one unit, if you allowed for common control room situations, it would end up with less than minimum staffing watching the operating plant while everybody was concerned that the plant had staff -- an accident of some kind.

MR. ZUDANS: So the variation is only with the number of units in the plant?

MR. GUPPY: That is correct.

MR. ZUDANS: Thank you.

MR. KERR: You mentioned you had discussed this with licensed people within your staff; I assume that you expect the public comments to provide whatever input you have from other operating people.

You have not carried on any informal discussions with non-NRC staff as to what sort of staffing is appropriate or needed?

MR. GUPPY: No, sir. I have not; I anticipate that we will probably get some reaction from them simply from the aspect that this is raising the minimum standards.

MR. KERR: I was not looking so much for reaction as I was for information because it wojld seem to me that although eight licensed people certainly gives one some cross section, that some information from operating organizations and entities would be worthwhile in your reaching conclusions.

MR. GUPPY: I understand that. I have not contacted the individual utilities; the Office of Nuclear reactor Regulation has done a survey of about 25 plants contained in these categories and has found out that they would have difficulty meeting the staffing requirements.

To my knowledge, there is only one that would and that would be Salem.

MR. KERR: What do you mean by "having difficulty"?

MR. GUPPY: Their present staffing indications meet -- in this case, they can meet my proposed staffing already.

MR. ZUDANS: Is there a clearcut logic? You have two uuits, one control room, the same number of operators, and two units, two control rooms.

MR. GUPPY: Again, that is based on the consideration under operating conditions that if I have a casualty or off-normal event in one unit, the attention of the supervisor -- I provide for the shift supervisor to go to that affected unit.

That will be directed towards that unit that has a problem and therefore if I allowed for common control room considerations by reducing either the number of SROs or ROs involved, then I would be left with less than the minimum desired staff in that operating plant to watch it.

So from that aspect, we developed a table so that there was no consideration given to common control rooms.

MR. ZUDANS: Actually, they were developed on the basis of two units, two control rooms, and if they choose to make one, they still have the same number of operators.

MR. GUPPY: That is correct.

MR. ZUDANS: What about three units and two control rooms? Are there other possibilities, like three units, three control rooms?

MR. GUPPY: Three units, three control rooms would be treated essentially like a single unit control room. Right now there are none presently operating three unit, three control rooms.

There is a three unit single control room at Dresden, and that is indicated by footnote E that says at sites that don't fall under these categories that are unique are addressed separately.

Every plant fits into one of those categories with the exception of Dresden. Now, I think there are some proposals for differences other than that, but at the present time the feeling is that they should have the same staffing requirements regardless of the control room designs that come along.

MR. KERR: What approach did you use to give you some handle on the number that you are proposing? What it just a matter of experience and judgment which said we have not had enough of these people around in the past, that we need more?

Or did you analyze specific situations and gather that there n situations arising in which the number of people available was toom small?

MR. GUPPY: The proposal was based on sitting down and forgetting the numbers that existed and saying, given a normal operating situation, what do I need to have? Given an accident situation in a single control room, what do I need to have?

During shutdown conditios, what do I need to have? I progressed up the line with the dual units and the single control room consideration. That one was the one that was discussed most and thought about the most because of the idea of the common control room.

And we eventually arrived at the common control room. We still needed the number of operators that are proposed.

MR. KERR: In the past, have there been numerical require ents for operators?

MR. GUPPY: The requirements contained presently in the regulations, 10 CFR Part 50.54 are one operator at all times in the control room with fuel in the reactor core and one senior operator on call except during specified conditions such as refueling or special evolutions.

The technical specifications have gone beyond that.

MR. KERR: Would it be accurate for me to conclude, then, that nobody had sat down before and done what you did, which was to say how many people do I need in normal and how many people do I need in accident situations?

MR. GUPPY: I cannot verify that, sir.

MR. MORRISON: I think it has been done on a case by case basis by a particular group in the Office of Nuclear Reactor Regulation that reviews the staffing requirements.

MR. KERR: I am just trying to understand the reason for the increase because, I mean, it is probably completely logical.

MR. MORRISON: The increase in what is in our regulations now or the increase that the plants normally provide?

MR. KERR: What is in the regulations now?

MR. MORRISON: What is in the regulations now is minimal. I don't think there is any disagreement that that is inadequate.

MR. KERR: No. I am wondering what will happen if, say, three or four years from now somebody else sits down and says, how many people do I need for normal and how many do I need for unusual situations? Is there some chain of logic which permits one to arrive at a number?

I mean, have the plants gotten more complicated than they were when th regulation came into existence or has our experience simply indicated that this requirement was inadequate now that we have more experience?

Or --

MR. GUPPY: I think that is probably a combination of both, Mr. Kerr. If you like, I will go through an explantation of how I arrived at the specific number that I have.

MR. KERR: Could you jut pick one: I don't want to spend too much time. But pick some number and --

MR. GUPPY: I will pick the two unit, one control room situation, since that is the most unusual one there and probably the most difficult to arrive at.

MR. MOELLER: As you begin that, could you remind me, if you have a two unit plant with one control room, are the operators generally licensed for both units?

MR. GUPPY: In some cases yes; some cases no. Not always.

MR. MOELLER: Which are you assuming?

MR. GUPPY: I am assuming that they are not licensed; it does not really make much difference in this case, although the NUREG-0694 assumes for that staffing requirement that all are licensed on all units at the site.

MR. MOELLER: If they weren't licensed -- say you had some operators licensed only for unit one and some for unit two, in an emergency are they allowed to go over andhelp the other people?

MR. GUPPY: No. I believe the final considerations there are handled by the emergency preparedness rule change, which gets extra people to the site, including ROs and SROs.

MR. KERR: You would assume that this rule is in effect and if in an emergency an operator decided to help the other unit, it would be a breach of the rule?

MR. GUPPY: I would say so, but I will not be involved with the enforcement of that, and I cannot say how that is going to turn out.

MR. KERR: But you wrote the rule with something in mind.

MR. GUPPY: That is correct. I wrote the rule with the intention that the people at the plant would be able to handle -- on each unit would be able to handle the initial stages of their event without consideration of the other unit being there.

MR. KERR: Okay. And then you did not mean to permit emergency situations to arise in which people would have to exercise some judgment as to what was the most crucial role that one should play?

MR. GUPPY: I --

MR. MORRISON: Could you repeat the question?

MR. KERR: Let's suppose there are four people in some joint control room; I would assume that in a very serious emergency there might be a situation in which all four people would be better involved with the emergency than having two people sitting and looking at the shutdown plant.

I am hypothesizing something. I guess I would be a little reluctant to have a rule which would say, "Under no circumstances should these two people get involved in the emergency because they are supposed to be watching the plant that is in good shape."

It would seem to me that one might allow emergency situations to develop in which one would say, in effect, to the crew, you ought to use your best judgment in this situation.

MR. MORRISON: I don't think that our regulations say that you cannot use your best judgment. I don't think we have anything in the regulations that indicate in that situation an oprator that was not licensed on a particular plant that was having the trouble, based on his knowledge, could not provide advice to the operators that were licensed.

I thi k our regulations would prohibit him from taking over and running that plant because he is not licensed at it.

MR. KERR: Well, I think that was not the thrust of the question, as I understood it. But I feel better about the situation, if that is the case. You would expect participation to occur or the situation --

MR. MORRISON: If the operator on the other plant felt that he could -- that he has observed something that his knowledge would indicate he ought to communicate with them, I would certainly hope that he would so advise the licensed operators.

And I do not think that in our regulations there is anything that prohibits that.

MR. ZUDANS: Did you at any time consider that for a single control room, multiple unit power plants all operators should be licensed for all units?

Is there a great deal of difficulty in doing that?

MR. GUPPY: I think you will find that most -- most utilities that have two units, one control room do license their SROs and ROs on both units for the flexibility of shift staffing.

MR. ZUDANS: Yes.

MR. GUPPY: However, you may come to a situation where one of them has not been licensed on the other plant yet, and he is therefore only qualified for one.

MR. ZUDANS: But that certainly would be a desirable situation to eliminate any such conflict that might exist.

When you explain how you arrived at those numbers, I would like you to remember that I like to see, for example, what is the function of each of those seven people that you propose to be there and how much time, percentage-wise, are they idle?

MR. GUPPY: Taking that into consideration, I will go ahead and discuss them. I will start off at the top with the shift supervisor.

MR. CATTON: Are they all required to be in the control room?

MR. GUPPY: No.

MR. CATTON: What is the requirement?

MR. GUPPY: The requirement is during operation that one SRO and one RO be in the control room. One operator is there as a relief operator, and he will normally be out touring the plant looking at things. The shift supervisor, obviously and most especially in the two unit situation or above will be roaming the plant again looking for things.

MR. CATTON: In the one unit, one control room --

MR. GUPPY: No, onlyone in the one. The shift supervisor is the overall supervisor in charge of operations.

MR. CATTON: He must stay in the control room?

MR. GUPPY: No. He is free to roam anywhere within the plant. The SRO is physically in the control room except during shutdown conditions, and I have defined, for lack of a better place to define it, as modes one through four for PWRs and modes one through three for BWRs.

And that is defined -- that is the break point between cold shutdown and hot shutdown in the technical specifications.

There may be other times when he is needed in there, and I have specifically asked for comments from the utilities concerning when that SRO physically needs to be within the control room.

The SRO will provide in the control room the big picture view; he will stand back and look at things. The reactor operator will be the man who is actually manipulating controls. If he needs help from that relief RO, then that is okay. If the SRO gets involved with the actual manipulation, then he actually becomes an RO as far as function is concerned.

The shift supervisor is the man designated in charge and able to roam the plan, able to see things that are going on.

During the shutdown condition, below 200 degrees or 212 degrees, depending on PWR or BWR, the SRO also roams the plant. The indication that I have from the SRO is that the shutdown condition is very similar to the Navy. He is extremely busy. There are exceptions to that, and some people have said that we ought to make a minimum staffing based on those exceptions, but they are very rare.

There is no maintenance or anything going on during a shutdown condition. And their indication is that normally they do double their shift staffing so that they can handle all the work that is going on, both administratively and practically from the oversight position.

MR. CATTON: How does this differ from the previous requirement?

MR. GUPPY: The previous requirements are very similar to what 0694 contains. As you can see, the minimum requirements --

MR. CATTON: I can see the numbers. I am referring to the required number of people in the control room.

MR. GUPPY: That was only one RO in the past; he was the only one required to be there except under special conditions. The SRO also had to be there.

MR. CATTON: And now in essence it is two.

MR. GUPPY: That is correct.

MR. KERR: Please continue.

MR. GUPPY: If we take the two units, two control rooms, we have listed one shift supervisor. He is in overall charge of the site on each shift. his ability to cover two plants is going to be pushed simply because of the physical size of the plant and being able to physically roam both plants.

The same situation exists with three units and two control rooms where he is covering three units.

Now, this assumes in both situations that the shift supervisor is qualified on both plants in order to be able to perform this function; if he is not, they must have more than one shift supervisor.

The SRO in each plant comes under the same heading, the same situation. I have two SROs listed for that one control room because in order to provide the oversight capability in the control room under operation conditions, we need an SRO in each control room; one in case we have an accident in one plant; the one SRO and shift supervisor can dedicate themselves to the one plant, and we will still have an SRO and an RO dedicating themselves to the operating or the non-affected plant.

The same situation would hold for the three units, two control rooms. And since the three units, two control rooms are essentially just two single units and one site, the same holds for them also.

The shift supervisor can also provide relief for the SRO for short periods of time, and that is designated in the rule.

The shift supervisor is also directed by the proposed rule to go to the affected unit in case of an accident. The reactor operators, essentially, I have two for each unit. That is based on the consideration for a single unit of havng a relief operator available for the guy who is stuck in a control room for eight hours or whatever time he happens to be there, given the utility's rotation and time schedule.

For the two unit, one control room, I have two relief operators, one for each plant. And the reason is if we have a situation where that relief oprator is involved with one plant for some length of time, even though we have common control rooms, the two plants are different, and in many cases the control rooms, even though they are common, are different also.

And from that aspect the idea of having a relief operator go to one control room and sit there for three or four hours or whatever he happens to sit there and then immediately be called into the other plant, it is going to take him some length of time to reconfigure his mind to that second plant, both in terms of the operating conditions and in terms of the physical conditions of the plant.

So from that aspect, I want a relief operator available for the plants; that also takes care of an accident situation where the shift may -- they may run into difficulties and they may need the extra SRO or the extra RO in the affected unit. And that would provide no other relief available for the operating unit.

Now, emergency planning procedures, I believe, call for 30 minute recall time, but some plants cannot pohysically make that just because of the physical distance from the plant to any populated area so that the design for all those people was to be able to handle the initial stages of the casualty and attempt to get the plant into a safe condition.

During shutdown condition, the numbers were arrived so tht we would -- the shift supervisor would be in overall control again of the plant during a shutdown condition.

Each SRO is in charge of his individual unit, and I wanted an SRO in each plant simply because it is very difficult for that shift supervisor to cover both plants in a maintenance situation. Very difficult.

It is difficult for the single SRO to cover that plant during a maintenance situation. The ROs, again -- that RO is still stuck at the panel during shutdown conditions, and during his eight or 10 or 12 hour shift, whatever the utlity has to be on at that time.

He is going to need relief also, so again, I have the relief oprator provided for that operator.

During the shutdown, the shift supervisor is extremely busy; I have indication from the SROs that I have talked to that people were lined up 20 deep outside the shift supervisor's office waiting to get tag-outs approved and system lineups approved.

So he is kept extremely busy during that time frame.

MR. KERR: Please continue.

MR. GUPPY: There is one other situation that is not specifically covered on that table itself and that is the special evolution situation. And I specifically address the refueling situation. In addition to those men who are assigned on this table, I have also proposed that an SRO be in charge and have no other concurrent duties over the refueling operation to keep track of what is going on during refueling shutdown.

MR. ZUDANS: You made an interesting statement. You said "lines 20 deep." Who are the people standing there?

MR. GUPPY: Normally people waiting to get systems released to go to work on them.

MR. ZUDANS: Don't they have some other level of decision making power that says who has priority over who?

MR. GUPPY: That may be, but the maintenance boss is trying to get everything done, as many systems as the shift supervisor who is in charge of the operations will allow to be taken out so tht he can still maintain the plant in a safe condition he will allow to be taken out.

MR. KERR: I think the point was that the shift supervisor is busy, and I do not think any of us would disagree with that.

MR. ZUDANS: No, I do not disagree, but what I am now forced to think is he might be too busy to make a reasonable decision.

MR. KERR: I think we concluded a little bit of hyperbole was involved here. The point was that the shift supervisor was busy.

MR. ZUDANS: Well, if you think so.

MR. KERR: We are all in favor of busy shift supervisors.

MR. MATHIS: As a matter of information, how many plants today are staffed essentially the way you are proposing?

MR. GUPPY: We have done a survey of 25 plants or the Office of Nuclear reactor Regulation has and of those 24 can meet the proposed staffing requirements listed.

MR. MATHIS: How many use this kind of a scheme at the present time?

MR. GUPPY: I don't know for a fact. I think all 24 of those I indicated do staff their plants in that fashion. They meet this or even exceed it both in operation and shutdown conditions.

MR. KERR: Are there other questions?

MR. CATTON: This is a matter of the rule catching up with practice, and you are really not imposing much on anybody.

MR. GUPPY: As far as imposition, no, that is true.

MR. CATTON: Where would TMI-2 fall in this? Did they meet these requirements?

MR. GUPPY: To the best of my knowledge, they do, yes, sir. I don't know that for an individual fact, but I believe they did so.

MR. CATTON: So really what is the purpose of this rule?

MR. KERR: It is not really quite this simply because as I think you know this decreases the flexibility which may be good or bad, but it means that one now has a letter of the law to follow, and previously operators could use more judgment. And maybe some of them used poor judgment.

MR. CATTON: There is one change that is clear, and that is the number of people required to be in the control room. It is now two operators as contrasted with one.

MR. GUPPY: That is correct. 0694 during operating conditions also requires the same thing; even though their staffing requirements are slightly less because of allowance for common control room considerations. They do require an SRO and an RO in the control room during operating conditions.

And these have been imposed, as I said, on at least three that I know of: Sequoyah, North Anna, and Salem.

MR. ZUDANS: Are these considered to be minimum requirements?

MR. GUPPY: That is correct, yes, sir.

MR. KERR: Other questions?

MR. ZUDANS: No, no.

MR. KERR: Please continue.

MR. GUPPY: I am finished with the presentation, sir.

MR. KERR: Okay. On page 4 of the proposed rule at line 7, I find the language of "command and control" used, which is good military terminology, but why is it used? Why is "command" used in this situation?

MR. GUPPY: That is my military background coming through, sir; no particular reason.

MR. MORRISON: Is it limited only to military?

MR. KERR: I don't know what it means. I don't know what it means in this context.

MR. GUPPY: My overall intent was simply that the senior licensed operator be there and physically in control of the operators.

MR. KERR: Yes. I did not know whether it carried a connotation in the Nuclear Regulatory Commission beyond control, for example, or responsible charge.

MR. MORRISON: How about increased management and control?

MR. KERR: See, I'm not sure because I don't know what the term means.

Are there other comments?

Is there a consensus that we approve this be published for pubic comment?

I think I gather a consensus. So we approve. We are ready for 1.97, but before we get to that, I propose a 10 minute break.

(Recess)

MR. KERR: We shall reconvene to consider Regulatory Guide 1.97.

Mr. Morrison?

MR. MORRISON: Mr. Hintze will make the presentation on 1.97.

MR HINTZE: Revision two to Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," is a guide that provides the design basis for selecting the variables necessary to follow the course of an accident and for taking actions necessary to mitigate the consequences of an accident.

It also provides design and qualification criteria for the instrumentation to monitor those variables. The guide endorses ANS 4.5 criteria for accident monitoring functions in a light-water-cooled nuclear power generating station.

For selecting the necessary variables, the guide defines five variable types and lists a minimum set of variables for each type.

Included in the minimum set are those variables needed for monitoring the onsite technical support center, the safety parameters display system, the near site emergency operations facility, and the Nuclear Data Link.

MR. CATTON: What was the first one?

MR HINTZE: The first one was the onsite technical support center.

MR. CATTON: Thank you.

MR HINTZE: The types of variables -- the vu-graph is not a word for word definition, just an essence of what the type is.

(Slide)

The definitions are more complete in the guide.

Type A: those variables that provide information for preplanned operator actions.

Type B: those variables that provide informaton to indicate whether plant safety functions are being accomplished.

MR. KERR: Is there a difference between preplanned oprator action and planned operator action?

MR HINTZE: I personally right now don't foresee any difference.

MR. KERR: Okay.

MR HINTZE: The safety functions have been defined as reactivity control, core cooling, reactor coolant system integrity, primary reactor containment integrity, and radioactive effluent control.

Type C: those variables that provide information to provide the potential for being breached or the actual breach of the barriers to fission product release. Those barriers are fuel cladding, primary coolant pressure boundary, and containment.

Type D: Those barriers that provide information to indicate the operation of individual safety systems.

Type E --

MR. ZUDANS: Hold on. What is the difference between type B and D?

MR HINTZE: Type B and D?

MR. ZUDANS: They both refer to -- the first one says safety funcion being accomplished. The other one says individual operation of safety systems.

How can you accomplish B without having D?

MR HINTZE: You cannot.

MR. ZUDANS: Why is D there?

MR HINTZE: D is a systems oriented --

MR. ZUDANS: D is individual systems.

MR HINTZE: Function oriented.

MR. ZUDANS: And D?

MR HINTZE: Let me say it again: B is function oriented. D is systems oriented.

MR. ZUDANS: Can the function oriented group -- the single instrument have the answers or do you need to process the signals through some other system? Can it be a single instrument under B?

MR HINTZE: The idea would to be able to have a single instrument to tell whether the function is being performed. The ideal is not always possible.

MR. CATTON: You would resort to D if there were a problem with B?

MR HINTZE: That is absolutely correct. That is the reason we have the --

MR. ZUDANS: Maybe you address later the

distinction, because after reading the reg guide, I am not so sure that B and D should be separate.

MR HINTZE: Okay.

MR. ZUDANS: I am not so sure; maybe I have just not seen it.

MR HINTZE: Let's go on, and if we don't make that clear, we will discuss it later.

Okay?

MR. ZUDANS: Yes.

MR HINTZE: Type E: those variables to be monitored as required for use in determining the magnitude of the release of radioactive materials and for continuous assessing of such releases.

The guide was issued for public comment in December 1979, and the comment period ended February 1980. Regulatory position C6 received the largest number of comments, a total of 14 comments.

This provision provides that instrumentation should be qualified for 200 days as opposed to 100 days as specified in ANS 4.5 draft four.

I should note that the standard has been modified and now requires that qualification for B instruments be at least the duration of the longest duration design basis event; for C instruments, to at least 100 days.

So this is more acceptable to the staff. The provision receiving the next largest number of comments, a total of 11 comments, was regulatory position C4. This provision provides that type D variables should be includedd in the list of variables to be monitored. That type D variable was defined in ANS 4.5 draft four, but was not included as a necessary part of the standard.

The consensus of the comments was that the D variables should be deleted. The staff does not agree. It is essential that the operator know what systems are important to safety or functioning and which are not in order o make intelligent decisions in mitigating the consequences of an accident.

MR. ZUDANS: That again raises the same question: doesn't the B have it already?

MR. WENZINGER: I wonder if I might try to answer that?

Basically, the type B instrument tells you whether or not, for example, the core is being cooled or reactivity is under control. It tells you that -- the type D instrument is intended to tell you the status of the various safety systems that may be accomplishing one of those functions.

Let me use the example of core cooling: in the case of type B, the instrument would tell you, yes, the core is being cooled or, no, it is not.

In case that it is not being cooled, say, the measurement you might be looking at could be reactor outlet temperature as an example.

If it is not being cooled, the question then arises: well, why is it not being cooled? If safety systems have been initiated and are presumably operating, the question is: which of these safety systems are not doing their job and why is the core not being cooled?

The type B instruments are monitors of the safety systems themselves so that you can tell which are operating and which are not so that you can learn why is the core not being cooled.

MR. ZUDANS: You are telling me there will be instruments that will give me direct answers whether or not the core is being cooled?

MR. WENZINGER: That is type B and the reason why it is being cooled or not cooled will be told to you by way of the type D instruments which tell you the status and operations situation in the individual systems that areaccomplishing that functionn.

MR. ZUDANS: I still maintain they still should be under the same group. I am not saying you should not have them.

MR. KERR: You understand his point, don't you? I don't mean you agree with it, but you understand what he is saying, don't you?

MR. WENZINGER: I understand the conclusion; I did not understand the reason whwy they should be under the same group.

MR. KERR: That is another question, but you understand the point he is making.

MR. WENZINGER: Yes.

MR. KERR: Not the logic, necessarily.

MR. ZUDANS: I am not saying that you should not have type D; I am only saying that type D should cover the entire range because that is a safety function, monitoring; whether you monitor by specific instrument that indicates some state of a system or some device that is coupled to a number of ratings or you look at the individual systems, whether they are running; it is still the same thing.

MR. WENZINGER: It is a question of importance. Is it more important to know the status of the reactor, or is it more important to know the status of the individual systems that are accomplishing the various safety functions?

We have made the proposal that is inherent in this particular regulatory guide, which is somewhat new, I have to admit, and will be followed up, hopefully, in the not too distant future by a general regulatory guide on this subject that covers the graded approach, if you will or the grey --

g-r-e-y approach to design requirements.

So, as pointed out by the Kemeny Commission and many others, we just don't have two kinds of things -- the gold plated or the other stuff.

That is intended by this regulatory guide to have a graded approach to the requirements that go from the most important to safety in terms of accident monitoring to those of lesser importance, not necessarily unimportant to safety, but of lesser importance.

And the type B work considered by us is one of the more imortant to safety and those in type D of lesser importance.

Now, the reason for that is that there are a number of ways of accomplishing core cooling, but it is important that one know whether the core is being cooled or not -- and there are certainly a very limited number of ways of determining that.

Therefore, we concluded it is more important and therefore the requirements should be more stringent on the type B; that is, to determine that the core in fact is being cooled, not to menton the other safety functions.

MR. ZUDANS: The reasoning sounds all right, except this is exactly what brings my question up; I don't see the type D instruments, by your own statement, would be used to make the conclusion in type B areas. Sometimes, not always.

MR. KERR: I think there is a fundamental disagreement here, and I believe you understand and you feel differently than he does, and he understands.

So, may we go ahead with the presentation. After the presentation -- I think the points you are making are very important.

But at least you have made it now, and I would say let's discuss it further after the presentation if we can.

MR HINTZE: Okay. Thank you.

The third largest number of comments -- eight comments -- was on regulatory position C3, which pertained to the definition of design basis accident events. The ANS standard, ANS 4.5 deletes anticipated operational occurrences from being included in the definition of design basis accident events.

The staff does not agree with this deletion. All events should be considered in order to have an integrated approach to accident monitoring. Anticipated operational occurrences, if not properly accounted for, could lead to degraded conditions.

Eight comments were also received on the variable, environs radioactivity, listed in tables two and three. The purpose of the measurement of this variable is to detect release of radioactive materials from unidentified release points.

The comments suggested that the 16 to 20 monitors were excessive. The staff's response is that the exact number of monitors is site dependent and that the numbers 16 to 20 is an estimated number for a typical plant. In total, there wee 69 comments consolidated from a much larger number of comments received during the comment period.

The consolidated comments and their resolutions are contained in the discussion of public comments.

Subsequent to the transmittal of the guide to the ACRS, additional letters were received from three commenters. We received a fourth one this morning as we entered the room: Geometrics and Endor Corporation and a transmittal from Westinghouse. We received one from GE this morning.

Geometrics was concerned with the deletin of the provision which stated that the -- at least one of the neutron flux measurements should be a fission counter. That deletion was made in consideration of several comments that the guide should specify what is wanted, not how it should be done.

The fission counter provides -- that provision was the only place in the guide that specified a specific instrument.

(Discusion off the record)

Endor Corporation expressed concern that the NRC was making little use of the peer review process; citing what he called the disparity between the draft ANS 4.5 standard and the proposed regulatory guide.

He provided some statistics on the number of comments accepted and made some pointed observations on the way the public comments were handled and stated that the guide was another example of staff defining unique solutions and methodologies to a problem rather than defining criteria and soliciting solutions from industry.

His comment on the way the public comments were handled has some justification. We did not really take the time or have the time to go in depth with every single comment because there were so many.

As one who has been associated with the development of guidance for accident monitoring instrumentation over the last seven years, it is my judgment that the present version of the guide is the only way guidance in this area can be given and understood.

As far as Regulatory Guide 1.9 is concerned, providing criteria by NRC and sosliciting solutions from industry has not produced agreeable results in the past. Westinghouse submitted by teletype an extract from their presentation to be given today from their position on revision two to Regulatory Guide 1.9.

They stated that it is inappropriate to expand the scope fo the guide beyond the scope of ANS 4.5 since other work is currently being pursued in relation to emergency support facilities and human factor reviews associated with optimized data presentations.

They also suggested --

MR. KERR: I think there is some concern that you are referring to it as Regulatory Guide 1.9.

MR HINTZE: I am sorry.

MR. KERR: I assumed that that was shorthand since you had gotten tired of saying "1.97."

MR HINTZE: I did not really mean to drop the 7. Thank you.

They also suggest the change in the definition of typeA variables in order to prevent its scope from being expanded beyond a reasonable extent. As to the first point, it seems prudent to us that all accident monitoring concerns should be consolidated in one document. This will help avoid duplication of the requirements which could be the case if each user of monitoring instrumentation imposed independently his own requirements for measurement.

It would also help assure that the plant operating organization has a coordinated approach to preventing -- to providing necessary information in every aspect of its responsibility to protect the health and safety of the public.

Regarding the proposed modification to the definition of type A variables, we share the concern for unwarranted expansion of type A -- of the scope of type A. We have some problem with the proposed modification; it omits manual initiation of automatically indicated -- initiated protective actions, which should be a consideration.

However, we would be willing to work with all parties involved to modify the definition and alleviate the concern.

Major changes in the guide, as compared with the one issued for public comment are: A, the guide was modified to account for changes in ANS 4.5 standard. The ANS 4.5 is now intended to be a standard addressing function and system level criteria.

The component level criteria will be addressed in IEEE standard 497, which is under development.

Consequently, all of the component criteria was removed from the ANS 4.5 standard. The guide was modified to include component design -- to include the component qualification criteria which had been deleted from ANS 4.5 standard.

Th guide was reformatted to align more closelywith ANS 4.5; that is, the variables are listed according to type. Table one was modified to provide just the design and qualification criteria.

Further changes: there are two sets of tables included in the guide; one set for future plants and future plants have been defined as plants licensed to operate after June 1982; and number two, for operating plants, plants -- that has been defined as plants licensed to operate before that date.

Specifically, the changes are, number one: former regulatory position C6, which pertains to the measurement duration, was deleted from -- was deeleted since ANS 4.5 has been modified.

Number two: regulatory position C4 was modified to provide for complete -- to provide more completely the design bases for types D and E variables.

Regulatory position C5 was added, which provides the process for selecting the type D and E variables.

Regulatory positin C6 was added, which provides the performance requirements for the D and E variables.

For regulatory position C5 was modified and is now position C7. Position C7 with a new position C8 provide the design and qualificaton criteria for the instrumentation to be measured in the selected variables -- of the selected variables.

Table one was modified to mesh with the

reformatting of the tables two and three, which now list the variables according to type.

I have a vu-graph of that; you have the table in your handout.

(Slide)

It is on page 2. If you will remember initially, the categories were listed according to instrument type. This became unmanageable in doing that because not all type D instruments were to be qualified to the same criteria. And so this table one is now reformatted and arranged to provided for the graded approach, which Mr. Wenzinger talked about in qualification criteria.

However, the table was drawn up with some thought of the varoius types of instruments that were defined. So that was the reason for changing table one.

The more stringent criteria are the lower numbered categories; the less stringent as we go father out. Tables two A and Three A were added and provide the variables for operating plants. And this is a new table that was not in the for comment issue.

As to the list of variables, one variable was deleted from table three during the comment period. I am not going to take time to go through those; those are in the handout that you have. three variables were added to table two and five variables were a'ded to table three.

We have some proposed additions to the tables that are in addition to the one that was transmitted to the ACRS. There are three deletions -- three additions to table two and two additions to table three.

In summary, Mr. Wenzinger, if you could --

(Slide)

As a comparison between the for comment issue and the issue we are now proposing, in table two there were 60 total in the for comment issue; in the final issue there are 66.

Table three, there were 51 total; in the current version, 56.

Some graduate students at Ohio State University took on a project of evaluating proposed revision two to Regulatory Guide 1.97 and concluded that all but four of the variables listed in the guide were considered as essential for accident monitoring.

They concluded that there was one additional variable that should be monitored, and the staff agrees with their addition and have included it in the guide.

That is the end of my presentation.

MR. KERR: Mr. Okrent?

MR. OKRENT: In considering who has commented on the reg guide, would you say that NUREG/CR-1440 is a comment on the guide? Have you seen the report?

MR HINTZE: Yes, I have seen the report. That was done under the auspices of Dr. DiSalvo.

MR. OKRENT: That is right. Do you consider it to be a comment on the guide?

MR HINTZE: We consider it more to be a verification of the parameters that we selected, that they would adequately cover situations which he took up in his study.

MR. OKRENT: I am curious to hear you state it that way because I thought when I read this report, which did not pretend to be a complete study of all sequences, that they felt that there was additional information that would be valuable for certain kinds of sequences.

MR HINTZE: I think part of the reason for my statement was that his -- as I remember when I read his report -- it considered multiple failures, which in the design of plants we do not consider.

We design for the single failure -- to meet the single failure criterion, not for multiple failures. And as I remember, that report did consider that.

MR. OKRENT: I am not sure what you mean; the single failure criterion for the instruments you are requiring or single failure criterion for other systems?

MR HINTZE: For systems, right, systems.

MR. OKRENT: You are kidding me. You mean to say you layed this reg guide out in terms of the single failure criterion? You must mean something else.

MR. WENZINGER: Dr. Okrent, we have in fact considered more than just single, individual failures in the plant system designs.

In fact, the type C instruments are specifically included for conditions which might be characterized as degraded conditions which could conceivably be caused by multiple failures.

MR. OKRENT: Can you give me an answer as to whether or not you think you have dealt with the comments here, whether you have included them by what you already have or whether you have ruled them out or for some reason -- I cannot tell from what I have heard.

MR. WENZINGER: The report you have in your hand hs been reviewed, and we have compared each recommendation in that report to what is in the guide.

I do not have on the tip of my tongue a one for one evaluation of which of the requirements -- excuse me -- the recomendations in the regulatoryguie have been included in the report you have there and which have not.

MR. KERR: Mr. Wenzinger --

MR. WENZINGER: But they were reviewed individually.

MR. KERR: It seemed to me that Professor Okrent really was asking whether you believed that 1.97 had been modified to take into account the recommendations of this report.

It is one thing to say you had read the report and compared it to 1.97. It is another thing to say whether or not it has been modified to meet the recommendatons.

From your answer, I cannot tell which of the two questions you are answering.

MR. WENZINGER: I understand. I would like Mr. Hintze to answer that question.

MR HINTZE: All of the key variables listed in types B and C which were to tell us whether the functions were being performed, and Mr. Wenzinger correctly indicated that with those variables we considered any accident, not just the single failure, as I had indicated.

So all the key variables that came out of this report we have added. The difference came in the variables as to which were to best indicate the opeeration of the system; the D variables, there were some differences in those.

MR. OKRENT: Let me look at table 5.1 in the report.

MR. KERR: Would you give a page number, please?

MR. OKRENT: It is page 50.

MR. KERR: Thank you.

MR. OKRENT: And I will pick items at random, and I must confess that I have not had a chance to look at what is in your latest version of the reg guide, since this is a rather recent report. It is dated May and June, but it has only recently come to the committee; I guess, yesterday. I know it was reproduced earlier.

It says RCIC valve positions not specifically in reg guide 1.97; LPIS valve positions not specifically included in reg guide 1.97.

MR. KERR: We were on page 50.

MR. OKRENT: I am sorry. On Page 50, containment sump water temperatures not included in reg guide 1.97. If you go through this table and go over to the righthand column, you will see various items which have been identified by the authors as not included and presumably which they concluded based on their studies could be useful.

I am not trying to endorse the report, but I am trying to understand whether in fact you have looked at this in detail and item by item have reached a decision that either it is already covered or it is not worth including, and if so, why, and so forth.

MR HINTZE: To answer your question, yes, we looked at the report. Is Mr. Benaroya here? He is our expert on the list of variables.

MR. KERR: Mr. Benaroya, come out from behind that table where you are hiding.

I guess he is not here.

MR. WENZINGER: We have word he is on the way down. The proceeding has gone in advance of the proposed schedule, so there are some persons that are missng for the moment.

MR. KERR: We could reserve that question.

MR. WENZINGER: Then we could proceed with it.

MR HINTZE: Dr. DiSalvo, who was the sponsor of this study, was part of the committee helping to select the variables.

I am sorry; I cannot answer in detail at this point.

MR. OKRENT: Well, in fact, the report raises some specific questions, but it really raises some general questions: whether the approach you have taken, at least in its initial thinking, was sufficiently broad.

In other words, is there merit to using the approach taken in this report to see whether there are certain specific pieces of information that can be really quite important to what the operator may be able to do to help the situation or to know what it going on, and so forth.

In fact, I would say this report is responsive in part to one of the ACRS recommendations made in its safety research report of about a year ago where they said they should look at -- in detail at the various kinds of accident sequences to see what happens.

And I think they looked in detail at certain of these and tried to see where the information would be useful if you had it. I would like to understand whether it is relevant to reg guide 1.97.

Well, when Mr. Benaroya -- if and when you are ready to talk about this report in detail, please tell me, and I will ask Sam to find me because I have to go and answer a phone call.

MR. KERR: Thank you.

Mr. Zudans, you had your hand up earlier. Has your question been answered?

MR. ZUDANS: That was with respect to table two under guide B on your page 50. Aren't those instruments already under type A included, like RCS hot log temperature, RCS cold leg temperature.

MR. KERR: Do you understand the temperature?

MR HINTZE: Yes. As you are probably aware, we did not address type A variables; we looked only at types B and C and we make a statement in the guide that in the process of determining type A, they will undoubtedly cover a lot of the variables wich are already listed.

MR. ZUDANS: You are not asking for duplicates?

MR HINTZE: Absolutely not, right.

MR. KERR: Mr. Lipinski?

MR. LIPINSKI: On table one, the second line lists single failure criteria.

MR. KERR: You are now referring to table one of what?

MR. LIPINSKI: It corresponds to table one in the reg guide as revised.

MR HINTZE: It is just a cleaned up version.

MR. LIPINSKI: Either place is applicable. The second line covers single failure criteria. Under categories one and two you say yes, and then for the remainder it is no.

It is not clear that each variable has been assessed, and in looking at this, I offer the following comment: in specifying that a measurement need not meet single failure criteria, questions should be asked. How immportant is the information?

Can I live without it?

If I need it, can I make repairs in an acceptable time limit?

If it cannot be repaired, do I have a backup source of information?

In going through table two, I have asked myself thse questions, and I have come up with examples where I think you need a single failure criteria.

MR. KERR: Incidentally, just for my edification, is the use of the plural here meant to imply that there are several single failure criteria, or is the word meant to be "criterion"?

MR HINTZE: It is meant to be criterion.

MR. KERR: My own feelig is, if there are several single failure criteria -- I thought this was a recognition of that. Okay.

MR HINTZE: Thank you for pointihg that out.

MR. LIPINSKI: Earlier you said in the case of the category two where you are loking for the safety function, in many cases the safety function cannot be determined by a direct measurement.

Therefore, you rely on category four as a backup source.

But you do not require single failure criteria to be applied to category four: namely, these measurements could be unavailable.

MR HINTZE: Yes, that is true.

MR. LIPINSKI: I think there is a shortcoming in looking at table two; the specific items where the single failure is not required.

MR HINTZE: The shortcoming would be in assignment of category, not in the table.

MR. LIPINSKI: No, the listing is one thing, but you also have the column that gives the category requirement, which is the last column in table two where you have the one and two. The single failure applies, but in any other category, it does not.

MR HINTZE: I guess what I meant -- what I thought I was saying is that if you find a parameter that you say should not have to meet the single failure criterion, then it should be category one rather than category three.

MR. LIPINSKI: Or four.

MR HINTZE: Or four, yes.

MR. LIPINSKI: Right.

MR HINTZE: And -- so the fault is not in table one but in the assigning of the category.

MR. LIPINSKI: Well, yes. It would be in the fault of table two as to whether you picked category four or category one.

MR HINTZE: Right.

MR. WENZINGER: If you look on table two, page 15 as an example, under reactivity control, you will find the principal measurement, neutron flux, which is category one and therefore redundant meeting, the single failure criterion, and yet there are alternate means which are provided by more than one mechanism to provide the backup.

So although type five is in fact, as you pointed out correctly, not redundant, there is more than one different type of measurement to provide an indication of the reactivity status of the reactor.

And that is also true for core cooling which you will find at the bottom of the page.

There are a number of measurements provided for core cooling. There are a number of measurements providing reactor coolant system integrity which is on the next page and also for containment integrity which is at the bottom of the page.

for type C, that is generally true as well. for example, under reactor coolant pressure boundary, there is the high range area radiation monitor and then two backups of different measurements that are provided. So as a general rule --

MR. LIPINSKI: Let's go to the next one, containment.

MR. WENZINGER: Okay.

MR. LIPINSKI: That is category four.

MR. WENZINGER: OKay. The principle here is looking at types which are variables which indicate a breach or potential breach for the containment, and those are individual, single measurements, as you have pointed out.

MR. LIPINSKI: Yes, but you do not require a single failure requirement on the containment, noble gases exposure rate, and --

MR HINTZE: The reason for that is we did not list the parameters twice or variables twice. Okay. So that the -- one of the earlier ones, it would also be the containment --

MR. WENZINGER: If you go back to page 16, for example, maintaining containment integrity; it is a safety function as well as a measurement of a variable; in the case of the breach of one of the barriers -- namely, containment.

So if you look at thebottm of page 16 -- the bottom of page 17 -- together those provide you with the information concerning containment integrity.

MR. LIPINSKI: But the radioactivity is a single measurement, and if it fails, I do not have any indication of what that radioactivity is for noble gas or exposure rate within containment.

It is a piece of information in its own right. I may know I have an in tact containment, but I don't know what I have in the conttainment.

MR. WENZINGER: Have you prepared a list of those items which you consider necessary to meet the single failure criteria?

MR. LIPINSKI: Well, page 18, secondary system. I don't know if you want to go through this list at this time in detail.

My question is whether somebody had systematically gone through these individual ones, examined the category and asked themselves these questions that I quoted earlier.

MR. KERR: I think the answer to that is no. Or is the answer yes?

MR HINTZE: I don't want to say know until I know what I am saying.

MR. LIPINSKI: Let me repeat the questions that I used as criteria.

In specifying that the measurement need not meet the single failure criteria, the questions should be asked: How important is the information?

Can I live without it?

If I need it, can I make repairs in an acceptable time limit? I cannot get into the containment. I don't have access.

If it cannot be repaired, do I have backup -- a backup source of information?

If, as you point out, you have other ways to make a judgment, that is fine. But if I look at a single pint measurement where I cannot get access to it, how important is it? Can I live without it?

MR HINTZE: Containment reactivity is a single failure criterion. It is on page 17 under reactor coolant pressure boundary; an indicaton of the breach of the boundary is the radioactivity in containment.

It is a category two, which is single failure.

MR. KERR: You are responding to a different question. His question was whether somebody had systematically gone through and asked these questions. My response was, no. You said you wanted to hear the questions again.

MR HINTZE: The answer is: yes, we have, and if we had Benaroya here --

MR. KERR: They have gone through and asked exactly those questions that you asked and have answered yes to all of them.

MR. WENZINGER: I would like to correct that a little bit. I don't know the questions we asked were precisely those that Dr. Lipinski asked, but they were very similar, and the aim was certainly the same.

MR. LIPINSKI: Okay.

MR. WENZINGER: That was my reason for asking you whether or not --

MR. KERR: You are willing to make available to this group your list of questions you have so that they can double check and make sure that they have taken into account your concerns?

MR. LIPINSKI: Right. It may be that I have not gone back through the list like they have to point out this overlap.

I may have gone through it once and not realized that there was an overlap and concluded that I really needed this measurement. YOu may say, look over here, and you have got it.

MR. WENZINGER: We had a version of this guide that did include in fact all the overlap, and I think all of those of us who reviewed it found it extremely confusing to find the instruments listed more than once.

In fact, we feel it would have implied incorrectly that perhaps four instead of two instruments might have been required in order to avoid any confusion in that regard.

We only listed them once.

MR. LIPINSKI: That takes care of my concern.

MR. KERR: Thank you.

Mr. Moeller?

MR. MOELLER: In terms of the type E instruments, I was curious whether they would be seismically qualified and wqhat your thinking was on them.

MR HINTZE: These are the radiation monitors? Could we ask Phil Stoddart to respond to that?

MR. STODDART: The only monitor that is required to be seismically qualified is the high range in-containment monitor. All the other monitors being outside are not fully seimically qualified. There is a requiremen that they be mounted in a manner equivalent to the seismic requirements for the buildings, but in most cases these are not the full seismic one category.

MR. MOELLER: And what was your thinking on that if you had a seismic event which in turn caused a serious accident in the plant and simultaneously destroyed your monitors that are telling you how much radioactive material is escapig into the environment?

You felt you could go repair them in time or what is the philosophy?

MR STODDART: The basic philosophy on that, for example, if a monitor is servicing a stack and that stack is subjected to the seismic event, the probability of that stack no longer standing -- in general, the equipment is very good, and a lot of the equipment has in fact been seismically qualified.

It is just not a requirement. We do feel that the instrumentation is as qualified as the buildings or facilities they service.

MR. MOELLER: Well, in a sense, is this another example, maybe, where the rules are not quite u to the level o the practice?

MR. SOTDDART: That might be. However, we did plan to revise the existing rules on seismic qualification. Perhaps Mr. Wenzinger might address that.

MR. KERR: Mr. Wenzinger, do you know what it was you might aidress?

MR. WENZINGER: No.

MR. KERR: I'm not sure I know either.

Would you tell Mr. Wenzinger what it is you want him to address?

MR. STODDART: We were discussing the seismic qualification of instrumentation, and I pointed out that we had not attempted to change the existing definitions for the seismic qualifications.

MR. KERR: Of type E instruments, I think; isn't that the qualification?

MR. MOELLER: Yes.

MR. WENZINGER: I guess I have to ask first the question: which radiation monitors are you referring to, those within the plant or those that might be surrounding the plant..

MR. STODDART: The only instrument fully seismically qualified is the in-containment radiation monitor. All of these others are not required to be seismically qualified, although many of the manufacturers have been doing this.

MR. WENZINGER: I presume the question was directed at those that are outside of the buildings and in the general area of the plant providing for monitoring of what might be released from the plant.

MR. MOELLER: Yes.

MR. WENZINGER: Okay. First of all, there are rather a large number of those devices. I guess you could argue that perhaps all of them would be caused to fail due to a seismic event. But they are also physically accessible as well.

It is not as though they are buttoned up in the containment. They can be reached. There should be no reason why they could not be repaired or replaced or perhaps a portable instrument substituted for the ones that are fixed.

MR. MOELLER: The previous commenter said that some of them were seismically qualified. Do you know which these are?

MR. WENZINGER: I would ask Phil to answer that.

MR. STODDART: A couple of the instrumentation vendors have been at the request of certain utilities -- have been fully seismically qualifying their instrumentation,more on a custom basis. However, they are using the same design for sales to other utilities' plants.

These are not sold as seismically qualified equipment, but essentially identical equipment has been seismically qualified.

MR. MOELLER: It seems to me in listening to the discussion, you do have on high range monitor inside the containment that must be seismically qualified. I would just like -- the reason I raise the question -- had you therefore likewise given consideration to all the monitors outside of containment and not decided that at least one of those might have been seismically qualified?

MR. WENZINGER: Not as a recomendation in the guide; that is correct.

MR. MOELLER: Okay. Now, in the guide, which refers back to ANS 4.5, it says that the airsampling and monitoring equipment -- it says the equipment is covered by IEEE 497, and yet that is what is said in ANS 4.5. And yet in ANS 4.5, they do not include type E instruments.

So, are type E instruments covered by IEEE 497 or are they not?

MR HINTZE: 497 is under development as of right now and has not been completed. They will address, as I understand it, only the instruments that ANS 4.5 addresses.

MR. MOELLER: Right. And they do not address a type E instrument.

So who addresses type E instruments?

MR. WENZINGER: We do, sir.

MR HINTZE: They are addressed in the guide.

MR. MOELLER: And you have the electrical requirements and comparable requirements as covered in IEEE

497? You have those in reg guide 1.97?

MR HINTZE: They are essentially in positions of five and eight, I believe, of the guide, and table one.

MR. MOELLER: You do state in reg guide 1.97 that the -- essentially the type E instruments are covered by ANSI N 13.1, which helps you to some degree, not necessarily in terms of electrical components, but in terms of design and installation, and so forth.

But you say you recognize that IEEE 497 does not apply to ttype E and you have taken care of that.

MR HINTZE: We have not recognized it at all as being n existence right now. We have included all of the requirements that it will contain, as we understand it in 1.97, in position eight and in table one.

MR. MOELLER: Okay. In the guide itself, at the top of page 10, in terms of monitoring using type E instruments, you list an item three, and you are telling us at this point in the guide that these, I gather, are places that would be monitored.

You have the planned paths for effluent release and then two and then three is onsite locations where unplanned releases of radioactive material will be detected.

I wondered if you could elaborate on that path or place of monitoring. Page 10, item three at the top.

MR HINTZE: Well, those again are the site dependent monitors that we talked about, the 15 to 20 or 16 to 20 that we indicated in the footnote referencing those monitored variables.

It is pretty difficult to tell them where to put them, that they will pick up any plant releases, but that note in intended to cover that point.

MR. KERR: What is the intent of this array, to just pick up --

MR. MOELLER: Where unplanned releases will be detected --

MR HINTZE: Releases that come from breaches in the containment through either a valve being left open or a door being left open.

MR. KERR: Is the idea that one will use enough detectors so that no matter where a release occurs, it will be detected?

MR HINTZE: The idea is to be sure that we know what is going out. If it goes out the stack, we can get that pretty easily. but if it does not go out the stack, admittedly this is a very hazy area as to how that can be done.

Phil, did you want to elaborate on that for us?

MR. STODDART: There are several layers of detection for releases. You start out with the radiation levels inside the reactor buildings, which would indicate releases of noble gases within the buildings.

You supplement that with effluent monitors which detect and measure the releses going out through the plant ventilation exhaust points; then to pick up that and any other releases that could occur by an unplanned release path; such as to say the side of a buiding could go out. We are asking for a ring of 16 to 20 very sensitive monitors surrounding the site which would pick up unplanned releases as well as te releases which go out through the predetermined paths.

MR. MOELLER: I think that helps me. Those are just then generally placed to try to catch anything that the others have missed.

While we are on page 10, this is a minor point, but it is the type that troubles me when I try to read it.

At the bottom of page 10, I have item eight and then I have an A and a B and then at the top of page 11 I go back to A.

I did not understand your breakdowns. You have eight A, eight B, and then eight A, eight B, eight C and then eight C again.

All I am saying is there are three items at the top of page 11; for me, they might better have been numbered.

MR. KERR: I think 11 must have come from some other reg guide and gotten in here inadvertently.

MR. MOELLER: I think A, B, and C at the top of page 11 might have been 1, 2, and 3 in parentheses.

MR HINTZE: Dr. Kerr is absolutely right. That is my error. I copied it from the old reg guide, and we will straighten that out.

MR. WENZINGER: We willmake them one, two, and three.

MR. MOELLER: Okay. One thing: this morning in the handout you gave us, you said you had deleted the requirement to know the flow rate through the charcoal delay bed in a BWR.

Is that correct?

MR HINTZE: That is correct.

MR. MOELLER: I could not find that you recorded a temperature in the offgas system.

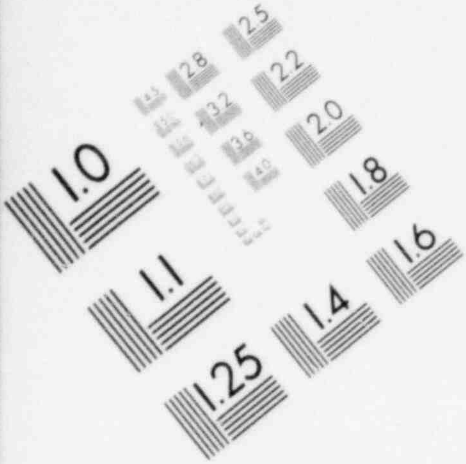
MR. STODDART: In the accident condition, that flow path is automatically blocked by a signal from the existing radiation monitor in that potential release path.

In the event of an accident, there would be zero flow through that system.

MR. MOELLER: What is you had a problem, though, in the offgas system?

Say I have an accident in it or a fire, for example, do I understand, then, that I do not know the

IMAGE EVALUATION
TEST TARGET (MT-3)



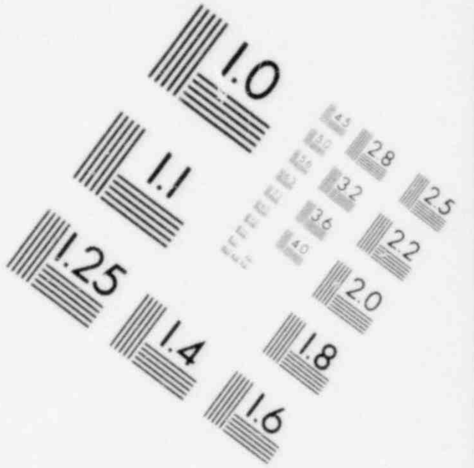
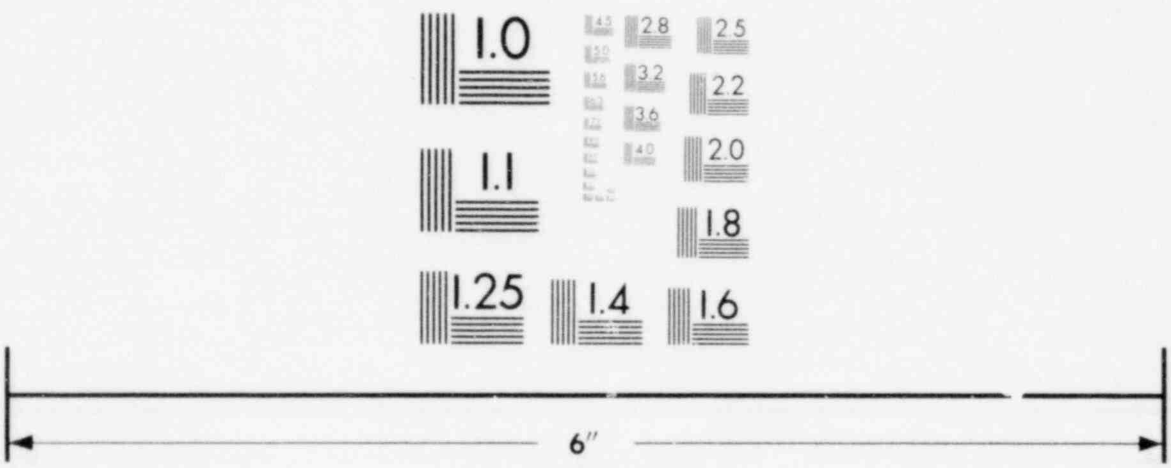
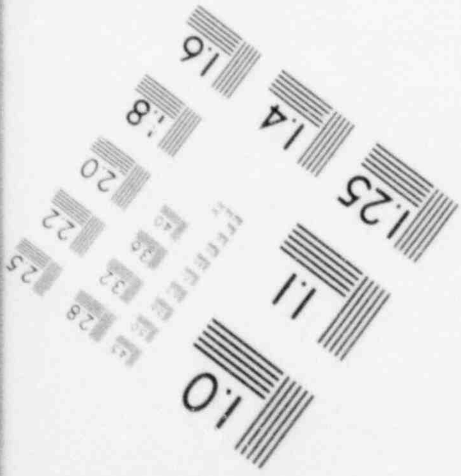
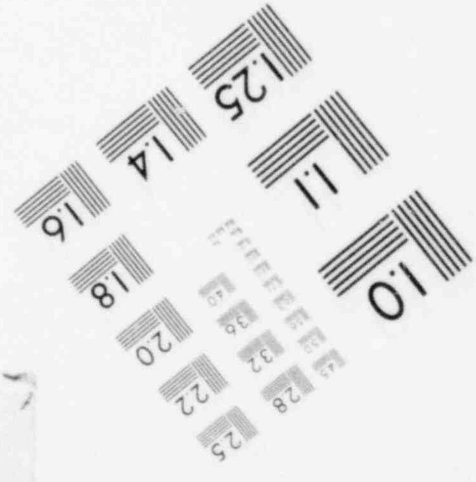


IMAGE EVALUATION
TEST TARGET (MT-3)







temperature in the offgas bed?

MR. STODDART: No. There is a full monitoring of temperatures, pressures, radiation level in those beds. However, it is not specifically identified as accident instrumentation.

MR. MOELLER: Okay, that helps me; so that the instruments are there, but they are not covered by 1.97.

MR. KERR: Mr. Moeller, while we are still in the vicinity of page 10, can I interject a question? On page 10 under type E instruments, number four talks about additional variables for defense in depth.

What is the significance of the variable for defensein depth?

MR HINTZE: As you notice, in categories B and C, we list some key variables and then we list some other variables that perform the same function or give you similar information but are listed with a lower category of requirements for them.

For instance, on reactivity control, the key variable there would be neutron flux. One can infer reactivity controlled by control rod position and content of boric acidcharging flow.

MR. KERR: When you say defense in depth, you are saying diversity?

MR HINTZE: Diversity, backup information.

MR. KERR: Okay.

MR. MORRISON: We would be glad to take out --

MR. KERR: I did not know what you meant.

MR. MORRISON: We will be more explicit.

MR. KERR: Excuse me.

Go ahead, please.

MR. MOELLER: Okay. I am nearing the end. The dew point temperature on page 22, for example -- I don't -- I am not knowledgeable about this, but is -60 degrees fahrenheit -- is that typical?

MR. KERR: This is also supposed to cover reactors in the artic.

(Laughter)

After all, one has to look ahead.

MR. MOELLER: I understood, you know, 120 degrees as the upper limit. That sort of made sense to me, but I did not understand the -60 degree fahrenheit lower limit requirement.

MR HINTZE: If you look on pages 5 and 7 of the handout --

MR. MOELLER: Yes, sir.

MR HINTZE: -- that unfortunately or fortunately has been deleted from the list of variables. So we no longer will require dew point temperature.

MR. KERR: What a shame.

(Laughter)

MR. MOELLER: You have deleted it, so I don't need to know whether it was right.

(Laughter)

I guess my last question right at the moment would be that you have given the tables two and three and then the tables two A and three A and one is for future plants. The two and three are for future plants. Two A and three A are for existing plants or ones to be completed by a certain date.

What are the basic differences in the two tables? In a nutshell, can you tell me what it is you are requiring -- not requiring on existing plants that you are requiring on the new ones?

MR HINTZE: The differences are to take into consideration the differences in plant design. The earlier boilers, for instance, have the Torus. The later designs have a coolant, so you would not require the same measurements.

So basically it is to --

MR. MOELLER: It is for the changes in design rather than lesser or more requirements.

MR HINTZE: No change in requirements.

MR. MOELLER: No change in requirements. Thank you.

MR. KERR: That brings up an interesting question since this is a regulatory guide. I get the impression as I read this and as I listen to the discussion that this really is a rule in effect and that it is not a regulatory guide anymore.

MR. MORRISON: It is a regulatory guide.

MR. KERR: Okay. We can continue playing this game, I suppose.

MR. CATTON: Are all reg guides enforced?

MR. MORRISON: No.

MR. KERR: No regulatory guide--

MR. MORRISON: They are not requirements. They staff will listen to alternates to accomplish the same thing in different ways.

MR. KERR: Don't you know the gospel according to the "St. Nuclear Regulatory Commission." Regulatory guides are only guides.

MR. MORRISON: I would be glad to cite specific examples to where alternatives to what is in the regulatory guides have been accepted.

MR. KERR: Mr. Zudans?

MR. ZUDANS: I have a question pertaining to type B instruments. Is there any way of monitoring reactor coolant inventory and if so, what do you use for that?

MR HINTZE: The reactor coolant inventory --

MR. ZUDANS: That is right.

MR HINTZE: I think Mr. Benaroya will probably want to answer that, but with the additions we have, let them flow in and let them flow out --

MR. ZUDANS: Those are in category D.

MR HINTZE: You mean in B?

MR. ZUDANS: I am talking about D.

MR HINTZE. I am sorry.

MR. ZUDANS: I consider reactor coolant inventory one of your more significant primary reactor safety systems.

MR. KERR: Zenon, what do you mean by inventory? Do you mean water level or total volume of coolant available?

MR. ZUDANS: Total volume of coolant in the system: what goes in and what goes out. There has to be a continuous balance.

MR. BENAROYA: For a boiler I don't think you can do it.

MR. ZUDANS: I am talking about a BWR.

MR. KERR: What is the information, the basic information you want, where the water level is or do you want to know more than that?

MR. ZUDANS: I am not interested in water level alone because it is not conclusive, and it does not tell me how much water there is in the system. Temperature does not tell me that.

MR. KERR: I want to know the question you want answered: whether water is on the fuel?

MR. ZUDANS: My -- well, it could be a consequence of my previous question, but the basic question is how much reactor coolant is in the reactor coolant system?

MR. KERR: In the system or in the vessel or both?

MR. ZUDANS: In the system, in the entire system because the system is assumed to be an expandable. If you have it, it is there.

MR. BENAROYA: The only way that we have now is on the category three in type D, and that is where the letdown flow is.

MR. ZUDANS: That is why I brought up type D as probably not being adequately qualified, as Dr. Lipinski also mentioned.

MR. BENAROYA: Let me add here -- I am sorry I am late -- that post accident monitoring does not include accident mitigation instrumentation. That is in a different category. And if the requirements for accident mitigation are higher, which they usually are, the ECCS system, then you go by the qualification of those instruments. And this is quite clear.

MR. KERR: Are you worried about the categories?

MR. ZUDANS: Or whether the information is available. There are two aspects; one is the category I wondered about before.

The other thing is: I would like to know where the reactor coolant inventory is at any given time because it is the most significant piece of information.

MR. KERR: So your question could be put: does the reg guide make reactor coolant information -- inventory information available with sufficient reliability?

MR. ZUDANS: That is the question. Thank you for the translation.

MR. KERR: But Mr. Benaroya was not listening, so he missed that gem of wisdom.

Next time, maybe.

MR. BENAROYA: Mr. Zudans, again, the main thing is this, for the ECCS systems and accident mitigation instrumentation, that would fall in a different category, and they would have higher requirements if they are necessary to mitigate an accident from the point of view of accident monitoring, and that is all we are talking about in this guide.

And all we are saying is we need a verification that this has happened.

MR. ZUDANS: Are you telling me that the same instuments essentially might show up under type A?

MR. BENAROYA: No, it might be under accident mitigation or emergency systems.

MR. KERR: Mr. Benaroya, rather than hypothesizing, can we deterine whether one has a way of knowing rather unambiguously and reliably what the coolant inventory is in, let's say, a PWR.

Is there some -- in whatever category -- does one have that information readily available?

MR. BENAROYA: Yes, we do.

MR. ZUDANS: How?

MR. BENAROYA: With the letdown flow in and the letdown flow out and the level in the pressurizer.

MR. ZUDANS: And the level in the quench tank?

MR. BENAROYA: Right.

MR. ZUDANS: And level in the containment sump and what else? Who integrates all these things and reports to the operator the status of the system?

The reg guide is supposed to address plant variables and status of plant systems.

MR. BENAROYA: Correct.

MR. ZUDANS: That is a plant variable as I understand. A single reading will tell you that. The status of plant systems right now we count half a dozen readings that you need and lots of logic to decide --

MR. BENAROYA: That is true. In a lot of cases what we are never -- we do not say that 1.97 is a computer that is going to diagnose whatever accident you have.

MR. ZUDANS: But the objective is that of a computer; you want to define what the systems are and you do not address that, how it is done afterwards.

What is the point in specifying all those instruments, that you don't have a mechanized device or automated device that will sum up the readings and tell you what the system status is.

MR. BENAROYA: 1.97's objective was not that; maybe we should have some other kind of an objective to do that.

MR. KERR: Who does have this objective, Mr. Benaroya or what regulatory guide or what --

MR. BENAROYA: I think we have to establish the philosophy that everything that is necessary for safety is not in guides or regulations. It is engineering. I think Leo can answer the question that you want.

MR. BELTRACCHI: I think the thrust of your question is really one towards diagnostics. And it is a questions of being able to measure the total mass inventory, and there is obviously no way of doing that.

However, there is technology that can be brought to bear to address that issue, and you alluded to the fact -- the measured, the unmeasured -- there are ways that you can model to synthesize the measurement.

Okay?

That technology -- I hve seen proposals on the very issues that you measure by synthesis the coolant mass. However, I have not seen anything in the form of a firm product.

Therefore, I would still put this in the area of a category of research type issue that could be developed for diagnostics. The technology is here to do it. It just has not been utilized.

MR. ZUDANS: Then the reg guide should be limited to variables and not to the status of systems.

MR. KERR: It is interesting since we are discussing philosophy; it seems to me that this guide originally had a title something like "Instrumentation to Follow the Course of a Serious Accident."

My original understanding of instrumentation was not sensors, but rather a system which would permit one to make measurements and from those measurements derive some information.

The current version seems to put emphasis on sensors. Mr. Benaroya, for example, tells me that the integration of this information -- it is something that will provide information -- it is somewhere else and not in this regulatory guide.

It seems to me that if one is really going to try to get information to follow the course of anything, one needs more than sensors. I am saying the obvious, and I apologize and indeed unless one has some logic developed, it is difficult for me to see how one knows what variables are appropriate. And I recognize that one cannot solve all the problems in one regulatory guide, but it seems to me a synthesis of some sort is fairly necessary before one decides on the variables and the sensors associated with that logic.

MR. BELTRACCHI: I guess I have to agree with much of your approach, but what you are saying is: if it is an online -- if it is used for diagnostics -- if you can get it online in real time, then I think there has to be some development work done in that area.

MR. KERR: What I am saying is: if the ultimate objective is to help someone follow the course of, let's say, an accident, he needs information which he can understand and which is useful; it seems to me that is where you start.

And then you ask yourself what sort of information and what sort of information is one going to need, and from that you then go to, well, I need temperature, pressure, derivative of temperature, or whatever.

But you do not start essentially by saying: what do I measure. That wold be one approach. I can me. ure temperature. I can measure pressure. I can measure flux, and so I ought to measure them because somebody may need them.

I mean, in a sense you have to do some of both. Obviously, you cannot get information that you cannot measure. But the impression I get in 1.97 is that there has been a lot of emphasis on sensors and variables, but that perhaps there has not been asmuch emphasis on information and it seems to me that that is fairly important if it is going to be useful.

MR. MINNERS: I am Warren Minners, Division of Safety Technology.

I don't think I am going to answer your question completely, Dr. Kerr, but the staff is working on a document which is now NUREG-0696, which gives some functional criteria for the technical support center and the emergency operations facility, which are conceived to contain the information displays which would be produced by the instruments which are specified in reg guide 1.97 plus any other instruments which the licensee believes is necessary to monitor accident situations and mitigate accident situations.

So people are thinking about how to use this informationin integrated systems so that accidents can be not only monitored but also controlled.

MR. KERR: Thank you.

Are there other questions?

MR. CATTON: I would like to pursue this inventory business a bit more. If you cannot figure out what the inventory is, you cannot --

MR. BENAROYA: I did not say that.

MR. ZUDANS: You need three weeks and four slide rules.

MR. BENAROYA: I disagree with that, too. If you can add, you can do it.

MR. KERR: I'm sorry. What?

MR. BENAROYA: Add. Simple addition. Subtraction sometimes, maybe. Simple mathematics.

MR. KERR: That lets me off because I cannot add.

MR. BENAROYA: Sorry, professor.

MR. CATTON: Maybe I ought to start over again.

Are you going to measure core water level? Is that a requirement?

MR. BENAROYA: It is.

MR. CATTON: Then I -- to me, that is the heart of the matter.

MR. BENAROYA: I have to qualify the question. For boilers -- we have it for pressurizers. It is a requirement that is under development, and when it is developed fully --

MR. CATTON: Repeat that.

MR. BENAROYA: For boilers it is in; for pressurizers it is under development.

MR. ZUDANS: For PWRs.

MR. BENAROYA: For pressurizers it is under development, and it is a requirement that will have to be installed eventually.

It is not now developed yet.

MR. CATTON: Why can't they use a level sensor from a PWR in a PWR?

MR. KERR: Mr. Catton, I am sure we both could design better sensors than now exist, but let's --

MR. BENAROYA: Let me say it does not work very well right now.

MR. KERR: Mr. Moeller?

MR. MOELLER: I am not sure there is a direct tie here, but I do have a question: I understand one of the proposals for the control of hydrogen in containment after an accident is various types of spark --

MR. KERR: Igniters they are called.

MR. MOELLER: -- that burn the hydrogen. Is there any possibility and have you looked at any possibility of any interaction of these igniters and instrumentation, any impact on the instrumentation in containment?

MR. KERR: Is that a reg guide 1.97 question or just a good question?

MR. MOELLER: No, it is 1.97.

MR. BENAROYA: Dr. Moeller, the only thing that we have in there is to measure the concentration of hydrogen. You should take the temperature and pressure calculated from LOCA type accidents, not from an explosion, if that is what you have in mind.

MR. KERR: I translate the answer to mean "no."

MR HINTZE: Are you talking about the environment that would be caused by burning the hudrogen and therefore affect instrumentation?

MR. MOELLER: Yes and any byproducts or side effects.

MR HINTZE: That is not specifically mentioned. It could come under the definition of the environment that an instrument must be qualified for. Now the radiation, the temperature, and all that, that is one which would have to be added to the list.

MR. BENAROYA: I have to disagree with Dr. Kerr because if the -- the answer is yes if you are saying burning. The answer is no if you say explosion.

MR. MOELLER: And I gather these igniters are designed to burn the hydrogen.

MR. BENAROYA: That is the general idea.

MR. KERR: They are designed to ignite it.

MR. MOELLER: To ignite it.

(Laughter)

MR. KERR: If one had an explosive mixture, then they would explode it, I guess. But they are like computers; they are sort of dumb.

(Laughter)

MR. MOELLER: I have a couple of other minor things. On page 3, the middle of the page, the paragraph that begins just below the middle, you have an example of serious events that could threaten the safety of conditions, degrade beyond -- those assumed are LOCAs, overpressure transients, anticipated -- the ATWS, reactivity excursions, and releases of rad materials, radioactive materials.

I do not understand the last one. The first do appear to me to be events and types of accidents.

Did you mean just the accompanying releases of these materials?

MR HINTZE: That is probably a better way of looking at it, yes, sir.

MR. MOELLER: On page 4, just below the middle of the page, the second word from the left, you talk about the blind operator.

Do you find that -- in order that the operator will not be blind as to the pressure inside of containment, I assume you mean unaware of the pressure.

MR HINTZE: Yes.

MR. MOELLER: At the bottom of page four,the last paragraph, about the fourth line, you have there that it is prudent to select the required accident monitoring information from the normal power plant instrumentation to enable the operator to use during accident conditions instruments with which he is most familiar.

Are you actually doing that?

MR HINTZE: That statement existed before we had a list of instruments.

MR. BENAROYA: This is guidance to the designer.

MR. MOELLER: Will that stay in the reg guide? Do you plan to keep that in it?

MR HINTZE: I think it is all right since we do not really define everything that is needed by the guide, particularly type A. I think it is appropriate.

MR. MOELLER: Let's see. I had one or two others if I can find them. I guess page 3, maybe, where they are -- well, no, I have already covered those.

Just a moment.

We were talking earlier about the gospel according to NRC, and I found -- oh, yes, on page 7, if you come down three, six, nine, 12, 15 lines -- it is three lines up from the end of that first longest paragraph at the top of page 7.

Those verses that you are singing should be v-e-r-s-u-s.

six lines up above that, there is a word -- the line ends with the word "limita" and I presume that was just a typo. Are you with me? The one where it just says "l-i-m-i-t-a." I assume it is limitation.

Thank you.

MR. KERR: Mr. Ray?

MR. RAY: While we are dealing with trivia --

(Laughter)

I wonder, this question of core coolant level indication that is covered at the bottom of page 2, indicating it is beyond the capability of present technology, and it is to be developed.

At the top of page 3, continuing that discourse, you say it is imortant that this capability be developed within a reasonable time.

I assume now we will all walk away from this guide and say that has been covered and now we are going to get a core level indicator sometime.

In other words, it is going to go in that long list on the shelf of generic items to be developed.

MR. KERR: Jerry, you are familiar with reg guide protocol. This is in the discussion, and therefore this is not an NRC position. It is just a discussion.

MR. RAY: Let me generalize the question: what pressure exists on the development of this device such that the industry will move on it and not just shrug it off?

MR. BENAROYA: It is in the TMI Action Plan.

MR. RAY: I see.

MR. BENAROYA: Item 2F2.

MR. RAY: Thank you.

On page 11, item 8B, it reads, "Whenever means for bypassing channels are included in the design, the design should facilitate administrative control of the access to such bypass means."

I would just like a little amplification of the concept behind that. Does this mean that the access would be means through the medium of a locked compartment or a locked cell or would the bypass be implemented by a switch which could be locked in position?

What is your concept as to how that might be accomplished?

MR HINTZE: Do you have that?

MR. WENZINGER: First of all, this is -- Al might correct me if I'm wrong -- a direct quote out of IEEE 279, which has been in the rules, I think, since 1972 or 1973 or something like that.

A general understanding of what that means, I think, goes across the gamut of the examples that you gave.

MR. RAY: It is that kind of thing.

MR. WENZINGER: It is a general requirement, and it does depend on the specific situation involved where the equipment is located behind a locked door, in a locked cabinet, and sometimes the controls are in fact purely administrative.

MR. LIPINSKI: On that same subject, there is reg guide 1.47 that deals with the bypassing. In the earlier discussion on the effectiveness of the reg guide, that still leaves me puzzled because I reviewed a system at a reactor vendor that was not built to reg guide 1.47 and the comment from the vendor was that this guide has not been implemented, and therefore they were not obligated to use the precepts in reg guide 1.47.

MR. WENZINGER: I would be glad to comment on that, Dr. Lipinski. As I think Mr. Morrison mentioned before, these regulatory guides, regardless of what might be said with regard to the gospel, are in fact no requirements.

If is acceptable for an applicant to propose an alternate means and if the staff in reviewing this application feels that those alternate means are acceptable, those alternate means can be used.

And that may have been a plant where you were which proposed alternate means and had not in fact obliged themselves with their own selection to use reg guide 1.47 and make it a condition of their license.

MR. LIPINSKI: Reg guide 1.47 is really specific in making it electronic rather than administrative. In this particular case it was relying on administrative controls.

MR. WENZINGER: 1.47 also allows for administrative controls for events that will not occur more than once a year.

MR. LIPINSKI: This was for monthly testing.

MR. WENZINGER: 1.47 was not being applied, but it may have been found acceptable, depending on the particular proposal that vendor had. And it is also possible that he was proceeding with his design on an assumption which may have been found to be unacceptable later in the review.

MR. KERR: Mr. Moeller?

MR. MOELLER: On the assumption that we are nearing the completion of the review, are we going to hear a discussion of NUREG/CR-1440?

MR. KERR: The first assumption is probably somewhat erroneous, but the the question is appropriate, and I have asked for Dr. Okrent.

He is tied up on the telephone and will be here subsequently.

MR. MOELLER: Another subject that I don't really know how to address, but I would like to hear some discussion of how the staff handled the critiques; you know, they indicated earlier, as we well know, that many people commented on the draft reg guide as it was submitted for public comment, and yet I notice one commenter here points out -- and I gather the same impression -- in looking at the responses to the critiques, this person pointed out that of the total comments -- that some 67 comments were received on table one and 56 of these resulted in no change.

And that is the impression you gain; the overall impression you gain looking at the comments is that most of them resulted in no change.

MR. KERR: I think that is a good question. May I make a suggestion? Since we do have six presentations scheduled, I would suggest that we discuss that after the presentations, because you may also want to ask some questions about the presentations.

I would hope we could make time available for that. Let me ask some questions in an effort to try to understand some of the thinking that went into this.

Let me go to page 15, table two, for example, and concentrate a moment on reactivity control. And I presume we are talking primarily about following an accident rather than a normal situation.

Is the idea that some combination of these four things that are mentioned, control rod position, neutron flux, soluble boron content, and boric acid charging flow will be necessary and/or sufficient to give one a good idea of reactivity control so that you need them.

For example, if I look at the neutron flux, what I really need in order to re-establish reactivity control is something about what is happeing to the fission rate and neutron detectors, which I assume have a habit of reading only the flux in the vicinity of the detector.

Now, if you have a nice, well behaved system in which you can infer something about the total flux pattern, knowing what the flux is in the vicinity of the detectors, then that gives you some information about reactivity control.

But if you have abnormal situations, then it is much more difficult.

Is this just based on the assumption that you will need to know something about flux and so you can put together after you give it some thought some logic that will give you information on reactivity control.

At what point in the thought process do I find myself here if I am worrying about accidents?

MR. BENAROYA: Well, actually, the main thrust of the information you have in front of you there is to tell you whether you are going back into criticality. That is the main reason for it.

If you have a problem, then you have the analysis, the sampling, the hydrogen content, radioactivity releases, and a lot of other things that will tell you.

MR. KERR: My point is: there is plenty of experience that indicates that local perturbations in neutron flux -- I should say local perturbations which lead to changes in response of what one might think to be neutron detectors don't tell you what is happening to reactivity, especially in accident situations.

Now, has some thought been given to the fact that you really are worried about accident situations here and not just talking about normal reactor operating experience because it seems to me unless you address the accident situation head on, just saying you are going to measure neutron flux does not have much significance.

MR. WENZINGER: The significance of all of the measurements in here are related to accidets and unusual situations.

The whole purpose of the guide was to describe the measurements --

MR. KERR: Unless you have addressed in some detail what it is you are going to do with this neutron flux in this accident, I do not think you are going to learn much about reactivity.

MR. BENAROYA: No, sir. All we are trying to determine is whether you are getting back into the regime where you could --

MR. KERR: I don't think you could.

MR. BENAROYA: From the counting?

MR. KERR: Exactly. That is exactly my point.

MR HINTZE: I think, Dr. Kerr --

MR. KERR: If you get a void somewhere or several detector responses go off, you could assume you are going critical when it may not mean that at all.

MR. BENAROYA: Idon't think we have said that 1.97 is a panacea to all --

MR. KERR: I am not talking about a panacea. I am talking about something that will give you useful information.

This is headed "Reactivity Control."

MR. BENAROYA: Give us a suggestion.

MR. KERR: I don't know how to do this in five minutes. My question is: have you given thought to the fact that you are dealing here not with the normal situation in interpreting reactivity in terms of what is happening in the neutron flux, but have you looked at the serious accident situation and said, aha, here is what I have to do is there is the possibility of large voids or whatever might occur in a serious accident.

MR. BENAROYA: Yes, we have. And that is the reason we have a lot of instruments that are being challenged by some people because it is under -- only under those conditions would they be valuable, like the core thermocouples under some conditions in some type of reactors.

MR HINTZE: In relation to reactivity control, the people tell me that neutron flux is the primary measurement, but as you say, not always is that going to be able to be in the right place or are you going to be able to tell exactly what is happening.

The next level of backup would be the control rod position, the boron content, and the temperature.

MR. KERR: Let's look at the soluble boron content. I find in parentheses "continuous indication." What does that mean?

MR HINTZE: It means it is a meter that gives you the boron content continuously.

MR. KERR: Boron meters tend to tell you a little bit-- not much -- about what is happening to the boron content in a very small volume, frequently a volume that is quite isolated from the core.

Now, I would assume what you want to know is something about the boron content and the water that is in the core region.

I don't know how you are going to get that on a continuous indication basis.

MR HINTZE: That is why we have sampling of core water, then.

MR. KERR: This says continuous indication. What does it mean?

MR. BENAROYA: It means that we have a meter.

MR. KERR: Do you think it is possible to get a continuous indication of the boron content of the water in the core region?

MR. BENAROYA: It says only we are taking the sample; we cannot assume anywhere else that --

MR. KERR: A sample system, is that what you mean by continuous indication?

MR HINTZE: No.

MR. BENAROYA: It is a continuous meter that measures the boron content at the point of sampling.

MR. KERR: But, Mr. Benaroya, that is useless.

MR. BENAROYA: Again I have to ask you, Dr. Kerr, what other alternative do you have to propose? That is the best we could come up with.

MR. KERR: I do not propose something that I consider useless.

MR. BENAROYA: I don't think it is useless. I think it is the only way we can know the boron content in the system, that we assume that there is a certain amount of mixing and that it is representative of what we have in the core.

MR. KERR: The experience of people who have used what are called boron meters has been that they tend to clog up, that they are not very accurate, that they are not very reliable.

If what you are saying is you are going to make them more reliable, even then you have not solved the problem of the relationship between -- and I am trying to keep in mind that I am not dealing with a normally operating reactor in which I have maybe good mixing and I have a fairly good idea of what temperatures I am dealing with.

MR. BENAROYA: We have the sampling also as a backup.

MR. KERR: I am talking about this that says we want continuous indication of the soluble boron content. What does that mean?

MR. BENAROYA: It means you are going to have an idea of the boron content in the system, and it is a representative sample of the system.

MR. KERR: Well, maybe that makes you feel good. It does not give me a lot of confidence that I know what I am doing.

On page 17 I have some indications that I need to know something about radioactivity concentration in various places and that the ranges given are in curies per cc.

Down at the bottom it is in fractions of r's.

Now, why does one talk about curies per gram, for example? Can you really measure that unless you know in some detail what the activity is or is what you measure really gammas or something?

MR. STODDART: You are primarily going on the calibration based on some -- the assumed values for the energy present.

Really, there is no direct way of measuring curies. What you are measuring is the radiation being emitted.

MR. KERR: If you cannot measure curies, why is that specified? I mean, I am not trying to answer the question for you because I do not know the answer. I have not looked at this in that much detail.

But if I were trying to measure it, I would not know how to measure a curie in a sample whose activity I did not know in some detail.

What I probably would measure is counts on a detector and that would give me some indication of gamma and maybe of beta. But my guess is these measuring devices are likely to be primarily gamma sensitive, aren't they?

MR. STODDART: That is correct.

MR. KERR: And it seems to me that therefore if you are primarily talking about sensors, you would want to specify this in terms of something that the sensor would tell you. MR. STODDART: The problem is that different sensors have variable sensitivities, and it is really necacessary --

MR. KERR: None of them measure curies.

MR. STODDART: That is correct. They measure a certain number of disintegrations per second which take place and they measure a certain number of counts per second or counts per minute, all of which are relatable to the curie activity by assuming --

MR. KERR: Assumiong you know what is there. But this is precisely the situation, it seems to me, an accident situation in which you don't have very good information on what is there.

MR. STODDART: That is correct, but over quite a large spectrum of gamma energies, you can very closely relate the counts per minute.

MR. KERR: You looked at it and you are convinced this is the way this to specify it.

MR. STODDART: You cannot really specify it in much of anything else. If you specify counts per second, then you are limiting yourself to certain instrumentation.

MR. KERR: I guess I would have the same question about r per hour.

But there is probably an easier translation there.

Any other questions?

MR. CATTON: I am still a little bit confused about this level sensor. It seems to me that when you want to know the level in a PWR, the flow is very low, and so the dynamic pressures are almost zero.

And if that is the case, the plain old delta t meter --

MR. KERR: You have some very good ideas about design of a level sensor. I urge you write them down. But we just cannot design them here.

MR. CATTON: I understand. But what I am b cehred by is the need for a design.

MR. KERR: We cannot do it. I mean, we agree -- the ACRS has written repeated letters saying one is needed.

MR. CATTON: They say they need a development program. I want to know why. Not the design, just why.

MR. KERR: Okay. Well, I don't know why either, but I bet you are not going to find out here.

MR. CATTON: Can I ask a question?

MR. KERR: Yes.

MR. CATTON: Why?

(Laughter)

MR. KERR: We don't have time for an answer. Dr. Okrent is here.

Would you permit me to take a 10 minute break so you can give somethought to the questions you want an answer to?

MR. OKRENT: Excellent.

MR. KERR: 10 minute break.

(Recess)

MR. KERR: Mr. Benaroya, we have some questions about NUREG/CR 1440, and you were represented in your absence as an expert.

(Laughter.)

I therefore will turn things over to Professor Okrent who wanted to ask some questions.

MR. OKRENT: I have not had a chance to fully digest everything in this report. If I understand --

MR. BENAROYA: Could I have a little background, Dr. Okrent?

MR. KERR: If you had another 15 minutes, you could.

MR. OKRENT: I gather they had looked at some specific sequences and in terms of the sequences tried to ask themselves what interpretation would be useful at different stages of the sequence. And as a result of this, have arrived at certain, I suppose you might say recommendations for instrumentation that could be useful.

MR. BENAROYA: Correct.

MR. OKRENT: And so I noted that in their Table 5.1 they had a certain number of items which they said where not included in Reg Guide 1.97. I guess that was the draft they had in hand when they were writing this report, so I guess I am interested in knowing to what extent and how you have factored in both the specific kinds of recommendations or suggestions made in this report and also the kind of thinking that they have gone through in arrivin; at your decision that what you now have in 1.97 is okay.

MR. BENAROYA: First let me say that Dr. DiSalvo, who is the project monitor for this report, was a member of our team in preparing 1.97. I personally read this report completely. and we took into consideration what they have. After reading it we found that indeed there were a few parameters that we had missed, and we included them in numerous places where it said it was not in 1.97 -- and maybe they were right because I do not know which of the 1.97's they had, probably the November 1979 version. Since then we have had extensive modifications to the Guide.

But most of the ones they say we don't have, we do indeed have, and there are very few where I disagreed with them because that parameter was either obtained in a different parameter from different methods, or I did not think it was necessary.

MR. OKRENT: Could we go down Table 5.1 and just look at the column marked "Comments." It begins, I guess, on page 47. The first point where I noted something was page 48, things where it says not in 1.97. I don't know if we have to go through all that, but I would like to get a flavor at least of what you're telling me specifically rather than the general comment.

MR. BENAROYA: Vessel water level for boilers is in for pressurized water reactor. It is a requirement that will be installed as soon as we have developed one, and they are supposed to be developed by January '81.

MR. OKRENT: Let's skip that. That has been talked about. Let's go on.

MR. BENAROYA: Okay.

MR. OKRENT: On page 50, containment sump water temperature.

MR. BENAROYA: We have that. By the way, that was added because of this report.

MR. OKRENT: I see. On page 52, condensate pump flow or discharge pressure. I am not endorsing these. I am just trying to understand what your thinking has been.

MR. BENAROYA: In this case the condensate pump we felt we had the auxiliary feedwater system, and the auxiliary feedwater system if that did not treat anything, we knew we had problems. It was part of the whole train.

MR. OKRENT: Is the condensate pump part of the auxiliary feedwater?

MR. BENAROYA: No, no. I am sorry. I am talking about the train, and we have a lot of other instrumentation in that train that will give you the same information. And when you look at the recommendations, it is potentially useful in diagnosing of initiating events. And since we already have the supply of feedwater to steam generator -- excuse me.

(Pause.)

In the table itself it says that its effectiveness in checking the supply of feedwater, we do have that as part of our 1.97. This takes you one step earlier than the requirement, and we felt that it was going too far in this case.

MR. OKRENT: So you think the one on condensate pump flow and discharge pressure is more detailed than you think is appropriate.

MR. BENAROYA: That is correct.

MR. OKRENT: How about steam supply?

MR. BENAROYA: We do have that.

MR. ZUDANS: You missed one on page 51 at the bottom, discharge pressure in main feedwater flow.

MR. BENAROYA: We have the flow meter in there. The pressure does not do anything. The pressure usually might be there when the valve is closed. The flow is more indicative of the condition.

MR. ZUDANS: That is correct.

MR. BENAROYA: You usually can have the block valve closed. As you start the pump you can have all kinds of pressures.

MR. ZUDANS: That is correct.

MR. OKRENT: All right.

MR. BENAROYA: We tried to keep in mind, Dr. Okrent, the philosophy that we should limit the number of instruments to a minimum number and not put everything and everything in there that might be needed as a third or fourth level of defense. We do usually have three levels.

MR. OKRENT: Page 3, LPIS, isolation valve position.

MR. BENAROYA: That is a good one. The valve positions, we are half pregnant in the Guide. I have to say that. We don't have all the valves. It is a long, long list, and we did put some valves there because of requirements of some people. If we put all the isolation valves away, it would take a huge book by itself, and we could not completely ignore them either because there were some very unhappy people who did ignore them all. So we arbitrarily set some valves in there and took out some others, and this one is not in the Guide, that is correct.

MR. OKRENT: Now, are you able to, in your opinion, tell that a check valve failure or an isolation valve failure has occurred with the current instrumentation, and if so, how?

MR. BENAROYA: I don't follow you.

MR. OKRENT: In other words, one of the sequences they analyzed in this is the assumption that you lose isolation between your primary system and connecting low pressure system.

MR. BENAROYA: That is correct. We depend on flow meters usually or level in the tank, depending on which sequence we are talking about.

MR. OKRENT: I'm sorry.

MR. BENAROYA: Level in the tank or steam generators or where it is pumping to a point --

MR. OKRENT: The steam --

MR. BENAROYA: I am just talking --

MR. OKRENT: These are things connected to the primary system.

MR. BENAROYA: I was talking in general throughout this table.

MR. OKRENT: But I want to find out how you have addressed this sequence, the one that involves the potential for loss of isolation between high pressure and low pressure systems. We are talking about the primary system now. It is connected at various places like to the RHR system and maybe some others and -- which has the potential for leading to a loss of coolant accident, and also loss of water from the containment building, so you end up with no ability to recirculate the water that you get into the primary system.

MR. BENAROYA: We don't look at mitigation of accidents in this case or how to initiate them. All we do is give this instrumentation to know where you are or what is happening.

MR. OKRENT: What I asked you was whether you had looked a what a study in regard to that sequence --

MR. BENAROYA: We have indeed because we have the same problem in some RHR systems. We have that problem. I am trying to remember which one it is that we have evaluated and made sure that something had to be done about it. But that is usually from an operation point of view and failure that would cause the accident, not monitoring the accident itself. That would cause the accident if two valves failed.

MR. OKRENT: That is right.

MR. BENAROYA: Then we have the instrumentation that would say well, you have a problem. You busted the line. You have a leak some place.

MR. OKRENT: That is part of the information in which you are interested. What I am trying to ascertain, and I don't think I've heard you say, is whether you have looked to see whether there is instrumentation that could be useful to tell the operator not only are you losing inventory and pressure from your primary system, but in fact this water is not collecting in the containment, but it is leaving the containment building and may be in fact via which route.

I am trying to understand do you think this is information not worth trying to get to the operator, impossible to get to the operator, already available to the operator? I don't think you have told me.

MR. BENAROYA: The reason is this. Where we have this category it is plant-oriented. It is a specific plant condition. Usually it happens in the RHR systems. That is taken into consideration as a part of design and approval of the system and not as post-accident monitoring.

MR. OKRENT: What is taken account of?

MR. BENAROYA: The failure of the check valve, so you will know something has gone wrong.

MR. MINNERS: I think you cannot specifically localize where a break is with the instrumentation in the Guide, but it does require that the sub-levels in the containment and in the other auxiliary buildings are required instrumentation, so in that sense you can get a general location; but you probably could not tell which pipe broke or which pipe failed. I don't believe that instrumentation is in the Guide.

MR. OKRENT: Well, have you reviewed the analysis done here? They suggest that maybe there could be things that an operator might be able to do that could alleviate the situation, if I recall what it says, if he knew soon enough. And I'm wondering whether you reviewed this critically and arrived at a decision that there is not anything, or there could be something, or just what.

MR. BENAROYA: We reviewed the report.

MR. OKRENT: I reviewed the report, too, but it's such a general statement. I am trying to focus in on what they call the V-sequence.

MR. MINNERS: The answer would be is that the sub-levels in the auxiliary building would have to be relied upon to give you some indication that the break was letting stuff outside containment.

MR. OKRENT: And you are satisfied that this is an adequate way, or the only way, or the best way, or just what, or in fact have you really reviewed this particular report in that regard in detail? Maybe the answer is no. I don't know.

MR. BENAROYA: I don't know what level you are talking about.

MR. OKRENT: Event V in particular, and thought and detail as to whether what you now have in the Guide is optimum in a practical sense.

MR. BENAROYA: What we checked was whether the instrumentation that was recommended would be useful to be included in 1.97 or not. That we did. Whether I checked critically their analysis, the answer is no, I did not.

MR. OKRENT: I guess I do not understand the answer.

MR. ZUDANS: Dr. Okrent, we previously asked the same question about reactor coolant inventory, and I did not even think about this event V. There is no answer.

MR. OKRENT: I said I am raising the question both specifically but also in general, because what they have tried to do here is take a somewhat different approach, I think, than has been taken previously -- not completely, but they try to look through a specific sequence to see what instrumentation would be potentially of interest.

There is some interest in initiating the studies of DiSalvo and so forth, and are now trying to see what way that people preparing the Guide have responded to these specific studies.

MR. MINNERS: From my view the Guide is a compromise. People said balance having knowledge versus having instrum nt -- certain instruments, and people made the judgment . Since it is kind of a collegial document, I think your question is kind of hard to answer. I think you have to look at the result; that is, they have certain instrumentation, and it is harder to understand what the intent was of the various people who looked at the Guide.

I think you really have to make your own judgment. What is there is there, and people should evaluate for themselves whether that is sufficient. And people were aware of the report that you are looking at.

People were certainly great aware of event V, and I don't know how else to answer your question as to what the intent was.

MR. OKRENT: I guess sometime today sounds like it's unlikely -- but maybe when we are going to meet with them tomorrow, they could come in with a nice, succinct discussion of event V as presented here.

MR. BENAROYA: We do not have that, Dr. Okrent.

MR. OKRENT. Let me finish what I think would be nice. Then you can tell us.

(Laughter.)

A nice, succinct discussion of what it was that followed out of the event V analysis here, and how the Reg Guide matches or does not match this. I consider this report as just another comment on the Reg Guide and one which I think those preparing the Guide should address -- I am not picking on event V because I know others are less interesting -- if they have others that they think are of equal or greater interest in here, and present the same kind of questions that would be relevant to that, too.

If you have not done this, then I do not know what you are telling me. You are ignoring certain information in your review. I have to assume you do not do that.

MR. KERR: You have heard the question and the associated comments.

MR. BENAROYA: All I can say is that the report that we got was way after the comment period. We did look into it because it is a very nice, noble way of looking at instrument requirements, and it is a very interesting way of doing it, and that is why we looked at it.

We tried to see what instruments, if any, should be added to the Guide, which we did when we thought they were necessary; but we did not do a systematic way of sitting down, evaluating, or recommending anything about it. And that was done a month or two ago. I certainly do not remember every event. If I did, I would be a genius, I think.

MR. KERR: You were represented as a genius, which is right next door to a genius.

(Laughter.)

MR. BENAROYA: Genius and expert. Expert, yes; genius, no.

MR. OKRENT: That's why I said you could do it until tomorrow. Then before you remember anything, only to look at this and see what you have and how they matched and how -- why whatever is the situation was okay.

MR. KERR: Mr. Zudans.

MR. ZUDANS: As a continuation of previous discussion on reactor coolant inventory, do you have an instrument to measure sump levels in the auxiliary building?

MR. BENAROYA: Yes.

MR. ZUDANS: Where is that listed?

MR. HINTZE: Page 19.

MR. KERR: Are there further questions?

(No response.)

If I evaluate my agenda correctly, this probably gets us to a point at which we can have comments from those who have asked to make comments, and my agenda indicates that we have some from representatives of the ANS.45 working group, Mr. Stanley and Mr. Summers.

Who is going to speak, or are you both going to? I have Stanley first. Is that appropriate?

Mr. Stanley, do you want to come to some point at which you can use a microphone, at which you can use this table? You had better come up, please.

Mr. Stanley, a question considering logistics. I show your presentation -- I presume this includes the two of you -- as about 45 minutes.

MR. STANLEY: We are going to try to hold it to thirty. I'm going to try to stay within, if you could alert me.

End of tape SRB 3/18

MR. KERR: Mr. Stanley, just a question concerning logistics. I show your presentation -- I assume this includes the two of you -- as about 45 minutes.

MR. STANLEY: We are going to try to hold it to 30.

MR. KERR: Okay.

MR. STANLEY: I am going to try to stay with 10. If you would alert me in 10 minutes, I would appreciate it.

What I would like to do basically is discuss some of the philosophic issues that we from ANS 4.5 see, and I am representing a number of people that have participated with our rating group that are in the audience. Mr. Summers will address himself to specifics in detail as part of this presentation.

There are four basic conclusions that I have come to. Point 1 is that the points of agreement between the REG GUIDE and the ANS 4.5, in my opinion, are too few in number and are too few in content and technical and technical agreement.

Point number 2 I would like to drive home is that the areas of difference between us, which were part of my public comments in February, have not narrowed since December of 1979. From my point of view, that result is unexpected.

Point 3. ANS 4.5 has been developing and has now a broad base of industry support for accident monitoring variables and requirements. I would like to come back to point 4 in just a minute.

The approach that we have taken that some of you were addressing earlier this morning in you comments was a systematic approach, and basically we defined the accident phases, we then defined what the functional requirements were, we defined a process for variable selection, we defined criteria to be applied to the variables that we had then selected. We defined the minimum variable set, and then we permitted the designer to select the variables and the performance requirements to meet the particular needs.

In other words, we attempted to follow and use a systematic approach. After much, much deliberation of the committee members over quite a period of time, we ended up endorsing just three types of instruments for accident monitoring. We saw the need to go no further in an accident monitoring instrumentation document than these.

There is the Type A for preplanned manual action, the Type B for critical safety functions -- and we defined five of those safety functions -- and Type C, the variables for barrier integrity, and after much deliberation, we cut ourselves off at these four: the failure of the fuel, the failure of the reactor coolant system, the failure of the containment, and then the potential for failure of the containment. And we believe we had good reasons for accomplishing that.

Now, to give you a perspective on where ANS 4.5 is, and this data is two days old, this particular sheet gives a complete synopsis of the sequence; but the important thing is from the arrow down because that is where we are at today. NUPPSCO met last week and gave it under 30 seconds consideration. The reconsideration period by the NUPPSCO balloters ends the end of this month. It will then be submitted to the Stadards Steering Committee for one month. It will be submitted the 1st of October to ANSI, and ANSI approval is expected in two months.

The document will carry a 1980 number and probably will be available around the 1st of February. It is moving fast, it is on track, it has been on schedule all the way through, and it does have industry support.

I would like to go back to point 4. In my point, a major overhaul of the REG GUIDE is needed. Now, I don't mean throw the whole thing out; I mean restructuring, which I think can be done within a fairly limited amount of time. The scope, the audience, the purpose of the document needs to be stated much more clearly than it is now.

The requirements that the document puts forward, in my opinion, should be tied to objectives and functions. Right now it is very difficult to tie those together and find out what objective or what function is triggering a particular requirement. The document, I believe, over the last four or five months has degraded in terms of clarity and understanding.

I would suggest strongly that it be reformatted; that the references to system-by-system be totally eliminated; and that the Type B, C, D, E or whatever you want to carry on through there be the structure of the document; that the format be improved, the clarity be improved, and that areas of ambiguity, which exist now and some of which you were pointing out, be removed; and finally, that the document be tested for reasonableness. I mean that in just that sense, practicality.

I would like to go into a very brief discussion of some of the differences as we see it, the significant differences between the document. In terms of purpose, the document's title is Instrumentation to Assess Plant and Environs Conditions During and After an Accident. On the other hand, the ANS document says it is Criteria for AMI functions, variables and requirements.

So we clearly have a different purpose between the two documents. Secondly, we have --

MR. KERR: You probably think that I know exactly what AMI means, but would you remind me?

MR. STANLEY: Accident monitoring instrumentation.

MR. KERR: Thank you.

MR. STANLEY: The audience. In the REG GUIDE it says it is addressing the operating organization. The audience for this document was only the control room operator. We felt that we could do a good job on solving what the operator needed and that was a big enough of a task. In the document, the scope of the REG GUIDE addresses accident monitoring instrumentation, safety system status displays, emergency plan support, safety parameter display, tech support center needs, emergency operations facility needs, and the nuclear data link.

The standard addresses strictly accident monitoring. In the scope area in terms of what events are covered, it covers accidents and anticipated operational occurrences. We have addressed only accidents. So it is very clear that in the area of purpose, audience and scope, there are wide differences, and I will have recommendations on how I would handle this later.

As you pointed out earlier, variable types A, B, C, D, E, a truncated version that we believe is correct, A, B, C. The specific technical requirements. With the last set of revisions through the working papers, Table 1 has been reorganized from the variable type A, B, C, D, E to be a qualification category. So the specific technical requirements are organized around the qualification category and are not directly easily relatable to functions and needs.

On the other hand, the requirements in the standard we have very deliberately tried to tie back to a function. The recording of a given variable is done on a variable basis for a particular function. We have listed specific situations. I would like to continue. Take only the TWR in this particular case, Table 2.

For the five functions, critical safety functions being solved, there are approximately 16 variables identified. In the ANS standard, the minimum set is 8, the maximum is about 11. However, when you look at the content, the identification of the variables, there is not the agreement that there ought to be at this point in time.

When you look at the type C, we have approximately the same number of variables, so you would say, gee, that one looks okay. Except if you look at the three variables in the REG GUIDE for the reactor coolant pressure boundary, they are not the same three that are in the standard. There is absolutely no correspondence between those.

Again, because of the introduction of type D variables and type E variables, you end up with approximately 50. That is the best count I could do by going through the list. Again, the standard did not address those two issues. We feel in type D we will be covered by ANS 4.6 or should be covered by one of the IEEE standards. It is not now currently covered very well. Type E, ANS 3 was being asked to look at setting up a working group to work on the radioactive effluent controls.

Now, this little piece of statistics at the bottom, I think, really illustrates the confusion to the poor user of the REG GUIDE. We have one table in the standard with six notes. We are boiled down there in the six that we feel we need. For just Tables 1, 2 and 3 there a total of 58 notes. I contend that it is going to be very, very difficult for the user to be able to make use of that document.

So I feel that the REG GUIDE is still in a relatively immature state in terms of communicating to the user, and I think that it should be improved. So I wanted to finish my portion of this talk with some recommendations as to how I would approach it.

Recommendation 1 is I would split the content of REG GUIDE 1.97 into topical sections -- accident monitoring, safety system status display and so forth -- and put it in various regulatory guides. I would make AMI be REG GUIDE 1.97 for it is compatible with ANS 4.5. The safety system status information could be fitted into the bypass REG GUIDE, 1.47.

The effluent discharge path requirements could be fitted into REG GUIDE 1.21, and the NUREG 0696 communication needs that are still emerging could be put into an entirely new REG GUIDE dealing with the communication needs of various audiences at various distances.

Then I would require that each topical section be self-sufficient: in other words, that it specify the criteria, it specify the requirements, it specify the variables, and have a logical structure for preparing that.

The third point is I think the REG GUIDE should really endorse ANS 4.5. It takes pages 8, 9, 10 and 11 to state how it doesn't endorse the standard. I really believe that the REG GUIDE should endorse it, and it shouldn't take four pages of exceptions.

Fourth, I would eliminate the confusion introduced in the last revision by the qualification criteria categories. I would tend to go toward function specific requirements, requirements that are specific to the function you are trying to do, and also requirements that are specific to the variable that you are interested in, not just the general category that all Qualification Category I variables have to be recorded or that all Qualification Category IV have to be recorded. But make it specific.

I would emphasize clarity in communication. In other words, I would assign that REG GUIDE to one person to rewrite it, not a committee. From my vantage point, it is very clear that this REG GUIDE is suffering from conflicting forces.

The last point I think we overlooked entirely. By saying -- and I heard some of it said around the table this morning -- that you want things to meet the single failure criteria, this line of thought is forcing down the path of inflexibility. We are doing 1.97 in the old way, with the criteria that we have had for many, many years. Consequently, we are not encouraging flexible solutions that may be more valuable to the operator, things like CRT graphics and trade-offs on criteria.

I believe it is entirely possible that in this area we could do some trade-offs and not affect or sacrifice safety.

So basically what I would like to do is conclude on that point and let Dave Summers address some specific comments from the ANS 4.5 perspective. If there are any short questions, I might take them now.

MR. ZUDANS: I have a short one. Does the ANS 4.5 address the question of reactor coolant inventory in some form or fashion?

MR. STANLEY: Yes. We discussed reactor coolant inventory at great length and determined that inventory per se was not an easily measured variable, but that by having measurements of the leakage into sumps and by having measurements of pressure on the primary system, one could infer that inventory was adequate. We discussed that for quite some time.

MR. ZUDANS: And your staff has then required such measurements be collected.

MR. STANLEY: Yes. If not, I would like to turn it over to Dave Summers.

MR. KERR: Mr. Stanley, I gather that among those things you point out there is a significant difference in the scope of 4.5 in addition to differences in viewpoint, even if one takes out that portion of 1.97 that represents 4.5. Suppose for the time we just take the part of 1.97 which deals with that with which 4.5 deals. It seems to me that there are even then significant differences in viewpoint.

MR. STANLEY: The differences are much smaller than you would otherwise believe. In the example that you had today of reactivity, you had the four variables. The one that had the qualification Category I, was neutron flux, and on that we are in total agreement. We have required neutron flux. The defense in depth concept, the diagnostic concept, is causing Table 2 to require those other three variables, control rod position, boron concentration, charging.

It is the blending over of the requirements of different audiences and different needs that is causing that table in the REG GUIDE to contain more requirements, and consequently it is harder to find out what the AMI portion is. In our meetings at ANS 4.5, there is a disagreement, not that large. There have been disagreements, but not the magnitudes that you would think by looking at the REG GUIDE.

MR. KERR: Again, I don't understand the defense in depth idea, but if you mean diversity in order to try to achieve greater reliability, which I guess is what is meant, was it the view of ANS that neutron flux would be a sufficient indication and that one did not need any --

MR. STANLEY: In that particular case, that happens to be a type B variable, type B safety function, and that was our recommendation; that we had as a type C, sampling of the coolant. But that is not an immediate --

MR. KERR: It seems to me that that represents a fairly significant difference in viewpoint, and it isn't obvious to me how one resolves that so readily.

MR. STANLEY: Except that there are three other variables in that section, we are type 4, qualification category 3.

MR. KERR: But it seems to me the difference in viewpoint is one of whether one depends primarily upon one variable or whether one needs some diversity in order to perhaps decrease the ambiguity or increase the reliability. I think that is a fairly significant point.

MR. STANLEY: Well, a statement was made today that it was for diversity. I am not sure that that is quite -- I am not sure in my mind that that is quite the reason. Defense in depth I would agree with.

MR. SUMMERS: Dr. Kerr.

DR. KERR: Yes, sir.

MR. SUMMERS: Excuse me, Dr. Kerr. Dave Summers from the Consumers Power, ANS 4.5 rep.

Specifically with regards to diversity, the ANS 4.5 standard does state that the diversity is preferred over redundancy. In this particular case of neutron flux, we could not think of any other single diverse indication or multiple sets of indications that we felt were better than neutron flux. This is admittedly a variable where you run into a problem that there is no real good cleancut answer. We felt this was the best.

DR. KERR: I am not trying to debate the merits of the positions, although I would be willing to some other place. But it does seem to me, if I understand the difference, that there is a fairly fundamental difference. As you have concluded, and maybe it doesn't carry over to all concluded, you have concluded one measurement is the only thing that is very significant. The staff has said we can think of four, and they don't necessarily say that they are all of equal importance, but they seem to me to be saying we are unwilling to depend on neutron flux alone; we think one needs some diversity in order to establish more reliability and perhaps less ambiguity.

I don't mean that they have achieved it. But it seems to me that is the position they have taken. Now again, without try to discuss the merits, it seems to me it is a fairly fundamental difference.

MR. STANLEY: Well, let me go back to this slide for a second. If you total these up, there are 16 variables that relate to the NRC, and 8 to 11 in the standard, and we are virtually the same on the number of variables for Type C. We don't agree that this particular variable is the same as that particular variable, but we are not off by a large fraction in the scope of what we are striving for. I think the areas of disagreement could be reconciled.

MR. HINTZE: Loren, I think it would be better to point out that some of the Type B are also Type C in function or help to define the Type C functions, so that you can't just say because we have the same number that we are therefore equal.

MR. STANLEY: What we tried to do in the standard is to make sure that Type B were for the critical safety functions and Type C were the extended range. In the REG GUIDE, if you have Type B variables with the extended range, you have confused the difference between B and C. Reactor coolant system pressure is zero to 3000.

MR. HINTZE: It is only confusing because we list them first and then only once, not --

MR. STANLEY: That is correct. That is part of the reformatting that I think is needed. You are blurring the distinctions to the user. I think we agree that we need a 3000.

MR. BENEROYA: Don't you think that the main difference is that you want four guides and we have ended up with a single one?

MR. STANLEY: That is part of it.

MR. KERR: That is what I was trying to get at. It seems to me the difference is more fundamental than that. If that were the only difference, it seems to me one could resolve it one way or the other. If that is the only difference, I guess I feel better; but it does not seem to me that is the principal difference.

MR. WRENZINGER: Dr. Kerr, I would like to comment on that. I think you are absolutely right, there are some fundamental differences. I would like to home in on one which may sound like an administrative problem when you first hear about it, but it is really not. That is the question of what constitutes accident monitoring instrumentation. Let me home in on a specific example, the Type D instrumentation.

I guess I was very surprised and I continue to be surprised and I suspect I will continue to be surprised at the thought that accident monitoring instrumentation does not contain monitors that tell the operator what is going on in the individual safety systems. This is just almost unbelievable to me. Although I understand that ANS is proposing that a standard be written on this subject, it apparently is still not going to be called accident monitoring.

I can't imagine an accident in progress where you don't need to know the status of the individual safety systems that are operating to mitigate the consequences of that accident. I think that is an extremely fundamental disagreement on which I don't see any agreement at the moment.

MR. KERR: Well, that one strikes me as not being particularly important if they really are going to set up a group that writes standards on monitoring of performance of systems. I have not gotten the impression that they think that is unimportant, but just that that is the job of some other group. To me that is a difference of opinion that is irrelevant as long as one has the standards.

MR. WRENZINGER: Well, if it is not for accident monitoring then I don't know what it is for.

MR. KERR: Okay.

MR. STANLEY: It is for system status. We have made that distinction.

MR. WRENZINGER: I wonder if Mr. Stanley might comment on how long he thinks it might be necessary to develop the standards that he has outlined.

MR. STANLEY: I am not current on the schedule for 4.6 or whether a working group has been set up in ANS 3 for the radioactive monitor ones. I am just not current on those.

MR. KERR: Other questions?

Thank you, sir.

MR. STANLEY: I will turn it over now to Dave Summers.

MR. CATTON: As long as you are still there,, I have a question. I notice that in your view, you don't need PWR in-core temperatures, nor do you need PWR vessel levels. Is this a result of your reasonableness category?

MR. STANLEY: Yes, very much so.

MR. CATTON: That is what I thought. Tha..k you. So you would change your position, then, if it was reasonable to have such instrumentation.

MR. STANLEY: Yes.

MR. SUMMERS: I thought I would start, as a means of introduction, with my past extensive testimony to the ACRS on this subject last November so you know what my credentials are in speaking to you today, one paragraph.

As a member of ANS 4.5, we set out, as Loren had mentioned, to come up with AMI objectives that had a number and clearly took a systematic approach to accident monitoring. As stated before, the idea was to characterize the safety status of a plant by these three Type A, B and C variable types. To do so in a systematic and practical way, we said AMI has to be clear and understandable.

To be clear and understandable, we said you have to have a minimum set. It has to be crisp so the operator can handle it. So we applied a sufficient and necessary criteria as we reviewed the number of variables. We stated that we wanted to have the most direct indication possible and we used this as part of our evaluation.

We said that AMI should be uniquely identified so that in an accident, the operator can distinguish readily between what instruments are, if I may use the phrase, super qualified, at least qualified, as opposed to others that may or may not be qualified; and then most appropriately, as a result of TMI considerations, we attempted to consider the man/machine interface in a number: can the operator assimilate all the information here telling him it is important and he has to be looking at it.

The other criteria, which I don't think we had quite as much difficulty with with the staff, was in terms of assurance of availability, that is the power supply and the qualification of equipment.

MR. KERR: Mr. Summers, do you think if you presented that set of objectives to the NRC staff, they would have any disagreement with those as desirable objectives?

MR. SUMMERS: I think they would say they are desirable objectives, but one of the overriding items in terms of the list put up here would be that, as stated, I think by Mr. Catton with regards to human engineering, that this recognizes a problem but we are not going to consider it.

Consequently, the defense in depth concept goes counter to that, and I think --

MR. KERR: No, I am simply saying that these were your objectives, and it occurs to me that they probably would have been acceptable to the NRC's objectives as well. I am trying to establish where the disagreements arise. I don't think there is a disagreement between you and the NRC on these objectives; do you?

MR. SUMMERS: I can't answer that completely clearly, Dr. Kerr.

MR. KERR: No, but I mean just give me your best judgment.

MR. SUMMERS: In my best judgment, in terms of applying the minimum set of sufficient and necessary criteria, that we came and held that fast; that as a criterion it --

MR. KERR: I do not believe that the NRC considers anything that they have asked for as unnecessary or insufficient. I think they ask for things that they consider necessary and --

MR. SUMMERS: And hence, in terms of your question, two sets of people are doing the same problem with two different viewpoints.

MR. KERR: No. What I am trying to state is you could have set out with completely different objectives, and in some senses you did. You stuck to AMI and they put in AMI and two or three other things, I think. But insofar as the AMI objectives, I don't see anything on there with which I think the staff would disagree.

MR. HINTZE: I think you can agree to that, Dave, without any problem.

(Laughter.)

MR. KERR: I don't mean that this is good or bad; I am just trying to find out where the point of departure arises.

MR. CATTON: I might mention, Dave, those objectives look quite similar also to this CR 1440.

MR. SUMMERS: I have not had a chance to review that.

MR. CATTON: It would be interesting to compare this third set of required instrumentation with the other two.

MR. SUMMERS: Briefly, we have in terms of REG GUIDE 1.97 five basic concerns. We feel that a systematic approach is missing, that the scope expansion, that is, both with Types D and E and likewise the expansion out of the control room into other areas of the plant, is unsupported in terms of functional requirements specified in the guide, and that the scope of expansion blurs the AMI focus, that is, the crispness of the information to the operator.

We think that the requirements are overly prescriptive and that human factors consideration is missing, and I would like to address each of these points separately.

In terms of the systematic approach being missing, the NRC has four pages of single-spaced exceptions, as Loren had pointed out, with respect to a 25-page standard. This was just kind of bulk comparisons. That may not be an adequate way to compare, but it is about 25 percent of the stadard in comments.

MR. KERR: I must admit I am curious as to how the NRC could use the word "endorse" with reference to what they did to the standard, but that is maybe here nor there. It seems clear that there is some disagreement.

MR. SUMMERS: As mentioned by Loren, the possible 20 variable matchups that we have in Type B and C. We only matched up on 10, but I understand from his discussion that that is because there wasn't cross-referencing. That is a format problem. REG GUIDE 1.97, we feel, does not evolve from a basic functional criteria or analysis. Again, out of the standard -- and this may be a formatting problem -- under Type B the radiological effluent control was eliminated as an AMI type B variable function. We said it was important and has been, in essence, downgraded in the REG GUIDE.

In terms of containment integrity for barrier monitoring, there is only environs monitoring and containment effluent monitoring. Again, I think this may be drawn out in terms of format problems so I shall move on.

The tables mandated unjustified diversity requirements on the functional level. This is to address your question, Dr. Kerr, specifically. ANS 4.5 has the requirement, or it states, if I may paraphrase, that diversity is preferred over redundancy on the functional level. That is, after you have identified a functional requirement, we designate one parameter and you have redundance requirements. It would be preferred if you can come up with a diverse variable that also is adequate, necessary and sufficient criteria is met, and that you have a diverse parameter that you can cross-connect between the two.

What we feel, at least in our reading of the guide and our interpretation of the guide, is that the redundancy requirements are also being applied on the diverse parameters on the functional level. This jacks up the number of instruments, and from our standpoint there is an adverse impact on human engineering.

DR. KERR: In what sense do you consider that unjustified?

MR. SUMMERS: That if you have as an objective to verify a certain functional requirement and we apply a single failure criterion in terms of diverse indications or redundant indications on a given parameter or two parameters, we feel that suffices in lieu of having redundant requirements on a multitude of parameters. I am not sure I --

MR. KERR: To say that you feel something is interesting, but that is not a very logical argument to demonstrate to me that something somebody else has done is unjustified. One is looking for some level of reliability and unambiguity. Did you establish some level and conclude that one could reach it without going to the diversity that NRC is requiring, or did you just use a feeling that you had?

MR. SUMMERS: Basically we went to a historical perspective of single failure criterion and applied that to --

MR. KERR: But I thought everybody had agreed that the single failure criterion has, if not become obsolete, at least is in the process of becoming obsolescent, and we want something better.

MR. SUMMERS: I guess the answer to the question directly is in lieu of a probabilistic risk assessment on a number of accidents, it is very difficult, without being arbitrary --

MR. KERR: Well, I would think a forward looking, progressive organization like the American Nuclear Society would be doing this kind of thing to some extent.

MR. SUMMERS: You must keep in mind the time frames by which we are acting.

MR. KERR: Okay.

MR. SUMMERS: And again, the time frame of being able to support a draft standard by November starting in late July. We have to make engineering judgments in terms of what the basic reliability criteria would be, and that was the single failure criteria.

MR. KERR: Okay.

MR. SUMMERS: In terms of the scope expansion, ANS 4.5 felt that scope expansion was unsupported in terms of the functional requirements. Basically, ANS 4.5,, being the reference document and being control room operator oriented, cannot really legitimately be used as a reference document for functional requirements when extending those functional requirements out to the entire plant organization.

In terms of functional requirements in identifying what the objective is, what the functional requirements are for the given emergency facilities that we are talking about today, there are really no functional requirements as a basis for determining the lists in the accompanying tables.

We might point out that in terms of these activities, functional requirements are now being defined by the NRC for these activities as part of the draft NUREG 0696 ongoing work. It is just our basic feeling that it is the cart preceding the horse in terms of the requirement, in that the parameter list is leading the way as opposed to the functions being required leading the way.

MR. ZUDANS: Under your Type C instrumentation that the ANS 4.5 proposes, how far do you go to the outside?

MR. SUMMERS: Excuse me. I --

MR. ZUDANS: How far do you go with the potential for reaching the boundaries and getting radiation out?

MR. SUMMERS: Well, we have the potential for breach of the containment and the actual breach of the containment.

MR. ZUDANS: Do you look at what is happening outside the --

MR. SUMMERS: Yes. We endorse requiring radiation monitors surrounding the plant.

MR. ZUDANS: That is under Type C.

MR. WRENZINGER: Dave, since there was a considerable debate with regard to the Type C during the meetings that both you and I were a party to, I wonder if for the benefit of the ACRS you might tell them why you chose to exclude the potential for the breach of a fuel and the potential for the breach of the primary boundary.

MR. SUMMERS: Loren, could I defer to you on that?

MR. STANLEY: Let me answer that one, if I could. The basic problem that we have is that the statement is made in the REG GUIDE and has been in their drafts for some time, that Type C would be instrumentation that would detect the potential for breach of the fuel clad, the reactor coolant pressure boundary and the containment. One of the industry commenters, and it was endorsed later on by a second industry commenter, pointed out that he didn't think we had the expertise to detect all of the potential causes, what are all the things that have the potential for breaching the fuel clad barrier and the reactor coolant pressure boundary barrier.

We deliberated on that for some time and we decided that we did not want to make a promise that we couldn't fulfill. So we elected to detect the breach of the three barriers and the potential for the breach of the containment, and not go beyond that because that would be promising something that could not be delivered.

MR. ZUDANS: That means that you are not going to monitor anything that happens outside with respect to release of radioactive materials in accordance with this --

MR. STANLEY: No, that is not true. We are monitoring outside, in our Type C. Environs monitoring is one of the things that detects actual breach. Now, the potential for breach of the containment is reactor pressure coolant boundary.

MR. ZUDANS: Is it then correct that your Type C contains the 1.97 Type E?

MR. STANLEY: Yes.

MR.. SUMMERS: We call it --

MR. STANLEY: To a certain extent.

MR.. ZUDANS: In other words, what is in your Type C covers Type C of 1.97 plus the Type E.

MR. SUMMERS: I think this is one of the criticisms that is very confusing to know what the functional requirements of the ANS document are as it is now transcribed.

MR. KERR: Mr. Stanley, now that you have seen how to detect those potentials for breach of cladding and pressure boundaries, maybe ANS 4.5 ought to go back and take another look, because the staff knows how to do it.

MR. STANLEY: I am sorry, but I have looked at the last copy of the REG GUIDE, and it says that the in-core thermocouple measures detect the potential for fuel clad barrier. It seems to me that that is an after the fact. It is not a potential thing at all. You have already encountered the region where you probably have perforated. I think the NRC has made promises that are not fulfilled in the actual tables, and we in ANS decided we didn't want to tackle that one.

MR. WRENZINGER: There was one measurement over which there was a good deal of debate, and I recognize you have included it as a potential for the breach of the containment. But I would suggest that the measurement that I think we all agree on, and that is the necessity to measure the pressure in the primary coolant boundary, is probably one indication -- I grant it is not the only indication -- but at least one indication of the potential for breach of the primary coolant boundary, not just the containment.

MR. KERR: It does not strike me that that is a very serious difference. If both of you are going to measure the pressure and have it readily available, what you use it for strikes me as being slightly irrelevant.

MR. WRENZINGER: I am only pointing that out because there really isn't a difference of opinion there, and yet it has been characterized that way.

MR. KERR: Yes. Maybe if you gentlemen had had the late, great Lyndon Johnson to say "Come, let us reason together for a few minutes," you could have resolved some of these differences. Thank you, Mr. Stanley.

MR. WRENZINGER: We reasoned together for more than just a few minutes.

MR. ZUDANS: Was my question fully answered? Does your Type C contain what 197 calls Type C and Type E?

MR. SUMMERS: The answer is no.

MR. ZUDANS: It was yes before.

MR. SUMMERS: Except on the one parameter. Specifically, if you say all Type E, the answer is no. ANS 4.5, again, addressing the control room operator, only addresses that part which is relevant to the control room operator. There are parts of Type E that are there as part of the emergency plan, sampling, off-site, and as far as ANS 4.5 is concerned, are not relevant to the control room operator. Those are not addressed.

MR. KERR: Does that fully answer your question?

MR. ZUDANS: Well, it only tells me that there are pieces that correspond and pieces that do not.

MR. KERR: Let me answer your question fully. No.

MR. ZUDANS: Then I don't think ANS goes far enough.

MR. KERR: Please continue, Mr. Summers.

MR. SUMMERS: In terms of the scope expansion, again, getting a little more on that, we felt that this blurred the focus. As Loren has stated, Type D and E variables, we felt, were not, in terms of a crisp presentation to the operator, functionally essential for accident monitoring. That does not preclude their need for safety status monitoring for the given safety system. We never had a disagreement on that. It was in terms of where that should be done. We felt that ANS 4.5 did not have the representation to address that. That was one of the reasons for not addressing.

Also, in terms of the AMI hierarchy, in terms of importance, it is more in a diagnostic sense. I might add that ANS 4.5, curiously, agrees with REG GUIDE 1.95, Rev. 1, in the statement and the discussion, where it noted based on a Battelle report that it should be noted that in safety analysis many parameters may be identified that will be desirable but less essential information to the operator. Any instrument used to measure these less essential -- i.e, backup -- parameters is outside the scope of this guide. We heartily endorse REG GUIDE 1.97, Rev. 1, for that statement.

Perhaps our most serious objections come in the area of requirements being overly prescriptive and in terms of human factors considerations. REG GUIDE 1.97, since it is not based on functional requirements, as we see it, in many areas, leaves the designer in kind of a tacky situation of really having to blindly comply. It is very hard to argue parameters when there is no common justice to analyze and show otherwise.

Specifically, we have a requirement, position C.5, which requires us to analyze and identify instruments for defense in depth. It is very difficult because that could mean every parameter in the plant. In such an approach where you attempt to comply with everything, I think you end up getting nothing. You have not had crispness in terms of the presentation of parameters to the operator. It results in a na...w and prescribed approach to safety.

Likewise, we feel that the NRC getting in this REG GUIDE into the position of designer has some unique problems in terms of designers trying to implement. Specifically, position C.7 of the guide states that criteria for variable Types D and E will be like Types B in the table; however, there is no -- excuse me, in table 1. However, there is no designation for Type B variables in table 1.

In terms of the REG GUIDE, at this point in time it is very hard to give a detailed consideration of project uniqueness, again since there is no analysis basing much of the requirements. The detailed design requirements often are unjustified or beyond the existing state of the art. Position C.8(a) mandates electrical isolation of all AMI instrumentation. Since a number of the AMI instruments now are not Class I, are non-I-E, we are now requiring electrical isolation between non-E parts in two systems, which doesn't make a whole heck of a lot of sense.

Position C.8(b) requires operational availability checking of instruments. At the high range radiation monitors where we have a number of very high range radiation monitors, where we have a number of very high range detectors, low range detectors, it may not be possible and it certainly is not one of our considerations to go off and have a check source to be able to automatically check the radiation levels at the higher dual-range devices.

I guess in terms of specific examples that we have heart ache, and one that was mentioned previously, environs radiation monitoring, which we endorse as a variable, in our guide we had designated 10^{-3} and 10^{2} R per hour range, and we left the number of stations unidentified. Based on a designer being able to look at his plant-specific considerations, the requirement in the guide is from 10^{-6} to 10^{1} R per hour.

I might add that the lower limit is a decade below ambient background at most sites. We just feel it is absolutely unreasonable. In terms of accident monitoring, it is not really accident monitoring oriented in that because you have the lower end, you end up having an ambiguity during an accident where shine from the containment, the LOCA, is picked up by these monitors, and if you have self-shielding from your auxiliary building or what not, the operator may be led to believe that he does have a release, unplanned release, which he is not having.

Again, in terms of getting into the specific design, there is a danger of not allowing the designer, the plant-specific designer to identify the requirements for his plant. I might add in terms of these ranges and in a number of stations, there have been a number of studies that were tentatively ignored in preparation of the guide, prepared by Battelle Northwest Laboratories for the DEC, in which stations, a limited number going down to even three of monitoring stations would suffice for accident monitoring capability.

Basically, the range that ANS 4.5 is specifying was generated as part of a working group which included Dr. John Folston from Georgia Tech and Dr. Mawny Schultz, formerly from Penn State, where we tried to ascertain specific range requirements, we considered shine problems, and these were ignored.

We have a problem with the core exist thermocouples where you have a requirement for 16 thermocouples for PWR and 50 for BWR. An obvious question is why the difference. For radiation exposure in areas required for access for safety-related equipment, we have a range requirement in the guide of 10^{-1} and 10^{4} R per hour. Gentlemen, I wouldn't go into a room at 10^{4} R per hour. I would have about 10 seconds. I wouldn't go into it below that.

Ten to the fourth R per hour is approximately ten seconds before you would see your lethal dose limit before you would be able, even in an access situation, to be able to drag a body out.

In terms of the high ranges for radioactive effluent monitors, we endorsed noble gas monitoring and we did not specify a range. I feel again that you have to take more than a nonmechanistic approach to range. The guide was based on vaporizing a core and dividing it by containment volume. That certainly is conservative.

However, we don't feel that it reflects reality. In our Sandia reports we indicate that a meltdown will be at least paged if it occurs. There are problems in terms of high range effluent radiation monitors not being available within the existing state of the art in terms of actually performing the requirements that are deemed necessary by the guide.

We have suggested independently for the high range radiation monitoring, the gross gamma radioactivity, would be an acceptable alternative to the very high range, because at that stage in the ballgame in terms of a release, it is whether your radioactivity is going up or down that counts. What a designer or emergency planner would be wanting to know, the iodine is the thing that would be doing harm to the public. Noble gas at that stage is just an indication that things are getting better or worse.

RCS radioactivity at 10 curies per cc, I thought that was kind of curious. You might be able to do that in a hot cell where you have a 10 cc sample, but with a 36-inch pipe with several hundred liters of water and 10 curies per cc I think that would probably be impossible despite your heat generation.

The requirement for providing reliable power for indication of voltage in the current on non-IE power supply status just doesn't really make sense, providing reliable power indications for non-IE power.

I guess I would like to highlight by admonition of the Kemeny Commission: stated that this commission believes that it is an absorbing concern with safety that will bring about safety, not just meeting of narrowly prescribed complex regulations. I submit that with the detailed, specific criteria of Reg Guide 197, this is a strong example of narrowly prescribed complex regulations.

Perhaps most significantly human factors consideration is missing. I do recall that one of the ACRS members had a comment, and I think it was Mr. Catton, I don't recall, with regard to human engineering. The basic reply was that it was recognized but there wasn't a lot we could do about it at this time.

ANS 4.5, and I think for the industry in general, would have to say that we have to do something about it. We have to take that as a yardstick against being alive. You have to look at the cost tradeoff in terms -- and excuse me for using the word "cost" -- the value of tradeoff, and you kill it before you consume it -- excuse me -- the value, safety value tradeoff with regards to human engineering.

Human factors enhancement in control room and accident monitoring is going to be at cross purposes. That is inherent. Actually monitoring, if you did it the way an accident monitoring designer, he would say put everything you can, all the information you can in front of the operator. Human engineering says make it as concise and as robust as possible so that the operator can assimilate that information.

If you blow him away with information or give him an overload, you end up defeating the entire purpose of accident monitoring.

MR. CATTON: Who is suggesting that the operator be given an overload? I think what is being suggested is that sufficient information be available if he wants it. I think it would be foolish to blast him with all the information at once, and I don't think anybody is suggesting that.

MR. SUMMERS: My next point here I think will give you some idea, if you can defer your comment till then.

Reg Guide 197 has a very substantial impact, and maybe this is an appropriate time. Again I will mention that the numbers I am putting up here is again ANS 4.5, sitting down, trying to take the reg guide and read it and interpret it. And we tried to be fair. The ranges you see in terms of the numbers that are put up on the overhead right now give a range in some cases of looking at a plant backfit.

Some of the problems you have in terms of human engineering, actually monitoring, is the fact that you have an existing control room, and some of these panels are non-IE panels and you just cannot get the channels, IE channels in the non-IE panels to separate and still be able to cram everything in.

In terms of the reg guide requirement of saying that the instrument should be the same one used by the operator in theory that is a real good idea. In reality, for backfitting it will be extremely difficult, especially in the extended ranges where the operator ends up in a situation where in an accident he will have to rely on an instrument channel that he normally ignores. It is reading zero during normal operations.

Likewise, as I have mentioned, because of the constraints in the control room you have the situation where you may have an AMI channel separated from another AMI channel because there are constraints of what you can put in existing panels. You may have a situation where you have the non-IE channel being relied on by the operator because the AMI channel could not be fit next to his controls and the AMI channel is sitting in another panel in the back of the room.

You have the problem of different qualification requirements. Specifically, some of the AMI channels will be more qualified than related instrument channels on the safety systems that are supposed to actuate and protect the plant. So you have another anomaly in there in terms of which one does he rely on.

Let me go through the list of displays. We racked up basically taking from a perspective of whether we could convince the NRC, the lower numbers are based on, whether we could convince that existing warning equipment, whether they met the qualification requirements, could be acceptable operated in place.

The high range is the more conservative if everything goes wrong in terms of your review. The bottom line is for total Class IE displays. We are talking in the vicinity of 20 to 30 additional Class IE displays re ANS 4.5, between 29 and 41, Reg Guide 1.97.

We are talking upgrading up to 8 per ANS 4.5 and upgrading up to 16 for 1.97.

Of course, one of the other things that come out is the fact that I literally used the designation Class 3, the environmentally qualified sensors. You will note that in, Mr. Catton, with respect to your comment on displays and flooding the operator, one of the problems you have is that again we don't have the flexibility necessary to go to plant, shoving things, isolating and putting them into a plant computer. When you are talking about applying a uniform building code, even at one-third the G levels, you are talking about for seismic events, most plant computers cannot handle that. If you get a normal shake, rattle, and roll, that is it for the computer. There's not too many seimically qualified mainframes.

So that you have another problem which I am not really reflecting here, and that is what you do with these Class 2E displays, the ones that are environmentally qualified but only required on demand. Well, to me all the qualifications that are now specified I think there are some major problems, at least we will have to do some negotiating, to be able to get that on demand as opposed to a display in the control room.

One of the significant points, trend recorder points. Now these I had problems -- Al, excuse me -- I had problems with really understanding whether these are supposed to be all Class 1E analog split charts. That seemed to be what it says. I don't think that is what you meant, but that is what it said. ANS 4.5 would have 34 recorder points; Reg Guide 1.97 would have 95 by the Table 1. Even if you accept 16 point recorders as acceptable for human engineering, that is one heck of a lot of recorders.

The power upgrade on non-IE displays, the categories 5 in Reg Guide 1.97 -- excuse me, categories 4 and 5, I think, would require reliable power battery back upgrades on 172 channels.

The total additional instrument channels, now what I am factoring in here is the fact for existing plants where you have to take the channel all the way back, for multi-range detectors -- I have not really addressed multi-range detectors where you would end up having possibly additional channels for the multi-range detectors. Assuming that will all be one channel, we computed 163 to 175 additional instrument channels. Admittedly, that is not all going in the control room, but that is a substantial impact in terms of being able to get this done in any reasonable fashion.

MR. KERR: Mr. Summers, I was told at the beginning of this presentation that it would take about a half an hour. We have now spent 70 minutes. I don't want to cut you short.

MR. SUMMERS: I will finish up in two minutes, Dr.

Kerr.

MR. KERR: Okay.

MR. SUMMERS: Our basic point then is human factors must play a significant part in the AMI. It cannot be ignored to make this thing work. We have to have flexibility to be able to have things in a computer based system, the less essential items, so they can be useful for the operator. And we should make AMI crisp and robust with a minimum set, so that it tells the operator in a very succinct way am I within the safety bounds defined by my design safety analysis.

I would point out in closing, at TMI where 50 to 100 alarms represented a severe imposition on the control room operator, 110 plus 53 Class IE displays would certainly have the same effect.

Thank you, unless there is any questions.

MR. KERR: Yes, sir.

MR. BENEROYA: David, forget 4.5 and qualification. How many instruments do we have in 1.97 that are not now installed in Palisades? Can you give us a list?

MR. SUMMERS: You are looking at a number that would be close.

MR. BENEROYA: How many?

MR. SUMMERS: As far as instrument channels, that is what I --

MR. BENEROYA: No, instruments. Okay, channels.

MR. SUMMERS: Channels. That is what I am saying.

MR. BENEROYA: Yes.

MR. SUMMERS: You take a normal existing plant, and we are talking in the vicinity of 163 to 175 instrument channels if the Reg Guide is implemented by the plant to the letter of the law. Excuse me, I realize it is not law, but if implemented it specifically adds --

MR. BENEROYA: David, now that is not the question. What are the instruments that are now in 1.97 that we don't have now in Palisades?

MR. SUMMERS: Well, if we are talking control room displays --

MR. BENEROYA: Any place in the plant. Yes, from the gate door to the control room. Any place.

MR. SUMMERS: I will give you a good example.

MR. BENEROYA: No, no, I don't want an example. The list. Do you have a list?

MR. SUMMERS: We have done this ad infinitum.

MR. BENEROYA: Yes. I know. So I want to hear the list, so people will know how many instruments are not now.

MR. SUMMERS: I don't know what else I can do.

MR. KERR: It seems to me that question is not very meaningful unless one has a better understanding than I have of how 1.97 fits into existing instruments. I must admit I don't know. This group has probably studied it in a lot more detail. My impression is that it will require some changes.

You are telling me that it will require very few apparently. Is that the import of your question?

MR. BENEROYA: Qualification, definitely there will be some changes; but in the number of instruments I don't think there will be much number of changes. So that when he talks about human factor, I don't think it is a problem for this one.

MR. KERR: It is a pretty simple process. All you do is rip out the existing instrumentation and replace it with qualified instrumentation. Is that --

MR. BENEROYA: Definitely not. Nobody said that. But that is where the implementation comes in and where we talk to each utility and find out what can be done at each place.

MR. KERR: Well, without defending any point of view, Mr. Kemeny at least, and since Mr. Kemeny obviously doesn't understand a single failure criterion and I am not sure whether he understands alarms either, but he did seem to indicate that existing power plants had somewhat too much clutter.

I don't know anything about human engineering, so that is enough.

MR. ZUDANS: Well, Dr. Kerr --

MR. KERR: Yes, sir.

MR. ZUDANS: -- that leaves me now unclear.

MR. KERR: All questions have to be restricted to those that can be answered in 30 seconds.

MR. ZUDANS: Okay, last line. Are these 163 to 175 new distinct instruments that have to be placed or are they already covered by instruments existing in the plant?

MR. SUMMERS: It is a mix.la

MR. ZUDANS: Well, you can't say total additional instrument channels.

MR. SUMMERS: No. When you go back and rationally see how will I implement this, it is a reasonable point to say that if I cannot put it in the existing panel because the panel is cluttered, then I can't change that out because it is a non-IE display. I have got to put it someplace else in the control. That is an additional channel.

MR. ZUDANS: Okay, that is fine. That means that there is still an answer that would be interesting to know; namely, if you would eliminate that need, which may be because of the way it is specified, would this number reduce dramatically?

MR. SUMMERS: It definitely would reduce, yes.

MR. ZUDANS: What would be the number then, if you could use all the lines and al' the racks and all the holes in the panel?

MR. SUMMERS: I possibly would be able to refine what we have by this afternoon.

MR. ZUDANS: Yes.

MR. SUMMERS: If this is going to continue. I don't have it handy now.

MR. KERR: Are there further questions? Thirty seconds.

MR. LIPINSKI: In looking at your single failure criteria you say diverse variables are preferred. Yet when I look at your general requirements for Type B variables for reactivity control I only find flux.a

MR. KERR: I am sorry, I thought he was being critical of required diversity, not in favor of it.

MR. LIPINSKI: No. He is in favor of it.

MR. KERR: Oh, he is? Okay, then I misunderstood.

MR. LIPINSKI: In the listing of all of his measurements here I do not find the diversity coming in here. Yet if I were to do this job according to your prescription I would have to expand your list.

MR. SUMMERS: Okay, what we were doing in ANS 4.5, again to understand the objective, was not to set really a minimum list but if you applied this list everything went away, but we were saying that this shall be one of the variables. You have to do an analysis to show that you are covered.

MR. LIPINSKI: Okay. If you had done your analysis for the person that is going to apply this, I think you will find that your list expands to look more like 1.97.

MR. SUMMERS: There is a possibility of that.

MR. LIPINSKI: They have done their analysis and they have come to conclusions and they are offering you guidance. I don't get the guidance from yours. You have left the work for me to do.

MR. SUMMERS: But it is prescribed, and it also has (inaudible) prescription in terms of range, in terms of qualifications. The designer is very much (inaudible)

MR. KERR: Other questions? Well, there is a bit of human engineering, I understand, and that is a lot of people like to have lunch. So I declare a lunch break, and we will begin again at five minutes after two.

(Whereupon, at 1:05 p.m., the dommittee was recessed, to be reconvened at 2:05 p.m. of the same day.)

End TR3

R4 BN

AFTERNOON SESSION

MR. KERR: We continue with our consideration of Regulatory Guide 1.97. We have a request for presentation from representatives of the Atomic Industrial forum. The first name on my list is Mr. Coley.

MR. WRENZINGER: Mr. Chairman, before Mr Coley starts his presentation, I wonder if I might ask a question with regard to the schedule. We do have a number of people here for Reg. Guides 1.8 and 1.33, and I wonder if the Chair would like to comment on the likelihood of getting to either or both of those.

MR. KERR: I plan to stop work at about five o'clock. I don't know how much longer the 1.97 will take. I would think it would not take an additional three hours, so it seems to me that we might get to one or both of those two.

MR. WRENZINGER: The schedule that was handed out is not correct because it indicated going to 6:15, or 6:30 at the latest.

MR. KERR: Let's just say that I might consider compressing it a little.

MR. WRENZINGER: Thank you.

MR. KERR: I cannot imagine that this is going to take another three hours, and I don't think that it is going to take long on these pre-comment items.

If you people feel good about working until 6:30, I could favorably reconsider.

MR. WRENZINGER: I was pleased to hear that because we were told that we might work until 8:00 o'clock, and that we were to be prepared to stay for as long as necessary.

MR. KERR: Cece is a younger and stronger man than I am.

Mr. Coley.

MR. COLEY: My name is Bill Coley, and I am Manager of Engineering Services Steam Production Department of Duke Power Company and I am here today representing the AIF Subcommittee on Safety Parameters Integration. I am also chairman of the AIF Subcommittee on Control Room Considerations.

We have a team of people representing our subcommittee today to make a presentation to you. The purpose of this presentation is to offer a way to allow the proposals for the emergency facilities to be realized, to be implemented, and placed in action in a very timely and safety effective manner, while at the same time providing a vehicle for resolving a great deal of the controversies surrounding Reg Guide 1.97. Perhaps, in the area of controversy around Reg Guide 1.97 we can all agree. Perhaps that is a point of common agreement.

The approach we would like to present is an outgrowth of the work of our Safety Parameter Integration Subcommittee, and the NRC technical staff. This work has evolved over the past three-and-a-half months, and has included some intensive interaction between our subcommittee and the staff. We have also involved a great deal of industry experts from around the industry in developing this approach.

We would like to make our presentation in three steps.

First, I would like to give you the rationale behind the approach, what we are proposing and why.

Second, we would like to give you an idea of the methodology that we have developed for making the analysis for what parameters should be monitored, and to give an example of the fruits of that effort, the first parameter list that we think ought to be implemented in all plants.

Finally, we would like to underscore some of the very serious problems that we see with Reg. Guide 1.97, and the effect that its implementation in its current form will have with regard to the emergency facilities.

At the time Reg. Guide 1.97 was developed, our industry did not have in place emergency plans of the scope that we now have, and emergency organizations established within each utility. Further, we as an industry did not have plans for the safety panel display system, the technical support center, and the emergency operations facilities, and other emergency facilities to support us on site accidents or site incidents.

Therefore, Reg. Guide 1.97 has been developed independent of these emergency facilities, which you should support. Consequently, Reg. Guide 1.97 is not in concert with the industry and NRC efforts on those emergency facilities.

This disconnect is very important to us as an industry at this time because the NRC is now requiring that the Reg. Guide 1.97 variables be the basis for implementation of emergency facilities. We feel that this is not in the best interest of creating in a timely manner those emergency facilities our industry needs.

We are also concerned certainly about Reg. Guide 1.97 being used as this basis since we feel that it ignores the very important area of human factors.

In our efforts with the NRC, we have embarked on a systematic approach for defining the data and the parameters necessary to support an accident or incident. This approach in contrast with the approach of Reg. Guide 1.97 integrates human factors considerations, the need for and the importance of the information, and the use of the information.

It is our feeling that Reg. Guide 1.97 in its present form, if implemented, will preempt this more timely and more safety effective approach we advocate.

We wish to suggest a phased approach and a systematic approach to defining these emergency facilities. First, we feel that we should sequentially apply the methodology that we have developed to defining, first, the requirements for safety parameter display system for the control room display to give the operator an overview of the safety status of the plant. We think the methodology should then be applied to the remaining emergency facilities.

It is our position that in taking this structured systematic approach the end result will be a parameter list plus functional requirements that fully meet the intent and the purpose of Reg. Guide 1.97.

Further, we think that this will allow us as an industry to implement in a timely manner those things which are most important, which will be timely and safety effective, and which will improve plant safety.

We are now in the process, as an industry, of several parallel efforts. One is the defining of the functional requirements of the emergency facilities. The second is a year-long human factors review of control rooms.

We feel that there is a logical evolution of the spirit and the purpose of Reg. Guide 1.97 in taking the progressive, systematic approach we propose. Accordingly, as I have indicated, we do not feel that if Reg. Guide 1.97 is implemented in its current form that it will be in the best interest of timely and safety effective improvements in our industry.

Our first step has been to develop a minimum universal parameter list for BWRs and PWRs for only the safety parameter display system. Again, this is the system which should be installed in a control room, or would be in a control room to give an operator the overall safety status of that plant.

We feel that, first, defining and implementing that facility and moving on to the other emergency facilities that we can identify all those parameters essential to operator focus in the control room, then the tech. support center, and other emergency planning facilities.

To give you an idea of the kind of methodology we propose, Dave Cain of the Nuclear Safety Analysis Center will give you the background behind the methodology they have developed, and the list of parameters we think should be on the safety parameter display system.

MR. MOELLER: Excuse me. You are speaking on behalf of AIF. Is Mr. Cain appearing as NSAC, or on behalf of the AIF group?

MR. COLEY: Mr. Cain, and the other speakers are part of the AIF team, which was put together to develop this one approach.

MR. MOELLER: Thank you.

MR. CAIN: Good afternoon. My name is David Cain, and I am with the Nuclear Safety Analysis Center, and concerned with the plant modifications and improvements, and with the safety related data acquisitions display.

In this context, the thrust of our recent efforts at NSAC has been to develop a structured approach to safety parameter identification and selection. We have worked with industry to determine which parameters are needed for displaying the various emergency facilites.

In our work, we have found that without a structured approach to parameter selection there is no way to reconcile the differences between the parameter lists that are drawn by the diverse and various industry groups. Indeed, without a formalized rationale, or a rational structure on which to base our agreements there is no option except to adopt the largest parameter list, or the union of all parameter lists to finesse the issue. In our view, this is far from being a desirable alternative.

What I would like to do today is to briefly highlight the approach that we have used to select parameters for the safety parameter display system which is required by the NRC Action Plan, and was described in a recent draft document on functional requirements for safety data display system. This is NUREG 0696.

The approach that we have developed has played, we think, a substantial role in achieving an industry consensus on a parameter list for pressurized water reactor display system, and we believe the same approach can be used to select and provide a rational basis for parameters used by any safety facility to monitor an accident. This includes the control room. It does include safety functions that extend for detection, diagnosis, or any operating function.

The procedure for safety parameter selection consists of three basic ingredients. First of all there is a need to define the functional requirements for specific safety display facility, be it a safety parameter display system, a display facility in a tech. support center, or whatever. Then a set of parameter selection criteria have to be find which embrace these requirements. Third, a decision logic must be developed which can be used to combine the various function criteria to serve as an acceptance test.

The functional requirements for the safety parameter display system are variously stated. A concise rendition is that a safety parameter display system should present to the operators a key set of plant parameters in a compact format to give him an overview status about the plant's safety condition. Such a system should serve the purposes of detection rather than diagnosis.

From this functional classification, a list of selection criteria can be prepared. First of all, to qualify -- these are the selection criteria that we have used -- as a parameter to use in a safety parameter display system, we believe that a variable might be a leading indicator of dominant accident sequence.

What I am talking about here is a variable that responds to particular branch point of event tree sequence. The points of the tree that we used were from WASH 1400, and consist of the dominant accident sequences for pressurized water reactors.

Or, a parameter could be a primary indicator for whether or not a key safety function is being accomplished such as reactivity control heat removal, and so forth. The parameter should be indicative of the status of a primary radioactive barrier. For fuel cladding, for example, the pressure boundary reactor building indicator.

In addition, because of the peculiar function served by the safety panel, as it is called, the variable must be useful primarily for detection as opposed to system status, for example. It should be directly measured. It should be a reliable parameter. That is, not in the sense of the statistics of failure for instrumentation, but does it really present to the operator the variable that you want measured.

Finally, the particular parameter must be useful to the operator from a spectrum of plant operating conditions. It is not narrowly applicable to the specific event, or specific point in time in accident sequence.

The selection logic for an optimum parameter set must reconcile two competing display characteristics. Simply stated, one is, "more is better" versus efficiency in design. The "more is better" attribute assures that the safety panel can be responsive to every conceivable accident situation by monitoring essentially an unlimited number of parameters.

The design efficiency attribute recognizes that the information overload human factors concerned, and the overriding need for a streamlined, finely tuned emergency facility design. Efficiency promotes use of a rather limited set of plant parameters. These considerations dictate that the logical decision structure incorporates both and and or components. This is explained in the next vu-graph.

The flow diagram shown here truly describes the procedures that we have used to obtain the safety parameter display system data set. As feedstock in this process, we took the union of six individual or candidate parameter list that we could have applied in any parameter list of specific plant in bulk. To achieve robustness in concert with the idea that "more is better" it was decided that a candidate could qualify if it were a leading indicator for events in a dominant accident event, or if the parameter provided primary indication that a critical safety function was accomplished, or if it served a key function in determining the status of a radioactive barrier. The parameter could qualify if any of these criteria were met.

However, the parameter, it was felt, should serve the purposes of detection because that is the fundamental role of the safety parameters display system. These are the lower string of parameters.

MR. KERR: What is the fundamental role of the safety display system?

MR. CAIN: The fundamental role is to present to the operator in a concise format the key parameters to let him know that he has got a problem. It is not necessarily there to tell him what the problem is specifically -- this or that pump failed, or you have a break in this or that location. It is to give him an overview of what is going on.

In addition to being directly monitored as a variable for the instrument itself, the measuring function, if you will, has to be reliable, and it must be useful on the spectrum of plant conditions. These are the "and" components in the decision logic, whereas the criteria listed above are the "or" components.

MR. ZUDANS: I can see the process would work nicely if your first line were a complete set. If you just take a sample consisting of a union of all those sets that you have listed at the top, and none of which may be complete, and then also your final results will be incomplete. How do you assure yourself of the completeness of the first line?

MR. CAIN: The process could be achieved by trying to really describe here the process, and that is a legitimate question. To be complete, in principle, you would have to apply the total group of plant parameters, even some of the most benign and absurd ones. So there was some pre-filtering that was necessarily applied to protect ourselves against the fact that we may have missed something.

You see, over on the left, is NSAC, and TEC who is our contractor that did some of the work. We decided to roll into our list the total group of lists from many different sources. There is some risk in doing this, but it is the best that we could do under those circumstances.

MR. LIPINSKI: Under diverse conditions, is it conceivable that you would only have certain accident sequences where a single measurement is of benefit, consequently you would not meet your diverse condition requirement. Would you reject it?

MR. CAIN: It is possible we would, and I think that that is a legitimate concern. However, something I have not pointed out to you is that from the human factor standpoint, if you really look into this, there are several studies that have been done on the amount of information an operator can assimilate in a reasonable period of time. It turns out to be about one bit per second. You can reduce it in terms of bits. It is a very limited amount.

For a safety panel parameter display system, the functions you can accommodate are about seven or eight fine histories of parameters before you begin to confuse the operator, and to provide any special insight as opposed to what is on the board already. For that reason, the safety panel, or the safety parameter display is necessarily incomplete.

It is not a control room display panel. There is a control room display panel, and this is to aid the operator, but not to substitute. The panel instrumentation is already there.

MR. LIPINSKI: That was not the purpose of the question. I will take containment pressure as an example.

I don't know how many accident cases you have examined, but the containment pressure will be minor in terms of the number of times that it will come up in various accident sequences unless you have ruptured the primary containment.

MR. CAIN: The containment integrity --

MR. BENEROYA: I don't think I agree with that statement because you neglect to keep it under negative pressure during normal sequence of operation of the accident --

MR. LIPINSKI: I may be wrong in selecting my example, but I would expect containment pressure to come up in a minimum number of cases for all the accident sequences that you are going to look at. Would you then reject it because it is not diverse -- that is the purpose of the question.

MR. CAIN: I think I would not, and it has not been rejected for that specific instance. Maybe I can go through and complete this, and then I can come back and pick that up.

What we have, then, is a logical -- or you can put it in a mathematical expression that is fully described here -- acceptance test, and that is indicated down below. This is the one that we have used in selecting the parameters.

The candidate parameters themselves, which is a union of all these sets can be developed into a selection matrix, as I have shown here, where we simply list the criteria satisfied by any particular parameters. Notice that the topmost parameter is hot leg temperature which is satisfied by all of the selection criteria except the reactor barriers. However, because of the decision logic that we have selected, it does become one of the safety systems for the safety parameter display system data set.

As you continue down the list, you can develop this sequentially.

Continuing, what we get as a direct end product is, in fact, the safety parameter display system list. This data set is the industry consensus from a data requirement to the safety parameter display system for a pressurized water reactor.

MR. MINNERS: I am sorry, but you skipped over the last part. How does that become the list?

MR. CAIN: This does not become the list. This is the matrix to describe the decisions that are made with respect to each particular selection criteria, and I was going to put up, and I am going to put up the list.

MR. LIPINSKI: Before you take the other one off, I have a question on your DC column with all the X's. Is this judgment on someone's part to enter the X's into these columns?

MR. CAIN: The whole thing is a judgment. There is nothing automatic about it.

MR. LIPINSKI: You did not look at specific accident sequences to see which parameters come up.

MR. CAIN: We did look, and that is under LI. We looked at specific accident sequences and there is a report on this which describes what are, in fact, leading indicators for specific branch points in those sequences. In every case, we came up with leading indicators for each of the branch points contained within this list, not necessarily more than one, like 10 or 100, but at least one. Some of these are secondary indicators for the same branch points.

MR. LIPINSKI: What was your source for the branch points?

MR. CAIN: WASH 1400.

In conclusion, what I tried to show is that there is a logical progression for developing data system requirements that begins with functional specifications, makes use of formal selection criteria. This structured approach maximizes the opportunity for arriving at an optimal data set for minimizing the subjective arguments as to the relative safety significance of the required numbers and kinds of parameters.

This step by step procedure should lead to a consistent, fully justified, in short, a much improved guideline for accident monitoring.

Thank you.

MR. MINNERS: You were going to put your second slide on and explain how you get to the decision criteria from this (inaudible).

MR. CAIN: You could put ones and zeros. Put ones for the X's. Then you put in a formula which is pre-formed, such as I am putting here at the bottom. If it is, yes, it is in; if it is, no, it is not.

When you can go back, you can argue, why don't you have --

MR. MINNERS: Why don't you put the list up.

MR. CAIN: Basically expressing what I said in words, this is just a concise description of what we did so you can understand. If you take the X's you have there, it is simply a Boolean expression. If you get a one from the result of that formulation, it is in. If you get a zero, it is out.

MR. MINNERS: What logic is that?

MR. CAIN: The logic I just described. What I am trying to show you is, rather than argue whether we should have, let us say, boron concentration because I think it is important and you don't, or because you think it is important and I don't, you step back from that and you say, "What are we really trying to do here? Let's find out what the key selection criteria we want to apply." If we want to argue about something, let's argue with that. If we come to agreement as to what the selection criteria are, it goes. If you want to complain about it -- this is the same speech I gave to the industry people -- argue with the criteria, and don't argue with the parameters.

MR. KERR: Mr. Cain, before we philosophize too much, let me get down to a very simple level. Go through and tell me again what is LI, SF, RB, etc. are.

MR. CAIN: There is a legend here on this diagram. LI is the leading indicator for a preanalyzed accident sequence.

MR. KERR: Who decides what a leading indicator is?

MR. CAIN: This is was decided in the course of the study performed by the Technology for Energy Corporated funded by us. We divided indicators into four categories. One is the leading indicator. Again, it is a somewhat subjective notion. The secondary indicator. No indicator at all, it is completely neutral. Four is a misleading indicator.

We feel that the leading indicator should be represented, but there is the risk --

MR. KERR: Now I understand the leading indicator. What is the safety function?

MR. CAIN: Let me give you a parameter that is also a leading indicator. Bear in mind that they are not mutually exclusive.

A safety function -- whether a key safety function is being accomplished, this is backing away --

MR. KERR: Who decides that?

MR. CAIN: This was decided by me.

MR. KERR: Okay. I just want to understand the system. Now I understand what the safety function is.

MR. CAIN: The radioactive barrier is the status of the fuel cladding, the primary system pressure boundary, or the pressure boundary per se for the containment building.

MR. KERR: In that logic chain, when I see an RB, how do I determine whether it is a one or a zero?

MR. CAIN: The containment pressure would definitely be a one. For the radioactive barrier, which I am talking about, it is the containment. So you can go through there.

MR. KERR: Would reactor coolant pressure also be one?

MR. CAIN: Yes.

MR. KERR: Who decides what a radioactive barrier is? Is it so obvious that anyone can decide?

MR. CAIN: What the barrier is, or whether the parameter fits with respect to the barrier.

MR. KERR: Yes.

MR. CAIN: I decided that. When I say, I decided that, I decided it once and we went through several iterations with the AIF Committee, and there were certain changes made based on things that were pointed out to me.

MR. KERR: What does D-detection mean?

MR. CAIN: Detection is whether the parameter primarily serves the purposes of detecting the problem, or whether its function is to detect something else.

MR. KERR: Give me an example.

MR. CAIN: Whether your high pressure injection system is operating or not. It is not detecting that you have a problem necessarily. It determines that you have high pressure injection. It is a system status indicator. Whereas, primary system pressure is quite a different animal.

I should restate or reaffirm the fact that this is not a substitute for judgment. Judgment is what it is all about. It is structured approach for making decisions so that we don't get into top level arguments, and we reduce it to the fundamentals.

MR. KERR: It strikes me that it is a way of formalizing judgments which might make you think that you were not utilizing judgment when you really are, but I don't object to that.

We are now at R-reliable measurement, all measurements are reliable. What does that mean?

MR. CAIN: I will give you an example of that. It is fixed in my mind because we came up with this argument yesterday.

People want to put in reactor coolant flow. When you think about it during an accident situation, particularly with regard to instrumentation currently installed or available, reactor coolant flow does not give you a reliable indication in mass transport. It just does not work. Because of that limitation --

MR. KERR: I am trying to understand the measurement. Why does a measurement of coolant flow not give an indication of coolant flow?

MR. CAIN: As far as a reliable indication of how much, it is not very good.

MR. WRENZINGER: Is it a question of reliability or one of accuracy?

MR. CAIN: I think that the two go hand in hand. I think that a reasonable accuracy can be expected, bearing in mind that if I had no other parameters that were worthy, reactor coolant flow would probably be one of them.

But under limited circumstances, where you want to reduce the number of parameters, it comes up last in all the other ones.

MR. KERR: The R is zero or one. It is either an R or it isn't.

MR. CAIN: Right.

We talked about the diverse conditions.

MR. ZUDANS: Does your scheme come up with reactor coolant volume or weight as a parameter at the end?

End 4

TP 1-7

MR. CAIN: The reactor vessel water level? Is that what you are after?

MR. ZUDANS: Inventory, yes. All the time.

(Laughter.)

MR. CAIN: There is one here. I will tell you how it came out on the evaluation. You can argue with what was done. If you could get a reliable indication -- that is what this tells you -- it would definitely be in there.

MR. ZUDANS: Why wouldn't you get reliable indication?

MR. CAIN: You want me to give my opinion.

MR. ZUDANS: Because it is a judgment, you know.

MR. CAIN: I think that the current instrumentation that has --

MR. ZUDANS: Oh, that has nothing to do with it You are not really tied down to current instrumentation. You are trying to resolve an idealistic problem of what is the minimum sufficient and necessary set.

MR. CAIN: My opinion is that we are talking about instrumentation that is going to be in a plant in a few months.

MR. ZUDANS: A few months.

MR. CAIN: Whenever this regulatory guide is --

MR. ZUDANS: We are not going to resolve the REG GUIDE in a few months, I think.

MR. KERR: The implementation schedule calls for fairly early effectiveness. I don't know what that means, whether it means it still has to be in place and operating, but it is early.

MR. CAIN: There is a host of reasons why the instruments that have been proposed, either commercially or experimental stage, may not work. I feel that it would be better, for instance, to put more emphasis of PWR on monitoring the core exit TC, thermocouple, and looking for superheat to give myself very reliable indication that I haven't undercovered the core. I would put more emphasis on that in the interim than putting in a reactor vessel water level indicator that may mislead the operator.

MR. ZUDANS: Why can't you provide the multiple measurements to account for a single parameter such as inventory?

MR. CAIN: I think that we need to distinguish between what the Safety Parameter Display System does and what it doesn't do. This is not the only instrumentation in the control room for monitoring an accident. I could describe to you what I would do to make this a larger set, to make it reflect the kind of decisions that you would make for the control room.

Having that information in the control room, telling the operator as a part of his training that it is probably not reliable when you saturate or it is probably not reliable under certain circumstances, but not putting on the Safety Parameter Display System is a good move. There are a number of situations where I have deliberately left the information off of this to make it a clean, concise display that I would put somewhere in the control room.

The process of deciding what goes in the control room works the same way. I could show you how I think it would be done in my own opinion. You come out with a somewhat larger set.

MR. CATTON: Why don't you make the same argument that the boiling water reactor people make: namely, that vessel level is one the most reliable kinds of measurements I have in order to decide whether or not I am in trouble, and then get rid of the T hot.

MR. CAIN: Not the core exit TC.

MR. CATTON: That is a different judgment.

MR. CAIN: Get rid of the T hot. Well, the T hot gives you more than inventory.

MR. CATTON: Sure. Throw off the top one because it is unreliable, based on this particular report I have got here, it tells me nothing, and require vessel level measurements of the same types as BWR. I'm just curious. Your judgment seems to run contrary to my own. That is not bad, but --

MR. CAIN: Ellery's presentation --

SPEAKER: Let's cover that.

MR. CAIN: We are going to do a similar kind of thing for the BWR.

MR. MOELLER: Could you put up your last slide -- I don't know why you didn't show it -- and take a moment and go through it?

MR. CAIN: I got ahead of myself, is the reason.

MR. WRENZINGER: There is a general question I think we need to address here so I can understand the perspective of all of this. We have all heard from the regulatory staff with regard to whether we think that what is in 1.97 is necessary and sufficient; we do. But we have heard from Mr. Stanley and others that what is in 4.5 is necessary and sufficient.

What say you with regard to to this listing? Is this necessary and sufficient for accident monitoring?

MR. CAIN: It is necessary but not sufficient, and I will explain what I mean. Recall that one of the criteria that are used to filter the candidate parameter is detection. That is not good enough. You want to do diagnose. There are a number of parameters that you want to add in, not necessarily on a display panel, which could be a CRT and a lot of high technology, to give the operator a real clear picture of what is going on.

MR. WRENZINGER: So you are not exactly talking about the totality of what you would consider to be necessary for accident monitoring. This is a subset of that.

MR. CAIN: I am talking about the approach that I think should be used to develop such a set, and I have applied it to an example, an important example, in fact, we think the most important example of all the emergency display facilities that have come down the road since TMI.

MR. WRENZINGER: But the instruments necessary to monitor the course of an accident would be this set and some others.

MR. CAIN: Yes. I can talk to you about that if you want, but right now I wanted to -- it is not the parameters; it is the process you use to get there. That is what I am trying to talk about.

MR. KERR: Okay. Continue. You might talk about this slide, if you like.

MR. CAIN: Would you like to talk about this? This is the end product, and we have chosen to break up the parameters or categorize them in accordance with safety functions because we think that the operator is primarily concerned with the accomplishment of safety functions. He is concerned about radioactive barriers, but the safety function should be and is his correct focus.

So what we have is a repeat. Some of you that have handouts can notice there is an asterisk after a number of these parameters. These are the ones that did become candidate -- well, they were the end product. They did satisfy the selection criteria. And they, in turn, are shown on this slide here. It is just a repeat of that.

MR. ZUDANS: Here you have under 2.1, inventory control, yet those four items listed, how would they control inventory?

MR. CAIN: Say you were pressurized. Let's say that you had to pressurize the water level, not too bad when you are pressurized.

MR. ZUDANS: When I am pressurized, yes.

MR. CAIN: When you are not pressurized, we can worry about -- what I prefer to worry about is the core exit temperature. It is a very reliable indicator that the core is covered when you see the absence of -- you don't have superheat, in other words. I think in a PWR, it is an extremely useful parameter for monitoring that function.

MR. ZUDANS: That means that really you are monitoring the actual core cooling as you --

MR. CAIN: I think that doing a best estimate, state of the art analysis, least means square estimate and all this good sort of thing on reactor coolant inventory is a useful exercise. We are entertaining some proposals on that. It isn't the state of the art today.

MR. ZUDANS: A good parameter to think about.

DR. KERR: Are there other questions? Is it related to this slide? I want to try to get through this slide before we get to general questions. Okay.

MR. LIPINSKI: Why aren't exit core TCs asterisked?

MR. CAIN: It should have been. That is an oversight. It definitely should. I think it should have satisfied the selection criteria.

SPEAKER: It did.

MR. CAIN: Yes, it does. Remember there are "and's" and "or's" there, and it doesn't have to satisfy all of them.

MR. KERR: Mr. Moeller.

MR. MOELLER: You have this slide under 2.1(b). You have combined the hot leg temperature and the core exit temperature. Do you mean, therefore, that either provides adequate information?

MR. CAIN: No, I don't mean that.

MR. MOELLER: Are you saying that either one would satisfy what you --

MR. CAIN: For plants that have them -- and I recognize that not all plants have core exit thermocouples, for plants that have them it is not a bad instrument at all. I am basing my comment primarily on the experience of Three Mile Island where, although it was not routinely read out, continuously read out, if it had been read out and indicated to the operators, it may have saved a lot of grief, and it certainly would have saved us a lot of grief in trying to find out what happened there.

So I am a strong believer, in plants that have them, in using them. However, it is true that if you produce a situation where your core is beginning to uncover, you see superheat and hot legs. That was also observed at Three Mile Island very early in the accident. As soon as they turned the pumps off, within a few minutes you got super heat, but it was missed by people who were at the scene. So it isn't bad.

MR. ZUDANS: There are a number of parameters in your initial set. Might I duplicate that? How is that eliminated by these criteria that you have?

MR. CAIN: I don't want to sound trivial, but you got a little ahead. Do you want to handle that? Okay.

MR. COLEY: The Safety Parameter Display System is one element of all the emergency facilities that we have been working with the NRC in defining, and we are defining the functions for that Safety Parameter Display System. Whether or not these would duplicate what is there is determined by the ultimate definition of a function in the Safety Parameter Display System. So that -- I understand draft NUREG 696 is being released.

MR. ZUDANS: I guess I must not have conveyed my question. You answered something else. You had parameter selection criteria. You had listed sev n items there, right?

MR. CAIN: Yes.

MR. ZUDANS: In those items there is no such thing as non-duplicates.

MR. CAIN: Do you mean like more than one TC?

MR. ZUDANS: Like hot leg temperature and core exit temperature

MR. CAIN: Rather than 50 core exit temperatures.

MR. ZUDANS: Or it could be 50 core exit temperatures, too, because they all would satisfy the same seven criteria. So you must have mentally or by judgment eliminated what you consider to be a duplicate information.

MR. CAIN: Ther is only one case where that happened. It was eliminated but for a different reason. The one we did eliminate -- I will give you an example -- is containment temperature, as opposed to containment pressure. If you look through, you see it satisfies everything except reliable. That is sort of a judgment call. Containment temperature tells you that you have got energetic release in the containment, as can pressure. So you can say, yes, they are duplicate. But the reason we eliminated is not for the reason it was duplicated, but because a containment temperature in one place does not give you a representative indication of what is going on unless you are very lucky in where you are located.

So, as a judgment call between whether it is reliable or whether it is not reliable, we decided not to include it. So that does happen. But there was no explicit attempt to eliminate duplication. If it satisfied all the criteria, it is in.

MR. KERR: Mr. Lipinski.

MR. LIPINSKI: Could we go back to your selection matrix?

MR. CAIN: Okay.

MR. KERR: Just a minute. I want to see if we can get through this slide, unless the selection matrix is necessary for you to understand this slide.

MR. LIPINSKI: It is only with respect to the elimination process as to how he got here based on this matrix.

MR. CAIN: There is not much to this slide to indicate, except that we have what we feel is the list, and I strongly feel, obviously, but nevertheless, the list for PWRs to use as a Safety Parameter Display System data set.

MR. LIPINSKI: That is the minimum set, which means it is sufficient --

MR. CAIN: To meet the objectives, to meet the functional requirements of the Safety Parameter Display

System. I am saying you could do this for any safety facility.

MR. KERR: Okay. Now Mr. --

MR. LIPINSKI: I don't agree with that until I have my discussion on the selection matrix.

MR. KERR: Mr. Lipinski wants to see the matrix.

MR. LIPINSKI: Now, based on your Boolean formula, failure to put an x in the first four columns rejects selection.

MR. CAIN: It would be the first four.

MR. LIPINSKI: Yes, the first four. So now if I run down the first column for detection, I find a lot of x's missing. Let's take RHR flow. Why is detection not an entry?

MR. CAIN: It is a secondary indicator, but if you were not removing residual heat --

MR. LIPINSKI: You have got some criteria in your mind, according to your discussion, that you are trying to satisfy, and you are looking at RHR flow as to whether it is satisfying for detection, correct? What criteria --

MR. CAIN: RHR flow would be sort of a diagnosis function, okay?

MR. LIPINSKI: Of what condition?

MR. CAIN: Inadequate heat removal.

MR. LIPINSKI: Okay, but you elect not to enter an x that flow -- if I do not have my auxiliary feedwater flow and my steam generators are nonfunctional, I must remove residual heat.

MR. CAIN: That's right.

MR. LIPINSKI: How do I determine whether I am removing residual heat?

MR. CAIN: How about core temperature?

MR. LIPINSKI: So you are going to settle for a single measurement without redundancy, which gets to the earlier question, or diversity.

MR. CAIN: Well, there is diversity. I cannot quantify, give you a number which tells you how much diversity there is in it. In a control room situation where you are monitoring accidents, this isn't the universe. If you put too many indicators in, leading indicator, secondary indicator and every other indicator, you get to an enormous number of parameters.

MR. LIPINSKI: The leading indicator is another column, but the earlier question you were asked was did you eliminate any of these based on diversity, okay? So already you have made a decision not to enter RHR flow.

MR. CAIN: That is correct, yes.

MR. LIPINSKI: So somewhere you are mentally exercising diversity and eliminating entries in that "D" column.

MR. CAIN: No, I am exercising detection, not diversity.

MR. LIPINSKI: I'm sorry, detection. But you are eliminating the detection based on a diversity decision. You told me that on RHR flow, temperature was your first variable, therefore you did not enter the x for RHR flow, because it was diverse.

MR. CAIN: As you move away from the center of the plant, which is the core, you get less and less immediately attached to the causal problem. You should center the action at the core and removal of the heat there. You begin to accommodate in a safety panel all of the subsystems that support the central focus of the attention, which is the core. You are getting into a diagnostic situation, not a detection situation.

MR. COLEY: Excuse me. Dave, the detection column listed here has to deal with the detection of those major functions on this one panel, which is the purpose of that panel.

MR. LIPINSKI: But I don't know what your functions are because you have not given me the equivalent list.

MR. COLEY: Those functions are by the Roman numerals: reactivity control core cooling, cooling system integrity, containment integrity and radioactivity release.

Those are the functions or those are the areas we were trying to detect. Now, that is the reason RHR flow does not appear there, because we are limiting the scope. This panel is defined, the function is defined as to be an overall safety status indication of the plant, and for that reason it is not listed as detection.

Now, as we get into this same analysis in the control room, RHR flow will be there because we are trying to perform different functions, one of which is diagnosis.

MR. LIPINSKI: But under heat transfer paths, you have got the steam generator water level, pressure, feedwater flow, main feedwater flow listed. Without any of those fuctioning, I don't have the equivalent with respect to RHR.

MR. CAIN: I can tell you why it shows up there. It is not because of the heat transfer path. This is a grouping for operator understanding, not a grouping to provide rationales why. As it turns out, those levels are leading indicators. If you go through the accident sequence, you have got to have that as a leading indicator. It is connected to the heat removal function, but it turns out to be a leading indicator in the accident sequence, and that is why it is there and RHR is not there.

MR. LIPINSKI: Let's continue down the column. RHR radiation monitor. You do not have an entry for the ejection on radiation.

MR. CAIN: Let's see. Go back here. There are more parameters than that, too, by the way.

MR. LIPINSKI: It is down in the second group, starting down in that last group after main -- all right.

MR. CAIN: RHR radiation monitoring.

SPEAKER: RCS.

MR. CAIN: RCS?

MR. LIPINSKI: RHR. He has got RHR radiation monitoring.

MR. CAIN: It is RHR.

MR. LIPINSKI: With no entry for detection.

MR. CAIN: That is right.

MR. LIPINSKI: Okay. Under what condition is this to be used and why you didn't enter under detection. What is the thought process?

MR. CAIN: The thought process there is that, first of all, in the case of an RHR radiation monitoring function, you would have detected in a gross problem radiation either from the station vent, main exhaust, you would have detected that the air condenser --

MR. LIPINSKI: Hold it. We may have our steam generators totally shut off under these conditions, and the RHR system functioning. TMI almost got there when they had to shut off their steam generators because they thought they had a leak. So if RHR is the only functioning circulating system, without going to feed and bleed, what do we have?

MR. CAIN: As far as detection?

MR. LIPINSKI: Yes, radiation and the primary coolant.

MR. CAIN: I think that as far as the -- that would be a breach of one of the principal barriers --

MR. LIPINSKI: Yes, the fuel barrier, right.

MR. CAIN: -- which would be cladding. I think that in order to breach the cladding you would have to -- I guess you could have a severe mechanical shock to the fuel, but you would probably have to overheat it. I think that you would probably overheat it. I wouldn't be surprised if you would see that.

MR. LIPINSKI: But you have eliminated this as one of the prime measurements.

MR. CAIN: Overheating the fuel?

MR. LIPINSKI: No, being able to measure radioactivity in the primary coolant with the steam generator system shut off.

MR. CAIN: The path to failing fuel requires overheating it.

MR. LIPINSKI: Okay.

MR. CAIN: If the operator gets to the problem where he hasn't detected the problem because he has missed T hot or core exit temperature being hot, then the Safety Parameter Display System has failed to serve its purpose. I will tell you, you can get into a judgment call. Rather than that, you could postulate -- I think there are going to be gross radiation detectors on primary system loops. Rather than RHR, just a gross radiation detection. You might be able to make an argument for that. In this case I think it is too restrictive.

MR. KERR: We have now spent an hour on one-quarter of a 45-minute presentation. I am going to reverse my decision, Bill. I think we probably are going to have to go beyond 5 o'clock because it is not fair to get your people down here, but we do have to make some sort of progress on this presentation.

I think at least you have given us some notes so we have the essence of the approach, whether we agree with it in detail or not. Are there other questions or comments?

MR. MINNERS: WASH-1400 does not have all accident sequences and it doesn't purport to. It only has those sequences that go to core melt.

MR. KERR: So your question is?

MR. MINNERS: How do you pick up the other accident sequences such as flow blockage? How would you pick up a flow blockage?

MR. CAIN: I'm glad you asked that because I forgot to say it. You can go down the road and tie your fortune and your future to pre-analyzed sequences, and you can just do that to your heart's content. But chances are, the next accident will be the one that wasn't analyzed. We tried to cover that in two different ways, and I think everybody else has, too, including R.G. 1.97. We covered that by trying to focus on function. That was one of the other indicators. And the other is radioactive barrier. You don't want to go down too far in analyzing every conceivable accident sequence. It's not productive.

MR. KERR: You only want to analyze the ones that are going to happen. I agree.

(Laughter.)

MR. COLEY: Dr. Kerr, in the interest of time, since we are running considerably longer, rather than go into the BWR parameter list, a similar exercise for the parameter list will go into the last part of our presentation.

One point I'd like to make about the selection process;

we concur that it is subjective, that you have to make judgments. But I don't think it's possible for any of us to arrive at any list without any making any judgments. I think one of the things that gives us a great deal of confidence in this approach is the fact that within a diverse industry group like AIF, we've been able to take this methodology, to look at these parameters and come to agreement on these parameter lists in a very short period of time. And the reason we think this is a better approach to defining the parameters you need is because it does take into account the function you're trying to accomplish, the need and the use for the information, and factors in human factors. That is, keeping the list down to a minimum.

Now, as part of our work, our extended effort on this, of course, human factors will be greatly considered in defining the way and manner that you display this information in the safety parameter display system. We feel that applying this methodology first to this system, then to the control room and to the other emergency facilities will give us a correct Reg Guide 1.97.

For the last part of our presentation, Xavier Polanski will give you some very specific areas or general areas, I guess, of disagreement or problems that we see with R.G. 1.97 that we think this methodology answers or ameliorates.

MR. POLANSKI: My name is Xavier Polanski, I work for Commonwealth Edison Company at Zion Nuclear Station. I am here today as a member of the AIF Subcommittee on Accident Monitoring Instrumentation which was formed a few years ago to work with the NRC on this Reg Guide. The AIF submitted their detailed comments on this Reg Guide in February, copies were sent to the Chairman of ACRS. Those comments are numerous but they revolve around a few central issues that I would just like to review.

The first issue is multiplicity of instruments to do the same job. This is the first page from Table 2, and we talked about this earlier, but it's our feeling that you don't need four separate instruments to monitor reactivity control; four separate instruments to monitor core cooling. That's just too many and we get into the problem of information overload and that sort of thing. And this is, indeed, at variance with the Reg Guide's own espousal of wanting to minimize the number of instruments used for accident monitoring.

MR. KERR: Excuse me, Mr. Polanski, how do you reach that conclusion that you don't need four? Do you do that with a matrix or is judgment?

MR. POLANSKI: It's judgment.

MR. KERR: And your judgment was based on what sort of reliability, or did you use any quantitative criteria?

MR. POLANSKI: I can't say that we did a mechanical or mathematical evaluation, but it's the general feeling of industry that neutron flux is the best indicator of reactivity control, and that one doesn't need all the parameters in addition. If four isn't enough, maybe we need six or seven.

MR. KERR: But how does industry reach the conclusion that one is enough?

MR. POLANSKI: Because --

MR. KERR: What sort of criteria do you have for knowing when you've got enough?

MR. POLANSKI: The main criterion, I suppose, is single failure criterion coupled with a feeling of how important the measurement is; whether that should be applied.

MR. KERR: Well, the single failure criterion, if neutron flux failed, you wouldn't have anything left, so that does not satisfy the single failure criterion.

MR. POLANSKI: Okay, but two of those would satisfy the single failure criterion; you wouldn't need four.

MR. KERR: I misunderstood. I thought you said one was enough.

MR. POLANSKI: We always get into an argument about how important is diversity and is it better to have a very good instrument you can rely on or two diverse ones, and --

MR. KERR: Mr. Polanski, I am not a believer in diversity, but I am a believer in reliability, and I am trying to find out whether you used any reliability criterion in trying to arrive at your decision, and I haven't heard any yet.

MR. POLANSKI: I guess I can't speak for the commentors on the Guide because I don't know what went on in their minds, but I'm saying it's just a general conclusion.

MR. KERR: Okay.

MR. WRENZINGER: Dr. Kerr, I wonder if I might ask a question which comes to mind having just heard the previous discussion. We heard, I think, a rationale that I think dignified, if I can use the phrase, a qualitative judgment on what is needed for at least one aspect of accident monitoring. Did you use that particular methodology to come with a conclusion that four was too many?

MR. POLANSKI: No, I did not. What I'm presenting is a summary of our comments in February, which were based on comments coming from industry. The work that's been done on the safety parameter display system is since then, and the two are really independent here.

MR. WRENZINGER: Has the work been done to determine what is enough?

MR. POLANSKI: Not yet for the control room for accident monitoring instrumentation, but it's the point of our talk today to say that it should be done, following a system similar to what Dave just described, that they used strictly for the SPDS.

MR. WRENZINGER: So what you're saying is you don't know what's enough but four is too many.

MR. POLANSKI: That's right.

MR. LIPINSKI: Let me inject one question. It was made by one of the previous presentations, and you're making the point now, but are you under the assumption that an operator has to digest all this information instantaneously? We just heard a presentation where a certain selection will be made in order to reduce the amount of information that he will look at, at any one time, to get a snapshot of the condition of the plant. And when you look at reactivity up there, neutron flux being a prime parameter, he'll only have to look at the backup parameters if he thinks there's some uncertainty about neutron flux.

MR. POLANSKI: That's right. Of course, the fact of the matter is that existing plants have backup indicators like in control rod position. But I think we're probably dwelling too much on one single point in the discussion. We wish to point out that you seem to have a multiplicity of instruments in the Reg Guide, and our important point is that they haven't really been justified.

Let me just talk about some of our concerns and then get to the major point.

MR. KERR: If I may use legalese, we will permit you to stipulate that there are a lot of instruments required in 1.97.

(Laughter.)

MR. LIPINSKI: You won't have the answer but I'll ask the question and let you think about it. How many of these instruments do you already have in Zion and how many will you have to add?

MR. POLANSKI: I haven't done the arithmetic, and the reason the question is very hard to answer is because at the same time you ask whether you have the instruments, you have to ask in what numbers and to what qualification levels.

MR. ZUDANS: I don't think that matters; that's an economics issue.

MR. POLANSKI: Okay. Another one is ranges, and if you ask me -- if I look at the Reg Guide list, it's dramatic because of the range changes and the diversity of requirements and that sort of thing. I can't tell you the number right offhand.

MR. CATTON: For many of them, the range change is the device you read rather than the transducer, though, isn't it?

MR. POLANSKI: No, in most cases it's both.

MR. KERR: Why don't we let the presentation proceed.

MR. POLANSKI: The second issue that we commented on in February is that questionable instruments are specified in the Regulatory Guide. We've talked already about coolant flow and the doubts the industry has expressed about its meaning, using the lower range to try to detect natural circulation and the like. The thermocouples are a controversial instrument, and we feel that public safety shouldn't be dependent on questionable instruments; that a solution has to be found and justified that doesn't depend on these questionable devices.

A third issue is that the qualification requirements in the Reg Guide are non-systematic and confusing. In another presentation we were looking at this Table 1 from the Reg Guide. We have six qualification categories. The requirements per category vary; some require environmental qualifications, others require continuous display and this sort of thing. There's no rationale provided for this sort. Why is something a Category 4 and not a Category 3, and why should it be a Category 4 or Category 3? There's nothing provided; all we have here is a table that we really don't understand. It's just a matrix without a rationale.

Our fourth issue is that many of the ranges are poorly justified, and the extended ranges are inconsistent with another principle espoused in the Reg Guide, which is using instruments in an accident that you use during normal plant operation.

A fifth issue is that any reading of the public comments shows this, and that's that the Reg Guide in its current form is confusing. It's clear from the commentors that people don't understand why instruments are included, where and why the Guide departs from traditional approaches to accident monitoring instrumentation, and this state of affairs just makes the Reg Guide very difficult to use.

Another issue is that the Guide is incomplete. For example, the Guide says that this information provided by the instruments listed should be for the plant operating organization, and there's no guidance at all provided as to where these readouts are supposed to be and how they're supposed to be used. But our most important comments and our most important objection to the Reg Guide in its current form is that a systematic, logical approach has not been taken to developing the list and requirements. The Reg Guide does not present a systematic technical justification for the list of instruments nor for the qualification requirements. Since that rationale has not been presented, it's not been properly discussed by industry, by the public, and many comments and much of the confusion about the Reg Guide results from the absence of this justification. It's only by having a systematic justification or rationale for the instruments and for the qualification requirements that we can be sure we havethe correct list of instruments and the correct requirements. And following a methodology similar to that presented by Dave Cain just before me is a way to do this, and we propose that this be done as a way of coming up with a correct instrument list. That the Reg Guide not be issued now, but that this rationale be developed so we're sure we have a correct list.

MR. KERR: Have you thought about how long the process that you propose might take before it produces an acceptable list?

MR. COLEY: I don't know that we have an end date for what we're doing because a great deal of the effort depends on the ultimate agreement on the functional definition for these emergency facilities. What we've seen thus far in the space of a month is we in industry in a pretty diverse group have been able to come to agreement on parameter lists for a boiling water reactor and a pressurized water reactor for this one emergency facility.

MR. KERR: Would you guess it might take a year or a month, 10 years?

MR. COLEY: I would hazard a guess that we could probably have the more timely and safety-effective areas implemented in the plant much, much faster than we can with the proposed schedule in Reg Guide 1.97. In fact, even considering 1.97 and its end date, there's still many, many questions to be answered. For instance, where does the information go, what is it used for, how is it displayed, and quite frankly, with some of the qualification requirements there is a real industry problem with even being able to get some of that equipment. I don't think we can.

I believe June 1982 is the date that Reg Guide 1.97 specifies. Oh, 1983. I question that we can do that as an industry

MR. HINTZE: That date was collaborated by AIF.

MR. KERR: "Plants currently operating are scheduled... ....should meet the provision ....to becompleted by January 1, while the balance of their requirements would be completed by June 1983."

MR. COLEY: I indicated we don't have an end date for what this whole process will do. In fact, to this point, we have developed lists that we agree with as industry for this one function in the control room.

In discussion of our effort yesterday, we agreed that we thought that within the space of two months we could define the list for the control room, what was needed in the control room of the station to supplement this safety parameter display system. From that point, of course, we would move to performing the same type of analysis and exercise for the Technical Support Center, which is probably the next most important area.

MR. ZUDANS: I kind of like the method that you presented, but all your input that David presented is based on a judgment, like all the results in the 1.97 are based on a judgment. I wonder aren't we really pitting one judgment against the other, essentially? It doesn't matter how slick and perfect the analytical process is, the Boolean algebra and all that.

MR. KERR: I don't want to defend either one method or the other, but in a sense what you're saying could also be applied to the fault tree method, and when one builds a fault tree, one is really taking information that exists and putting it in a framework which, in a sense, makes it look like magic but it's a judgment. But the advantage of the system is that it at least formalizes and gives one a framework which one can comprehend better.

If this methodology does that in some fashion better than some other methodology, it probably has something to recommend it. I agree with you, I think it's important to recognize that much of it involves judgment.

MR. ZUDANS: I just wanted to add one more thing, because I like the method, I like to include the criteria so that such things as Walt discussed here can be resolved without saying I decided that. That's not good enough.

MR. CAIN: That's exactly the place where you want to make your changes.

MR. ZUDANS: Right, I agree.

MR. CAIN: Then you don't get into endless arguments about relative importance without any basis.

MR. MINNERS: Mr. Coley, would you care to hazard that if you went through your process, what would be the difference between the end result of your process or Reg Guide 1.97. Would you have half as many instruments, twice as many, the same amount?

MR. COLEY: I really couldn't tell you without a lot more foresight than I have in being able to project I couldn't tell you. But I can tell you this. I think you would come up with a list that does something that Reg Guide 1.97 list doesn't, even if it's exactly the same list. You'd come up with a list that says what the important parameters are and where they ought to be displayed, and would consider the human factors involved in saying what is the best way to display the parameters, even if we ultimately come up with the same list, which is quite possible.

MR. MINNERS: But we could use your method after the fact and make a decision of where to display them.

MR. COLEY: Not at this point in time. Of course, I have not seen the draft NUREG 0696, but as I understand, the position being taken there is that Reg Guide 1.97 is the list for all those facilities and that doesn't provide us --

MR. MINNERS: No, it doesn't tell you where to put 1.97.

MR. HINTZE: It's a list of the measurements and the instrumentation, but not where you display them.

MR. KERR: It seems to me it's going to be difficult to see where the two are coming out. It's certainly clear that they are different at this point, and whether they finally come out at the same point depends on how they are applied.

MR. HINTZE: At what point in this process are you going to come up with what information the operator can use to take action? So far you said this particular first one told him he's in trouble; it doesn't tell him what to do. Where are you going to define the instruments to tell him what to do?

MR. COLEY: Fine. That is the second part of this effort; just a projection on the part of those of us on the subcommittee here yesterday. We felt that within a space of about two months we could have that, which is what the operator needs to do his job, which includes detection, diagnosis, assessment and mitigation.

MR. KERR: I don't want to cut off discussion between the staff and AIF, but I would urge that once in a while the AIF get together with the NRC staff or vice versa at times other than at subcommittee meetings. But with that injunction, you have a question?

MR. WRENZINGER: I understand from the discussion from Mr. Stanley that a national standards committee; namely, the ANS, has come up with approximately I think 20 parameters that they consider necessary. The AIF, on the other hand, I think came up with a number which is similar. Now, whether or not the lists are identical is not the point. I would suspect they're fairly similar but I think what AIF said different than what I heard ANS say -- and they may want to correct me if I heard something incorrectly -- was that the AIF list is considered imcomplete, you have a lot more work to do and the list may well I think you said even perhaps get as large as what's in 1.97. I didn't hear the ANS say that; did I detect some disagreement amongst the national standards committee and the industry group?

MR. COLEY: No, I don't think you did. I think the basis of the ANS effort is to define accident monitoring information. That was their objective. I think our objective is larger than that. We're attempting to define, first of all, the parameters needed in the safety status display system, the control room for detection, diagnosis, mitigation and assessment of an accident, and then those parameters that are needed in another facility, the Tech Support Center.

MR. WRENZINGER: So your scope is very similar, then, to 1.97 which extends much beyond the control room.

MR. COLEY: Yes. The scope of our effort in this methodology I think is consistent with what we understand the intent of Reg Guide 1.97 to be at this point in time. I think certainly the intent of Reg Guide 1.97 has changed significantly over the past few months.

MR. BENANOYA: 1.97?

MR. COLEY: Yes.

MR. BENANOYA: I object to that. It hasn't changed an iota since we first met in July 1979.

MR. COLEY: Let me --

MR. KERR: Gentlemen, this could go on and on, and I urge that you get to know each other and talk to each other.

MR. WRENZINGER: We do know each other, we have talked and these disputes have continued.

MR. KERR: You mean you've asked this same question and gotten the same answer before.

MR. STANLEY: Could I clarify one point? The only thing I can say for the ANS 4.5 list is that it does represent a consensus. The members in industry, 45 people in UPPSCO, are no longer desiring to have a change made. Now, every one of those members would like to have one or two different things. And when you get to a plant-specific case, it could be larger. So ours should be considered an absolute minimum; I don't personally yet consider it fully sufficient.

MR. KERR: Okay. Where are we in the presentation process?

MR. COLEY: I'd just like to summarize, I guess, what our concern with Reg Guide 1.97 if implemented in its present form is that it falls short of defining the use and function of information, how it's used, fails to integrate the very important need of human factors. The other things that concerns us very much, of course, is the fact that Reg Guide 1.97 has been defined as the basis for all of the emergency facilities we're now implementing in nuclear power plants or to implement in the future.

It's our concern that simply stating those parameters belong in all those facilities will probably lessen the effectiveness and usefulness of those facilities. For instance, can we put Reg Guide 1.97 parameters in everywhere, in all of those facilities, or do we put those in those facilities that belong there and support the function we're trying to accomplish.

So we would propose that for developing our concept of a correct Reg Guide 1.97, and again, I think the scope that we have in mind is exactly the same one that Vic espouses for Reg Guide 1.97 --. We differ in that we would like to see that achieved through the systematic development, through a systematic methodology, and we're confident that this approach will give us those important changes in plant safety that we really need at this point in time. And we urge your support of that kind of approach.

MR. KERR: Thank you, Mr. Coley, are there questions or comments? I'm going to declare a ten minute break at this point.

(Short recess.)

Tl 7

MR. KERR: We have scheduled now a presentation from the GE Company and the BWR Owners' Group, and the first name on my list is Dave Waters.

Mr. Waters.

MR. WATERS: Thank you, Dr. Kerr.

I am Dave Waters from Carolina Power and Light Company, representing the BWR Owners' Group. The particular one, and there are many, is one that was formed about a year ago to address post-TMI issues. I will present a portion of our presentation this afternoon, and Mr. Craig Sawyer from General Electric Company will go through also a part of the presentation dealing with some of the analyses and work that we have done, and summarizing the core exit thermocouple discussion which is in this document which I heard referred to by several people as they had read it last night.

I apologize to the staff that we did not get it to them any earlier so they could have time to review it and have comments to us. With that apology, I will go on. Maybe they had a chance this morning.

The purpose of our presentation is to provide BWR comments on Draft 2 of Regulatory Guide 1.97, which we have done in our white paper that we provided to you, and to discuss the technical aspects of core exit temperature measurement requirement, which is one particular item that we have a particular problem with.

You notice in the white paper we had some 13 comments on specific aspects of Tables 3 and 3-A. Rather than discuss the philosophy of the Regulatory Guide, we wish to address just certain portions of it without saying that we do not support the efforts described earlier by ANS and AIF. We do support that.

Just a brief history of comments by the Owners' Group. We did meet as several separate groups of near-term operating license plants in December with the staff, and as operating plant owners in February with the staff to discuss the additional tables that were going to be provided to Regulatory Guide 1.97 and the Revision 2.

We provided these comments, near-term OLs, I believe, and provided their comments in January, and the operating plants provided their comments informally in March to the staff. During that time, at one point an earlier version of Draft 2 did not have core exit thermocouples as a requirement for operating plants. Since then, as you are aware, it is in the current version of Draft 2, but I refer to Mr. Orlotto's forwarding letter of July 7th in which he says that this requirement for core exit thermocouples is still under discussion.

That will be the gist of our presentation today, the reasons why we believe on a technical basis, not on an emotional basis and not necessarily on a cost basis, but on a technical basis, why exit core thermocouples is a marginally useful, if not totally useless, piece of information in a boiling water reactor.

Our concern, as I say, is that the revision to Regulatory Guide 1.97 is, I say, inappropriate now, and I would qualify the use of the word "inappropriate" with the type of discussions that have gone earlier, particularly the AIF discussion, the more orderly approach to the instrumentation lists and the places that they will be provided. That needs to be done before we get into issuance of the regulatory guide at this point in time, we believe.

The second point which we will cover is core exit measurement is not necessary for BWR. We leave the additional specific comments, the 13 additional specific comments on Tables 3 and 3-A for your consideration, not in this meeting.

MR. CATTON: How far down into the core can you track level?

MR. WATERS: Pardon?

MR. CATTON: How far down into the core can you track liquid level?

MR. WATERS: In most of the later BWRs we can track it down to the bottom of the active fuel. In some of the earlier plants, particularly BWR-1s and 2s, level instrumentation does not go that low. So level instrumentation would not go down that far in those particular plants, but in later plants it would.

MR. CATTON: Are your comments, both in this report that we got this morning and what you talked about today, directed towards all of the BWRs or just the one where you can track the level to the bottom?

MR. WATERS: It is directed towards all the BWRs. This implies, of course, that the earlier BWRs, in order to support these comments, would have to install additional level instrumentation.

MR. CATTON: Oh, okay.

MR. WATERS: It is an implication. I don't want to speak for them specifically.

MR. CATTON: Just to make sure I understand, for systems where you can track the level to the bottom of the active core, you feel no need for the thermocouples, the core exit temperatures.

MR. WATERS: That is right.

MR. CATTON: For systems that cannot track it to the bottom of the active core, you feel there may be a need to track it.

MR. WATERS: I'm sorry. I misunderstood your question. No, I don't feel there is a need in any case that -- if you have a BWR that does not track level to the bottom of the active fuel, just putting in four exit thermocouples is not going to solve the problem. Let us get into the technical discussion and I think you will see that more clearly.

MR. CATTON: Okay. I thought I understood.

MR. WATERS: Did I confuse you?

MR. CATTON: Go ahead.

MR. WATERS: Simply, these additional comments that we provided, the 13 additional, reflect unique BWR futures -- features -- futures, maybe, too; provide variable selection criteria because they integrate with the procedure guidelines that the Owners' Group has developed and has provided to the staff for their review and approval. They integrate with NUREG 696 and they focus on key variables. They elimiinate marginal variables, and again, notably core exit temperature measurement for the BWR.

Without any further ado, I will turn it over to Craig Sawyer to go onto the technical discussion. I have one last slide in my package, which I will present after Craig is done, which is a summary of the impact that we believe, from radiation and cost factors for operating plants, operating BWRs and those under construction.

MR. SAWYER: In the writeup which we provided you, we go through a logical development from two sides of the story. First of all, if you wanted to put thermocouples in a BWR, where would you put them? What would be the most practical place to put them? We developed that line of logic. And also from the other side, we looked at it from the point of view of, given a certain event scenario leading to core heatup, core melt, late recovery and potentially some core damage, does it make sense to have thermocouples in interpreting what is going on?

In the time that we have allotted, I chose to cut back going through all the arguments and all the scenarios, and instead concentrate on the scenario for which we can see some utility for thermocouples and concentrate on what it means to have or not have thermocouples under those circumstances.

The first chart I have got here goes in to the requirements per the current version of REG GUIDE 1.97, for the reasons for having core exit temperature measurements for BWRs. That is to indicate the potential for or actual fuel clad breach, and by means of a footnote, to measure the extent and trend of core damage down to the 5 to 10 percent core blockage level, assuming no ECCS is functioning. That is the statement of the REG GUIDE.

The next chart here I want to go into for a moment, and the text does a much better development of this, what variables we already have in the BWR which can indicate cladding breach. First of all, a definition. We believe that cladding breach occurs when there is a combination of high cladding temperature and high hoop stress, and by high temperature we mean somewhere near the rupture temperature of 2200 degrees Fahrenheit, and/or if there is a long time at excessive temperatures such as the order of 1500 degrees Fahrenheit where you can produce significant oxidation of the zirconium cladding and thereby reduce its strength over a longer period of time.

Variables indicative of the breach. We have on BWRs right now high hydrogen level in the containment, high steam line radiation, fission product monitor products in the reactor coolant, containment air and suppression pool water, offgas radiation levels, low water level, which we will go into in great detail in a moment, and complete loss -- knowledge that you have no systems pumping water in -- complete loss of makeup. That's ECCS plus other systems, which we also go into in some more detail.

These currently measured variables, we believe, provide diversity, provide unambiguous indication, and are qualified and tested for accident conditions. So we believe we already have currently measured variables that provide information about the potential for or actual cladding breach.

I am not going to spend much time on this chart because it summarizes the three phases that I want to talk about in a particular scenario for discussion here on the next three charts. There is an error on this chart which I will correct, and I hope you will, too. This should say prior to core uncovery.

The three phases we want to talk about are of situations, no matter how you get there, whether it be by a break or just a stuck open valve and no makeup systems, but some m[illegible]anism that threatens to uncover the core. Prior to core uncovery, the BWR operates saturated. Water level is the key variable. I will go into these in much more detail in a moment.

During the core heatup phase, which is the second phase, we believe, and we have had several discussions with the staff and I think we are in agreement on this point, that there is some utility if water level is below the top of fuel and there is no makeup, in which case you will, in addition to knowing that water level is low, have a secondary indication from thermocouples, which, by the way, could be located under those conditions anywhere, not necessarily at the core exit.

MR. KERR: You say it would be useful under those circumstances. Useful in what sense? That it would give you information --

MR. SAWYER: They would provide another indication to the operator other than those he already has that the core is heating up. He already knows that he has a problem because water level is low. If I may postpone that for a moment, sir, we will into that again on the charts.

MR. KERR: Fine.

MR. SAWYER: I want to make the point that during the core heatup phase, the thermocouples will not provide unambiguous information when core sprays are operating, when there is a two-phase mixture in the upper plen¨m: for example, under certain accident conditions when you have counter-current flow limiting situations which fill the upper plenum with water, or when the water level is above the core. The third phase is during recovery phase.

In a general sense, we are not worried in the BWR about natural circulation. We are not worried about bubbles and inability to get enough water circulating to remove the decay heat from the core as long as the core is covered in a bulk sense. We require the operators, through the guidelines that we have issued and the staff is reviewing right now, to depressurize the reactor if necessary to provide enough injection systems and to maintain the water level. That is his primary function during emergencies.

We have done studies that show that once water level is recovered, presuming that it ever uncovered, in a bulk sense, that there is no mechanism that we can come up with that wi'l cause a propagation should there be local damage, and I will go into that in some more detail in a moment. And it is primarily because there are numerous paths for flow on individual bundles. On the BWR, every single bundle is channeled and every bundle has its own thermohydraulic flow path for removing its heat.

That same channel which does that thermohydraulic interaction to remove the heat from a bundle also provides the necessary separation to prevent propagation. During the recovery phase, we believe thermocouples will not indicate it above saturated in any event.

I will now go on to the next three charts. We have looked at a large number of scenarios in the last year since TMI, but basically they all come down to the same thing. The only way in which you can put BWR in trouble is if you withdraw makeup systems and don't, either in a slow sense as in loss of feedwater events or a stuck open valve or small breaks, water level is decreasing, threatening to reach the top of the fuel and there is no makeup action going on, either automatically or manually by the operator to restore water level.

The large break is a special scenario because the core is uncovered for a short period of time and then flooded with water, and as in all risk analyses, the greatest risk for the BWR comes from these more likely events, small breaks and degraded transients.

So let me take a typical example which we have run through. Others are very similar to this. There are three phases. The first phase I am talking about here is core covered, and what I have shown on the left for all three of these charts is the water level with the top of fuel and bottom of fuel indicated, referenced to an arbitrary zero plane. Water level reference to the left. Fuel temperature for an average bundle, and thermocouples located in the practical location that we could put them into a core, which would be in the bypass zone in the LPRM strings for BWRs.

During the first phase, as I mentioned before, the core is covered, the reactor is running saturated, and there is no additional information that could come from having thermocouples, whether they be located above the core or in the core. The temperature scale I have indicated out to the right for the temperature.

First the operator perceives a low level SCRAM, which is enunciated in the control room. At a lower water level, high pressure ECCS, it is supposed to automatically turn on. At yet a lower level, the low pressure ECCS will turn on, and for some events, they will get an automatic depressurization with an additional delay of 120 seconds, and/or for operator guidelines the operator is instructed to depressurize at that point to insure that when the low pressure pumps are finally running at the rated speed, the reactor is at a pressure which will permit the injection flow to occur.

In a typical scenario, this is what operator guidelines have prescribed. An operator might actually be taking action before low pressure ECCS on level has occurred if he confirms to himself that in fact he has no high pressure injection. We have prescribed the latest possible time, which I indicated there, that he should take that action.

During the second phase, which is the time in which you can get damage in the core, I have shown here a continuation of that scenario. For convenience, we presumed fuel temperature calculated at the midplane and fuel temperature measured by means of a thermocouple located at the midplane.

We could have done a similar analysis for fuel temperature at the core exit, but it wasn't as interesting because the midplane is more typical of what the hot spot in a reactor is going to be. So it would start sooner. You would get a slightly earlier indication, but it would cross over and not get too high a temperature.

What we have shown here is that during this period of time you have a general low water level in the reactor; there is still steam cooling going on so that the temperatures do not approach 2200 degrees until the water level gets extremely low in the core. For the sake of argument we have presumed that, for example, when the fuel temperature at the midplane exceeds about 1500 degrees, you will begin to get detectable hydrogen production, and on that time scale have shown approximately when you would see significant hydrogen production and be able to detect fission products in the wetwell airspace should this scenario continue.

For this case, if there is no ECCS systems on, the bypass thermocouples will, in fact, be tracking with some temperature delay of about 100 to 200 degrees what is going on in the fuel. However, as indicated in the summary chart which I have for you, if there is a core spray operating, even at only 5 percent or so of its rated capacity, it is sufficient to remove all super heat in the upper plenum. So with the core spray running even only partially successful, the bypass thermocouple under those circumstances would be following this path, the original path.

So, there is a case in which the fact that the thermocouple is tracking or not tracking depends upon the operation of the ECCS system.

MR. WRENZINGER: A question.

MR. SAWYER: yes.

MR. WRENZINGER: Does that depend on the location of the thermocouple?

MR. SAWYER: No, it wouldn t depend on the location of the thermocouple.

MR. ZUDANS: Did you have a core spray parameter that will indicate whether it is in or not?

MR. SAWYER: The core spray? All the ECCS systems have flow and head that will allow you to confirm that in fact you are getting the injection, and injection valve position, too.

During the third phase, what was shown here, for the sake of argument, is suppose that I don't go to a full core melt but get a delayed makeup. Here we have postulated one of the ECCS systems on the line late in the scenario, with the reactor depressurized, and get a rapid reflood from the core sprays and/or core injections systems, which will immediately drive the bypass thermocouples and any unblocked fuel channels back down to essentially saturation temperature again.

For the sake of argument, I show here a channel 100 percent blocked. We have done analyses that show that you have to have the channels under these circumstances more than 99 percent of the cross-sectional area of the channel blocked in order for the channel to continue heating up. So the circumstances under which you are trying to get this information are extremely narrow in that regard.

For all channels that aren't blocked, of course, they will also follow this pathway down, essentially riding right on top of the bypass thermocouples when you essentially quench the reactor again. So once again there is a dichotomy here where there is a choice, as there was here, where what is going on with the thermocouple is not necessarily what is going on with the core.

Pretty much for all other scenarios that we have generated, because the reactor stays essentially saturated, there really is no additional information that we feel you can learn from thermocouples, whether they be located near or in the core. So this is the worst one. And I think, as I said before, we have always agreed with the staff's position that for this time period here with no core sprays operating, thermocouples will provide information in addition to the fact that the operator already knows he has low water level and he already, by design and by our operator guidelines, if he has water level low or if for any reason he is not sure where water level is, is supposed to depressurize and flood the reactor as his rules.

MR. WRENZINGER: A question on ECCS initiation. What is the parameter that is used to initiate ECCS?

MR. SAWYER: Low water level and/or high drywell pressure.

MR. WRENZINGER: So if you just simply have a low water level, no high drywell pressure --

MR. SAWYER: You will get ECCS for that one. It is and/or.

MR. WRENZINGER: No, I say where you don't have --

MR. SAWYER: If you don't have low water level --

MR. WRENZINGER: And you don't have --

MR. SAWYER: High drywell pressure --

MR. WRENZINGER: Then you --

MR. SAWYER: You do not get automatic ECCS.

MR. WRENZINGER: Okay. Now, if for some reason the low water level instrumentation is broken and you actually do have low water level, how would you get ECCS initiation?

MR. SAWYER: That is a very good question, in fact one which we have discussed wit' the staff because it has never been clear to us whether this requirement, particularly when discussion got around to measuring local damage as opposed to just global effects such as my water level instrumentation has all common mode failed, what the reason is for the thermocouple.

A typical BWR operating plant has two, and the later ones have four level measuring devices attached to the reactor. On those are hung a number of instruments that are powered by safety grade, and in some cases nonsafety grade power, depending upon the function. So you would have to postulate pretty much a common mode failure of a lot of instrumentation in order to not have the water level instrumentation.

MR. WRENZINGER: Aren't they all the same kind of BP cells?

MR. SAWYER: Yes. That's what I say, it has to be a common mode failure.

MR. WRENZINGER: So one common mode failure could cause all the water level instrumentation to be failed.

MR. SAWYER: What is that common mode?

MR. WRENZINGER: Some manufacturing defect, perhaps.

MR. SAWYER: Yes, if they all failed at exactly the same time during the event.

MR. KERR: Common mode failure by definition is a failure that causes everything to fail simultaneously, so all you have to do is say common mode failure and that does it.

MR. SAWYER: It is hard for me to postulate that all the BP cells made by a manufacturer would decide to fail during this particular event.

MR. KERR: You don't understand common mode failures. They fail things simultaneously and --

MR. SAWYER: I know how it is done in an analysis, but I am just talking about what I think would happen. But as I said, if you want to apply a diversity argument, then we would say that if you really don't believe that the water level instrumentation that we have has adequate protection against common mode failure, it is not necessary to have 50 core exit thermocouples.

MR. KERR: I am not sure I understand the drift of this conversation. Are you suggesting that the reason you want thermocouples is to trigger an ECCS?

MR. SAWYER: He was worried, I think, that the ECCS functions, as well as many other automatic safety functions on a BWR, are triggered by water level.

MR. WRENZINGER: And then the point he made earlier was that if the automatic system didn't operate, the operator would actuate it. If the operator is going to use the same information, how is he going to know to actuate it? And therefore, how is the water going to be injected?

MR. SAWYER: You have to understand that the instrumentation which does fire off the ECCS, or the operator, for that matter, in decisionmaking process is redundant or is not the same. The failure of one cell, for example, will not stop that process.

MR. WRENZINGER: But again, if we talk about common mode failures, the instrumentation --

MR. KERR: The nice thing about common mode failure is it gets you, just like that.

MR. SAWYER: Okay.

MR. WRENZINGER: It kills both automatic and manual.

MR. SAWYER: If that is the requirement, which is not what I believe you have said in the REG GUIDE, but if that is the requirement, it certainly can be met a lot easier than putting in 50 thermocouples to measure core exit temperature.

MR. KERR: Common mode failure can get you there, too. But I would think that less than 50 might be required, I agree.

MR. CATTON: For your older BWRs, once your level gets down the top of the core, you are going to be in the blind. Right?

MR. SAWYER: That's correct, on a couple of the older BWRs, yes, that is right.

MR. CATTON: Are you going to recommend anything for that or do you figure that that's okay.

MR. SAWYER: I happen to know that some of those plants are already taking action to extend their level range. This was intended to be a generic discussion as opposed to a particular application to a particular BWR.

MR. CATTON: I understand. I can kind of buy your arguments on you can track the water level through the whole core.

MR. SAWYER: Yes.

MR. CATTON: But for situations where you can't track the water level, I don't know that I would buy the arguments about the exit thermocouples, or exit temperatures.

MR. SAWYER: I understand what you are saying. I am not personally in a position to recommend what an older BWR should or should not do. That discussion really should be made with the utility.

MR. CATTON: I understand.

End 1

MR. WATERS: Just to wrap up and summarize our discussion, our presentation today, I would like to give you some feel for what we believe are the costs in terms of dollars and radiation dosage associated with the installation of in-core thermocouples in the power range monitor position in those strings.

As we said before, this is what we feel is the most feasible or the only feasible place to install them. In looking at the dollars, this is a summary of what is in the handout or the white paper, we see that about $400,000 per plant for one that we call the forward fit, one that is not in operation as of yet, and $600,000 per plant for an operating plant which would be a backfit situation. And of course you can do the arithmetic, and that comes out to $28 million for the 58 plants under consideration, all the operating and all the ones that are currently intended to be built.

The numbers were arrived at looking at how much it would cost to run so much wire through several penetrations if we have the penetrations available, running from underneath the reactor vessel out through the drywell, running to the control room and providing the recording. Doing the engineering for that, doing the hanger engineering, one estimate I believe was something like 70 or 80 hangers within the drywell for the conduits and so forth that would be required. This may be a factor of two or three either way.

The main thing is to give you an appreciation for the cost and say it is not extraordinary. It is high, but it is only a factor of two or three higher than what the staff came up with in their cost value assessment. I think they used an average of like $200,000 per instrument to modify it. And this would be on the order of two to three times that.

So yes, the cost is substantial, but it is not the basis of our argument, as I said earlier.

Cost in terms of radiation dose, the maintenance, the annual radiation dose for maintenance is the 8 man rem that we use there, is an average of the numbers that we have in the white paper. We had a range of from 2 to 15 man rem for all of the handling of the control rod drives and the LPRM strings, and the 8 is simply an average of that. That comes out to 18,500 man rem over a 40-year life. Of course that is not definitively accurate because some of the plants are operating plants, but it gives you an idea of the arithmetic.

The installation, that was one portion that we did not cover specifically in the white paper. So I would refer you to this. We feel that it would be 100 man rem per operating plant. This would be a backfit item, so this would only occur on 25 plants. So the summary there is 21,000 man rem for maintaining and installing the 40 to 50, essentially 40 thermocouples if you installed one in every LPRM string.

In summary, we feel on a technical basis that the usefulness by core exit thermocouples, in this sense putting them in the LPRM strings, is limited, extremely limited and is not worth putting them in, I feel personally, even if they were free. If we could get someone to put them in free and not pay that $600,000, I am not sure I would want them in there because they might provide a source of confusion to the operator rather than provide him useful information that he could rely upon and know that he had to -- that he could make the right decision once he had that piece of information.

I refer again to the slide, or the series of slides that Craig presented.

MR. KERR: Are there no thermocouples in existing BWR's?

MR. SAWYER: There are one or two BWR's that have thermocouples located external to the vessel, but they were put there not for this purpose but for the purpose of quantifying things like irradiation damage --

MR. KERR: No, I didn't mean external to the vessel. I mean within the fuel region.

MR. SAWYER: No, there aren't.

MR. KERR: There aren't?

MR. SAWYER: No.

MR. WATERS: And again just to, rather than 40 thermocouples or some number of that magnitude, Craig also presented one thermocouple for one particular accident sequence, which is a no-makeup sequence, would be just as useful as the 40 distributed throughout.

And another problem that we have, a final problem, we have difficulty as a result justifying their use and the use that the operator would make of them. If this becomes a requirement we will be asked as we have experienced in past practice to justify them and to show how they would be used, and that, we see, is something that is kind of like the promise that can't be delivered. That was discussed this morning.

MR. KERR: You have discussed this some with the NRC staff, I take it?

MR. WATERS: Yes, we discussed this with the staff about two or three weeks ago, I think shortly after the Reg Guide was sent to the ACRS. In fact, I believe it was a month ago, wasn't it, Jack, I believe on the 10th of July, and we were given the challenge at that time to go away and do work to provide a technical, a more technical basis, do our homework a little bit better, and we were also told that our best opportunity would be to present this type of information to the ACRS for their consideration of whether core exit thermocouples were necessary for BWR's or not.

MR. KERR: Well, the staff must have had some reason that they thought they would be useful, that you did find their arguments persuasive?

MR. WATERS: No, we did not, especially, more so, now that we have gone back and looked at the analyses that have been done in the last month. We have done a lot of additional work. We have looked at some of the scenarios which were discussed in our meeting of a month ago and have resulted in the information that Craig presented, and we stand by our argument and we feel that we have a better technical basis than we had a month ago to remain convinced that installing these is unwarranted and we believe unreasonable.

MR. KERR: Thank you, Mr. Waters. Any further questions?

MR. CATTON: Where are you going to place these thermocouples?

MR. WATERS: We believe the only feasible place, and this is pointed out in the white paper, is to put them in the LPRM strings if we were to put in multiple thermocouples. Putting them in other locations --

MR. KERR: Excuse me, do you know what the LPRM string is?

MR. CATTON: I take it is not at the top of the fuel.

MR. WATERS: No, it is not at the top of the fuel. It is in the by-pass region. You have the channelized fuel assemblies, and it is outside those channels.

MR. KERR: Excuse me, that is inside the channel boxes.

MR. CATTON: Okay, I know where that is.

MR. KERR: Okay.

MR. WATERS: From our discussions today with the PWR folks and so forth I thought everybody understood how a BWR worked but --

MR. KERR: He understands it. He understands it now.

MR. WATERS: Yes, okay. We sometimes feel like the left-out choice when all of the discussions concentrate on PWR parameter lists.

MR. CATTON: (inaudible)

MR. WATERS: Okay, that is only, that handle is for insertion and removal of the fuel assembly during refueling operations.

MR. CATTON: But it doesn't stay in there after you put it in?

MR. WATERS: The handle goes down and it stays in there, but it comes out. So it is moveable piece. It is not a fixed 40-year, lifetime, or something that remains fixed in the plant. It comes out after refueling. So if you were to place something on there, you would have to connect and disconnect, for example, during refueling. This is an underwater operation. This is something that is fraught with problems. We are fraught with problems just trying to grab onto those handles and pull fuel assemblies in and out.

MR. CATTON: -- -- the natural place to pull those out.

MR. WATERS: It is if you don't want to read it. It would be a great place to put one.

(Laughter.)

I think that we would agree that the best place to put a thermocouple outside of any other considerations, the other considerations being of a very large magnitude, would be to put a thermocouple in every fuel rod. Then you would know. That we think is highly impractical. Putting a single thermocouple --

MR. KERR: He said it first.

MR. WATERS: Putting them at the top of 564 bundles would give you better information -- be with you in a minute, Jack -- would be better information, but the feasibility of putting it there would be again very large problems, especially because once a year or so you have to get in to the top of the reactor and do something with it, to those fuel assemblies. You do not have the type of arrangement that you have in a PWR where you have the thermocouples coming down through the upper package, through the upper head, and through counterseals and so forth, and located in a mixing device that is in the upper package. You do not have that type of upper package in a BWR.

MR. KERR: Do you have a question or comment?

MR. ROSENTHAL: Jack Rosenthal, Implementation Control Systems Branch. I believe there are logically something like this. We recognize that the LPRM strings were the easiest place to put the thermocouples. And depending on what we thought the utility of having thermocouples would be in the LPRM's, we would come up with some implementation date. We also recognized that wasn't the optimal location, that it was better to put them in the fuel assembly someplace.

It was clear to us that would require more engineering work and hence that would change the implementation date. I believe in the staff's thinking it wasn't a question of wanting the thermocouples but only deciding where they should go and deciding on a reasonable engineering completion date based on where we thought they would go.

I think that is the logic we had.

MR. WATERS: Okay, you are saying this in definition of Mr. Arlata's comment in his letter?

MR. ROSENTHAL: No, we reviewed that a month ago in Madison.

MR. KERR: Mr. Johnston?

MR. JOHNSTON: William Johnston, the Core Performance Branch. We have had the opportunity of discussing some of these things with GE. The difficulties that we have had with their presentations in the past and the same one that they have made today is in the assumptions that they put into their calculations. And if you look at some of the assumptions that were presented in the package today, you will find again that they predecide the answer before they start the calculation, which makes it not really an objective calculation.

As we have indicated to them, we indicated there were two areas that we were interested in. It was to provide information confirming that the core was either remaining cooled or to provide an estimate of the extent and degree of core heatup if the water level was falling below the top of the core. To that extent we all agree.

We are not only concerned about when the cladding fails and whether we can detect hydrogen. You obviously don't get hydrogen until you have gotten hotter, then the clad generally fails.

But the point that I think is really the technical issue and which we have been encouraging GE to evaluate is whether the cannisters can fail by oxidation or anything else during this kind of an event.

If the assumption is made that the wall of the cannister will never get hot enough to breach or fail or anything, then a thermocouple that is located in the space where four of them come together, while it will indicate temperature and it will follow the temperature of the system as it warms up, it will in fact, as we agree, it will be rewetted when you reflood the core. And in that case it would not indicate the degree of damage to the core. If on the other hand, the cannister is oxidized and becomes, so to speak, rubbelized or becomes damaged when you reflood the system because you have got it hot enough and oxidized it enough, then you are not dealing with a system with by-passes and all these things that is assumed in their calculations, but you are dealing with a situation which is more similar to what portions of TMI probably is.

You do have a more rubbelized, or at least you have messed up the geometry. And under those conditions I don't feel that GE has made an attempt to calculate the usefulness of the thermocouples under those type of conditions.

MR. KERR: What would you do --

MR. JOHNSTON: Excuse me. If you look at the assumptions that are obtained in their graphs here, the heatup rate is approximately 1 degree F. per second in their sample. The kinds of heatup that GE uses in their other calculations are between 1 and 7 degrees per second. In a 1000 degrees it would go up 1000 degrees F. in this one. If you use some of the other bases for calculation it could have gone up as high as 7000 degrees F., which I think anyone will agree is a temperature at which one has some concern.

So I think that the heating rates that are used in the calculation here are probably low by a factor of at least 2 and probably 3 or 4. I think the temperatures reached would be higher. The references that are used in their discussion about assuming channels blocked in the 99 percent flow and so forth, flow blockage, are calculations that GE made for their inlet flow blockage calculations, which assume that the pumps are running and you have a pressure that is forcing the water up through that region, not presumably the situation that we would be talking about in which the pumps are not on and you are not forcing water and you would not automatically have natural circulation under those conditions. So if you also apply the criteria that we heard from the AIF this morning or this afternoon as to whether they are prime indicators and so forth and you use the WASH-1400 types of scenarios, you will find that the thermocouples get the same points that they got on Dave Cade's presentation.

MR. KERR: Let me see if I understand what you are saying. You are saying that with water above the top of the core you anticipate a possible situation in which the channel blocks is oxidized significantly?

MR. JOHNSTON: They would have oxidized while the core was heating up before the water recovery.

MR. KERR: Well, but you see, the presentation I heard GE made says that they can see perhaps some use for these things if water is below the top of the core. But as long as water is above the top of the core they can't.

Now do you see some usefulness for them when water is above the top of the core?

MR. JOHNSTON: Not if the water level never drops below the top of core.

MR. KERR: Okay, so on that you agree?

MR. JOHNSTON: Yes.

MR. KERR: You only disagree with them when they drop the water below the top of the core?

MR. JOHNSTON: Sure. When you have an accident that causes the water to drop below the core you start to heat up the fuel rods. There is no argument about that.

MR. KERR: Okay. Now what are you going to do with this information you get from the 50 thermocouples?

MR. JOHNSTON: During --

MR. KERR: When the water drops below the top of the core.

MR. JOHNSTON: All right. Well, there are two parts to the discussion. One of them certainly is that there is information to the operators that there is a distribution of temperatures within the core and you are seeing the temperature rise.

It starts to rise --

MR. KERR: But I mean, if he knows the water is below the top of the core he doesn't need a thermocouple to tell him that the temperature has gone up.

MR. JOHNSTON: That is true, but we also discussed single failure modes already in which you wouldn't have that information available, or --

MR. KERR: I am assuming now --

MR. JOHNSTON: (simultaneous conversation)

MR. KERR: If you are using this as a redundant system because your water level doesn't work, that is one question. But I am assuming now that you have information so that you know where the water level is. Now you still want the thermocouples?

MR. JOHNSTON: If you know where your water level is and you know that it is continuing to fall below the midplane of the core, you know then that your rods in the upper half of the core are on a temperature ramp, which involves oxidation.

MR. KERR: Right.

MR. JOHNSTON: You won't know -- you would like to know how hot it got because that is going to determine now much oxidation and damage you are going to get to your zirc alloy shrouds and rods -- --

MR. KERR: What would you do with this information if you had it?

MR. JOHNSTON: It helps you to decide how you are going to handle the remainder of the r^covery from the accident. If you feel quite sure that you have damaged no shrouds, that they have not lost their geometry, then you will probably know that you have natural circulation. You were not going to measure it apparently. You know that you have it because --

MR. KERR: Okay.

MR. JOHNSTON: -- you will know that you have not lost geometry or you will have indication that indeed you have lost geometry, which tells you something about the seriousness of the event.

MR. KERR: And what would you do differently in the two cases?

MR. JOHNSTON: I have to go back to the TMI situation in which there was a great deal of uncertainty as to whether the pump should have been turned back on again, whether the pump should have been shut off at what point, because we didn't know enough about the state of the core.

MR. KERR: But this is not a PWR.

MR. JOHNSTON: I know it is not.

MR. KERR: And this is the argument, it seems to me, on which, this is the point on which GE is basing its argument. It is not a PWR core.

MR. JOHNSTON: Well, the point that I --

MR. KERR: So there may be reasons, or there may be things that you would do differently, but I don't think TMI is a good analogy.

MR. JOHNSTON: Well, I think the point that I would like to make is that it makes no difference who designed the core if the core becomes uncovered and it heats up. Zirc alloy is zirc alloy. It doesn't know what it pedigree is.

MR. KERR: No, I agree. I grant you hot zirc alloy in the presence of oxygen will oxidize.

MR. JOHNSTON: And it won't be --

MR. KERR: But what I am trying to find out is what you -- and scientifically this is interesting, and academically -- what I am trying to find out is what an operator would do with the information with the information which says the channel boxes have oxidized versus what he would do if he knew the channel boxes hadn't oxidized. Is there some different procedure he would follow?

MR. JOHNSTON: I think what it will do it will tell you, it will help -- the circumstances under which the thermocouples are going to give you information in the recovery region are dependent upon the extent of damage of the core during the previous regions.

MR. KERR: What will the operator do differently? I am not trying to be facetious because I think you have got to ask questions like this if you are really trying to help the operator. Now what you are trying to do is help somebody who wants to study the accident later on, two or three months later and try to estimate what happened to the core. That is a legitimate objective. But if what you are trying to do is to tell an operator what to do during the course of an accident, it seems to me you have got to ask yourself what would the operator do with this information.

MR. JOHNSTON: I think there is two ways you can approach that. The operators at TMI, and all I can do is talk about the only accident we ever had, because if this discussion --

MR. KERR: I am sorry, this is the only thing --

MR. JOHNSTON: -- -- said it couldn't happen --

MR. KERR: This is the only thing you could do. In fact, if all you do is study the TMI accident, we have not made any progress. What you have got to try to do is anticipate the next accident, and especially the accident in a BWR. If we keep reliving the TMI incident we haven't learned much.

MR. JOHNSTON: Then you have given me a difficult thing to answer.

MR. KERR: Of course I have. And I don't mean that I have the answer to it. I don't. But if we are going to help operators, it seems to me we have got to try to ask ourselves what sort of information will be useful to an operator in carrying out his next step? What does he do?

MR. JOHNSTON: I think that is a fair question. And let me attempt to answer it. And I still have to use a point of reference, nevertheless. One case has to do when the operator suddenly realizes something he has been ignoring for some time, and I have to say that that has happened once already.

Under those conditions he sees some information that he hadn't noticed before, and he takes action to get more water into that system that he hadn't been doing before for whatever reason it was.

The other things, if we are observing that the thermocouple temperatures are continuing to drift upward after you have presumably recovered the core, you got the water level above it but you got thermocouples in there reading that are showing high temperature regions. And I view that there is no difference whether it is a PWR or a BWR, and if you have got a rubble bed you are going to have regions in which water has not penetrated and you are hot. If your thermocouples are located in that kind of a region, you have got information about whether the trend of the system is up, whether the system is getting hotter or getting cooler.

MR. KERR: Okay, but what would the operator do differently?

MR. JOHNSTON: He may depressurize, he may repressurize.

MR. KERR: He has already depressurized. If he is in a BWR he has already depressurized.

MR. JOHNSTON: I don't know whether under Atlas conditions he has depressurized. That is one of the assumptions that he hasn't. That is a boildown under pressure.

MR. KERR: Well, if he has gotten to the point where the water is below the top of the core, he has depressurized as far as he can depressurize, because he has got all valves open. So he can't do anything else to depressurize.

I know we can't settle it here, but I do think you have got to ask questions like that.

MR. JOHNSTON: That is fine, but I think we have the same kinds of dialogue for every single instrument in every reactor as to the --

MR. KERR: Well, I think you should.

MR. JOHNSTON: -- same regard.

MR. KERR: I think you should.

MR. ROSENTHAL: I just wanted to make one more point, and that is that the -- -- channels and radiation monitors, et cetera, are global, and they indicate that for this horrendous scenario where you fail fuel, total failure, but they don't tell you the locations, you don't know if you have a small area that is highly damaged or a big area.

MR. KERR: But I would still ask what does the operator do differently if he knows there is a small area that has been damaged or that half the core has been damaged. If there is something he does differently and that information tells him what to do, that is one thing. But if he doesn't do anything independently, whether he has got a small amount of damage or a big amount of damage, then I don't see that the information does him much good.

I am not trying to prejudge. I am simply saying I think you have to ask that question.

MR. JOHNSTON: What would he see if he saw the water level going down?

MR. KERR: Well, if he sees water level going down --

MR. JOHNSTON: (inaudible) do something to raise it up.

MR. KERR: That is right.

MR. JOHNSTON: All right, I just give you the same answer. It would be just as valid.

MR. KERR: No, but you see, if the water level gives him all the information he needs to take action, then it seems to me the thermocouples don't help things any. I mean, I may be missing something.

MR. ROSENTHAL: Well, I don't think I am meaning in terms of the first few hours that has passed. What happens the next day in this event, where the core is supposedly recovered, or is recovered, the instrument -- the levels are up, whether it has subsequent recovery operations, and there I can't quantify it but it seems useful to know the extent of the core damage.

MR. SAWYER: Dr. Kerr, if I may, I know we are running out of time, and I don't think this is the appropriate forum to be having a technical debate on numbers that the staff has only had a chance to see for about a day. But I just wanted to leave at least on the record that we disagree with the statements that were put on the record by the staff and I think we need to get together and in more detail go over exactly what we have done.

MR. KERR: I would think that that would be a good idea.

Does that complete your presentation?

MR. SAWYER: Yes. If there are no further questions.

MR. KERR: Any other comments or questions? Thank you, sir.

MR. SAWYER: Thank you.

MR. KERR: My agenda shows a presentation from Westinghouse by Mr. Timmons. Is Mr. Timmons still here? He is.

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MR. TIMMONS: My name is Tom Timmons from Westinghouse. I'm the manager of the Mechanical and Fluid Systems Evaluation Group in the Nuclear Safety Department. Since many of us have suffered through an extended period of discussion I'll try to make this as brief as possible.

I gave Mr. Duraiswamy some copies of a detailed position and I'll just highlight some of that and then go into a short discussion on some of my views as to what accident monitoring is and perhaps some comments to address some of the issues that people have been talking about during the day.

One of the problems that Westinghouse has with the current form of Reg. Guide 1.97 is that the Reg. Guide encompasses too many functions. This includes the technical support center, the emergency operations facility, the data link and also the control room. Without giving specific help to the designers as to where to put what instruments, everything could go in the control room or everything could go in the guard shack and the discussion as to what goes where would have to be forged on an individual basis with the NRC staff.

Westinghouse is also concerned that the Reg. Guide presents detailed requirements

MR. KERR: Do I interpret this, then, to think that Westinghouse thinks that the Reg. Guide is not descriptive enough?

MR. TIMMONS: That's my next comment -- that it's too prescriptive in some areas and too loosely worded in others as to give any kind of a guidance to the operator. The NRC staff is very well aware of the fact that I'm hard to please.

The Reg. Guide presents detailed requirements without going into some of the criteria that should be used to derive the requirements. It gives requirements for instrumentations, for ranges for things, but it doesn't give any basis for the requirement. If you're going to have a document that gives requirements it should give some sort of a detailedl basis so that the designer can understand the reasons why the requirements are being levied on the particular design.

A third concern is that the Reg. Guide fails to utilize ongoing work in the areas of the technical support center, emergency operating facility, and human factors analyses of the control room and also of the other facilities which would be used for accidents and incidents.

In the attachment to the handout there's a number of logical and technical problems which are ennumerated, some of which have already been previously discussed and I won't go into those in any great detail.

With respect to accident monitoring

instrumentation is there are four main things, I think -- ANS 4.5 -- the Reg. Guide, and Westinghouse all feel should be in a set of accident monitoring instrumentation. I think everybody could agree that these are criteria or a small set of criteria which would be useful in helping the designer to design the instrumentation and also the operator to understand what it is and how to use it. In large measure the differences in philosophy are -- between the various factions -- are merely a difference of degree.

The NRC staff says that it's an accident monitoring Reg. Guide and then goes about and includes anticipated operational occurrences, which I don't call accidents. I think that that tends to blur the focus of the instrumentation when you say that you're going to include a bunch of other events and have instrumentation specifically address those and then tell the operators that those instruments are part of the accident monitoring instrumentation set and he should be aware of those and be trained to use them and spend a lot of time learning what their characteristics are and how to use them.

The idea of a minimum set has been bandied about by a number of people in a number of contexts. ANS 4.5 says the minimum set is about twenty variables. The Reg. Guide says a minimum set is 66 variables for a PWR 56 or a BWR. When you discuss minimum sets you have to decide how the minimum set should be arrived at and what things influence the known set. If you decide that the minimum set, as ANS 4.5 decided, a small number, you have to make tradeoffs as to how many instruments the operator or the person who is going to be using the information can be trained to use and can use properly in the event of an occurrence. There's been some discussion as to why neutron flux has been added as the single instrument for purposes of measuring reactivity control and not having four as in the Reg. Guide. If you have four you identify all four of them to the operator as being accident monitoring. You tell him that when he has an accident or an untoward occurrence that he has to check for reactivity control. In the training of the operator he's trained to check all four every time and he has to be able to reconcile any differences which occur in reading the four of them.

And then if you make them Type B, or Type A or Type C, then you have the requirement that they also be redundant, so then he's got eight things to check. And then if there are other things he may twelve or sixteen to check. So you're proliferating the number of things to check.

MR. KERR: I must admit that I don't find that argument very convincing. If indeed one needs this information in order to make a decision. It seems to me the argument's stronger if you say that the other information is reliable and I don't need it. But to tell me that you're going to confuse an operator by giving him the information he needs to make a decision says to me that you either need smarter operators or better systems.

You have got, I think, if you need to make a decision you need the information that will be required to make that decision. And if it takes on variable, fine. If it takes four then you'd better get it and you better have an operator or system that is smart enough to analyze it so he can make that decision. But to say that you're going to confuse the operator if he really needs the information to make a decision I find not very strong an argument.

Now if he doesn't need the information, sure you don't want it. But --

MR. TIMMONS: Well, I think that's a bone of contention among various people in the industry and the staff as to whether or not he needs all of that information in order to make the decision when, besides having neutron flux he has other indications which tell him the same thing -- that there's something going on in the core that he doesn't want going on.

MR. HINTZE: I think Mr. Timmons is arguing on the basis of an incorrect premise and that is that all of them will be uniquely identified -- only the ones and twos will be uniquely identified. And in that case and in the case of core neutron reactivity control there's only one, which is the same as the ANS standard.

MR. KERR: So the operator doesn't have to know about the other three?

MR. HINTZE: He has to know about them because he knows they're there. But they're not uniquely identified in terms of having a red circle around them.

MR. KERR: That might be even more confusing because then he's got to understand colors.

MR. TIMMONS: Another thing that is necessary is that the thing that you chose to display to the operator or the person interested in the event is the most direct indication, wherever that's possible. Thus a level is a direct indication of whether there's water -- hopefully it's a direct indication of whether there's water in the core. If you were to specify a variable as inventory -- mass inventory -- in the reactor cooling system it would be very difficult to come up with a direct thing that indicates how much mass there is in the coolant system because of the possible leakage pass and the sources of where the water can go and that type of thing.

MR. ZUDANS: May I ask a quick question. I didn't miss your joke. That's okay. But I did miss the point. What was this uniquely identified? What did you say about this uniquely identified?

MR. HINTZE: Perhaps I shouldn't have said it.

MR. TIMMONS: In table 1 of the Reg. Guide there is a line item that says that certain qualification categories are required to be uniquely identified to the operator so that he knows that those instruments are accident monitoring instruments and that he should use those in diagnosing, following the course of the event, and determining whether the actions that are being taken are sufficient or whether there are other things he should be doing in order to influence the course of the accident.

MR. ZUDANS: And out of those four only one is?

MR. HINTZE: Yes. We only require those uniquely identified as those in categories one and two, which would say that the backup or defense in depth instruments would not necessarily be uniquely identified. However, the operator would know they are in place and they've been qualified to be used.

MR. ZUDANS: Thank you.

MR. TIMMONS: The last item is a consistent set of criteria and design bases so that the uses, the reasons behind the choice of the instruments, what the instruments are, the functions that they serve, what actions can be taken based on the instrume' s, whether the instruments are to be believed in all conditions would be plain to the people who would be using a set of accident monitoring instrumentation.

MR. KERR: Do think there is any disagreement between yourself and the NRC staff on those criteria, with the possible exception of interpretation of accidents?

MR. TIMMONS: In the area of criteria and design bases I think that the bases behind the requirements -- a number of the requirements in the Reg. Guide -- are lacking.

MR. KERR: But I think the NRC would agree on a minimum set, on a most direct indication, and on consistent criteria and design bases. I bet everybody on the staff would agree on that.

MR. TIMMONS: Yeah.

MR. KERR: Okay. I just want to establish what it is --

MR. TIMMONS: I agree that they have done that in the Reg. Guide.

MR. KERR: But everybody's following the same criteria. You heard the story about the two grandmothers in Brooklyn who could never get together. They lived across the alley from each other and they were always shouting and they couldn't get together because they were arguing from different premises. Now you're starting with the same set of premises, I think, so --

MR. TIMMON: I we all agree that the premises are the same. It's a matter of whether or not the distance between the premises is sufficient to come to some closure as to whether the right set of criteria have been implemented and used and the right set of instruments have been decided upon.

MR. ZUDANS: Have you heard the presentation by David King on impact criteria?

MR. TIMMONS: Yes.

MR. ZUDANS: Well, I think that it's a more complete set than yours.

MR. TIMMONS: I think it's a different set. I'm not so sure that it's more complete.

MR. ZUDANS: Because you're talking about criteria sets, not the outcome.

MR. TIMMONS: It's a structured approach. The ANS 4.5 approach was structured. Westinghouse internally went through a process of trying to determine what the optimum set of accident monitoring instrumentation was, which is also a fairly structured approach. If you use slightly different approaches you're likely to come out with slightly different lists of instruments.

MR. ZUDANS: Now (inaudible). Do you have some kind of mock-up table that you would recommend that Westinghouse uses?

MR. TIMMONS: I don't have it with me now.

MR. ZUDANS: But you do recommend less instruments than (inaudible).

MR. TIMMONS: We came out with a list of instruments in the end of May, early June, that was either nineteen or twenty instruments. That predated the lists that same out in ANS 4.5. That was in 1979.

MR. KERR: Did the staff, in its promulgation of 1.97 leave out any that you suggested?

MR. TIMMONS: I don't recall. I don't think they left out any of that we had.

MR. KERR: Any further questions? What significance should I attach to the fact that each of these pages is stamped with a large "preliminary" stamp?

MR. TIMMONS: The significance of that is that when we left Pittsburgh last night the letter hadn't been signed off by the appropriate person. You can ignore that "preliminary". It's since been signed off.

MR. KERR: Thank you.

Is Mr. Stern here from the Westinghouse Plant Owners group?

MR. TIMMONS: No, he's not here today.

MR. KERR: Okay. Is Mr. Raj Gopal here? He is indeed. He represents an organization or an individual -- I don't know which -- called Lightwater Instrument Specialists. No, it has to be more than one person.

MR. GOPAL: I'm manager of instrumentation development at Westinghouse, but I'm not representing Westinghouse now. I'm here to represent a group of specialists -- light water reactor instrumentation specialists.

At a meeting -- a one-day session -- where we had representatives from three national labs, three reactor vendors, one utility and an equipment supplier to consider Reg. Guide 1.97 and give our evaluation and recommendations to you. The chairman of that session couldn't be here, so I'm just representing that group of specialists.

The summary of what we discussed has been passed out to all of you so that summarizes what happened at that meeting. Of course, this has not been approved by all the participants yet, but it was read at the meeting and people generally agreed that was the consensus of the group.

Of course the first point we are trying to make is that as instrument engineers the guide would be more useful to us if the rationale for choosing the various variables was presented. Even better would have been that if functional requirements were given we could have selected what instrument would do the job in the best possible manner. Of course you have had all this, so I'm not going to dwell on this point any further.

The second task we undertook was to list all the variables that were given in the Reg. Guide and go through each one to identify what is installed in existing plants and what are their qualifications as they are now and what's commercially available and what might give a development requirement. It became clear that what is installed in plants is quite dependent on which plant we consider, but in our discussion it became obvious that in most instances instruments specified in Reg. Guide 1.97 are available. However, they are rarely qualified now to category three and to make them meet category one will be a lengthy and expensive process and it is our opinion that it will tax the commercial capabilities of providing such instrumentation.

The other problem we had with the Reg. Guide was that we could not establish any priorities so that there cannot be any assignment of what instrument channels should be worked first insofar as development or qualification can be met

The third point is that the timeframe for implementing this Reg. Guide -- that is, June '82 for new plants and June, '83 for retrofitted existing plants -- will not allow sufficient time for qualification to category one of the many required instruments. Of course, we had several problems in what the qualification requirements are, especially as to what the -- I mean, all instruments are not going to extend to all conceivable accident conditions, so it will be necessary to identify what instruments are useful to the operator and what will be the minimum qualification requirement- on.

The fifth point is that the instrument qualification program cannot address the issue of gauging without establishment of some accelerated life testing criteria.

The sixth point is that we ran into serious problems and if you really put all this additional instruments how can you get wires out from inside of containment to outside? Of course there is a technical fix to such a problem, but it's not existent now.

The last general point we got to was that we had great difficulty with the Reg. Guide was that there were no accuracy requirements. The ranges were spelled as zero to some extended range. Operating range is generally quite narrow so if the operator has to use these instruments during normal operation use, the reading should be something that's meaningful to him. So I think what the required ranges, what the accuracies and what's the range that should be displaced during normal time and given normal operation and what should be the range during accidents -- all of this we think needs further clarification.

So these are the general comments, but some of the specific problems that we had was summarized starting with

8. Now we talk about reactor vessel level indication. Technically there are solutions available now and that can be -- the new systems can be developed even faster than qualifying certain other instruments to category one. So we just -- we couldn't understand why it's not included in one of the tables.

MR. KERR: Mr. Raj Gopal, if you are just going to pretty much read this list of specific problems areas -- and it seems to me they are relevant -- I would suggest that you make -- rather than read these you make any additional comments you want to make and then ask for questions, since we are trying to --

MR. GOPAL: I guess on this the only comments I want to make are relevant to hydrogen monitors. We don't think -- as experts -- we don' think they exist now and the other one is on the radiation monitors. There seems to be a trend that radiation monitors meet those requirements. But it is our opinion that those radiation monitors will not work under accident conditions and we don't think -- there is technology available, but I don t think there is any hardware available and it will take time to develop this thing.

The only other concern we had was on thermal couples to the -- where they are now they will not go up to 2300 unless we change them all. So that's basically the general comments we had. If you have any questions on these I will be glad to answer them.

MR. KERR: Thank you very much. Are there questions? Yes, sir.

MR. STODDART: I'd like to make a comment on the radiation monitoring. Both this presentation and to Mr. Sommers. The general gist of this has been that the instrumentation is not available, will not work, and so forth. I don't think this is really true. For example, on the containment radiation monitors there are two vendors who are pretty well along on qualification programs for full local conditions and operation of the systems.

The state of the art as represented, perhaps, by the instrument vendors catalogues a year or so ago certainly did not represent this. But state-of-the-art has been developed at the national laboratories and in the weapons programs they had this sort of equipment twenty years ago.

MR. KERR: I understood him to say that technology existed but that instruments that you could purchase which would withstand the environment probably didn't. I don't see any disagreement between what he says and what you're saying.

MR. STODDART: As I mentioned, two vendors are quoting very short delivery in containment radiation monitors, specifically the monitor reading of 10 roentgens per hour. I don't think I need to be specific about the vendors, but --

MR. KERR: I don't either, but I guess that I have some skepticism about some of the things that are purportedly measured in here, too, in terms of laboratory instruments being available -- field type instruments being quite a different matter -- and I sure believe that if you look at this in detail you'll find that that's the case.

MR. GOPAL: Just one comment. You know, this was a representative from a defense laboratory and another one from EG&G. Those two, at least, concurred that what's sold commercially will not work under accident conditions. So it's not my opinion. It's the consensus that was developed from various labs.

MR. KERR: You may be right.

MR. STODDART: These tests I'm speaking about are being conducted by Wiley Laboratories under the same conditions as in the other containment instrumentation.

MR. GOPAL: Well, the problem is played out on shielding. What would that instrument read? That's more of a problem than just meeting environmental qualifications. It can be different than in the extreme conditions and pressure conditions. It may not be the same as an accident.

MR. KERR: Are there other questions or comments? Thank you very much, sir. Does the staff have additional comments?

Well, the schedule as it now stands calls for us to take this to the full Committee tomorrow. The NRC staff is asking for endorsement by the ACRS, I believe, of the Reg. Guide in its present form. Do members of the Subcommittee want to try to arrive at any recommendation at this point? Or do we want to recommend that presentations be made to the full Committee and we hold a discussion and try to arrive at a recommendation at that point? I'm open to suggestion.

MR. MATHIS: Bill, I don't feel we're in any position -- I should say I personally am -- in any position to have the nerve at this stage to take it to the full committee. I wouldn't know exactly what to tell them..

MR. KERR: You mean to take a recommendation to the full committee? I don't have any hesitation about taking a presentation to the committee because I think it needs to get an update on what's going on.

MR. RAY: I think if a decision were to be forthcoming --

MR. KERR: Excuse. Jerry we want not to miss a word.

MR. RAY: If a decision were to be forthcoming in line of the desires of the staff to the effect, for instance, that this is not acceptable, I think more than the subcommittee should debate that.

MR. KERR: No, I'm suggesting that we might want to make a recommendation. It would be just that. We don't make the decision. But it's certain that such a prestigeous subcommittee's recommendation would be taken very seriously by the committee. Mr. Lipinski.

MR. LIPINSKI: One of the key things that should be presented to the full committee, I think, is a summary statement as to where the differences lie with respect to the industry viewpoint versus the Reg. Guide, and I think this feature of the functional specifications that have been complained about from AIF, ANS, I think is one of the key areas that seems to be of objection to accepting the Reg. Guide. I'm sure the staff has done it and that's part of the problem -- that it isn't part of the document and if industry saw the work then maybe they would be -- they're willing to accept it. Particularly, say, in what the key variables are, what the factor variables are, what the accident situations are and as to why the particular ranges have been accepted to be specified the way they are.

And as to what the committee decides to do after being this information I think will be up to the full committee to make a decision.

MR. KERR: I think that's a good point, Walt. It also seems to me that there is another fairly significant point of contention and that is that Reg. Guide 1.97 is aimed at solving a number of problems simultaneously, which is an efficient way of proceeding, certainly, if it works. But at least it seems to me that the consensus we've heard from industry is that it perhaps tries to cover too many things in one document and thereby produces some overload in the information transfer procerss.

It does, it seems to me, have in it elements of systems to follow the course of an accident, systems which will -- if I can go to a mode which I am reluctant to follow -- permit the Governor of Pennsylvania to know whether to evacuate people or not in a timely manner, systems which would permit information to be gathered which would be displayed in an emergency operating center, systems which would lend themselves well to instrumentation in an off-site emergency center, and a nuclear data link. Now when one has to take into account all of these considerations simultaneously the document and the approach is, perforce, somewhat more complicated and yet I sympathize with the staff because it would be unfortunate if each one of these things were approached in some way so that when you got through the total systems were completely inconsistent one with the other.

So that it seems to me there's some logic in trying to do what the staff has tried to do, and yet it adds to the complexity of the document and to the complexity of understanding, and I don't know that -- my personal preference would be to try to hammer at these problems one at a time, but I think if one tried to do that and tried to do it successfully there would have to be fairly close coordination between the various parties of it. Because there is overlap.

I also think that one of the complicating features of the situation at this point is that some of these systems aren't yet defined so that if one tries to talk about functional requirements they just don't exist. And the staff has had to labor under this -- if I interpret the situation correctly -- they've had to labor under this and try to come up with something even though in some cases nobody is exactly certain yet what he will do with the information.

MR. LIPINSKI: Reg. Guide 1.97 in terms of being a comprehensive list covers the instrumentation requirements as to how the information is to be displayed, selected for these other various functions as yet to be covered. And reading some of the other documents they refer back to Reg. Guide 1.97 as being the source for the input information for some of these other systems.

If the package was totally visible then you would have assurance that all the details have been covered and at this point intuitively I look at the list and say well I think it's fairly comprehensive. It probably will do the job. But I wouldn't want to say that with one hundred percent assurance.

MR. HINTZE: Could I make a statement, Dr. Kerr? This is your discussion, but I --

MR. KERR: Well, if it's relevant and succinct, yes.

MR. HINTZE: I'll try to make it both. The list of the parameters were developed on the basis of what the control room operator is going to need, plus some extra ones for emeregency preparedness. These inner panels -- the safety display panels -- came along after we had the list developed and their requirements were compared with what we already had without even considering them in the first place. And as far as I can remember, there was only one parameter added after they came into existence and we began to consider them.

MR. KERR: I think everybody involved agrees that you have a pretty complete list.

MR. HINTZE: Well, I say that in defense of trying to meet a whole bunch of requirements at the same time. I'm saying that if you consider the primary requirement -- and that is controlling the plant -- as the primary thing and then you make any other displays a subset of those then you have no problem.

MR. KERR: Well, again, I find myself reflecting on some of the comments made in the Kemeny Commission Report, which were all these buzzers buzzing and light flashing and indicators indicating. There was a myriad of things -- information available -- apprently to the operator and it was the conclusion of that group -- I'm not sure it was a valid one -- but I've never been absolutely convinced that this was what caused the operators to do the wrong thing. But at least it was the conclusion of that group that one needed a much simpler system at which to look.

Now it seems to me 1.97 is very inclusive, but I'm looking for the simplicity and the simplicity of it has escaped me so far.

MR. WRENZINGER: Dr. Kerr, I'd like to make, I think, two points and one was just made by the most recent speaker. But let me make one other point just before that.

I think, first of all, and I'm sure you are aware of this -- let me remind you -- that Reg. Guide 1.97 does not specify the need for any particular alarms of any kind. It talks primarily to the parameters that should be measured. That's the first point.

The second point is -- and I'll read directly from the gentleman, I forget his name, I'm sorry, who made the last presentation. In most instances instruments for measuring the specified variables are already installed and operating LWRs.

MR. KERR: But when you say that -- and with all due respect to you -- they aren't. They aren't qualified. They aren't separated. They aren't a lot of things. And so one is going to have to go in --

MR. WRENZINGER: Yes, but I was responding to your point about the operator being saturated with information.

MR. KERR: Yes, but what I could conceive of is a plan which said look, let's go into these things and throw away two-thirds of the stuff that we don't need and let's put in a much simpler system which will operate when we've got an accident going. Now, you know, I'm talking about Alice in Wonderland or something, probably, but, you know, to say that we aren't adding any additional information to me is not very convincing if somebody has looked at the most recent accident and said the trouble is that they had so much information they couldn't absorb it.

Now I don't know whether that's the right analysis or not, but that's what at least one Committee said. And if you're going to follow that Committee what you'd say is hey, we've got too much information. We only need about six variables but they all need to be very meaningful ones and a big board with those six variables so the operator can unambiguously know what to do.

Now I don't think life is that simple. Don't misunderstand me. But you see I'm not sure we need more information. We may need better information and better analyses.

MR. WRENZINGER: We agree that better information is needed and that's one of the primary reasons for specifying the qualification requirements that are currently included in 1.97.

MR. WHITE: I think the accurate standards and coordination. I think the (inaudible) are mostly related to limiting conditions for operation -- the things that are related to tech specs that say, hey you shouldn't be operating here. Now I think we're talking about a different set of instrumentation in this post-accident monitoring.

I'm trying to relate the Kemeny Report statement. Yes, it looks -- go to a simulator. It lights up like a Christmas tree. But much of the information isn't necessarily that which is specific. Certainly the lights saying that you're out of limits aren't necesssarily valid for a post-accident condition.

MR. KERR: Okay. The other thing Kemeny said -- and again I don't know about the validity of this -- he said we have all given too much emphasis to equipment and not enough to people. It seems to me that 1.97 is giving emphasis almost entirely to equipment. Now maybe it has to because that's what it is. It's equipment to follow the course of an accident.

But has one really looked and said hey, what's really needed is maybe not any new information at all but a different group of people or a different mindset or something -- to coin a new phrase -- that permits us to make better use of this. Again, I'm sure you guys probably went through this. It's just that it isn't anywhere that I can see it so that I can follow through your logic and say, hey, this is exactly the right set of information that's needed for these newly trained operators and this new management organization to help them follow an accident better.

End 4

It's not there, it's in your minds but I don't have it so I can't interpret it.

MR. HINTZE: It seems to me there's two ways of looking at the problem. One is, you design a plant for the operator, or do you train the operator for the plant. Now, the plant is a design, they've got certain systems in place. Those systems have certain functions to perform. Are you going to say that because the operator can't look at every system he doesn't need to have the information about those systems available to him? I don't think you're saying that. We've got to start with the plant as designed; the parameters that tell us those systems -- or else you've got to build the plant simpler so one operator can look at it.

MR. KERR: I hate to give more credence to the Kemeny Commission report, but as I read it, it said when we first started this investigation, we though probably we were going to find that a lot of equipment malfunctioned, or that the equipment wasn't so good. We have now concluded that the equipment is damn good and what went wrong was the people. I don't know that this is a valid conclusion, but what I'm saying is it is not possible for me to apprehend the response of 1.97 to this comment. It may be there, it may be very strong in what you finally concluded. It's just that the information that's available to me does not enable me to see how one has responded to that comment, which is a very significant comment if it's true.

MR. MORRISON: Dr. Kerr, could I make a comment on that? It's true that Reg Guide 1.97 applies and is intended to only treat a part of the problem. It's the equipment and a very small part of the equipment; namely, accident monitoring instrumentation. The operator, the personnel problem, is being handled on a number of fronts. One of the things that you reviewed here was on the increased staffing. In the control room we have actions going on to improve the qualification and training of the operators, so there's a broad range of actions that's being taken and on that front, that's separate from the Reg Guide 1.97. Now, they should mesh.

The point I'd like to make, though, is if you assume that -- if you're concerned about operator overload based on the Kemeny Commission recommendation, that may well have been valid and maybe valid with the instrumentation we're providing here, for the operators as they were trained before Three Mile Island. But I think we all recognize that that was inadequate.

MR. MATHIS: Along that line, I think we had a good example here a while ago of the kind of problem that I have anyway, and that was when we were talking about the thermocouples in boiling water reactors. And the question arose as to what are you going to do with the information; how is the operator going to use it, and we didn't get an answer.

MR. MORRISON: I think that's a valid question.

MR. MATHIS: These are the kinds of things that give me trouble, anyway.

MR. WRENZINGER: But that creates a basic problem that I think we recognize that we were faced with when we began work on this item. You know, if I were to look back and forget that TMI had occurred and say, what in the world did I need those outlet thermocouples for, I think I might have been in as difficult a position to answer that question. But I think in hindsight we can say gee, having those thermocouples, had we paid more attention to them and the information been more readily available to the operator, we would have been able to save at least part of the day.

You're always faced with that problem in an event that you don't know what it is and what the next event is going to be. We made the best attempt that we can and that's specifically exemplified I think in the Type C instruments of providing information that gives the operator a notion that he's gone beyond what was expected and gives some information that allows him to know especially the extent of these instruments, that he knows which way he's going so he can fix it.

MR. KERR: Okay. But there is a significant difference between now and Three Mile Island, and it's very significant; that is, about 90% of the people in this business didn't really believe you could have a serious accident at a reactor. There isn't anybody anymore who believes that.

MR. BENANOYA: Yes. Because if you'll just come to our 1.97 meetings.

MR. KERR: No, Vic, if you think that, you're missing -- People believe now, and hence, they're willing to look in more detail at off-normal situations. They may be not looking at the right things, but there's been more looking at off-normal situations in the last year thar there was in the last 20 years. And real bona fide looking.

Well, I don't know how much more we ought to say about 1.97. I gather that we take to the Committee our accumulated wisdom and talk if we're asked. I will try to make some presentation to the full Committee without making any recommendation and I expect it will be an interesting discussion.

MR. ZUDANS: I'd just like to make a very short comment. I think it would do lots of good if the staff would tabulate their instruments and make some judgment. Your judgment is at the end product; the judgment that NSAC and AIF made was of the content; they used some structured procedures. I don't really see that there's a great deal of difference. You can make your judgment that that's how well you know the system. But would you be able to label each of these things as to their intended function. If it says EES I guess that stands for safety parameters, if it's for technical support system, if it's for operating room or if it's for accident monitoring instrumentation. There have been claims made here that you've covered all these four grounds with your set of instruments. I might find that they are not all the instruments I'd like to see, but that's besides the point.

If you could label them, then I think you would do lots of additional work with the same shot.

MR. WRENZINGER: Just two comments in answer. One is that they're all accident monitoring instrumentation. And the second question is I understand your request with regard to the various nuclear data link, onsite technical support center and so forth. Did you want us to do that between now and tomorrow morning?

MR. KERR: I don't because I don't think you can do it. But Mr. Zudans might.

MR. ZUDANS: I think it's something you could do later. And maybe retrospect you have a set that you feel comfortable with.

MR. KERR: But I am puzzled by one of your comments because I thought you had concluded that some of the instruments were needed to monitor anticipated transients, not just accidents.

MR. WRENZINGER: The use of accidents in the sense that I just used it included the anticipated operational occurrences and monitoring the course of those -- I'll call them events -- to assure that you don't get to what is classically known as an accident.

MR. KERR: But it seems to me that you are really sort of deluding us when you say anticipated transients or accidents. I'm not unwilling to monitor anticipated transients, but at least it's a very new nomenclature if they have now become accidents.

MR. HINTZE: Dr. Kerr, those will come up mostly in the Type A variable.

MR. KERR: I'm not trying to disagree that they need looking. It just seems to me it's slightly inaccurate to say that you're only monitoring accidents because the English text says that you're monitoring anticipated transients and I don't believe they're accidents.

MR. WRENZINGER: Yes, I understand your comment.

MR. ZUDANS: I think the entire Type D, you are not monitoring accidents; you're simply making more information available to the operator. But the fact that those systems function, information is already available so the entire Type D is not the AMI; it's something else. Not that they are bad.

MR. WRENZINGER: I think we'll have to agree to disagree on that topic, as to whether they're accident monitoring or not. I would only add that we feel, I believe, that they are necessary in order to cope with the accident, if you will --

MR. ZUDANS: But that's not monitoring.

MR. WRENZINGER: Well, it's monitoring what's going on in the individual safety systems so one knows what to do about what's going on in those systems in order to cope with the accident.

MR. HINTZE: In terms of the list of variables, that's really the basic difference between us and ANS 4.5, the D, because when you consider the D and C which they cover and the B and C which we cover, the difference is very small.

MR. ZUDANS: Yes, I understand that. But it is difficult for me to accept that the Type B is for accident monitoring. It provides useful information and I'm not saying they shouldn't be there. I'd like you to give them the right label. What's their real purpose?

MR. KERR: Gentlemen, I'm going to declare this discussion closed and have a ten-minute break, after which we will take up two more proposed regulatory guides for comment.

(A short recess was taken.)

MR. KERR: Mr. Morrison, according to my agenda, it's 5:40 p.m. and we're ready to talk about proposed Reg Guide 1.8 Revision 2.

MR. MORRISON: Okay, the spokesman for this will be Mr. Milhoan.

MR. MILHOAN: I'm going to, because of the time of day, make the presentation rather brief. I have slides prepared on individual questions or background material as it comes up, and after the initial part if you want additional discussion I will be glad to go into it.

This is the second proposed revision to Reg Guide 1.8, Personnel Qualification and Training. It is being re-issued for public comment. The first proposed Revision was issued in February of 1979, and discussed with the ACRS Regulatory Activities

Subcommittee in December 1978.

After the Three Mile Island accident, additional public comments were requested in the area of personnel qualification and training in May of 1979. The additional public comments were forwarded to the ANS 3 subcommittee, along with consideration being given to the revision of this particular Reg Guide. This Guide incorporates the revised staff guidance completed to date in the area of personnel qualifications and training, and it also endorses with appropriate exceptions the December 1979 draft of the ANS 3.1 standard which has undergone significant revision since the 1978 standard was published.

The Guide also contains a considerable discussion section which discusses ongoing staff efforts. You were provided in your submittal package enclosures which summarize -- which contain documents which summarize many of the ongoing staff areas.

The Guide is being issued at this time to invite public comments on the present staff position, with the recognition that in this particular area of personnel qualification and training the area is receiving considerable review by the staff. But the positions in the Guide hopefully will be consistent with future staff efforts in the area of personnel qualifications and training.

With that in mind, if you want discussions of the other areas of ongoing staff efforts I'd be glad to do it, but I think they were summarized in the Guide.

MR. KERR: You recognize that what is being proposed here is that this be sent out for public comments, so we're being asked to ultimately give our approval to that and in the meantime make any comments that are appropriate.

MR. ZUDANS: I haven't really had a chance to read it in detail, but I saw the passing grade, 80% overall and 30% in each category. Do you want to accept an operator with a 30% grade in any given category? 70% is like an average grade?

MR. MILHOAN: The grading criteria reflect Commission approval of the SECY-79 330E recommendations that the grading criteria have been revised from previous grading criteria. When you talk about grading criteria, you have to talk about also the passing marks of the exam, the difficulty of the exam. There has been considerable effort that is being accomplished by the staff in the area of grading the exams. For example, time criteria are now established for the exams. Additional categories are being added to the examinations.

The statistics on the pass/fail grade -- Ithink if I remember correctly, the revised grading criteria by going to the 80% overall, 70% in each category, if applied to old examinations would result in something in the area of a 40% greater fail rate for the reactor operators. So the grading criteria have been signficantly upgraded.

MR. ZUDANS: So 70% doesn't necessarily mean C average.

MR. MILHOAN: Yes. I think the difficulty of the examination --

MR. KERR: There's a related question, too, which I wish I had the answer, and that is whether these written examinations really tell you very much about an operator's capability. I have been skeptical of this for some time but with no particular basis for the skepticism other than that I have read some of the questions that are given on operator exams, and I'm just not sure that they have a lot to do with -- but the exams are being improved, and I agree with what I think you're saying, that to talk about a grade is not too relevant. It's what on the exam and how difficult it is, and you can bury that. Given that there's a set pass/fail rate, you can sort of determine what the operators are going to look like by changing the exam. The staff still has a lot of discretion in making up the questions.

MR. MILHOAN: You recognize that the examination is both written and oral and a simulator portion is going to be proposed. There's a contract presently out, and you have a copy of the contract, with Analysis and Technology, that is going to look into this particular question of the pass/fail rate of the examinations, the content of the examinations, how NRC administers the examinations, and the results of that investigation should be available at the end of this year, by probably the last of October. So we'll be sending you that information.

MR. MATHIS: Can you give us any significant highlights of the differences between the Revision 2 of 1.8 and the ANS 3.1?

MR. MILHOAN: Yes, I can. The major changes which are incorporated -- and I'll take the ANS 3.1 draft first. The major changes that are incorporated in the ANS 3.1 draft are, first of all, a reformatting and redefinition of the Section 4 of the standard called Qualification, to define in terms of education, experience and trainin., the required qualifications. In previous versions of the standard, these qualifications were lumped together, you allowed a certain academic education to account toward experience and it was a jumble and it was very difficult to determine the actual qualifications you desired of an individual. That has been changed.

The other upgrade concerns upgrading of a number of specific qualification requirements. In this regard, a Bachelor of Science degree has been specified for a number of plant positions, and by that I mean starting with the professional technical group leaders, the manager positions; that has been incorporated in the standard.

The Reg Guide incorporates a provision for a Bachelor's Degree for the shift supervisor. A special appendix to the Guide because we expect significant comment in this area, has been prepared in an attempt to foster public comments on this specific question.

The training requirements in Section 5 of the standard have been significantly upgraded, and by that I mean the expansion and more definition of the training program for the licensed operators and senior operators. The requirement for a position task analysis has been added to section 5, but the training program for other personnel in Section 5 is not that definitive of the standard to date.

MR. KERR: In adding a degree requirement to a number of the positions, was it the intent that by adding the degree requirement you would be selecting a different type of person, or that the training one got in the course of getting the degree would be relevant to their job position?

MR. MILHOAN: I think if you -- I think first of all that Bill Morrison said both. I think it's a recognition of what we think would be the academic education necessary for accomplishment of the job function, recognizing that you would have plant-specific training in addition to the academic education requirement. Does that answer your question?

MR. KERR: I think you said the same thing he said except in slightly different words. I guess the answer is you just sort of had the feeling that you'd have better operators if they had a degree.

MR. MILHOAN: You're talking about the shift supervisor.

MR. KERR: Well, your statement was that you had raised qualifications and in a number of cases you're now requiring degrees; whereas, you didn't before.

MR. MILHOAN: That's right, the standard was silent on education requirements before. It had recommendations only.

MR. KERR: You do some selection now to the job market. There are certain positions in the job market that are open to people with degrees that aren't open to people without degrees. So you're now selecting from that pool rather than from the larger pool which included both people with and without degrees. Was it a conscious choice on your part that you wanted to select from this different pool?

MR. MILHOAN: I think with the position of shift supervisor is the area where you're talking about changing selection, pool of selection, of personnel. I think if you look at the professional technical group leaders and the managers of the plants, for the most part -- and I'm talking about in the area of take plant manager, for example. We've done a brief survey of 60 plants, and 57 of the 60 are already BS degrees. As you go on down, some of the positions are not that good, so I don't think there's a different pool you would be selecting these people from. With the shift supervisor I think that's a different question. The implementation of that particular provision would have to be very cautiously applied, and we have developed a separate appendix on that to try to describe that particular area and to get some public feedback.

MR. KERR: I guess I'm a little puzzled. If you have changed the plant manager requirement from one that didn't mention a degree to one that now mentions a degree --

MR. MILHOAN: Yes. Before in the standard, there was no requirement for education for a plant manager. There was a recommendation that he should have a BS degree.

MR. KERR: I won't push this too far, but I would suggest that if the majority of people already have a degree, and you're now requiring a degree, the people you're likely to be eliminating are those very unusual and very competent people who will make it even without a degree. You see, you're eliminating the mediocre people who have degrees because some of them are already there. You're eliminating the people who probably have unusual capability and who made it even though they didn't have a degree.

Now, I don't know that that's so, but you ought to think about that.

MR. MILHOAN: Hopefully, in that case there would be exceptions. In other words, that would be an exception to the standard. We're trying to provide a basis with also recognition that there will be exception cases in which this should be applied. So that's recognized.

MR. KERR: If it's handled with discretion, certainly.

MR. ZUDANS: This college level education doesn't really mean that every operator has to have a degree?

MR. MILHOAN: The answer to your question is no, but for the shift supervisor there is a regulatory position; for senior reactor operators, reactor operators, the answer is no, they do not have to have degrees. But we're trying to define the term college-level education as used in the standard.

MR. ZUDANS: Well, you say he has to have completed course work at an accredited institution. That's equivalent to a BS.

MR. MILHOAN: Just because he's completed course work doesn't necessarily mean he has a degree. In other words, he may take courses at an accredited collegiate institution to satisfy the requirements.

MR. KERR: What sort of accreditation did you have in mind?

MR. MILHOAN: We were talking about -- in the standard we say by a nationally recognized agency such as EBET. It used to be the engineering council for professional development, which has been renamed.

MR. KERR: But the only reason I asked the question is most places, be they college or university, that have an engineering school will have the college accredited, their agencies as accredited colleges, or will have the university accredited, or agencies as accredited universities. In addition, the engineering college will, if it's accredited by whatever it is, also have an accreditation. So to say from an accredited program, may be all you want to say, but that doesn't mean, for example, if he takes engineering courses he may take them from an accredited institution -- he still won't necessarily be taking them in an accredited engineering program. And I'm not sure it's necessary, but I want to point out that there are at least two levels of accreditation that you're likely to encounter.

MR. MILHOAN: We were talking about curricula accreditation.

MR. KERR: If you say an accredited curriculum, okay. Is that what it says?

MR. MILHOAN: That's what is meant.

Incidentally, I must apologize to you, Mr. Moeller, because I thought you would be here when we would have a chance to raise a question on 1.97 and you weren't.

MR. MOELLER: Mr. Chairman, I have some general remarks and some specific remarks on this revision of Reg Guide 1.8. Let me begin with my general remarks, and I make them in a constructive vein.

As I read the Guide, I note the discussion of the maintenance manager, and there we list specific courses, or there are specific courses listed that that maintenance manager should take. I look at a shift supervisor and I see specific courses that he or she should take. I look at the senior operator and I see specific courses that they should take. And then when I reach the radi ion protection manager and look for the description there, I read a direct implication in the Guide that everything this person needs to know can be learned on the job, although it says that, quote, "some formal education in radiation protection" would be desirable.

As a professor at a college or university which offers both a Master's degree and a Doctorate in radiation protection or health physics, I would highly urge that we give the same treatment to the radiation protection manager that we've given to the other people listed, and in fact, enumerate some of the courses that this person should have under his or her belt. Such as, radiation biology, radiation dosimetry, air sampling and respiratory protection and radiation shielding, just to enumerate several.

MR. KERR: Also, industrial psychology.

MR. MOELLER: I, in fact, find it demeaning to the radiation protection profession, which I consider myself to be a member of, the way this Guide is currently written, and indeed, I would call for you to give consideration to expanding that section along the lines that I've just enumerated.

You also in the Guide call for examination, written examinations, for operators, and I certainly agree with that. And you have a come a long way in that you now do cite the certification program of the American Board of Health Physics, particularly the certification for health physicists at power reactors.

The program for that certification procedure, or the certification program itself, is, what, 20 years or so old now, and the portion of that certification program applying to reactor health physicists has been carefully developed with input from the industry itself, and after many, many years of negotiations and so forth that program now is ongoing.

I think it's time that the NRC staff bit the bullet and required this certification by the American Board of Health Physics in their reactor specialty for the radiation protection managers at these plants. The industry, as I say, had input to it. If you are really an organization that is dedicated to upgrading the quality of the radiation protection manager at these plants, you would not hesitate to make such a requirement, and if indeed the industry is interested in improving the qualifications of their radiation protection managers, they would have no objection to such a requirement.

The reviews that have been conducted in the past months since TMI, specifically the review of the Rad Protection Program at TMI 2 showed it was very much below the desirable level. The NRC's survey program which is currently underway under your guidance of the Radiation Protection Programs at the 70 operating nuclear power plants has shown that a number ofthem have very poor radiation protection programs. It's time we upgraded them. It's time without any doubt that you require the certification.

I would even go further, and I wouldn't put it in the Guide, but I certainly would encourage the NRC Commissioners or the directors of your I&E group and your own standards group and so forth to encourage the NRC senior staff itself to prepare for and take the certification exam if they haven't done it and become certified, because then this would show the industry that the people on the NRC staff were willing to go to the same degree, go through the same procedures and prove their own competence the same that they're asking the people they're inspecting prove their competence.

Perhaps I am biased to some degree on this in that I, at one time, served on the examination panel for the American Board of Health Physics and later I served on the Board itself and I chaired the Board for some four years. But at the same time I say that, I went through the examination procedure, and I personally would say to you that I have more confidence in that certification program than I do in any degrees that a person would have. Because a person who goes through and takes the written exam and takes the oral exam and meets the requirements for Board certification and is finally certified, he or she can be proud of that certification. And you could full well know that any person with such Board certification working at any nuclear power plant, I think you could have full confidence in their capabilities. And I would have full confidence that through such a step, I know that we would be upgrading the quality of the people at these plants because where they're qualified and can take the exam and be certified, then that's fine. But when they aren't qualified and they need to dig in and study, fine, we're upgrading the quality of those people.

MR. KERR: Just parenthetically, following Professor Moeller's injunction, I hope you won't require that the people with engineering degrees be raised to professional engineers. And I'm glad to know that that certification program does ensure high quality, and I have no doubt that it does. I just didn't want the analogy pushed too far.

MR. ZUDANS: Is that similar to professional engineering?

MR. MOELLER: Very much so, yes.

MR. ZUDANS: Then it's pretty difficult.

MR. MOELLER: It's a tough exam but we would know that they are good people at the plants in charge of that particular portion of the operation.

MR. ZUDANS: Does the Board have a grandfather clause?

MR. MOELLER: I'm proud of what the Board did. It had a grandfather clause and it certified 100 health physicists back in 1958 or 1959 or 1960 when it began, and today they will not even grandfather the President of the Health Physics Society; they won't grandfather anyone after those first few, and I fully support that. Everybody including myself took the exam, and I'm for it. I'm against any grandfathering whatsoever.

In terms of specific comments on your Reg Guide, I would like, Mr. Chairman, to go through rapidly --

MR. KERR: Is it something you need to comment on or can you just give your suggestions?

MR. MOELLER: I can give suggestions in many cases; in fact, let me formally give them a page of suggestions which I've done up. But let me ask then about a couple things. On page 5 at the bottom, lines 25 through 27, you mention the criteria for onsite and offsite organizations that will provide assurance of safe operation of the plant during normal and abnormal conditions. I, for one, did not fully understand that. We need not cover it here, but let me say that I had trouble in understanding it.

On page 8 you mentioned NPO and the fact that they have developed or are developing recommendations for the qualifications, education and training of the plant shift technical adviser. I was curious as to how their recommendations compared to yours, or those in the Guide.

On page 9, you talk about, and our Chairman has already referred to this, the NRC accreditation of training institutions. That's in lines 16 through 18. I would be curious as to examples of such institutions and such training programs.

On page 12, in lines 22 to 24, I presume that sentence -- excuse me, on page 12, lines 14 and 15, I presume that sentence beginning in line 14, "Additionally, temporary placements should have experience in the field of the individual for which they are serving as a replacement." I presume that sentence belongs at the end of line 18.

MR. MILHOAN: Yes, it does. It was inserted wrong.

MR. MOELLER: Okay.

MR. MILHOAN: Before you go on, can I respond to you in part. The draft management organization criteria was an enclosure to the June 19th submittal of the management organization criteria that was developed by NPR. That document has since been revised and we'll be pleased to forward you that revised document.

The information about the NPO certification, that is presently under review by the staff and it's my opinion that the staff will find that NPO description compares very favorably with the staff's position. The accreditation comment that you had, a separate Commission information paper will be prepared on that subject. The study has not been completed yet and we'll be pleased to forward it at that time, the paper on the accreditation study. I think that brings us up to date on the comments.

MR. MOELLER: Right. On page 15, line 2, I did not understand -- it seems ambiguous. You said Section 4.4.3 and you're referring to the ANS standard, allows one year's credit toward NPB experience for a chemistry and radiochemistry training program, period.

MR. MILHOAN: It should be for completion of the chemistry and radiochemistry program.

MR. MOELLER: Is this some specially-defined program?

MR. MILHOAN: Yes. It's a vendor-conducted type program.

MR. MOLLER: All right. In terms of the chemistry and radiochemistry person at a nuclear power plant, I realize that that title is probably a misnomer, but I notice, and this isn't your problem, but in the ANS standard they require an engineering degree for the chemistry and radiochemistry supervisor or whatever he's called. Why don't they require chemistry degree for that person? That's on page 13 of the ANS Guide.

MR. KERR: You can say you don't know since you aren't part of that.

MR. MOELLER: Well, that is something that was confusing to me. Also, in your guide on page 20, in line 24, you said that the ANS says that the person should have a course in reactor theory, and then on your own discussion onthe second line on page 21 you said reactor control theory, so I searched this out to see if there was some hidden meaning between the ANS requiring reactor theory and you requiring reactor control theory and I found that you had made an error and left out the word "control", unless I've made an error, but I think you have.

On page 24 --

MR. MILHOAN: Yes, I did.

MR. MOELLER: On page 24, in lines 19 to 26, I find that the two statements are not compatible. Lines 19 through 26 on page 24, in line 19, you say,"In establishing equivalency with a BS degree, consideration should be given not only to formal courses in engineering and related sciences, but also to education in the liberal arts." So you're saying in that sense be very liberal in the interpretation of whether the fellow has or the woman has a BS degree.

Then the next sentence says, quote, "It is recommended that the use of the equivalency to a Bachelor of Science degree be exercised only a limited degree." So as I say, I find the two sentences in opposition to one another.

MR. MILHOAN: I didn't read the first sentence the way you do. In establishing equivalency to a BS degree you just cannot consider the technical courses only; you have to consider the other courses in establishing equivalency is how I read this.

MR. KERR: I certainly don't see why the NRC should start requiring that people have a liberal education for operator reactor. I don't see anything wrong with people being liberally educated but I'll be darned if I can see why we're getting into that. I mean that is really going pretty far.

MR. MORRISON: I think generally when you get into things like communications, that's sort of liberal arts; it's not technical training.

MR. KERR: But that is not liberal arts; it is precisely not liberal arts. Written communication --

MR. MORRISON: I didn't say written communication. I said communcations, the broad general subject of communication.

MR. KERR: But if you want people to learn how to communicate, say they need training in communications. But to say that -- well.

MR. MOELLER: Mr. Chairman, those are my more significant remarks. I appreciate the opportunity.

MR. KERR: Thank you, Mr. Moeller, and I thought all those comments were very constructive. Are there other comments?

MR. MILHOAN: Before you drop the subject, Mr. Moeller, I think we can handle your first comment concerning specifying if agreement, since it's a public comment guide, specifying the courses for the radiation protection manager as part of the college degree would be -- I think we can work on that and incorporate that in the guide prior to public comment.

Your second statement about the required certification that is a different question and I think we will have to take a look at it separate from publication of this particular guide for public comment, because that would tend to considerably hold up that question.

MR. MOELLER: Right. I understand your remarks, but I would encourage you to talk to the industry and see -- and I have not talked with them, but just see what their reaction would be, because if it is favorable, then I see no reason why it should not be. This, to me, would be a major step forward.

MR. KERR: Are there other comments on this?

MR. CATTON: I just have one comment. I read the BETA report, that's Basic Energy Technology Association, NUREG CR1280. They're kind of critical of the present NRC program, and I wonder if you've gone through and incorporated their comments into your thinking.

MR. MILHOAN: In the discussion section of the Guide we said the BETA report is out for public comment tat the present time. The analysis and technology contract also has a charter to review the BETA report. During the public comment period, we will review the BETA report and take into consideration; not necessarily incorporate all the BETA recommendations but take into consideration during the public comment period the BETA report. It's just that we didn't have time to do a complete review of it.

MR. RAY: I have a question for Dr. Moeller. Dade, would the requirement of certification of the health physicists automatically require some minimum academic study and qualification?

MR. MOELLER: The answer is no. The American Board of Health Physics will accept experience and work in lieu of a degree. And if you're able to pass that exam, they know you're top flight. So they don't require the degree.

MR. MILHOAN: It's an exception. If I read it correctly, it's an exception.

MR. MOELLER: It's an exception.

MR. MILHOAN: In fact, one of the parts of the radiation protection manager, and we only did a brief survey of 48 of them, and we found that only 3 of the 48 did not hold college degrees, and 26 of the 48 had an MS degree or higher; very highly qualified group.

MR. KERR: Is it true that this Guide is being written preparatory to having the Navy take over and operate all the nuclear power pla   in the U.S?

(Laughter.)

Is the procedure that we approve this going out for public comment or does the full Committee approve it? Does the Subcommittee approve this for going out for public comment? We approve it.

The next item is discussion of proposed Revision 3 to Reg Guide 1.33. This discussion will be limited to 10 minutes.

MR. SCARBOROUGH: The first proposed Revision 3 to Reg Guide 1.33 was sent out for public comment in August 1979. Since that time, a number of studies have been underway, the Lessons Learned has come out from Three Mile Island. A number of these studies are discussed in the discussion section of the Guide, similar to the 1.8 Guide. These studies, the completed reports and reports that are going to be issued here in the near future will all be considered as they come out. Some of them already have been considered to some degree in the Guide itself.

Also, the ANS 3.2 standard which is endorsed by this Reg Guide is undergoing extensive revision through ANS itself. It's incorporated a number of the lesson learned from TMI.

As a result of this ongoing revision of 3.2, theGuide endorses a draft version of ANS 3.2. We've received permission from ANS to endorse this version. Because of the living document of this draft 3.2, an additional draft has now come out. A later draft that takes into account a number of these Reg positions. We've discussed them in detail with the 3.2 working group, revising the standard. They've tried to include a number ofour Reg positions, and the later draft we haven't received permission yet from ANS to endorse the draft. They're meeting I believe this week to determine if that will be acceptable. If that later draft is available for us to endorse in the near future, what we propose to do would be to take the revision to the Reg Guide, revise it further, to endorse this later draft. There would be no change in the regulatory positions in terms of the total Guide endorsing a draft; a total regulatory guidance would be the same; it would just be some more would be included in the draft of the ANS document. We've seen a copy of their later draft, there's no change except a number of the Reg positions are incorporated into their draft. It will just make the paperwork and the build of issuing the Guide much less work for the editors and people who make the production.

I'm prepared to answer any questions you have on the contents of the Guide. I won't go through it. There's a number of changes. The standard itself has been significantly improved. The fact that there are a number of Reg positions does not indicate the true worth of the standard;they haven't included a lot of guidance and we do very much approve of the standard as it is now.

MR. KERR: Are there questions or comments? I see none, and we therefore approve submitting this for public comment.

One other item of business. The information available to me would indicate that the staff has only one guide to discuss if we had a meeting in September. I therefore am going to decide that we will not have a September meeting of the Regulatory Activities Subcommittee. In the meantime, if some backlog of guides does develop, I suppose you can get in touch with Sam.

Gentlemen, I thank you for your patience and assistance.

(Thereupon, at 6:20 p.m., the meeting in the above-entitled matter adjourned, to reconvene at 8:30 a.m. the following day.)

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

ACRS - Subcommittee on Regulatory Activities

in the matter of: Discussion on limited revisions to 10 CFR Part 50

Date of Proceeding: August 6, 1980

Docket Number: ______

Place of Proceeding: Washington, D. C.

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

David S. Parker

Official Reporter (Typed)

(SIGNATURE OF REPORTER)

NUCLEAR REGULATORY COMMISSION

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were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

Suzanne R. Babineau

Official Reporter (Typed)

Suzanne Babineau

Official Reporter (Signature)

VARIABLE TYPES

TYPE A - Those variables that provide information needed for preplanned operator actions.

TYPE B - Those variables that provide information to indicate whether plant safety functions are being accomplished.

TYPE C - Those variables that provide information to indicate the potential for being breached or the actual breach of the barriers to fission prod .t release.

TYPE D - Those variables that provide information to indicate the operation of individual safety systems.

TYPE E - Those variables to be monitored as required for use in determining the magnitude of the release of radioactive materials and for continuously assessing such release.

#1

TABLE 1

DESIGN AND QUALIFICATION CRITERIA CATEGORIES

CRITERIA	CATEGORIES 1	2	3	4	5	6
1. Seismic qualification[26]	yes	yes	no[22]	no[22]	no	no
2. Single failure criteria[21]	yes	yes	no	no	no	no
3. Environmental qualification[26]	yes	yes[4]	yes[23]	yes[23]	no	no
4. Power source	1E[6]	1E[6]	N1E[7]	N1E[7]	N1E[7]	AR[24]
5. Out-of-service interval	8	8	9	10	10	N/A
6.						
7. Quality assurance[11]	yes	yes	yes	yes	yes	yes
8. Display type[13]	Con[14]	Con[14]	OD[15]	OD[15]	OD[15]	AR[24]
9. Display method	Rec[17]	Rec[17]	Ind[18]	Rec[18][17]	Ind[18]	AR[24]
10. Unique identification[27]	yes	yes	no	no	no	no
11. Periodic testing[25]	yes	yes	yes	yes	AR[24]	AR[24]

#2

DELETIONS & ADDITIONS FROM/TO FOR COMMENT ISSUE

DELETIONS

Charcoal Delay Gas System Gas Flow or Radioactivity Level (from Table 3)

ADDITIONS

TABLE 2

- Type B - Soluble Boron Content
- Type C - Radioactivity - Steam Turbine Driven Auxiliary Feedwater Pump Vent
- Type D - Steam Flow to Auxiliary Feedwater Pump

TABLE 3

- Type B - (1) Suppression Chamber Air Temperature
  - (2) Drywell Temperature
- Type D - (1) HPCI Flow
  - (2) Core Spray Flow
  - (3) SLCS Flow

Purpose & Variables	Range	Category
TYPE D - (continued)		
Auxiliary Systems (continued)		
Letdown Flow - In	0 to 110% design flow	3
Letdown Flow - Out	0 to 110% design flow	3
Sump Water Temperature	50°F to 250°F	3
TYPE E - (continued)		
Gaseous Effluent Volumetric Flow Rate	0 to 110% design flow	4

#7

Purpose & Variables	Range	Category
TYPE E - (continued)		
POSTACCIDENT SAMPLING* CAPABILITY (Analysis Capability Onsite)		
Primary Coolant & Sump	Grab Sample	5[13, 14, 21]
Gross Activity	10 μCi/ml to 10 Ci/ml	
Gamma Spectrum	(Isotopic Analysis)	
Boron Content	0 to 6000 ppm	
Chloride Content	0 to 20 ppm	
Disolved Oxygen	0 to 20 ppm	
Disolved Hydrogen	0 to 1000 cc/kg	
pH	1 to 13	
Containment Air	Grab Sample	5[13, 21]
Hydrogen Content	0 to 10% 0 to 30% for ice condensors	
Oxygen Content	0 to 30%	
Gamma Spectrum	(Noble gas analysis)	
METEOROLOGY[15]		
Wind Direction	0 to 360° (±5° accuracy with a defliction of 15°. Starting speed 0.22 mps (0.5 mph) Damping ratio between 0.4 and 0.6, distance constant ≤2 meters)	4
Wind Speed	0 to 30 mps (67 mph)(±0.22 mps (0.5 mph) accuracy for wind speed less than 11 mps (25 mph), with a starting threshold of less than 0.22 mps (0.5 mph))	4
Estimation of Atmospheric Stability	Based on vertical temperature difference from primary system -5°C to 10°C (-9°F to 18°F) and ±0.15°C accuracy per 50 meter intervals (±0.3°F accuracy per 164-foot intervals) or analogous range for backup system.	4

*The time for taking and analyzing samples should be 3 hours or less from the time the decision is made to sample, except chloride which should be within 24 hours.

#5

Purpose & Variables	Range	Category
TYPE D - (continued		
Auxiliary Systems (continued)		
Control Rod Drive System Return Flow	0 to 110% design flow	3
TYPE E - (continued)		
Gaseous Effluent Volumetric Flow Rate	0 to 110% design flow	4

#6

Purpose & Variables	Range	Category
TYPE E - (continued)		
POSTACCIDENT SAMPLING* CAPABILITY (Analysis Capability Onsite)		
Primary Coolant & Sump	Grab Sample	5[13, 14, 20]
Gross Activity	10 µCi/ml to 10 Ci/ml	
Gamma Spectrum	(Isotopic Analysis)	
Boron Content	0 to 1000 ppm	
Chloride Content	0 to 20 ppm	
Disolved Oxygen	0 to 20 ppm	
Disolved Hydrogen	0 to 1000 cc/kg	
pH	1 to 12	
Containment Air	Grab Sample	5[13, 20]
Hydrogen Content	0 to 30%	
Oxygen Content	0 to 30%	
Gamma Spectrum	(Noble gas analysis)	
METEOROLOGY[15]		
Wind Direction	0 to 360° (±5° accuracy with a defliction of 15°. Starting speed 0.22 mps (0.5 mph) Damping ratio between 0.4 and 0.6, distance constant ≤2 meters)	4
Wind Speed	0 to 30 mps (67 mph)(±0.22 mps (0.5 mph) accuracy for wind speed less than 11 mps (25 mph), with a starting threshold of less than 0.22 mps (0.5 mph))	4
Estimation of Atmospheric Stability	Based on vertical temperature difference from primary system -5°C to 10°C (-9°F to 18°F) and ±0.15°C accuracy per 50 meter intervals (±0.3°F accuracy per 164-foot intervals) or analogous range for backup system.	4

*The time for taking and analyzing samples should be 3 hours or less from the time the decision is made to sample, except chloride which should be within 24 hours.

TABLES 2 & 2A

Purpose and Variables	Range	Category
TYPE B (Changed from Type D)		
Steam Generator Level	From tube sheet to separators	1 (3 for B & W plants)

TABLES 3 & 3A

Purpose and Variables	Range	Category
TYPE B		
Control Rod Position	Full in or not in	5 (for 1 hr minimum)

#8

SUMMARY COMPARISON

TABLE 2

	For Comment	Proposed Final
TYPE B	13	17
TYPE C	3	7
TYPE D	23	31
TYPE E	21	11
	60	66

TABLE 3

	For Comment	Proposed Final
TYPE B	14	13
TYPE C	4	7
TYPE D	13	26
TYPE E	20	10
	51	56

SRO/Tape 1
Stanley

R.G. 1.97 AND ANS 4.5

POINT 1 - THE POINTS OF AGREEMENT ARE TOO FEW IN NUMBER AND IN CONTENT

POINT 2 - THE AREAS OF DIFFERENCE HAVE NOT NARROWED SINCE 12-79; AN UNEXPECTED RESULT

POINT 3 - ANS 4.5 HAS A BROAD BASE OF INDUSTRY SUPPORT FOR ACCIDENT MONITORING VARIABLES AND REQUIREMENTS

POINT 4 - MAJOR OVERHAUL OF R.G. 1.97 IS NEEDED FOR:

(A) SCOPE, AUDIENCE, PURPOSE

(B) REQUIREMENTS TIED TO OBJECTIVES AND FUNCTIONS

(C) FORMAT, CLARITY, UNAMBIGUITY

(D) REASONABLENESS

LS
8/4/80

ANS 4.5 APPROACH

1. Defined Accident Phases
2. Defined Functional Requirements
3. Defined Process For Variable Selection
4. Defined Criteria To Be Applied To Variables (Based On Functional Requirements)
5. Defined Minimum Variable Set
6. Designer Selects Variables/Performance Requirements By Applying Criteria/Designer Analysis

M O N I T O R I N G   F U N C T I O N S

TYPE A - PREPLANNED MANUAL ACTION

TYPE B - CRITICAL SAFETY FUNCTIONS

REACTIVITY CONTROL

CORE COOLING

REACTOR COOLANT SYSTEM INTEGRITY

PRIMARY CONTAINMENT INTEGRITY

RADIOACTIVE EFFLUENT CONTROL

TYPE C - BARRIER INTEGRITY

FUEL FAILURE

REACTOR COOLANT SYSTEM BREACH

PRIMARY CONTAINMENT BREACH

POTENTIAL FOR PRIMARY CONTAINMENT BREACH

ANS 4.5 PROGRESS

7-31-79	WRITING GROUP FORMED
10-15-79	ANS-4 BALLOT ON DRAFT 3 COMPLETED
2-29-80	NUPPSCO BALLOT ON DRAFT 5 COMPLETED
4-2-80	DRAFT 6A DISTRIBUTED
6-17-80	NUPPSCO LETTERS RECEIVED
7-14-80	FINAL CHANGES TO DRAFT 6A SUBMITTED
8-31-80(E)	NUPPSCO RECONSIDERATION PERIOD ENDS
9-1-80(E)	SUBMITTAL TO STANDARDS STEERING COMMITTEE
10-1-80(E)	SUBMITTAL TO ANSI
12-1-80(E)	ANSI APPROVAL
2-1-81(E)	PRINTED COPY DISTRIBUTION

LS
8/4/80

SIGNIFICANT DIFFERENCES

	R.G. 1.97	ANS 4.5
PURPOSE	ASSESS PLANT AND ENVIRONS CONDITIONS DURING/AFTER ACCIDENT	CRITERIA FOR AMI FUNCTIONS, VARIABLES, REQUIREMENTS.
AUDIENCE	OPERATING ORGANIZATION	CONTROL ROOM OPERATOR
SCOPE	AMI, STATUS, E-PLAN SUPPORT, SAFETY PARAMETER DISPLAY, TECH. SUPPORT CENTER, EMERG. OPERATIONS FACILITY, NUCLEAR DATA LINK	ACCIDENT MONITORING.
	ACCIDENTS AND ANCIP. OPER. OCCURRENCES	ACCIDENTS
VARIABLE TYPES	A, B, C, D, E	A, B, C
SPECIFIC TECHNICAL REQUIREMENTS	ORGANIZED BY TABLE 1 QUAL. CRITERIA	ORGANIZED BY FUNCTION AND VARIABLE

LS
8/4/80

SIGNIFICANT DIFFERENCES (CONTINUED)

	R.G. 1.97	ANS 4.5
TYPE B VARIABLES (PWR)		
REACTOR CONTROL	4	1
CORE COOLING	5	1 TO 4
RCS INTEGRITY	4	3
CONT. INTEGRITY	3	2
RADIOACTIVE EFF. CONTROL	0	1
TYPE C VARIABLES (PWR)		
FUEL CLAD BARRIER	2	1 TO 2
RCPB BARRIER	3	3
CONT. BARRIER	2	2 TO 4
TYPE D VARIABLES	~30	NONE
TYPE E VARIABLES	~19	NONE
TABLE NOTES	TABLE 1 - 17	6
	TABLE 2 - 21	
	TABLE 3 - 20	

LS
8/4/80

RECOMMENDED STEPS

1. SPLIT RG 1.97 CONTENT INTO TOPICAL SECTIONS OF VARIOUS REGULATORY GUIDES
   - AMI INTO RG 1.97
   - SAFETY SYSTEM STATUS INTO RG 1.47
   - EFFLUENT DISCHARGE PATH MON INTO RG 1.21
   - NUREG 0696 COMMUNICATION NEEDS IN NEW RG

2. MAKE EACH TOPICAL SECTION SELF-SUFFICIENT
   - SPECIFY CRITERIA
   - SPECIFY REQUIREMENTS
   - SPECIFY VARIABLES

3. REALLY ENDORSE ANS 4.5 FOR AMI PORTION

4. ELIMINATE CONFUSION INTRODUCED BY TABLE 1 QUALIFICATION CRITERIA CATEGORIES
   - FUNCTION-SPECIFIC REQUIREMENTS
   - VARIABLE-SPECIFIC REQUIREMENTS

5. EMPHASIZE CLARITY IN COMMUNICATING REQUIREMENTS
   - ONE INDIVIDUAL RE-WRITE

6. ENCOURAGE SOLUTION FLEXIBILITY
   - CRT GRAPHICS
   - TRADE-OFFS

Summers
Tape 2
+ 3

SYSTEMATIC APPROACH MISSING

- BASIC APPROACH OF ANS 4.5 ABANDONED BY GUIDE
- REG. GUIDE 1.97 DOES NOT EVOLVE FROM BASIC FUNCTIONAL CRITERIA/ANALYSES
- TABLES MANDATE UNJUSTIFIED DIVERSITY REQUIREMENTS ON FUNCTIONAL LEVEL

REQUIREMENTS OVERLY PRESCRIPTIVE

- SINCE REG. GUIDE 1.97 IS NOT BASED ON FUNCTIONAL REQUIREMENTS AND A PLANT ANALYSIS, BLIND COMPLIANCE IS REQUIRED
- COMPLEXITY IS NOT NECESSARILY A VIRTUE
- DETAIL DESIGN REQUIREMENTS OFTEN UNJUSTIFIED AND/OR BEYOND THE EXISTING STATE-OF-THE-ART
- APPROACH COUNTER TO KEMENY COMMISSION ADMONITION
- REG. GUIDE 1.97 SHOULD ADDRESS AMI FUNCTIONAL REQUIREMENTS NOT DESIGN THE SYSTEM

HUMAN FACTORS CONSIDERATION MISSING

- HUMAN FACTORS ENHANCEMENT IN THE CONTROL ROOM AND AMI AT CROSS PURPOSES
- NECESSARY/SUFFICIENT CRITERIA MUST BE APPLIED
- REG. GUIDE 1.97 HAS SUBSTANTIAL IMPACT
    - INFORMATION OVERLOAD
    - BACKFIT ANOMOLIES
- HUMAN FACTORS PLAY SIGNIFICANT PART IF AMI TO BE SAFETY IMPROVEMENT

SCOPE EXPENSION UNSUPPORTED

- ANS 4.5 CONTROL ROOM OPERATOR ORIENTED
- REG. GUIDE 1.97 EXTENDS SCOPE TO ENTIRE OPERATING ORGANIZATION
- NO BASE DOCUMENT REFERENCE OR FUNCTIONAL REQUIREMENTS ARE IDENTIFIED IN GUIDE FOR INCREASED SCOPE
- INCREASED SCOPE IS JUST NOW BEING FUNCTIONALLY DEFINED

SCOPE EXPANSION BLURS AMI FOCUS

- PRIOR AMI DEFINITION RECOGNIZED SCOPE LIMITATION (REG. GUIDE 1.97, REV 1)
- TYPE D & E VARIABLES NOT FUNCTIONALLY ESSENTIAL
- TYPE D VARIABLES WOULD MORE APPROPRIATELY BE ADDRESSED AS PART OF A STANDARD ON SAFETY SYSTEM REQUIREMENTS
- TYPE E VARIABLES FOR "DEFENSE-IN-DEPTH AND DIAGNOSIS" ARE INAPPROPRIATE

AMI IMPACT

	ANS 4.5	REG. GUIDE 1.97
TOTAL CLASS IE DISPLAYS	34	53
• ADDITIONAL	20-30	29-41
• UPGRADED	0-8	8-16
• EXISTING	4-6	4-8
TOTAL "CLASS 2E" DISPLAYS	NONE	110
• ADDITIONAL		71
• UPGRADED		39
TREND RECORDER POINTS	34	95
POWER UPGRADE ON NON-1E DISPLAYS	NONE	172
TOTAL ADDITIONAL INSTRUMENT CHANNELS	20-30	163-175

Tape 4
Coley +
Cain

Presentation by William Coley
on behalf of the AIF Subcommittee on
Safety Parameter Integration
ACRS Subcommittee on Regulatory Activities
August 6, 1980

My name is William Coley. I am Manager of Engineering Services Steam Production Department at Duke Power Company and I am here today representing the AIF Subcommittee on Safety Parameter Integration. I am also chairman of the AIF Subcommittee on Control Room Considerations.

The purpose of my presentation today is to offer a way to allow the proposals for emergency facilities to be resolved and implemented in the most timely and safety effective way and at the same time provide a vehicle for resolving the controversy surrounding the proposed R.G. 1.97 instrumentation list and requirements. This proposed approach is an outgrowth of intensive interactions between our Subcommittee on Safety Parameter Integration and NRC technical management concerning development of an integrated approach for defining the requirements for SPDS, TSC, EOF and other facilities to support crisis management. This effort has involved a series of meetings over the last three months with many experts who have contributed to our approach. In presenting this approach we intend to proceed in three distinct steps:

(1) To explain the rationale behind our approach.
(2) To propose an example list of parameters that should be given first precedence and is the first step in development of subsequent lists and requirements resulting in an integrated data display system.
(3) To underscore the serious problems with the currently proposed R.G. 1.97 requirements and the subsequent implications of these problems on emergency facilities.

At the time work was initiated on Regulatory Guide 1.97, industry did not have in place structured crisis management

2

plans and organizations to address fully a major site emergency. Further, emergency facilities such as the SPDS, TSC, and EOF, which support the crisis management plan were not defined. Thus, the selection of variables in R.G. 1.97 was not related to their use in these emergency facilities. Consequently, the requirements of R.G. 1.97 are not in concert with industry and NRC efforts on these facilities.

This disconnect is particularly important since the NRC is now tying the instrumentation requirements for these facilities to R.G. 1.97.

Additionally, R.G. 1.97 does not recognize the current industry efforts and evolving NRC requirements to improve the operator interface; in fact, it has not addressed human engineering factors which validate the usefulness and help to the operator of the parameters selected.

In our efforts with NRC Staff to define the functional requirements of emergency facilities, we have embarked on a systematic approach to establishing the data requirements for emergency facilities. This approach in contrast to R.G. 1.97, integrates the consideration of human factors engineering, the need for and importance of the information, and the function for which the information is going to be used. Implementation of R.G. 1.97 in its present form would preempt this timely and more safety effective approach.

Through sequential application of this methodology to first meet the requirements for the SPDS and other emergency facilities, a set of accident parameters can be defined which are generic to the detection and mitigation of any site accident. Further, the application of the methodology should allow us to implement more quickly in operating plants those factors which have potential for the greatest improvement in safety.

We are now in the process of several parallel efforts. One is to review the functional requirements of the emergency facilities. Another is to do a human factors review of the Control Room. We see a logical evolution of the intent and original spirit of R.G. 1.97 through the progressive development of the emergency facilities, the human factors control room review, and then consideration of what requirements remain to be addressed in other regulatory guides. Accordingly, it is our judgement that the instrumentation requirements in R. G. 1.97 should not be implemented until such time as the appropriateness of these requirements can be verified through this progressive development. As discussed above, implementation of R. G. 1.97 in its present form at this point in time will preempt this timely and more safety effective approach.

Our first step in this approach has been to develop a minimum parameter set for localized display in the control room. We have selected those SPDS parameters that we feel are essential for focused attention of the operator. Dave Cain of NSAC will provide the methodology for selecting these parameters and the resulting list of parameters for PWRs. Ellery Hammond representing the BWR Owners Group will also give a presentation on SPDS instrument selection from a BWR perspective. To further illustrate some of the specific problems with R.G. 1.97, we have submitted to you our previous comments on it. Xavier Polanski will highlight our general concerns.

STRUCTURED PARAMETER SELECTION PROCESS

- FUNCTIONAL REQUIREMENTS
- SELECTION CRITERIA
- DECISION LOGIC

PARAMETER SELECTION CRITERIA (SPDS)

- LEADING INDICATOR
- PLANT SAFETY FUNCTION
- RADIOACTIVE BARRIER
- DETECTION
- DIRECT MEASUREMENT
- RELIABILITY
- DIVERSE PLANT CONDITIONS

THE OPTIMAL PARAMETER SET

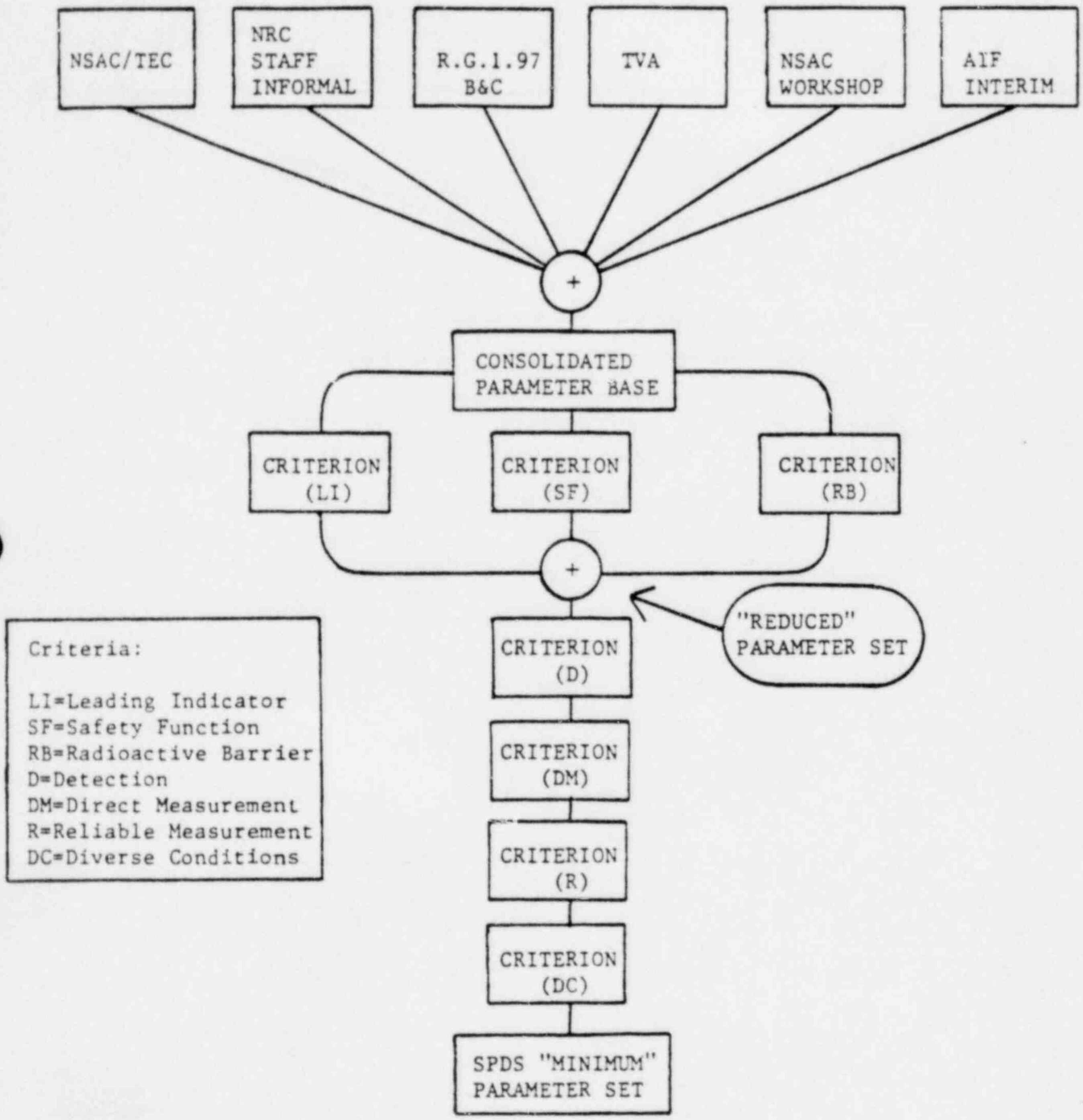
MORE IS BETTER

VS.

EFFICIENCY IN DESIGN

a

PARAMETER SELECTION PROCEDURE: SPDS



SELECTION MATRIX

Consolidated Parameter Base	D	DM	R	DC	LI	SF	RB	COMMENTS
T hot*	x	x	x	x	x	x		Proposed as an alternative to Core Exit Tc's.
T cold*	x	x	x	x	x	x		
S/G . el*	x	x	x	x	x	x		
S/G Pressure*	x	x	x	x	x	x		
Cont. Rad. Mon.*	x	x	x	x	x		x	
Core Exit Tc's	x	x	x	x	x	x		
Vessel Level	x	x		x	x	x		State of the art precludes reliable, unambiguous level measurement at this time.
RHR Flow		x	x		x			
Aux. FW Flow*	x	x	x	x	x	x		Should be augmented by normal feedwater for normal operations.
CST Level		x	x	x	x			
RCS Flow Rate		x			x	x		
S/G RV Pos.		x	x	x	x			
RCS Rad. Mon.	x	x	x	x			x	Installation of high range rad. monitoring instruments under present requirements would be sufficient to meet present selection criteria.
Cond. A/E Mon.*	x	x	x	x			x	
CR Pos.	x	x		x	x	x		Control rod position not considered reliable, nor practical, given number of variables to be monitored by SPDS.
Main Fac. Exh. Mon.*	x	x	x	x			x	
RHR Rad. Mon.		x	x				x	
Pzr. Level*	x	x	x	x	x	x		
RCS Press*	x	x	x	x	x	x		
Cont. Sump Level*	x	x	x	x	x	x		
Drain TK Level		x	x	x	x			
RWS' evel		x	x	x				
SRV & PURV Pos.		x	x	x	x			
Boric Acid Chg. Flow		x	x		x			
Bo[illegible] Conc.	x			x				Boron conc. req'd after TMI(2); methods are unreliable and do not account for concentration in core during boil-off.

SELECTION MATRIX

Consolidated Parameter Base	D	DM	R	DC	LI	SF	RB	COMMENTS
CVCS Tank Level		x	x	x	x			
Neutron Flux*	x	x	x	x	x	x		
Letdown Flow		x	x	x	x			
Coolant Subcooling	x		x	x	x	x		Subcooling and/or superheat may be computed internal to SPDS.
Cont. Press.*	x	x	x	x	x	x		
Cont. H_2 Conc.	x					x		On-line H_2 monitoring presently considered unreliable.
Cont. Iso. Valve Pos.		x	x	x				
Cont. Temp.	x	x		x	x	x		
Heat Removal--Cont. Fan Cool.			x		x			

*AIF Minimum SPDS Parameter Set for PWR

Tape 5 + 6

MINIMUM SPDS PARAMETER SET FOR PWR

I. REACTIVITY CONTROL

1. NEUTRON FLUX (<1% POWER)

II. REACTOR CORE COOLING

1. CORE HEAT REMOVAL AND RCS INVENTORY CONTROL
   - RCS COLD LEG TEMP
   - RCS HOT LEG TEMP OR CORE EXIT TEMP
   - RCS PRESSURE
   - PRESSURIZER WATER LEVEL
2. HEAT TRANSFER PATHS
   - STEAM GENERATOR WATER LEVEL
   - STEAM GENERATOR PRESSURE
   - AUXILIARY FEEDWATER FLOW
   - MAIN FEEDWATER FLOW

III. REACTOR COOLING SYSTEM INTEGRITY

1. RCS PRESSURE
2. CONTAINMENT PRESSURE
3. RCS TEMPERATURE (HOT LEG OR CORE EXIT)
4. CONTAINMENT HIGH-RANGE AREA RADIATION
5. CONTAINMENT SUMP WATER LEVEL
6. SECONDARY SIDE RADIATION (AIR EJECTOR OFF-GAS)
7. PRESSURIZER WATER LEVEL

IV. CONTAINMENT INTEGRITY

1. CONTAINMENT PRESSURE

V. RADIOACTIVITY RELEASE (FINAL RELEASE POINT MONITORS)

1. STACK RADIOACTIVITY NOBLE GASES
2. AIR EJECTOR RADIOACTIVITY NOBLE GASES

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METHODOLOGY FOR

BWR SPDS

ACRS
8-6-80
EH-1

14

BWR SAFETY PARAMETER DEVELOPMENT

BASED ON EMERGENCY GUIDELINES

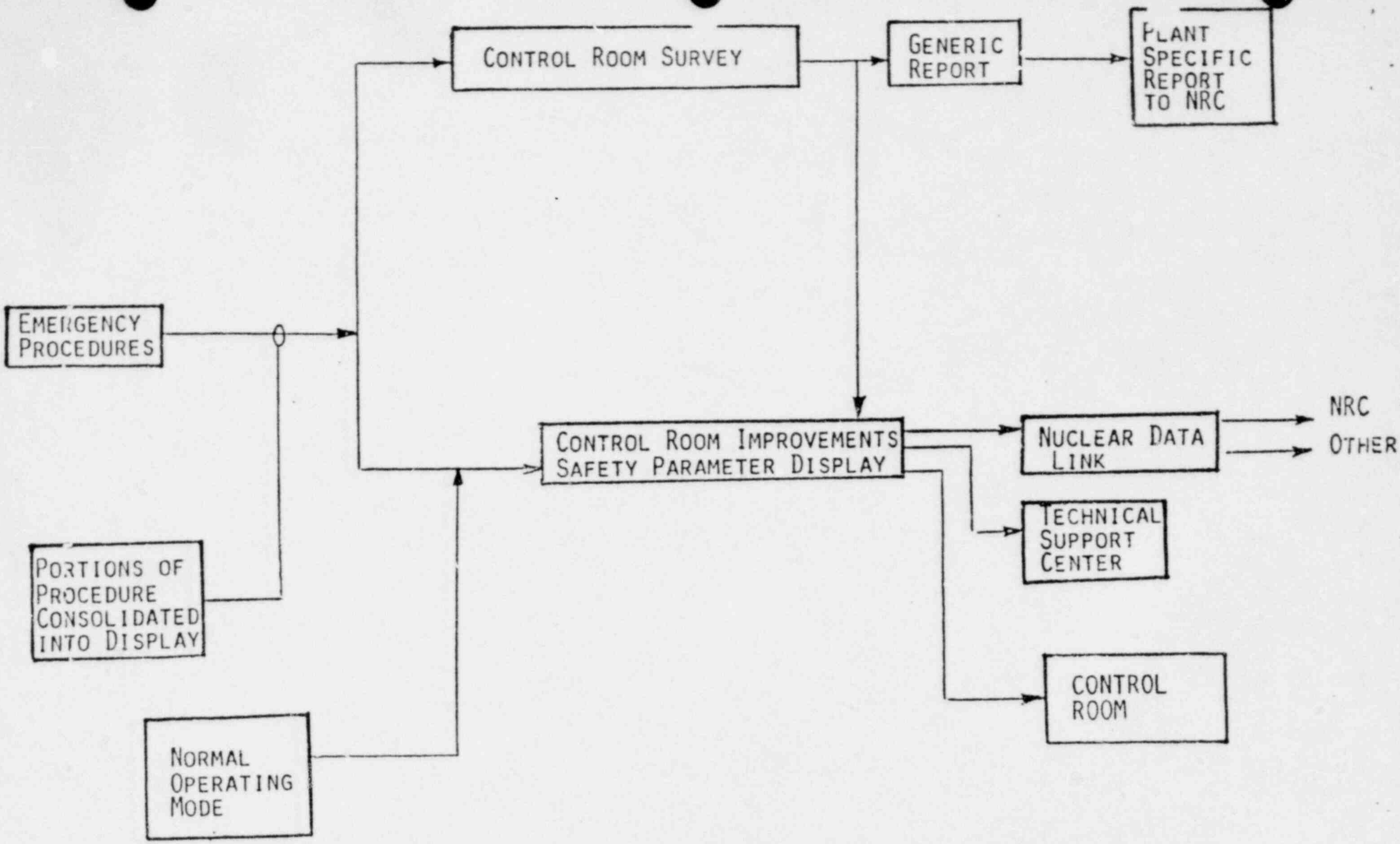
- o DEVELOPED BY OWNER CONSENSUS
- o SYMPTOM BASED
- o COVER MULTIPLE FAILURES

DEVELOPED FROM KEY GUIDELINE FUNCTIONS

- o LEVEL CONTROL
- o CONTAINMENT CONTROL
- o SHUTDOWN
- o CONTINGENCIES

PRIMARY VARIABLES WERE DETERMINED

- o INDICATE STATUS/VALUE OF SAFETY PARAMETER
- o SUPPORTED BY SECONDARY VARIABLES



NORMAL AND TRANSIENT
SAFETY PARAMETER DISPLAY

ACRS
8-6-80
EH-3

TABL

EMERGENCY PROCEDURE GUIDELINES

CONTAINMENT CONTROL GUIDELINE

Operator Action	Action Ident #	Supporting Parameters	Where is Information Available & How Shown	
Entry any of,				
• High Suppression Pool Temp.	1	Suppression pool temp.	CR	
• High Drywell Temp.	2	Drywell temp. (C 9)	CR	
• High Drywell Pressure	3	Drywell pressure	CR	
• High Suppression Pool Water level	4	Suppression pool water level (C 12)	CR	
		NOTE 1: Display suggested		
Monitor and control all entry conditions concurrently	5	(4 entry conditions (C12))	All in CR	
Close any SRV within (2 minutes), or Scram Reactor	5-1 5-2	SRV positions Rod positions	CR/Ind. Lights CR/Ind. Lights	
Operate available Suppression pool cooling when pool temp. exceeds normal operating limit.	5A	Suppression pool temp. (C 7, 8, 18, 20)	CR	
If Suppression pool temp. reaches scram limit, scram the reactor or verify scrammed.	5A-1	Suppression pool temp. Control rod position Neutron flux (SRM) NOTE 2	CR CR (P680) and lights CR (P680), meter/recorder	
Control suppression pool temp. and/or RPV pressure below the heat capacity limit.	5A-2	(C 16, 19, 20) Suppression pool temp. RPV pressure	 CR CR	

ACRS
8-6-80
EH-4

Minimum SPDS Parameter Set for BWR

I. Reactivity Control

1. SRM Period/Neutron Flux

II. Reactor Core Cooling

1. Core Heat Removal

   Reactor Water Level

2. Heat Transfer Paths

   Suppression Pool Water Level

   RHR Water Temperature

   RHR SW Exit Temperature

III. Reactor Cooling System Integrity

1. RCS Pressure
2. Drywell Sump Collection Rate
3. Drywell Pressure

IV. Containment Integrity

1. Suppression Pool Water Temperature
2. Suppression Pool Pressure
3. Drywell Pressure
4. Suppression Pool Water Level

V. Radioactivity Release

1. Reactor Building Exhaust Ventilation Radioactivity
2. Standby Gas Teatment System Radioactivity
3. Off-Gas Stack Radioactivity
4. Process Liquid Radioactivity

ACRS
8-6-80
EH-5

18

Tape 7
Waters

REG. GUIDE 1.97 (DRAFT 2 - REV. 2)

BWR COMMENTS

PURPOSE

- PROVIDE BWR COMMENTS ON DRAFT 2
- DISCUSS TECHNICAL ASPECTS OF CORE EXIT TEMPERATURE MEASUREMENT REQUIREMENT

CONCERNS

- REVISION TO REG. GUIDE 1.97 INAPPROPRIATE NOW
- CORE EXIT MEASUREMENT NOT NECESSARY FOR BWR
- ADDITIONAL SPECIFIC COMMENTS IN POSITION PAPER

8/1/80

SUMMARY OF RECOMMENDED REG. GUIDE 1.97 CHANGES

- o REFLECT UNIQUE BWR FEATURES
- o PROVIDE VARIABLE SELECTION CRITERIA
  - INTEGRATE WITH PROCEDURE GUIDELINES
  - INTEGRATE WITH NUREG-0696
  - FOCUS ON KEY VARIABLES
- o ELIMINATE MARGINAL VARIABLES (NOTABLY CORE EXIT TEMPERATURE MEASUREMENT FOR THE BWR)

8/1/80

IMPACT OF CORE DISCHARGE TEMPERATURE MEASUREMENT

- O BASIS: TC IN PRM ASSEMBLY
- O COST: DOLLARS
  - $400K/PLANT - FORWARD FIT

    TOTAL FOR 33 PLANTS: $13 MILLION
  - $600K/PLANT - BACKFIT

    TOTAL FOR 25 PLANTS: $15 MILLION

    AGGREGATE FOR 58 PLANTS: **$28 MILLION**
- O COST: DOSE
  - MAINTENANCE = 8 MAN REM/YR/PLANT - ALL PLANTS;

    58 PLANTS X 40 YRS X 8 = 18,500 MAN REM FOR TOTAL PLANT LIFE
  - INSTALLATION - 100 MAN REM/PLANT - BACKFIT

    25 PLANTS X 100 = 2500 MAN REM TOTAL

    GRAND TOTAL: **21,000 MAN REM**

COST HIGH FOR VERY MARGINAL BENEFIT

8/1/80

Tape 7
Sawyer

R.G. 1.97 REASONS FOR CORE EXIT TEMPERATURE FOR BWRs

- INDICATE POTENTIAL FOR OR ACTUAL FUEL CLAD BREACH.
- MEASURE EXTENT AND TREND OF CORE DAMAGE
  - 5-10% CORE BLOCKAGE WITH NO ECCS

CDS-1
8/6/80

CURRENT VARIABLES WHICH INDICATE CLADDING BREACH

- CLADDING BREACH OCCURS WHEN:
  - HIGH CLADDING TEMPERATURE/HIGH HOOP STRESS
    - BWR RUPTURE TEMPERATURE 2200F
  - CLADDING OXIDATION
- VARIABLES INDICATIVE OF BREACH
  - HIGH HYDROGEN LEVELS
  - HIGH STEAM LINE RADIATION
  - FISSION PRODUCTS IN REACTOR COOLANT/ CONTAINMENT AIR/SUPPRESSION POOL WATER
  - OFFGAS RADIATION LEVELS
  - LOW WATER LEVEL
  - LOSS OF MAKEUP
- CURRENTLY MEASURED VARIABLES
  - PROVIDE DIVERSITY
  - UNAMBIGUOUS INDICATION
  - QUALIFIED AND TESTED

MANY CURRENTLY MEASURED VARIABLES ALREADY PROVIDE INFORMATION ABOUT CLADDING BREACH

EVALUATION OF SITUATIONS WHERE TC's MIGHT BE USED

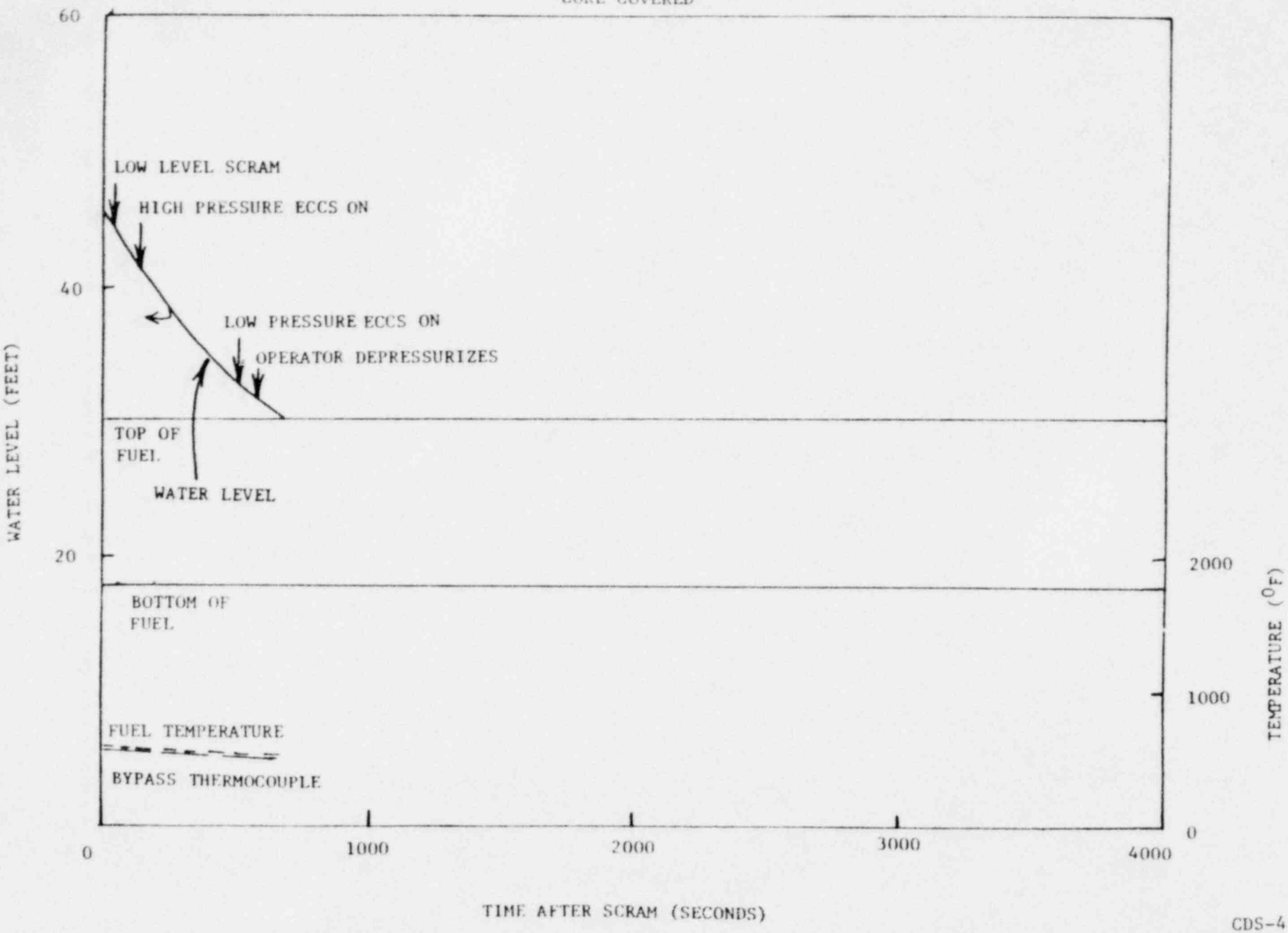
- PRIOR TO ~~CLADDING BREACH~~ Core uncovery
  - BWR OPERATES SATURATED
  - WATER LEVEL KEY VARIABLE THAT DETERMINES ECCS INITIATION AND OPERATOR ACTION
- DURING CORE HEATUP
  - ONLY USEFUL IF
    - WATER LEVEL BELOW TOP OF FUEL AND NO MAKEUP
  - NOT USEFUL WHEN
    - CORE SPRAYS OPERATING
    - TWO PHASE MIXTURE IN UPPER PLENUM (CCFL)
    - WATER LEVEL ABOVE CORE
- DURING RECOVERY PHASE
  - NATURAL CIRCULATION NOT A CONCERN
  - OPERATOR REQUIRED TO DEPRESSURIZE AND MAINTAIN LEVEL
  - NO CORE DAMAGE PROPAGATION WHEN CORE COVERED
    - NUMEROUS PATHS FOR FLOW PER BUNDLE
  - TC's WILL NOT INDICATE ABOVE SATURATED

TC's ONLY USEFUL WHEN CORE AND UPPER PLENUM COMPLETELY EMPTY

CDS-3
8/6/80

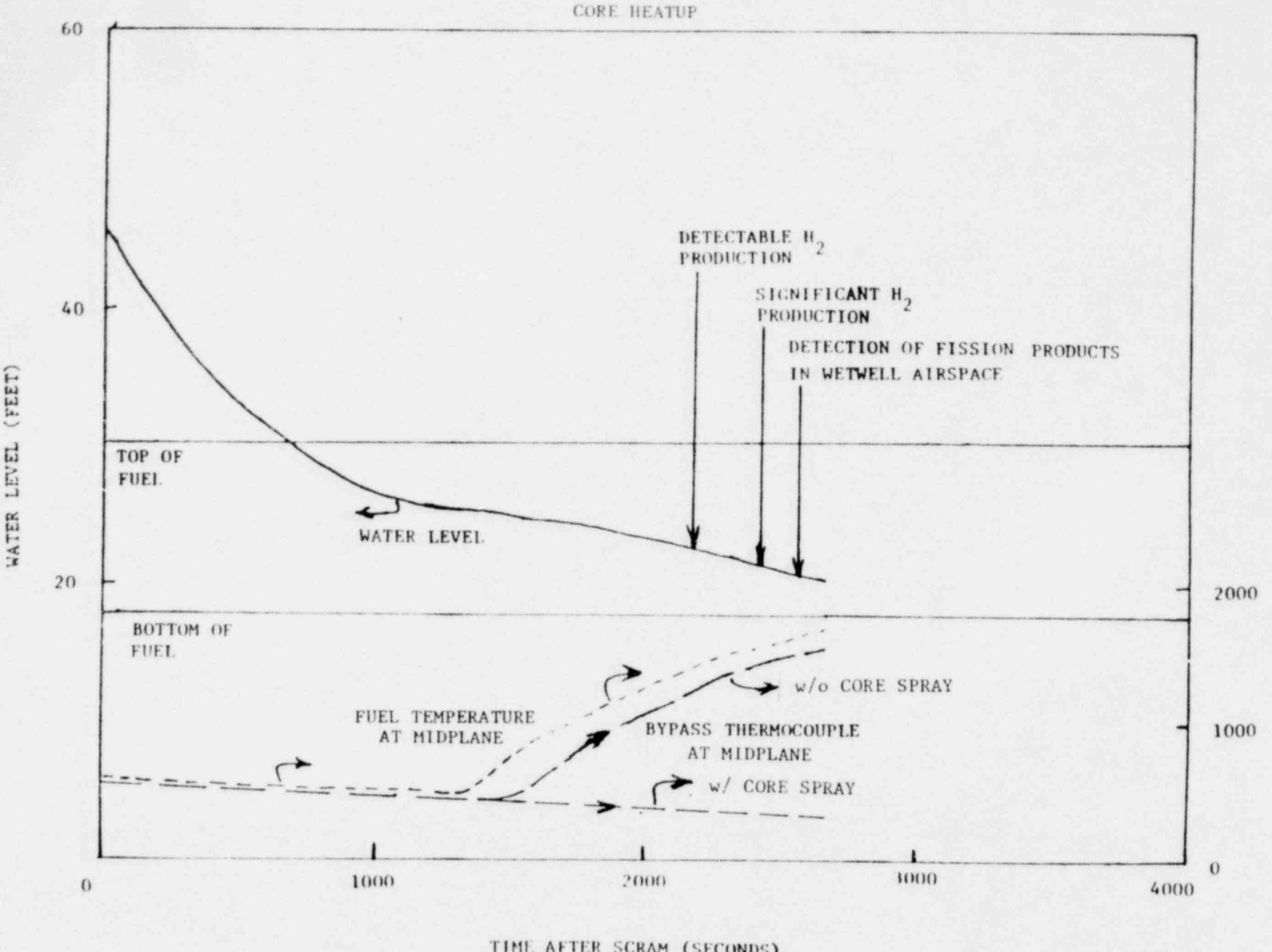
BYPASS THERMOCOUPLE RESPONSE FOR AN EXTREMELY DEGRADED CASE

CORE COVERED



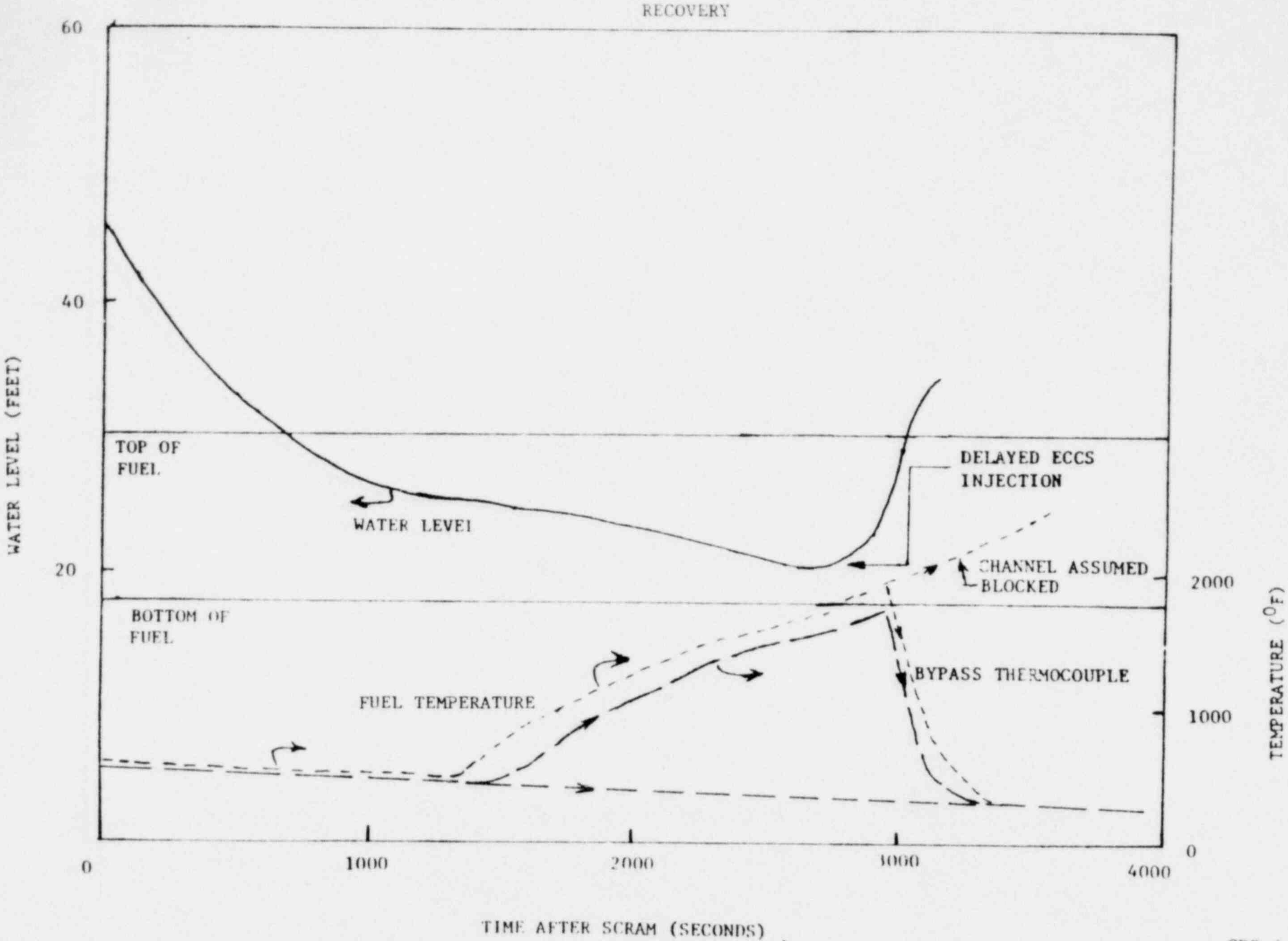
CDS-4
8/6/80

BYPASS THERMOCOUPLE RESPONSE FOR AN EXTREMELY DEGRADED CASE



CDS-5
8/6/80

BYPASS THERMOCOUPLE RESPONSE FOR AN EXTREMELY DEGRADED CASE



CDS-6
8/6/80

CONCLUSIONS

- CONSIDERABLE NUMBER OF VARIABLES ALREADY MEASURED WHICH INDICATE (POTENTIAL FOR) CLADDING BREACH.
- NO CORE DAMAGE PROPAGATION EXPECTED.
- TEMPERATURE MEASUREMENT NOT A RELIABLE INDICATOR OR EXTENT AND TREND OF CORE DAMAGE.

Tape 9
Timmons

Westinghouse Position in Regard to
Draft Regulatory Guide 1.97 Revision 2

Westinghouse is a designer of Nuclear Steam Supply Systems and associated support equipment, and thus is in a position to provide relevant and practical comments on the type of Regulatory Guidance which will be clear and useful to designers. We supplied such comments previously and were disappointed in the lack of serious consideration given them in deriving this latest draft of the guide.

Westinghouse realizes that the NRC and the nuclear industry need an integrated approach to the subject of Emergency Response. Accident monitoring instrumentation, Emergency Response Facilities and human engineering considerations are all important parts of the subject. Westinghouse firmly believes that Regulatory Guide 1.97 could provide an appropriate address to accident monitoring for the control room operator, but that its effectiveness in that area is currently diminished by the attempt to address Emergency Response Facilities. We understand that further guidance is being developed to provide criteria for the Technical Support Center, Emergency Operations Facility, Safety Parameter Display System, etc., and to integrate emergency response facilities into a logical and consistent package. Regulatory Guide 1.97 is separable from these other criteria and should not be used as the vehicle of integration until the other criteria are established.

In this light we would like to make a brief statement of position concerning the latest draft of Regulatory Guide 1.97 Revision 2; and we would like to specifically address the following three points: 1) the appropriateness of the specification of detailed functional requirements by the NRC Staff, 2) the appropriateness of the scope of the present draft guide, and 3) the technical problems and inconsistencies within the current version.

1. In promulgating the latest draft of Regulatory Guide 1.97 Revision 2 the NRC Staff has stepped outside of the traditional and appropriate role of regulator and is now specifying detailed functional requirements. It is our position that the NRC should limit its regulatory role to the specification of general criteria, and allow the industry to translate these into specific requirements and designs which are optimized for specific plant characteristics. If however, the NRC Staff persists in the specification of detailed functional requirements, then a consistent basis document must be established which explains to the designer why the functional requirements have been established.

2. Work is currently being pursued in relation to Emergency Response Facilities and human factors reviews associated with optimized data presentation; these will supply additional input to post-accident monitoring criteria and cover the areas beyond the scope of ANS 4.5. In relation to these Emergency Response Facilities there exists a potential major problem with draft Regulatory Guide 1.97 Revision 2 and with draft ANS 4.5. As currently written both ANS

PRELIMINARY

4.5 and Regulatory Guide 1.97 could impose inappropriate Class IE qualification and design criteria on the Emergency Response Facilities. A more detailed explanation of the problem and a proposed resolution has been indicated in Attachment 2.

3. Regardless of the previously indicated problems there are some logical and technical problems and inconsistencies within this latest draft of the guide and in the Staff response to public comments. Some examples of the most significant items are described in Attachment 1.

In light of the problems indicated in the above discussions Westinghouse can not endorse the current draft of Regulatory Guide 1.97 Revision 2.

PRELIMINARY

Attachment 1: Logical and Technical Problems

A. The General Design Criteria which are to be addressed by this document are directly concerned with accident conditions as indicated in the Code of Federal Regulations. As a result, there is no direction within the basis for this document which requires an address of "anticipated operational occurrences."

B. Draft Regulatory Guide 1.97 Revision 2 provides in Table 1 a set of design and qualification criteria categories. The Regulatory Guide fails to provide a justified correlation between the numerical categories and the variable types. Since the categories are applied to several different variable types there seems to be a lack of consistent rationale for the application of these categories, much less a basis document for their creation and application.

C. Containment Hydrogen Concentration does not fall under the definition of type B as it does not indicate the Maintenance of Containment Integrity. Per the definitions provided for variable types, H_2 concentration is a type C variable.

D. Condensate Storage Tank level does not provide under type B an indication of core cooling. It is a part of a support system which is properly monitored under the NRC type D.

E. Main Feedwater Flow should be deleted from this Regulatory Guide since the Main Feedwater System is not a safety system.

F. In Regulatory Position C5, Section 5.1 of ANS 4.5 is endorsed. ANS 4.5, Section 5.1.2 for type B states "identification of the monitored variables that provide the most direct indication needed to assess the accomplishing or maintaining of:...." The large number of variables indicated as type B in Regulatory Guide 1.97 is in conflict with the endorsement of Section 5.1 of the ANS draft standard in that much more than the most direct indication is specified.

G. Page 7 in the discussion section states that the temperature limitation for PWR core exit thermocouples is lower for operating plants. However, Table 2A does not reflect this statement. The maximum value indicated for operating and non-operating plants is 2300°F.

H. The discussion states that direct indication of coolant level in the reactor vessel is not currently available for PWR's; if this is true then there is no reason to indicate low RCS flow in the table of variables. The -12% to +12% flow is primarily required as an indicator of natural circulation and there are other methods available to verify natural circulation based on subcooling and heat removal from the steam generators (parameters already indicated in Table 2). As a result the development of a -12% to +12% flow indicator is not necessary. Furthermore, how

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a -12% to +12% flow indicator could be calibrated without bypassing safety systems is not clear, and it is questionable whether a negative RCS flow could be obtained for calibration purposes.

I. In response to public comment number 15 which suggested that the Regulatory Guide was too prescriptive and should instead consist of criteria, the Staff merely disagrees with the comment without adequate justification for their position.

J. In response to public comment number 26 which suggests that continuous display of types A, B, and C variables may be undesirable from a human factors viewpoint, the Staff indicates that the operator must learn to use the information. This does not address the real human factors problem of optimum presentation of data.

K. Contrary to public comments that certain instrumentation is not within the state-of-the-art, the NRC Staff makes numerous statements to this effect. The Staff should be required to provide a list of acceptable vendors of this instrumentation and provide their endorsement of the instrument acceptability and qualification.

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Attachment 2: Inappropriateness of Class IE Emergency Response Facilities

The Regulatory Position in the Regulatory Guide references ANS 4.5's definition of type A, B, and C variables and the associated general criteria. As currently defined, both types A and B cover many functions that are performed by the Emergency Response Facilities (Technical Support Center, etc.) and consequently can lead to the application of requirements in section 6.0 of ANS 4.5 and Table 1 of draft Regulatory Guide 1.97 Revision 2 to the Emergency Response Facilities. These requirements would impose inappropriate Class 1E qualification and design criteria on these facilities.

In addition the definition of type A variables can lead to the application of these requirements to any instrumentation circuits which provide information to the operator that are identified in written procedures (pre-planned manual actions), independent of whether the action is required for safety purposes.

We believe that these potential problems can be corrected by the following modifications:

a. Modify the definition of type A variables to read:

   Type A variables are those variables to be monitored that provide the primary information required to permit the control room operator to take the specified manually controlled actions for which no automatic control is provided and which are required for safety systems to accomplish their safety functions for design basis accident events.

   Primary information is that which is essential for the direct accomplishment of the specified safety functions and does not include those variables which are associated with contingency actions that may also be identified in written procedures.

b. Change the scope of draft Regulatory Guide 1.97 Revision 2 to limit the application of the requirements for equipment to that part of the instrumentation system and its vital supporting features or power sources which provide the direct display of the process variables. Table 1 should contain a note that these requirements are not applicable to instrumentation systems provided as operator aids for the purpose of enhancement of information presentations for the identification or diagnosis of disturbances.

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Tape 9 Gopal

Short minutes of LWR I&C Specialists Meeting on Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident, "Revision 2, Draft 2 (July 7, 1980)

A meeting was held on August 1, 1980 at ORNL, hosted by Oak Ridge National Laboratory, attended by 17 instrumentation development and applications specialists to review the status and needs for development of instruments needed to meet the requirements of Reg. Guide 1.97, Rev. 2, Draft 2. Representatives from Combustion Engineering, EG&G-INEL, G. E.-San Jose, ORNL, Sandia Laboratories, Technology for Energy Corporation, TVA, and Westinghouse attended.

Summary:

Tables 1-3A in the subject draft list particular variables, measurement of which are presumed to satisfy the main purpose of the Guide. The guide would be more useful to the instrument engineer if the rationale for choosing these variables were presented. Better still, the definition of the criteria for selecting variables and their ranges would allow the plant designer to specify functional requirements and design options for this particular plant.

The instruments and ranges specified in Tables 1, 2, 3, 1A, 2A, and 3A of Draft 2 were discussed in some detail and the following general observations were made.

1. In most instances, instruments for measuring the specified variables are already installed in operating LWRs, however, rarely are they qualified to Category 3 in Table 1 and 1A.

   Qualification of the required instruments, particularly to Category 1, will be a lengthy and expensive process, taxing commercial capabilities for providing such instruments.

2. Reg. Guide 1.97 does not provide detailed functional requirements for the instruments listed so that priorities can be assigned to development, qualification, manufacture, and installation of specific instruments.

3. The time frame for implementation of Reg. Guide 1.97 -- June 1982 for new plants and January 1981 - June 1983 for retrofit in existing plants -- does not allow sufficient time for qualification to Category 1 of many of the required instruments.

4. Accident conditions are not sufficiently specified that the required instruments can be qualified to survive them. Clearly, instruments cannot survive all conceivable accident conditions. In some more severe accidents, some of the listed instruments will not be useful to the operator and need not be qualified to survive such conditions.

5. An instrument qualification program cannot adequately address the problem of aging without the establishment of criteria for accelerated life testing.

6. The large number of additional instruments needed for compliance with Regulatory Guide 1.97 could create major problems of signal cabling and containment penetration. To meet these needs the development and qualification of radiation - and environmentally hardened multiplexing equipment for location within the containment will be required.

7. In general, the ranges for the measured variables given in the tables are not accompanied by accuracy statements and the conditions under which these accuracies are needed are not given. Ranges given as "0 to -- " do not define the lowest non-zero limit of the measured variable. Some of the ranges selected seem inappropriate as a technical requirement.

Some specific problem areas were identified:

8. Since the statements in the Discussion Part 8, pages 2 and 3 so strongly identified the need for status of coolant level in the PWR reactor vessel, we do not understand why this variable was not listed in Tables 2 or 2A. Several techniques are being developed for measuring coolant level in PWRs which could be qualified within reasonable time limits.

9. In Table 2, under core cooling, the Reactor Coolant Loop Flow range is given as 0-120% and -12% to +12%. If a requirement for measuring convective flow in a PWR during accident conditions is required, it should be so stated.

10. Even if all of the five items listed under core cooling in Table 1 (page 15) were measured, adequate core cooling of PWRs could not be established for small or large break LOCA accidents. Only natural circulation conditions of an intact system could be verified. This section could benefit from coordination with the vendor studies on inadequate core cooling.

11. Vendor Maintaining Containment Integrity, page 16. measurement of Containment Hydrogen Concentration is required. Concern was expressed that all methods of monitoring hydrogen content used in present plants are inadequate. A specific development program would be required to meet this requirement.

12. Under Fuel Cladding on page 17, Core Exit Temperatures of 150°F to 2300°F are to be measured. Thermocouples with stainless steel sheaths,used in some existing plants, will not withstand temperatures in excess of 1500°F due to steam oxidation, however, inconel sheathes thermocouples will meet this requirement.

13. Requirements for measuring radioactivity under Sections on Reactor Coolant Pressure Boundary and Containment on page 17 cannot be met with existing equipment under accident conditions. However

techniques are known for measuring all the required variables. A major effort would be required to transfer this technology from the laboratory to industry to provide qualified commercial equipment capable of withstanding an accident environment.

14. Under Airborne Radioactive materials released from the plant, page 21, two items require monitoring of particulates in the presence of radioactive noble gases. This is beyond the present state of the art without some separation of the gas and particulate phases.

15. Under post-accident sampling on page 22, grab samples are specified for primary coolant, sumps, and containment air. We believe state of the art technology could permit on-line monitoring.

16. In the section on meteorology, starting on page 22, the requirements, accuracies, etc., should be made consistent with the more definative Nureg 0-654.

* * *

GENERAL ELECTRIC

NUCLEAR POWER

SYSTEMS DIVISION

GENERAL ELECTRIC COMPANY, 175 CURTNER AVE., SAN JOSE, CALIFORNIA 95125

August 4, 1980

Advisory Committee on Reactor Safeguards
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Sam Duraiswamy

SUBJECT: REGULATORY GUIDE 1.97 (DRAFT 2 OF REVISION 2) - BWR COMMENTS

References:

1) GE letter Buchholz, R. H. to Secretary of the Commission, "Comments on the Draft of Revision 2 to Regulatory Guide 1.97", dated March 28, 1980.

2) GE letter Sherwood, G. G. to Roger J. Mattson, "Draft Regulatory Guide 1.97, Revision 2", dated May 30, 1980.

Gentlemen:

This letter is written to provide the ACRS comments from the BWR perspective on Draft 2 of Revision 2 to Regulatory Guide 1.97, "Instrumentation for Light Water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following and Accident". Specifically, Attachment 1 provides the technical basis for not requiring core exit temperature measurements in the BWR; Attachment 2 provides several additional recommendations for changes to Draft 2 necessitated by recognition of specific BWR design features. Marked-up copies of Tables 3 & 3A in Draft 2 are provided in Attachment 3 to show suggested modifications. Attachment 1 has been reviewed by and is submitted on behalf of the BWR Owners Group.

General Electric has provided the Staff comments on all aspects of Revision 2 in References 1 and 2. The Attachments in this submittal are focused on those proposed requirements which are particularly inappropriate for the BWR. Emphasis is placed on the core exit temperature measurement because of its extreme cost from both a personnel exposure and a dollar viewpoint, compared to its value. General Electric has systematically reviewed use of core exit temperature measurement and concluded that only in the case of core uncovery with no normal, emergency, or alternate water make-up systems available to replenish vessel inventory would unambiguous and definitive information be provided the operator. As discussed in Attachment 1 even in this case there are several other indications available which provide ample indication of propagating core damage.

General Electric and the BWR Owners Group recognize the need to take all necessary actions identified as the result of post TMI evaluations. However, as discussed in Attachment 1 the requirement for core exit temperature measurment is unnecessary when BWR design features and capabilities are systematically considered. We look forward to further discussion of this matter with the ACRS during the August 6, 1980 meeting.

Very truly yours,

R H Buchholz

R. H. Buchholz, Manager
BWR Systems Licensing

Attachments

cc: T. D. Keenan
D. Waters
BWR Owners Group
L. S. Gifford
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V. Benanoya

ATTACHMENT 1

GENERAL ELECTRIC AND BWR OWNER'S GROUP COMMENTS TO THE ACRS ON CORE EXIT TEMPERATURE MEASUREMENT PER DRAFT 2 OF REVISION 2, REGULATORY GUIDE 1.97

1. Technical Basis

1.1 Background

The reason cited in R.G. 1.97 for requiring core exit temperature measurement for accident monitoring is to indicate the potential for, or actual occurrence of, fuel cladding breach. The NRC staff has also indicated that they desire to identify local hot areas and the propagation of core damage; they have suggested that approximately 50 thermocouples should be utilized. This quantity is felt by the staff to be sufficient to detect blockage of 5-10% of the core with no core spray (or other ECCS) at a high confidence level and with a sufficient allowance for attrition.

1.2 Detection of High Core Temperature

In assessing the plant safety improvement resulting from core exit temperature measurements, several periods during the course of an event must be evaluated. The first period is prior to core uncovery. The BWR operates under saturated conditions with very strong natural circulation inside the reactor pressure vessel. Studies (Reference 1) have shown that, as long as the core remains covered with water, adequate core cooling is assured. Therefore, for there to be a cladding breach, there must first be a challenge threatening to uncover the core. Thus, reactor water level is a key parameter on which both automatic and operator actions are based. Water level is also the primary measure of accomplishment of the core cooling safety function during accident situations. The BWR provides multiple and redundant water level instrumentation for these purposes. During this time period, core exit thermocouples would be indicating, at most, saturation temperature corresponding to the reactor vessel pressure. Core exit thermocouple readings would probably be erratically indicating lower temperatures due to the subcooling effect of ECCS (core spray and LPCI). The use of core exit thermocouples would not provide useful additional information for the plant operator and the erratic readings may be confusing.

The second time period when knowledge of core exit temperatures might be useful is during fuel heatup following core uncovery. It is during this time that the potential for cladding breach exists, and, depending on the duration and amount of core uncovery, the potential exists for creating local flow blockage as a result of core damage. Reactor vessel water level provides the ability to detect core uncovery and, thus, by itself, indicates the potential for cladding perforations. Automatic and operator manual actions would already be underway to restore water level to cover the core. Continued monitoring of reactor water level and water makeup system performance parameters provides the capability for monitoring this critical safety function.

There are many other parameters available to the operator that are reliable indicators of actual fuel clad breach. These include high steam line radiation, high offgas radiation levels, high area radiation levels in the containment, high hydrogen concentration in the containment, and high radioactivity in reactor or suppression pool water. Details of these current provisions are discussed in Section 1.3.

Core exit temperature measurement will not provide an unambiguous indication of either the potential for or actual clad damage. This results since the BWR's multiple, safety-grade core spray systems would continue to supply water spray over the top of the core even though the core may be uncovered in a bulk sense. Even if there is only one core spray system functioning (out of two provided), the core exit temperature, whether measured locally or in bulk, will not be superheated. The core sprays need only provide 300 gallons per minute of their total typical design flow rate of 12,000 gpm to remove any superheating in the steam. In the BWR 5 and 6 designs, the Low Pressure Coolant Injection (LPCI) system directly floods the core bypass region, providing further subcooling. The Staff contends that these ECCS functions not be considered when determining the merits of core exit temperature measurement; that contention is unreasonable.

During fuel heat-up following core uncovery, there is only one condition for the BWR that a core exit temperature measurement would provide unambiguous and definitive information useful to the operator. This occurs in the highly unlikely event that, following a loss of water inventory, no normal, emergency, or alternate water makeup systems are available to replenish coolant inventory to the pressure vessel. During this situation the core is cooled by water and steam flow for a considerable period of time until the water in the core region is boiled off. Under such conditions, measurement of steam superheat anywhere above the core region would indicate core heatup and a low water level. However, should this condition occur the operator would be taking all appropriate actions to restore water level above the core based only on knowledge that water level is low and no injection is available.

The third time period, called the recovery phase, covers the interval after the operator has restored the water level in the core region. If there were no significant core damage, core exit temperature measurement would not provide any relevant information. The possibility of thermocouples providing useful information for operator actions has been raised by the Staff for the situation when 5-10% of the core is damaged. The Staff contends that high core exit temperature readings would indicate localized propagating core damage and guide the operator in long term decision making.

This position is unreasonable because: (a) once water level is restored in the core, core damage will not propagate to the rest of the core from the postulated 5-10% damaged core, and (b) temperature readings would not provide relevant information. A detailed discussion of both these points follows.

Core damage propagation, when the core is covered, has been discussed in a Licensing topical report (Reference 2). Because each bundle in the

BWR core is surrounded by a flow channel, cross-flow between bundles is eliminated and any thermal-hydraulic effects of localized core damage remain localized. Each channel forms an essentially independent flow path connecting the upper and lower plena and the core bypass region. To assure no damage to an undamaged fuel assembly, less than one gallon of coolant per minute must be provided. Since there are three independent flow paths into each fuel assembly (the top and bottom of the fuel bundle, and the flow paths between the bundle and bypass), any core damage propagation must start by almost complete blockage of all these paths. Calculations have been performed which show that all three paths have to be greater than 99% blocked for any damage to result. Even if almost total flow blockage of the bundles were postulated, this situation would not be likely to persist for long. Localized heating of the cladding would result in molten cladding coming in contact with the channel wall. Such localized heating of the channel would eventually form a hole in the channel, thus opening another flow path for the coolant from the bypass region to enter and cool the fuel rods.

Calculations have also been performed for the situation with 5-10% core damage and with an uncoolable geometry postulated to determine if superheated steam can be detected in the region around the damaged portion of the core. The calculations were done assuming the available instruments were those directly adjacent to the bundles in the damaged core region. The analyses show that the heat generation (decay heat and heat from metal water reaction) in the post-recovery phase are so low that, under all situations analyzed, nucleate boiling would be maintained and no superheat would be measured in the bypass region surrounding the damaged core.

It has been suggested by the NRC staff that if a temperature sensor was located adjacent to the assumed local blockage and if it were postulated that it could indicate some superheat, the operator could restart recirculation pumps. This would then force coolant through the partially blocked flow paths. However, as indicated above superheat would not be observed and the operator would have no knowledge that this action is necessary. In addition, because of the strong inherent natural circulation in the BWR, this action would be likely to be helpful for only a very limited situation where greater than 99% but less than 100% of all available flow paths were blocked. Therefore, operator actions would be no different: the principal emphasis would still be only on maintaining reactor water inventory. The addition of 50 thermocouple data readouts may, indeed, add to operator confusion such that the reliability of operator action is reduced.

The most practical location to install thermocouples in a BWR is in the in-core power range monitor (PRM) instrument assemblies. All other locations (see Section 2) would require additional penetrations and major redesign of the vessel internals and/or the fuel bundles. A review of the temperature response of a thermocouple in the PRM assembly indicates that it would only provide an indication of gross core discharge superheat conditions in the highly unlikely event that no water makeup systems were operating for an extended period. But for such a situation, as discussed above, a single thermocouple anywhere above the core would provide comparably useful information as to the existence of a bulk superheat condition. Figure 1 shows the response of the various variables already available to the operator to guide his actions during a core uncovery event. It also shows the expected temperature response of thermocouples in the PRM tubes if there should be no normal, emergency or alternate water makeup systems of any kind in operation. The comparisons show that the operator already has multiple and unambiguous indications to guide his actions during the core heat-up time period.

1.3 Detection of Propagating Core Damage

For the worst-case assumptions (i.e. uncovered core and no make-up) for which the NRC staff proposes that thermocouple indication would be useful, alternate means are available to provide trend information relating to the possible propagation of core damage (PCD). Those means which were previously available or are presently required by R.G. 1.97 and NUREG 0578 and provide direct indication of PCD, with or without ECCS functional, include: (1) reactor and suppression pool water/containment air sampling and analysis for radioactive material, (2) containment gross gamma monitoring, and (3) containment hydrogen monitoring. Other measured variables required in R.G. 1.97 could also be used to infer PCD.

Analysis of reactor water samples would measure fission product activity and the concentration of dissolved hydrogen in the reactor water. The fission product activity from the gap/plenum would be released within several minutes after the onset of fuel clad perforations. It is expected that the reactor water sampling system will be sufficiently sensitive to detect the hydrogen concentration resulting from the reaction of as little as four pounds of zirconium. This is equivalent to a metal-water reaction involving about 3% of the cladding of a single fuel bundle.

For the dry-core case, vessel depressurization is expected. It will occur naturally if the event is initiated by a primary system break of sufficient size. It will occur by automatic or manual actuation for the no-break or small-break case because of safety/relief valve (S/RV) actuation. Thus, for the entire spectrum of initiating events, indication of core damage will be provided by various instruments in the containment. These include the suppression pool water/containment air sampler system, gross containment gamma monitor, and the containment hydrogen monitor. The gross gamma monitor would detect fuel clad gap/plenum activity release within several minutes from the onset of clad perforation.

Activity due to noble gases alone should provide sufficient indication of PCD. For the relatively straightforward case involving blockage of a single fuel assembly during normal plant operation, analysis (Reference 2) shows that within 9 seconds, fuel element melting would be detected by the steam line radiation monitor; scram and steamline closure would follow within 4 seconds. The off-gas radiation monitor would alarm within two minutes.

The more complex case involving main steam isolation valve (MSIV) closure for reasons other than high steam line radiation has also been investigated. For this case, the safety relief valves (S/RV) open within seconds to relieve vessel pressure, and noble gases are transported via the S/RV discharge piping to the suppression pool water, then released to the containment free volume. The results of this analysis are illustrated in Figure 1 for the situation in which all reactor water makeup systems (normal, emergency and alternate) are postulated to remain inoperative for an extended period. Eventually the water level is reduced such that the readings on all thermocouples would increase with a distribution related to the core power distribution. For the situation in which the bulk water level has been significantly reduced there would be little or no correlation between thermocouple readings and core area cross sectional blockage. In this case the insufficient reactor water inventory would affect all fuel assemblies independent of whether or not blockage exists. The extent to which actual fuel failures occur could only be assessed by monitoring fission gas release to the primary system or the containment. Gross gamma monitoring should provide a more rapid indication of PCD for purposes of operator action. Confirming indications of the rate of PCD will be provided by the suppression pool water/containment air sampler system, [illegible] s the containment hydrogen monitor. The containment hydroge[illegible] is expected to be sufficiently sensitive to detect PCD as low a[illegible] to 3% core-wide, metal-water reaction per day.

2. Design and Operational Considerations

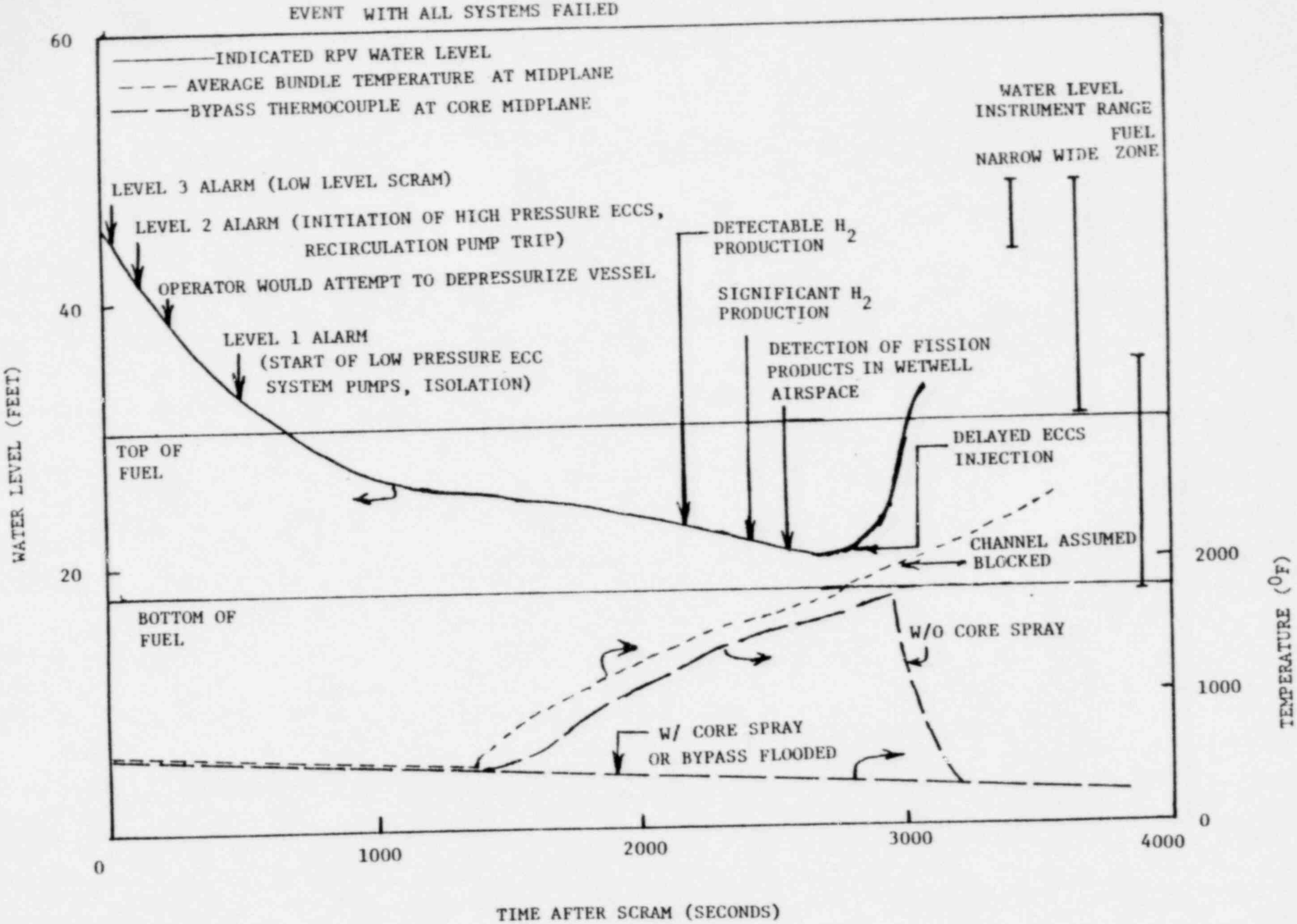
There are three possible locations for thermocouples within a BWR. These are: within or on the fuel assembly; on the shroud head with leads projecting downward to near the fuel assembly discharge; and in the PRM assemblies. While detailed design investigations have not been performed, the first alternate is considered unacceptable since it would create localized flow disturbances and cladding stress concentrations with the potential for initiating fuel damage. Both the first and second alternatives are also considered unacceptable due to the interference created between the thermocouple lead supports and the ECCS function - specifically core spray. They create an extremely difficult vessel and vessel internal design problem because of the multiple penetrations required in order to route the thermocouple leads. These alternatives could significantly impact the duration of each refueling outage. For both, the number of thermocouples required could be large, since the BWR utilizes a channeled fuel design which, as previously discussed, prevents propagating core damage.

Only placement in the PRM assemblies is technically feasible without extensive plant redesign. The PRM assembly is inserted into the reactor vessel from above the core with the vessel head and separator and dryer assemblies removed in earlier BWR designs, and from below the core in the BWR 6 design.

In both BWR/6 and pre-BWR/6 designs, the PRM assemblies are secured to the top grid within the vessel. The top of the PRM latches approximately 10 inches below the top of the channel of the fuel assembly. The PRM latching mechanism design precludes locating the thermocouple higher than approximately 13 inches below the top of the fuel channel.

FIGURE 1

COMPARISON OF BYPASS THERMOCOUPLE RESPONSE TO SIGNIFICANT VARIABLES CURRENTLY AVAILABLE TO THE OPERATOR FOR A DEGRADED LOSS OF INVENTORY EVENT WITH ALL SYSTEMS FAILED



To withstand the 200-day, post-accident drywell environment of radiation, spray, and immersion for BWR/6, requires metal-sheathed cabling with waterproof connectors from the vessel through the containment penetration. Based on preliminary design considerations, a minimum of two connectors -- one located at the bottom of and the other about one or two feet below the in-core housing flange--would be required for each PRM to permit its replacement. Difficulties are expected during both maintenance and installation.

Making, breaking, and testing for leak tightness of the thermocouple connectors is estimated to require 10 minutes each (with allowance for occasional stripping of threads and lead breakage) during maintenance. An appropriate means for leak testing each connector has not been developed, and end-to-end testing of the metal-sheathed cable may be required. It is therefore estimated that 40 minutes extra (due to thermocouple addition) would be required each time a PRM assembly was replaced. For pre-BWR/6 units, average PRM assembly replacement is expected to be 25% per year; for BWR/6, PRM assembly replacement is estimated as 15%/year (limited by life of the thermocouple or structural deterioration of the assembly). For an 1100 MWe plant utilizing 41 PRM assemblies, the manhour exposure for a crew of three would be:

Pre BWR/6 - 3×0.67 Hr. $\times .25 \times 41 \cong 20.0$ manhours
BWR/6 - 3×0.67 Hr. $\times .15 \times 41 \cong 12.0$ manhours

Actual dose rates under the vessel vary from plant to plant; from 40 mr/hr to over 300 mr/hr have been observed. Thus, the plant annual personnel exposure would be expected to increase by ~0.8 to 6 man-rems/year for pre-BWR/6 plants and ~0.5 to 4.0 man-rems/year for BWR/6 plants.

Also, additional personnel exposure can be expected as a result of increased control rod drive (CRD) removal complexity. The presence of the thermocouple leads would further restrict personnel space availability and increase the possibility of damage to the cable leads and connectors during drive removal and replacement. Detailed studies and field experience would be required for a complete assessment, but some increase (perhaps 10 minutes) in CRD servicing time can certainly be expected. Such an increase would result in an exposure time increase for a crew of four of 40 minutes per drive, or a total increase of $0.25 \times 180 \times .67 = 30$ manhours per year. The annual plant personnel exposure increase would be in the range of 1.2 to 9 man-rems/year.

The total annual plant personnel exposure increase due to PRM, thermocouple and control rod drive maintenance would be in the range of 2 to 15 man-rems/year for pre-BWR/6 plants and 1.7 to 14 man-rems/year for BWR/6 plants.

For installation, thermocouple leads would require routing from under the vessel in four separate arrays of about ten leads each, with the thermocouple leads distributed inside the pedestal in such a manner that each bundle would contain leads from the thermocouples located in each core quadrant. Complete isolation of these leads from the consequences of a specific accident is not feasible in operating plants, and is also thought to be unfeasible for plants under construction and design. Each of the four bundles of thermocouple leads is assumed to be routed through the containment in a structural housing to provide some protection during the accident (e.g. jet impingement). Assuming two penetrations can be made available through which the thermocouple leads could be brought through containment, the installation of the leads in the containment is expected to take about 2,000 installation manhours. It should be noted that spare penetrations may not be available on operating plants considering other current NRC requirements. Including installation, modification engineering, and field engineering, the cost is approximately $300,000* per plant.

Installation outside the drywell is assumed to be in a two-bundle configuration, with Division I power to one bundle and Division II power to the other bundle. Four multi-point recorders in the control room are assumed, although this is uncertain considering that the readings may be significantly delayed and illegible (due to similarity of readout).

On this basis, total installation cost is estimated to average $600,000* on operating plants and $400,000* on plants in construction. Exposures to installation personnel in each operating plant is estimated to be 100* man-rems assuming a 50 mr/hr general radiation field.

Excluding prototype testing, it is estimated that initial shipments of PRMs including thermocouples could begin 18 months after design initiation.

Note, application of the single-failure criterion of Table 1, Item 2 of R.G. 1.97 would eliminate readings from 50% of the thermocouples and accident consequence criteria could eliminate readings from another 25%. This presumed loss of installed thermocouples is of little consequence, since as previously discussed, exit thermocouples will be of little use in detecting local fuel temperature. Only 25% of the thermocouples (assuming 50 total) would still indicate bulk core uncovery with no water makeup. Even this function is of little value, but at least in this sense, it is concluded that the single failure criterion can be met.

* These estimates are approximate. Precise definition would require plant by plant assessment. Probable accuracy: ±50%

3. Regulatory Requirements

Because of their marginal usefulness and associated design and installation problems, core exit thermocouples, if required, should have a Design and Qualification category no more severe than 4 (Reference R.G. 1.97, Table 1) since,

a) As previously discussed, thermocouples cannot provide an effective indication of core cooling and would not provide a reliable additional basis for operator action.

b) Any meaningful thermocouple reading would occur long after other core damage indications have become evident. On-demand scanning of the thermocouples should be more than adequate. Continuous readout of thermocouple data could further confuse the operator as to true core status.

c) It is not possible to meet all the Category 1, 2 or 3 criteria assuming that one thermocouple per PRM assembly is required.

d) It is unrealistic to postulate the occurrence of an SSE level earthquake simultaneous with an event in which all ECCS are also presumed inoperative.

Finally, if core exit thermocouples are to be required, they should not be specified via a Regulatory Guide. The requirement should be deleted from Regulatory Guide 1.97 and the issue added to the scheduled core damage rulemaking.

4. Conclusion

It has been determined that core exit thermocouples provide only marginally useful additional information to the operator. Moreover, the only practical location for their installation in any plant (operating or in design) would result in no significant enhancement of the operator's ability to protect the plant or public.

The combination of existing or planned (as a result of R.G. 1.97) instrumentation is sufficient to detect not only the presence of PCD, but also its rate and trend without core exit thermocouples. This is true for all possible loss of primary system coolant events independent of ECCS operational combinations. Detection is expected to occur within several minutes following initial clad perforations with PCD trend detection capability extending beyond 100 days.

The introduction of thermocouples in the PRM assemblies constitutes not only a significant design problem, but also subjects plant personnel to increased radiation exposure.

For all of these reasons, core exit thermocouples should not be required in boiling water reactors in operation or design.

REFERENCES

Reference 1. NEDO-24708, "Additional Information Required for NRC Staff Generic Report on Boiling Water Reactors," August 1979

Reference 2. Licensing Topical Report: Consequences of a Postulated Flow Blockage Incident in a Boiling Water Reactor NEDO-10174, October 1977

ATTACHMENT II

GENERAL ELECTRIC COMMENTS TO THE ACRS

ON OTHER PROVISIONS OF DRAFT 2 OF REVISION 2 TO REGULATORY GUIDE 1.97

1. Reactivity Control by Neutron Flux

Tables 3 and 3A in NRC Regulatory Guide 1.97 (Draft 2, Rev. 2) would require that neutron flux be monitored as a means of providing the plant operating staff with an indication of the reactivity control status of the core. The guide also would require that instrumentation meeting design and qualification Category 1 be provided to monitor neutron flux over a very wide range from one count per second (cps) to 1% (rated) power corresponding to a core average neutron flux measurement range from 10^{-11} to 10^{-2} of full reactor power. ANS Standard 4.5 requires flux measurement over the range from 10^{-8} to 10^{-3} of full reactor power. The neutron flux range requirements of R.G. 1.97 exceed that which is available for a fixed position detector.

The intent of these requirements appears to be the assurance that core average thermal neutron flux can be reliably defined as decreasing, constant or increasing, over a range extending from a significant power level to somewhat below the minimum neutron flux at initial criticality. The rate of flux change would allow the calculation of reactor period, and the absolute count rate can be compared to that of previous reference values at various conditions to infer roughly whether the core is fully shutdown. It is assumed that 1) basic core geometry is maintained, 2) the bottom head and core volume are flooded at least to the level corresponding to the top of the jet pumps, and 3) localized core region voiding does not occur near the detector.

Experience has shown that the full-in SRM count rate at initial criticality due to decay of spontaneous neutron sources is approximately 1000 cps at 200 days corresponding to 10^{-8} of rated core average thermal flux. With a six decade SRM range capability, the full-in SRM reading would be off-scale at approximately 10^{-5} of rated core average thermal neutron flux. Withdrawal of the SRM at initial criticality to reduce the count rate by a factor of 10^{-3} would allow a full scale reading at approximately 10^{-2} of rated core average thermal neutron flux. Although detailed analyses have not been performed, the neutron flux at this positon is expected to increase by several orders of magnitude at rated power and could significantly shorten detector life.

An approach which is considered to meet the intent of R.G. 1.97 is to power the SRM's in core Quadrants 1 and 3 by Division I power, and those in core Quadrants 2 and 4 by Division II power. One each of the Division I and II power SRM's will be inserted such that full scale (10^{6} cps) corresponds to approximately 10^{-2} rated power. One each of the Division 1 and 2 SRM's will be withdrawn somewhat further such that full scale corresponds to approximately 10^{5} cps at 1% power. Since the SRM drive mechanisms are not seismically or environmentally qualified to operate in the accident environment and are not powered by a Class IE power supply, the SRM position would remain fixed (locked in) during all modes of plant operation, except startup and possibly refueling. The more fully inserted SRM's can measure as low as 10^{-8} of core average flux. The more fully withdrawn SRM's should have sufficiently long life to assure that period can be assessed down to approximately 10^{-7} of rated core power.

This approach meets the intent of R.G. 1.97, including the effect of a single active failure in the power supply system. However, it will not meet the R.G. 1.97 requirements for those hypothesized specific accidents for which the resulting mechanical consequences could disable one of the two signal cables of the single power division remaining after the postulated single active failure. This approach will not necessarily satisfy the requirement for one cps minimum sensitivity because: (1) burn-up of the inserted detectors will reduce their sensitivity, (2) neutron flux at the location of the withdrawn detector may be too low, and (3) neutron flux will decay at 200 days to a very low level.

Sufficient analyses have not as yet been performed to assess fission chamber neutron flux for various core lifetimes and rod patterns. Preliminary indications are that the proposed approach could reduce the life of the two more fully inserted fission chambers to approximately one year, while the life of the other two would be approximately five years (versus the present 10-year or more life.) This would represent a significant increase in SRM replacement expense.

The BWR employs four SRM chambers, one located in each quadrant of the core. The sensor, electronics and mechanical/structural support portions of the assemblies do not now meet R.G. 1.97 Category 1 requirements. Specifically, the following changes would be required:

1. Seismic redesign and qualification,

2. Signal cable and connector upgrade to meet long-term high radiation and water immersion service,

3. Connection to on-site emergency power. (Two SRM's each on Division I and II power.)

The feasibility of seismic upgrade and emergency power provision is uncertain. Approximately six months will be required to assess seismic feasibility and, if qualification is not possible, a substantial redesign may be required. The other design changes appear to be technically achievable.

Therefore, it is recommended that the following changes be made to R.G. 1.97:

1. The range of neutron flux measurement should be revised to reflect a range of approximately 10^{-8} to 10^{-2} of core average thermal neutron flux at rated thermal power. This change more properly reflects a measurable design criteria and clarifies that SRM's need not be calibrated to core power.

2. Add a note to Tables 3 and 3A identifying that a reduced range of five decades is acceptable for the low probability condition in which the specified event could disable one neutron flux measurement channel. Since this would occur only when the single active failure was hypothesized to disable two of the neutron flux channels, no significant impact on plant safety would result. In addition, even one SRM channel is sufficient to eventually detect whether any part of the core is supercritical. Operator action (eg., to initiate boron injection) still could be accomplished prior to the generation of sufficient core power to produce core damage.

2. Main Steam Line Flow

Regulatory Guide 1.97, Table 3, requires that main steam line flow be monitored to provide an indication that the core cooling function is being performed. For a BWR, there is no relationship between the accomplishment of core cooling and the presence or absence of steam flow in the main steam lines since 1) MSIV closure will occur, and 2) steam flow is independent of inventory provided there is water in the vessel.

Main steam flow recording is provided in the BWR control room; however, the design and qualification criteria for the control room readout are roughly equivalent to R.G. 1.97, Category 5, rather than Category 1 as is required.

Since there is no known relationship between steam flow and core cooling in the BWR, the main steam flow requirement of R.G. 1.97 is unwarranted and should be deleted for the BWR.

3. Core Coolant Level in the Reactor

The GE design provides a Category 1 water level measurement and indication to approximately the top of active fuel rather than bottom of the core support plate to assure initiation of all necessary safety functions and provide appropriate operator information. R.G. 1.97 should be revised to make a less stringent criteria category apply to the range of water level from the bottom of the core support plate to top of active fuel. Full range redundant indication is available when offsite power is available. Even if water level indication below the top of the fuel was not available, low water level indication on the Category I instruments (i.e. those for water level above the core) would be unequivocal indication that full ECCS should be maintained. Operator action would be no different even if he knew from an instrument reading that the water level was below the top of the core. It is excessively conservative to impose the higher water level measurement requirements for the low probability occurrence of the Design Basis Accident simultaneous with loss of offsite power and ECCS functions.

4. Primary Containment Pressure (Drywell)

For the Mark III plant, the drywell is not the primary containment; hence, the word "Drywell" should be deleted. However, for Mark I and II plants, the drywell is part of primary containment and hence the word "Drywell" is appropriate.

5. Drywell Temperature for Mark III

There is no relationship between drywell temperature and the maintenance of containment integrity. This variable should be deleted from the Type B and (if for some reason desired) inserted under Type D as a Category 4 variable.

6. Containment High Range Area Radiation

The requirement for the 10^7 R/hr range to apply to the secondary containment portion of the reactor building is unjustified. A range of 10^3 to 10^4 R/hr is more than adequate for the secondary containment.

7. Emergency Ventilation Damper Positions

The dampers significant to safety are those in the openings between secondary containment and the environs. Add "between secondary containment and the environs" to that variable description in Table 3.

8. Effluent Radioactivity - Noble Gases

The words, "release points" should be added after the phrase, "reactor building or secondary containment," in order to make it consistent with that which follows, and to make it more explicit as to what is to be monitored.

9. Post-Accident Sampling Capability in Sumps

The suppression chamber is the collection point to which all drains in the post-accident mode would eventually collect and, hence, the suppression chamber would be the only meaningful measurement. Tables 3 and 3A should be revised to read, "Suppression Chamber Water" in lieu of "Sumps."

10. Type D

Accurate measurement of zero or low flow in any of the lines is virtually impossible. Note #1 should be revised to add "The accuracy should be $\pm$5% of design flow."

11. Steam Flow to RCIC

This variable is not a measure of the performance of the RCIC system and should be deleted.

12. Containment and Drywell Hydrogen Concentration

Present commercially available equipment is designed to sense hydrogen concentrations ranging from 0.1 to 10 volume percent hydrogen (dry), rather than the range of 0 to 30% specified in Table 3 of R.G. 1.97. The current range is considered acceptable since it adequately covers the range over which hydrogen is of practical importance for all planned operator actions. The range is consistent with the requirement to monitor the accomplishment of critical safety functions. Monitoring for the event for which hydrogen could be postulated to exceed 10 v/o is adequately provided for by the Containment Air H_2 grab sampling requirements specified elsewhere in Table 3 of R.G. 1.97.

Tables 3 and 3A should be revised to require a range of 0.1 to 10 v/o (dry) for this variable.

Since the containment and drywell communicate freely through vacuum breakers for all pressure suppression plants and for BWR 6 plants mixing between the two volumes is assured by the drywell mixer system, it is adequate to monitor the two volumes sequentially but not simultaneously. Simultaneous measurement would double the number of sensors required to meet the single failure criteria. A note should be added to the variable to read as follows: "Simultaneous sampling of each volume is not required. Sampling transfer from one volume to the other with a maximum sampling interruption of 30 min. is satisfactory."

This variable in Table 3A should be revised to read Suppression Chamber and drywell hydrogen concentration since both volumes are primary containment.

13. Containment and Drywell Oxygen Concentration (for those plants with inerted containments)

The recent staff decision (Facility Operating License Nos. DPR 33, DPR-52 and DP2-63 for Browns Ferry Units Nos. 1, 2 and 3 - June 22, 1978) supports the position that the control of combustable concentrations in inerted containments can be adequately accomplished by monitoring the hydrogen concentration. This is a technically appropriate position. If, for some reason oxygen monitoring is desired, it is adequately provided for by the Containment Air O_2 grab sampling requirements specified elsewhere in Table 3 of R.G. 1.97.

Tables 3 and 3A should be revised to delete this variable.

ATTACHMENT 3

GENERAL ELECTRIC'S SUGGESTED REVISIONS TO

TABLES 3 AND 3A OF DRAFT 2 OF

REVISION 2 TO REGULATORY GUIDE 1.97

TABLE 3

BWR VARIABLES

Purpose & Variables	Range	Design & Qualification Criteria Category (See Table 1)
TYPE A - Variables Which Indicate Necessity for Pre-planned Manual Actions	Plant specific	1
TYPE B - Variables Which Indicate Accomplishment of Critical Safety Functions		
Reactivity Control		
Control Rod Position	Full in or not full in	5 (for 2 hrs minimum)
Neutron Flux	10^{-8} TO 10^{-2} FULL ~~1 c/s to 1%~~ power	1
Core Cooling		
Coolant Level in the Reactor	2/3 ~~Bottom~~ of core HEIGHT ~~support plate~~ to above top of discharge plenum BOTTOM OF CORE SUPPORT PLATE TO 2/3 CORE HEIGHT	1 4
~~Main Steamline Flow~~	~~[illegible] design flow[1]~~	~~2~~
Maintaining Reactor Cooling System Integrity		
RCS Pressure	15 psia to 1500 psig	1^{3}
Main Steamline Isolation Valves' Leakage Control System Pressure	0 to 15" of water 0 to 5 psid	1
Primary System Safety Relief Valve Positions, including ADS or Flow Through or Pressure in Valve Lines	Closed-not closed or 0 to 50 psig	1

[1]Design flow - the maximum flow anticipated in normal operation. THE ACCURACY SHOULD BE ± 5% OF DESIGN FLOW

TABLE 3 - (continued)

Purpose & Variables	Range	Category
TYPE B - (continued)		
Maintaining Containment Integrity		
Primary Containment Pressure ~~(Drywell)~~	10 psia pressure to 3 times design pressure[2] for concrete; 4 times design pressure for steel	2[21]
Containment and Drywell Hydrogen Concentration	0 to [illegible]% (handwritten: 10) (capability of operating from 12 psia to maximum design pressure[2])	1
~~Containment and Drywell Oxygen Concentration (for those plants with inerted containments)~~	~~0 to 20% (capability of operating from 12 psia to design pressure[2])~~	~~1~~
Primary Containment Isolation Valve Position (excluding check valves)	Closed-not closed	1
Suppression Chamber Air Temperature	30°F to 230°F	1
Drywell Temperature	40°F to 440°F	4 ~~1~~
TYPE C - Variables Which Indicate Breach or Potential for Breach of Barriers to Fission Product Release		
Fuel Cladding		
~~Core Exit Temperature~~	~~150°F to 2300°F~~	~~1~~
Radioactivity Concentration or Radiation Level in Circulating Primary Coolant	Normal to 10 Ci/gm	5[19]

DELETE FROM CATEGORY B. MOVE TO CATEGORY D.

[2]Design pressure - that value corresponding to ASME code values that are obtained at or below code-allowable material design stress values.

TABLE 3 - (continued)

Purpose & Variables	Range	Category
TYPE C - (continued)		
<u>Reactor Coolant Pressure Boundary</u>		
PRIMARY Containment High-Range Area Radiation	1 to 10^{7} R/hr ~~(60 keV to 3 MeV photons with ±20% accuracy for photons of 0.1 to 3 MeV)~~	2[5,18] ~~(for Mark III containments, two redundant monitors are required for primary containment & reactor building)~~
REACTOR BUILDING HIGH RANGE AREA RADIATION	1 TO 10^{4} R/HR	2[5,18]
Drywell Drain Sumps Level (Identified and Unidentified Leakage)	Bottom to top	1
<u>Containment</u>		
Standby Gas Treatment System Vent	10^{-6} to 10^{5} μCi/cc	4[16,17]
Effluent Radioactivity - Noble Gases	10^{-6} to 10^{5} μCi/cc ~~(Xe-133 calibration)~~	4[6,16,17]
Environs Radioactivity - Exposure Rate	10^{-6} to 10^{4} R/hr ~~(60 keV to 3 MeV)~~	4[7,18]
TYPE D - Variables Which Indicate Operation of Individual Safety Systems		
<u>Power Conversion Systems</u>		
Main Feedwater Flow	0 to 110% design flow[1]	5
Condensate Storage Tank Level	Bottom to top	5

TABLE 3 - (continued)

Purpose & Variables	Range	Category
TYPE D - (continued)		
Containment Systems		
Containment Spray Flow	0 to 110% design flow[1]	3
Drywell Pressure FOR MARK III CONTAINMENTS	12 psia to 3 psig 0 to 110% design pressure[2]	3
Suppression Chamber Water Level	Top of vent to top of weir well	3
Suppression Chamber Water Temperature	30°F to 230°F	3
Auxiliary Systems		
~~Steam Flow to RCIC~~	~~0 to 110% design flow[1]~~	~~3~~
HPCI Flow	0 to 110% design flow[1]	3
RCIC Flow	0 to 110% design flow[1]	3
Core Spray Flow	0 to 110% design flow[1]	3
RHR System Flow (LPCI)	0 to 110% design flow[1]	3
RHR Heat Exchanger Outlet Temperature (LPCI)	32°F to 350°F	3
Service Cooling Water Temperature	32°F to 200°F	3
Service Cooling Water Flow	0 to 110% design flow[1]	3
Flow in Ultimate Heat Sink Loop	0 to 110% design flow[1]	3
Temperature in Ultimate Heat Sink Loop	30°F to 150°F	3
Ultimate Heat Sink Level	Plant specific	3

TABLE 3 - (continued)

Purpose & Variables	Range	Category
TYPE D - (continued)		
Auxiliary Systems (continued)		
SLCS Storage Tank Level	Bottom to top	5
Sump Level in Spaces of Equipment Required for Safety	To corresponding level of safety equipment failure	5
SLCS Flow	0 to 110% design flow[1]	5
RADWASTE SYSTEMS		
High Radioactivity Liquid Tank Level	Top to bottom	5
VENTILATION SYSTEMS		
Emergency Ventilation Damper Position BETWEEN SECONDARY CONTAINMENT AND THE ENVIRONS	Open-closed status	3
Temperature of Space in Vicinity of Equipment Required for Safety	30°F to 180°F	5
POWER SUPPLIES		
Status of Class 1E Power ~~supplies~~ and Systems Sources	Voltages currents pressures	3[8]
Status of Non-Class 1E Power ~~supplies~~ and Systems Sources	Voltages currents pressures	5[9]

TABLE 3 - (continued)

Purpose & Variables	Range	Category
TYPE E - Variables Which Indicate Magnitude and Direction of Dispersion of Released Radioactive Materials		
RADIATION EXPOSURE RATES (INSIDE BUILDINGS OR AREAS WHERE ACCESS IS REQUIRED TO SERVICE SAFETY-RELATED EQUIPMENT		
Radiation Exposure Rates	R/hr 10^{-1} to 10^{4} R/hr ~~for photons~~	4[18]
AIRBORNE RADIOACTIVE MATERIALS RELEASED FROM THE PLANT		
Effluent Radioactivity - Noble Gases		
Reactor Bldg or Secondary Containment RELEASE POINTS	10^{-6} to 10^{4} μCi/cc	4[16, 17]
.Other Release Points (including fuel handling building, auxiliary building, and turbine building)	10^{-6} to 10^{2} μCi/cc ~~Xe-133 calibration~~	4[16, 17]
Effluent Radioactivity - ~~[illegible]~~ Radiohalogens and Particulates	10^{-3} to 10^{2} μCi/cc	4[10]
Environs Radioactivity - Radiohalogens and Particulates	10^{-9} to 10^{-3} μCi/cc for both radiohalogens and particulates	4[11]
Plant and Environs Radioactivity & Radiation (portable instruments)	High Range 0.1 to 10^{4} R/hr photons 0.1 to 10^{4} rads/hr betas and low-energy photons	6[12]
	multi-channel gamma-ray spectrometer	6

Purpose & Variables	Range	Category
TYPE E - (continued)		
POSTACCIDENT SAMPLING CAPABILITY (Analysis Capability Onsite)		
Primary Coolant	Grab Sample	5[13]
Gross Activity	10 µCi/ml to 10 Ci/ml	
Gamma Spectrum	(Isotopic Analysis)	
Boron Content	0 to 1%	
SUPPRESSION CHAMBER WATER ~~Sump~~	Grab Sample	5[13,14,20]
Gross Activity	10 µCi/ml to 10 Ci/ml	
Gamma Spectrum	(Isotopic Analysis)	
pH	2 to 12	
Containment Air	Grab Sample	5[13,20]
H_2		
O_2		
Gamma Spectrum	(Noble gas analysis)	
METEOROLOGY[15]		
Wind Direction	0 to 360° (±5° accuracy with a deflection of 15°. Starting speed 0.45 mps (1 mph))	5
Wind Speed	0 to 30 mps (67 mph) (±0.22 mps (0.5 mph) accuracy for wind speeds less that 11 mps (25 mph), with a starting threshold of less than 0.45 mps (1 mph))	5
Temperature	-40°F to 120°F (±0.9°F accuracy)	5
Vertical Temperature Difference	-9°F to +9°F (±0.3°F accuracy per 164-foot intervals)	5
Precipitation	Recording rain gage with range sufficient to ensure accuracy of total accumulation within 10% of recorded value - 0.01" resolution	5

TABLE 3

BWR VARIABLES

Purpose & Variables	Range	Design & Qualification Criteria Category (See Table 1A)
TYPE E - (continued)		
METEOROLOGY[15] - continued		
Dew Point Temperature	-60°F to 120°F (±2.7°F accuracy for temperature range, -22°F to 68°F when relative humidity is greater than 60%)	5

TABLE 3 (continued)

NOTES continued -

[3]The maximum value may be revised upward to satisfy ATWS requirements.

[4]Approximately 50 thermocouples should be available, the exact number needed will depend on thermocouple location and other characteristics. In the absence of core spray the thermocouples should detect 5 to 10% core area cross sectional blockage, with high confidence. Sufficient numbers should be installed to account for attrition.

[5]Minimum of two monitors at widely separated locations.

[6]Provisions should be made to monitor all identified pathways for release of gaseous radioactive materials to the environs in conformance with General Design Criterion 64. Monitoring of individual effluent streams only is required where such streams are released directly to the environment. If two or more streams are combined prior to release from a common discharge point, monitoring of the combined stream is considered to meet the intent of this guide provided such monitoring has a range adequate to measure worst-case releases.

[7]For estimating release rates of radioactive materials released during an accident from unidentified release paths (not covered by effluent monitors) - continuous readout capability. (Approximately 16 to 20 locations - site dependent.)

[8]Status indication of all Class 1E A-C buses, D-C buses, inverter output buses and pneumatic supplies.

[9]Status indication of all non-Class 1E inverter output buses, D-C buses and pneumatic supplies.

[10]To provide information regarding release of radioactive halogens and particulates. Continuous collection of representative samples followed by onsite laboratory measurements of samples for radiohalogens and particulates. The design envelope for shielding, handling, and analytical purposes should assume 30 minutes of integrated sampling time at sampler design flow, an average concentration of 10^2 μCi/cc of radioiodine in gaseous or vapor form, an average concentration of 10^2 μCi/cc of particulate radioiodines and particulates other than radioiodines, and an average gamma photon energy of 0.5 Mev per disintegration.

[11]For estimating release rates of radioactive materials released during an accident from unidentified release paths (not covered by effluent monitors). Continuous collection of representative samples followed by laboratory measurements of the samples (Approximately 16 to 20 locations - site dependent.)

[12]To monitor radiation and airborne radioactivity concentrations in many areas throughout the facility and the site environs where it is impractical to install stationary monitors capable of covering both normal and accident levels.

[13]To provide means for safe and convenient sampling. These provisions should include:

1. Shielding to maintain radiation doses ALARA,
2. Sample containers with container-sampling port connector compatability,
3. Capability of sampling under primary system pressure and negative pressure,
4. Handling and transport capability, and
5. Pre-arrangement for analysis and interpretation.

TABLE 3 (continued)

NOTES continued -

14 An installed capability should be provided for obtaining ~~containment sump~~ SUPPRESSION CHAMBER WATER, ECCS pump room sumps, and other similar auxiliary building sump liquid samples.

15 Meteorological measurements should conform to the provisions of the forthcoming revision to Regulatory Guide 1.23, "Onsite Meteorological Programs".

16 Monitors should be capable of detecting and measuring radioactive gaseous effluent concentrations with compositions ranging from fresh equilibrium noble gas fission product mixtures to 10-day old mixtures, with overall system accuracies of ± 1/2 decade. Calibration should be performed using radiation sources representative of both low and high energy portions of the emission spectrum. For low-energy gamma photon calibration, source emission energies should fall within the range of approximately 60 keV to 150 keV (examples - Am-241, Cd-109, Tm-171, and Co-57). For high-energy gamma photon calibration, source emission energies should fall within the range of approximately 500 keV to 1.5 MeV (examples - Cs-137, Mn-54, and Co-60). Effluent concentrations may be expressed in terms of Xe-133 equivalents or in terms of the equivalent of any noble gas nuclide(s).

17 It is not expected that a single monitoring device will have sufficient range to encompass the entire range provided in this guide and that multiple components or systems will be needed. Existing equipment may be utilized to monitor any portion of the stated range within the equipment design rating. Additional extended range instrumentation should overlap the range of existing instrumentation by at least a factor of 2.

18 Detectors should respond to gamma radiation photons within any energy range from 60 keV to 3 MeV with an accuracy of ±20% at any specific photon energy from 0.1 MeV to 3 MeV. Overall system accuracy should be within ±1/2 decade over the entire range.

19 Measurement should be made of the gross gamma radiation emanating from circulating primary coolant, with instrument calibration permitting conversion of readout to radioactivity concentrations in terms of either curies/gram or curies/unit-volume. System accuracy should be ±1/2 order of magnitude. The point of measurement should be external to a circulating primary coolant line or loop, such as a hot leg, and should not be a line or loop subject to isolation, e.g., PWR letdown line or BWR main steam line. While such an instrument may not be currently available off-the-shelf, the staff considers that the necessary components are available commercially and have been employed and demonstrated under adverse environmental conditions in high-level hot cell operations for many years.

20 Sampling or monitoring of radioactive liquids and gases should be performed in a manner which assures procurement of representative samples. For gases, the criteria of ANSI N13.1 should be applied. For liquids, provisions should be made for sampling from well-mixed turbulent zones and sampling lines should be designed to minimize plateout or deposition.

21 FOR MARK I AND MARK II CONTAINMENTS THE MEASUREMENT SHOULD BE OF DRYWELL PRESSURE.

TABLE 3 A

BWR VARIABLES

Purpose & Variables	Range	Design & Qualification Criteria Category (See Table 1)
TYPE A - Variables Which Indicate Necessity for Pre-planned Manual Actions	Plant specific	1
TYPE B - Variables Which Indicate Accomplishment of Critical Safety Functions		
Reactivity Control		
Control Rod Position	Full in or not full in	5 (for 2 hrs minimum)
Neutron Flux	10^{-8} TO 10^{-2} FULL ~~[illegible]~~ power	1
Core Cooling		
Coolant Level in the Reactor	2/3 ~~Bottom~~ of core HEIGHT ~~support plate~~ to above top of discharge plenum	1[21]
	BOTTOM OF CORE SUPPORT PLATE TO 2/3 CORE HEIGHT	4
~~Main Steamline Flow~~	~~0 to [illegible] design flow~~	~~1~~
Maintaining Reactor Cooling System Integrity		
RCS Pressure	15 psia to 1500 psig	1[3]
Main Steamline Isolation Valves' Leakage Control System Pressure	0 to 15" of water 0 to 5 psid	1
Primary System Safety Relief Valve Positions, including ADS or Flow Through or Pressure in Valve Lines	Closed-not closed or 0 to 50 psig	1[21]

*Design flow - the maximum flow anticipated in normal operation. THE ACCURACY SHOULD BE ± 5% OF DESIGN FLOW.

TABLE 3A- (continued)

Purpose & Variables	Range	Category
TYPE B - (continued)		
<u>Maintaining Containment Integrity</u>		
Primary Containment Pressure (Drywell/Wetwell)	10 psia pressure to 3 times design pressure[2] for concrete; 4 times design pressure for steel	2 [21, 22]
Containment and Drywell Hydrogen Concentration	0 to 10% (capability of operating from 12 psia to maximum design pressure[2])	1 [21]
~~Containment and Drywell Oxygen Concentration (for those plants with inerted containments)~~	~~0 to 20% (capability of operating from 12 psia to design pressure[2])~~	~~1~~
Primary Containment Isolation Valve Position (excluding check valves)	Closed-not closed	1
Suppression Chamber Air Temperature	30°F to 230°F	1
Drywell Temperature	40°F to 440°F	4 [5]
TYPE C - Variables Which Indicate Breach or Potential for Breach of Barriers to Fission Product Release		
<u>Fuel Cladding</u>		
~~Core Exit Temperature~~	~~200°F to 2300°F~~	~~1 [4]~~
Radioactivity Concentration or Radiation Level in Circulating Primary Coolant	Normal to 10 Ci/gm	5 [19]

DELETE FROM CATEGORY B. MOVE TO CATEGORY D.

[2]Design pressure - that value corresponding to ASME code values that are obtained at or below code-allowable material design stress values.

TABLE 3A- (continued)

Purpose & Variables	Range	Category
TYPE D - (continued)		
Containment Systems		
Containment Spray Flow	0 to 110% design flow[1]	3
Suppression Chamber Water Temperature	30°F to 230°F	3
Auxiliary Systems		
Steam Flow to RCIC	0 to 110% design flow[1]	3
HPCI Flow	0 to 110% design flow[1]	3
RCIC Flow	0 to 110% design flow[1]	3
RHR System Flow (LPCI)	0 to 110% design flow[1]	3
RHR Heat Exchanger Outlet Temperature (LPCI)	32°F to 350°F	3
Service Cooling Water Temperature	32°F to 200°F	3
Service Cooling Water Flow	0 to 110% design flow[1]	3
Flow in Ultimate Heat Sink Loop	0 to 110% design flow[1]	3
Temperature in Ultimate Heat Sink Loop	30°F to 150°F	3
Ultimate Heat Sink Level	Plant specific	3

TABLE 3A- (continued)

Purpose & Variables	Range	Category
TYPE C - (continued)		
Reactor Coolant Pressure Boundary		
PRIMARY Containment High-Range Area Radiation	1 to 10^{7} R/hr ~~[illegible]~~	2[5,18,21] ~~(for Mark III containments, two redundant monitors are required for primary containment & reactor building)~~
REACTOR BUILDING HIGH RANGE AREA RADIATION	1 TO 10^{4} R/HR	2[5,18,21]
Containment Water Level	0 to 5 feet above normal water level	1[21]
Containment		
Standby Gas Treatment System Vent	10^{-6} to 10^{5} μCi/cc	4[16,17,21]
Effluent Radioactivity - Noble Gases	10^{-6} to 10^{5} μCi/cc ~~(Xe-133 calibration)~~	4[6,16,17,21]
Environs Radioactivity - Exposure Rate	10^{-6} to 10^{4} R/hr ~~(60 keV to 3 MeV)~~	4[7,18]
TYPE D - Variables Which Indicate Operation of Individual Safety Systems		
Power Conversion Systems		
Main Feedwater Flow	0 to 110% design flow[4]	5
Condensate Storage Tank Level	Bottom to top	5

TABLE 3A- (continued)

Purpose & Variables	Range	Category
TYPE D - (continued)		
Auxiliary Systems (continued)		
SLCS Storage Tank Level	Bottom to top	5
Sump Level in Spaces of Equipment Required for Safety	To corresponding level of safety equipment failure	5
SLCS Flow	0 to 110% design flow[1]	5
RADWASTE SYSTEMS		
High Radioactivity Liquid Tank Level	Top to bottom	5
VENTILATION SYSTEMS		
Emergency Ventilation Damper Position BETWEEN SECONDARY CONTAINMENT AND THE ENVIRONS	Open-closed status	3
Temperature of Space in Vicinity of Equipment Required for Safety	30°F to 180°F	5
POWER SUPPLIES		
Status of Class 1E Power ~~Supplies~~ and Systems Sources	Voltages currents pressures	3[8]
Status of Non-Class 1E Power ~~Supplies~~ and Systems Sources	Voltages currents pressures	5[9]

TABLE 3A- (continued)

Purpose & Variables	Range	Category
TYPE E - Variables Which Indicate Magnitude and Direction of Dispersion of Released Radioactive Materials		
RADIATION EXPOSURE RATES INSIDE BUILDINGS OR AREAS WHERE ACCESS IS REQUIRED TO SERVICE SAFETY-RELATED EQUIPMENT		
Radiation Exposure Rates	R/hr 10^{-1} to 10^{4} R/hr ~~[illegible]~~	4[18]
AIRBORNE RADIOACTIVE MATERIALS RELEASED FROM THE PLANT		
Effluent Radioactivity - Noble Gases		
Reactor Bldg or Secondary Containment RELEASE POINTS	10^{-6} to 10^{4} µCi/cc	4[16, 17]
.Other Release Points (including fuel handling building, auxiliary building, and turbine building)	10^{-6} to 10^{3} µCi/cc ~~[illegible]~~	4[16, 17, 21]
Effluent Radioactivity - ~~[illegible]~~ Radiohalogens and Particulates	10^{-3} to 10^{2} µCi/cc	4[10]
Environs Radioactivity - Radiohalogens and Particulates	10^{-9} to 10^{-3} µCi/cc for both radiohalogens and particulates	4[11]
Plant and Environs Radioactivity & Radiation (portable instruments)	High Range 0.1 to 10^{4} R/hr photons 0.1 to 10^{4} rads/hr betas and low-energy photons	6[12]
	multi-channel gamma-ray spectrometer	6

Purpose & Variables	Range	Category
PE E - (continued)		
POSTACCIDENT SAMPLING CAPABILITY (Analysis Capability Onsite)		
Primary Coolant	Grab Sample	5[13, 21, 22]
Gross Activity	10 μCi/ml to 10 Ci/ml	
Gamma Spectrum	(Isotopic Analysis)	
Boron Content	0 to 1%	
SUPPRESSION CHAMBER WATER ~~Sump~~	Grab Sample	5[13, 14, 20, 22]
Gross Activity	10 μCi/ml to 10 Ci/ml	
Gamma Spectrum	(Isotopic Analysis)	
pH	2 to 12	
Containment Air	Grab Sample	5[13, 20, 22]
H_2		
O_2		
Gamma Spectrum	(Noble gas analysis)	
METEOROLOGY[15]		
Wind Direction	0 to 360° (±5° accuracy with a deflection of 15°. Starting speed 0.45 mps (1 mph))	5
Wind Speed	0 to 30 mps (67 mph) (±0.22 mps (0.5 mph) accuracy for wind speeds less that 11 mps (25 mph), with a starting threshold of less than 0.45 mps (1 mph))	5
Temperature	-40°F to 120°F (±0.9°F accuracy)	5
Vertical Temperature Difference	-9°F to +9°F (±0.3°F accuracy per 164-foot intervals)	5
Precipitation	Recording rain gage with range sufficient to ensure accuracy of total accumulation within 10% of recorded value - 0.01" resolution	5

TABLE 3A

BWR VARIABLES

pose & Variables	Range	Design & Qualification Criteria Category (See Table 1A)
- (continued)		
EOROLOGY[15] - continued		
Dew Point Temperature	-60°F to 120°F (±2.7°F accuracy for temperature range, -22°F to 68°F when relative humidity is greater than 60%)	5

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