UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

Subcommittee on Class 9 Accidents

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE ON CLASS 9 ACCIDENTS

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

Friday, August 2, 1985

The subcommittee reconvened, pursuant to recess, at 8:30 a.m., William Kerr, Chairman of the Subcommittee, presiding.

ACRS MEMBERS PRESENT:

W. KERR, Chairman
D. MOELLER
R. AXTMANN
P. SHEWMON
C. SIESS
D. WARD

ACRS CONSULTANTS PRESENT:

J. LEE
I. CATTON
M. BENDER
M. CORRADINI
P. DAVIS

COGNIZANT STAFF ENGINEERS PRESENT:

R. SAVIO
D. HOUSTON

NRC STAFF AND PRESENTERS PRESENT:

M. SILBERBERG
J. MITCHELL
J. HULMAN
T. SPEIS
R. BARRETT
Z. ROSZTOCZY
A. BUHL
E. BURNS
M. HITCHLER
M. KENTON
J. GABOR

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P R O C E E D I N G S

MR. KERR: The meeting will come to order.

This is a second day of the meeting of the Advisory Committee on Reactor Safeguards Subcommittee on Class Nine Accidents.

We are exploring the BMI 2104 approach to calculating source terms, and today we are going to hear from NRR about their plans for making use of this in dealing with a severe accident issue.

We will proceed with this second day of the meeting then and the agenda says I call upon Mr. Bernero, and you may not recognize Mr. Bernero when he arises, but I will at least call upon him and if he is not here someone will substitute.

Mr. Hulman.

MR. HULMAN: Mr. Bernero sends his regrets. He has a problem this morning with issuing the River Bend License and asks that you please forgive him for not showing up, but he has given me some information to pass on to you.

What he wanted me to convey to you was information regarding the severe accident policy statement. You may not know it, but the Commission has approved the issuance of the policy statement. It is in the printer. The Federal Register notice will be issued on Monday. It will

have two attachments to it.

One attachment is about 20 pages or more of comments by Commissioner Asselstine indicating the reasons for his dissent, and it will also include a set of comments by the Chairman in response to Commissioner Asselstine's dissent.

The staff's evaluation and a copy of the Commission policy statement will be issued as NUREG 1070, and that NUREG is at the printers and will be distributed on Wednesday so that not only you as members of the ACRS, but the public in general will have available to it the staff's assessment as well as the policy statement.

What we had proposed to do on the agenda following that was to introduce the staff's plans for implementing the severe accident policy statement.

Dr. Speis and Zoltan Rosztoczy were to come on the agenda at this point, but they are not here yet. So I would like to flip-flop the agenda a little bit and ask Rich Barrett, who is Item D on the agenda, if he will make the presentation on the review of the Peach Bottom TC sequence, Item 3D on the agenda, a case study.

MR. BARRETT: Dr. Speis is here, and perhaps you would like to reflip-flop the agenda.

MR. SPEIS: Mr. Chairman, can I proceed?

MR. KERR: Please.

MR. SPEIS: I am sorry. I guess I missed the introductory remarks.

MR. KERR: Well, you can make some additional ones, if you like.

MR. SPEIS: Good morning then.

Today we are going to talk about the implementation of the severe accident program. The staff will discuss the approach that it plans to take to implement the severe accident program and later on either this morning or in the afternoon I guess, I don't have the agenda in front of me, the IDCOR people will present their approach.

MR. KERR: Mr. Speis, is there a difference between the severe accident policy and the severe accident program? I assume there could be.

MR. SPEIS: The severe accident program flows from the severe accident policy.

MR. KERR: Okay. So perhaps then you should tell us what the severe accident program is.

MR. SPEIS: That is my objective for the next few minutes, Mr. Chairman.

(Slide)

I have summarized the things that are key to the discussion today that are in the severe accident policy statement, and of course I will focus on the implementation

of the program itself.

If you recall, there are three key things in the severe accident policy statement, the systematic examination of existing plants, the issuance of guidance on the role of PRAs and amendment of NRC regulations as appropriate.

I will focus on the first part, the systematic examination of existing plants. I don't have anything to say about the second subject. Mr. Bernero and Mr. Hulman will discuss certain things relating to the third item which could flow from the source term activities.

If you recall, the policy statement states that . . . "The Commission plans to formulate an integrated systematic approach to an examination of its nuclear power plant for possible significant risk contributors that might be plant specific and might be missed absent a systematic search. . . " I am continuing a quote from the Commission's policy statement. "During the next two years, the Commission will formulate a systematic approach, including the development of guidelines and procedural criteria, with an expectation that such an approach will be implemented by licensees. . . "

As I have already said two or three times, this will be the focus of our presentation today. I don't know who put this in my viewgraph, but since it is there, the

Office of Nuclear Reactor Regulation is being reorganized, you probably heard about it, and all the severe accident related activities will be focused in one division, the Division of Safety and Reactor Overview.

This includes both implementation of the severe accident program, any changes to the regulation as a result of the source term and interactions with IDCOR. So that all the activities will be focused in one place, and hopefully there will be a more orderly process in our interactions with the ACRS and with the industry. So there will be one point of contact basically.

The development of the program will of course require extensive interactions with both the industry and you people, and in my last viewgraph I would like to propose a series of meetings for the next year that we would like to have with you to discuss the technical details and other things that are important in implementing the severe accident program.

(Slide)

I think I am going to bore you with a viewgraph that you probably saw yesterday from Mel Silberberg's presentation, even though I wasn't here.

This viewgraph delineates the responsibilities between the Office of Research and the Office of Nuclear Reactor Regulation. Basically our responsibilities are to

take all the information and see if we can make some sense out of it.

One of the things, and Mr. Hulman maybe discussed this already with you, will be to see what changes can be made to the regulations as a result of the source term reassessment effort that you heard yesterday. The other one is the things that I mentioned already, the severe accident regulatory implementation. There is no use repeating this. This is just for frame of reference.

(Slide)

Before I get to this next complicated viewgraph, and I will leave this for last, so let me start with the description of some of the other activities, and then I will try to summarize them using the pictorial representation.

(Slide)

Let me say a few things about the industry effort that you will hear in great detail later on from their representatives here.

If you will recall, following the TMI accident an industry group was formed to study severe accidents in existing nuclear reactors. The program was named IDCOR. The industry program has done an extensive amount of work in the last few years and it has culminated in the detailed examination of four reference plants with respect to severe

accidents. They have documented the results and they have presented them to us in a series of meetings over the last two years or so. We have briefed you before on those meetings, the results and the important things that emanated from these meetings.

As a result of these meetings, 19 outstanding technical issues were identified for further dialogue with the industry, and basically these dialogues have taken place and we have reached an understanding on the approach to the resolution of these 19 issues.

Later on Dr. Rosztoczy from our office will describe what those issues are and what is the approach that has been agreed with IDCOR regarding the resolution.

IDCOR is presently developing a methodology to apply what they have learned from the four reference studies and to apply them to the systematic examination of all plants, and this methodology will be presented to you today.

What they have attempted to do is distill the essence of those studies and come up with a methodology that is not as detailed as a complete PRA and see if they can apply this methodology to individual plants to identify any vulnerabilities that could be present either in areas that would initiate a severe accident or in mitigating one by focusing on the containment. But you will hear more

details later on. So there is no use in dwelling on it any further.

MR. KERR: Will there be an IDCOR systematic examination and an NRC systematic examination, or is there going to be one systematic examination? How do these two or three or one relate?

(Slide)

That tells me.

(Laughter.)

MR. SPEIS: Well, I was hoping to leave this for last. IDCOR is undertaking the systematic examination, and it will be utilized as input. We will review this in addition to other activities that have been underway by the Office of Research, and out of that will come the NRC guidance. So we are not undertaking per se any specific development methodology, even though we will be auditing some aspects of it and in some key areas that will be questions. So we will do more than auditing. But that program is being defined at the present time and Zoltan will discuss a little bit more about it.

MR. KERR: Well, in your first slide you quoted from a severe accident policy that the Commission plans to formulate an integrated systematic approach.

MR. SPEIS: We hope that the methodology that IDCOR is developing will be acceptable to us.

MR. KERR: Okay. That is what I was trying to understand. There won't be two separate systematic ---

MR. SPEIS: No, it won't be two separate. As I said already, we will be utilizing information that Research is developing, we will be auditing, we will be doing independent calculations as necessary, but we hope that the IDCOR methodology can be the vehicle.

I am not so sure I finished my previous viewgraph. Let me see.

(Pause.)

(Slide)

Yes, I think so. I say here that following our review and approval we hope that this methodology can be used for the systematic evaluation of the existing plants by the licensees.

I understand that IDCOR's charter expires at the end of '85. So we hope that since this activity will be very -- it is not going to end by the end of '85. Nothing ends so soon. I hope that somehow they stay in business so some interaction can continue so we can handle the implementation, but that is something that we will have to discuss further with them.

(Slide)

There are some more words of some things that I either said already or I alluded to them. I am going to say

a few things about the research part of the program, which will fit into the implementation box that I showed you earlier.

They have the source term methodology effort that you heard yesterday, and I understand that it is still scheduled to be issued on August 7th.

The other activity that we think it is very important that Research is doing and it is going to be an important input to our process is the reassessment of five reference plants by the Office of Research, so-called their baseline risk evaluation program or something.

What they plan to do is take five reference plants, and the four of them are the same as the ones that IDCOR has analyzed in detail and kind of integrate all the up-to-date information in the severe accident area and take a look at the accident sequences, the arrival rate and fold into the analysis any recent knowledge that we have about containment loadings, containment performance and of course the source term, science, the physics and the chemistry and come up with a baseline risk profile from those plants.

In addition, those studies will include an evaluation of options that will further reduce either the probability of an accident or the consequences, and also this will involve cost-benefit type of evaluations of a number of options that would go either way, either reduce

the probability or reduce the consequences.

I have as a qualification at the bottom, the RES evaluation will be based on internal events only, will not address the accident management and will provide only a limited parametric assessment of common mode failures.

MR. KERR: Dr. Speis, I don't understand the usefulness of the approach if it does not include external events since, as has been pointed out, many of the current PRAs seem to indicate that they are a very contributor to risk. So I don't understand how they are going to be very useful in assessing the risk of the plants that are out there.

MR. SPEIS: I will say a few things.

Is Mel Ernst here by any chance?

MR. KERR: Well, what Mel Ernst will say or Mel Silberberg, either, is that is NRR's problem.

MR. SILBERBERG: I don't know that I said that yesterday.

MR. KERR: I will retract that statement.

(Laughter.)

But it is NRR's problem since they are going to do it and turn it over to you, and what are you going to do about assessing external events?

MR. SPEIS: It is our problem. We plan to look into this area. There are a number of programs at the

Office of Research, as in our office, dealing with external events and how they contribute to risk. One of the programs is A-46.

MR. KERR: Now perhaps the staff doesn't believe these recent PRA's that have been done. But if they are a major contributor to risk, how is it logical to carry out what are supposed to be representative PRAs and ignore them?

MR. SPEIS: Well, the reason I had this on the viewgraph is to make sure that you know what Research is doing, but we plan to address this issue, and possibly at the first detailed meeting that we have with you we will ---

MR. KERR: Well, why don't you address RES and suggest that they include external events?

MR. SPEIS: Zoltan, do you have something to say about that?

MR. ROSZTOCZY: Yes. Dr. Kerr, presently how 1150 is planned, the report, it will note include external events. Simply what it means is that in order to produce that information in that report on the schedule that was outlined to you yesterday they will not be able to include external events.

There are various programs ongoing on external events or items related to external events. Research has a

separate research program on seismic, for example, which addresses all the questions that normally one needs to address when you are talking about seismic events.

What has not yet been decided and has not yet been formulated is how are we planning to incorporate external events. The expectation is that one way or another we are going to address the external events and we are going to incorporate it into the overall evaluation, but we haven't decided yet how.

So we would like to ask your patience along these lines, and at the same time we are ready to give you a promise that the next time when we will be here then we will have the external events on the agenda and we will spell out our thoughts and our approach that we are planning to take on external events.

MR. KERR: Mr. Rosztoczy, I am a very patient man, and I think any of my colleagues will verify that. What I am trying to understand is how one justifies the expenditure of a considerable amount of effort in reviewing these reference plants and at the same time ignores what at least on the surface appear to be principle risk contributors, and I don't see why a schedule for getting out a particular publication, if the results of the publication aren't very significant, is an important contributor to that decision.

I was just trying to understand what the staff has in mind. I am not trying to suggest that I can manage, and I can't even manage a lot of other things that I am responsible for managing, but I would like to understand why you are doing it since to me it seems to be sort of contrary to ---

MR. ROSZTOCZY: We have two main sources of information right now that is the basis for our review. Once source is the IDCOR evaluation, they have evaluated all the reference plants, and the other one is the NRC evaluation of the reference plants for NRC and NRC contractors.

As it turned out, both of those inputs are coming without external events. The IDCOR evaluation did not include the external events and the NRC evaluation does not include the external events. These decisions were made many years ago and we are now getting to the point of publishing the results of the evaluation, but the basic decisions were made many years ago.

MR. KERR: Mr. Rosztoczy ---

MR. ROSZTOCZY: Resulting from this there is a program on seismic and there is a program on some external events, but we have to figure out, and this is what we are telling you that we haven't done yet, is how do we fold in the information that will come from different sources. It

comes from Research, but from a different source within Research. We have to figure out what information do we need as a minimum and how can it be folded in, and we are telling you that we are not ready yet to discuss it, but we will be next time when we see you.

MR. KERR: Well, suppose that one concluded after some examination that PRAs that didn't include external events were worthless, and this is a hypothetical question and I am not suggesting that that would be the case. Would you still go ahead with this schedule that was formulated years ago?

MR. ROSZTOCZY: If one could arrive to such a conclusion, then obviously we would not.

MR. SPEIS: Dr. Kerr, I think we understand your point very well and maybe we should be talking to our friends at Research to see if we can do something about that.

You know, even though Zoltan said that we plan to see what information exists and see what use we can make of it in our studies, it might still be possible that those five studies which supposedly are supposed to be out of date, you know, the technology as we know it today, that maybe they should have some consideration. So let us discuss this with our management in the Office of Research. We get your point.

MR. KERR: Thank you, sir.

MR. DAVIS: Themis, I have a question on that same item. You said that you will not address accident management. That bothers me a little bit, too. It seems like the IDCOR results, if I remember correctly, indicated that a rather substantial benefit could be accrued by considering accident management, and I particularly remember the BWR Mark I situation where some accidents can be effectively mitigated by operator action particularly if you have enough time.

Furthermore, yesterday in Mel Ernst's presentation he said recovery would be considered of accident sequences. To me that means accident management, but you may be using a different definition.

MR. SPEIS: What I am talking about here is once you are in a degraded situation what additional efforts can be pursued to recover from that situation or even mitigate the consequences, and I don't know in what context Mel used the word "recovery."

I am referring here to a situation where you already are in a degraded core regime and what valiant efforts can be undertaken, either human or rigging up certain equipments or systems to stop the further progression of the event. That is what I am talking here about.

MR. DAVIS: You are talking here more about heroic type actions rather than ---

MR. SPEIS: Yes, where the core has already entered into a degraded situation. But what I am referring here to is these RES studies. I don't think, based on my best knowledge, that they will include what I just described, but our program will consider, or the implementation program accident management efforts activities will be folded in to the extent possible.

MR. DAVIS: Thank you.

(Slide.)

MR. SPEIS: Now you probably heard about this yesterday. These five reference plant studies will be available to us on an incremental basis starting sometime in November or October or something like that and will be finalized sometime in the late spring of 1986.

Let me focus a little bit on this thing, on this implementation, the systematic examination of existing plants, and Zoltan will address each one of these separately so you can have as good an understanding as possible so we can have a meaningful dialogue in this coming year.

As I show you in the box, we in NRR will review both the IDCOR and the RES analysis performed for the five or so reference plants and try to understand them,

understand the differences and to try to pass a judgment on the adequacy of these studies vis-a-vis severe accident risk.

Also, we will be reviewing the IDCOR proposed methodology on the individual plant analyses using the conclusions and the lessons learned from the reference plant studies and also pass a judgment on the acceptability of this approach and whether it can be used as the tool to do the systematic review of the individual plants.

MR. KERR: Can you give us some idea of how you will decide whether it is acceptable or not?

MR. SPEIS: Well, there are a number of goals that float around and some of them are final and some of them have not been finalized.

MR. KERR: I was thinking, for example, RES will be doing some sort of review of some reference plants, and presumably there is some overlap between their reference plants and IDCOR's reference plants.

MR. SPEIS: I think four of them are the same basically.

MR. KERR: For example, will acceptability depend on how close to the same result the two approaches are? I am trying to get some understanding of whether you have thought about how you will determine acceptability.

MR. SPEIS: Well, Zoltan will be discussing in

more detail later what criteria.

MR. KERR: Okay. If he is going to talk about it that is fine.

MR. SPEIS: Then use the inside experienced gained from these reference plan reviews, the methodology of previous analyses that we have done in the last two years, the Zion effort and the Indian Point, Limerick and other detailed PRA studies that the licensees and the staff have done and evaluated and distill all that information and come up with the so-called generic guidelines and procedural criteria to review the individual plants.

The way we visualize this is these guidelines and criteria will be kind of divided possibly into the prevention and mitigation areas.

MR. KERR: In the IDCOR methodology as it is presently conceived, are external events going to be ignored?

MR. SPEIS: I think we said already the reference studies don't include external events.

MR. KERR: I know that, but the reference study is not the methodology. It may be part of the methodology, but ---

MR. SPEIS: As I and Zoltan said, our distillation of all the information, appropriate input will be provided from the external events area. That is thing we

wanted to discuss further with you.

MR. KERR: I am referring now to the methodology which IDCOR is developing and with which you must have some familiarity.

MR. SPEIS: Yes.

MR. KERR: Does it propose to include external events?

MR. SPEIS: As it is presently proposed, it does not include external events.

MR. KERR: Thank you.

MR. SPEIS: The distillation of this would be in the recommendations to the Commission telling them here is the approach that we have developed to examine the individual plants, and they will have to decide whether they will accept it or reject it or what.

Currently we are in the planning stage of this program. We will give you a status report of these efforts and Zoltan will do momentarily. We expect to complete Items 1, 2 and 3 by the summer or fall of '86 and have our recommendations to the Commission sometime in November or late fall of 1986.

(Slide)

You people already have provided comments in a letter from the Chairman of the ACRS to the Chairman of NRC on how you view this methodology and how one can develop a

systematic approach to examine individual plants based on reference studies, and I am referring to the letter dated April 15, 1985. We find the letter extremely useful and there are a lot of insights in the letter. We plan to use the recommendations or the insights that have been provided in this letter.

We also have discussed this letter with IDCOR in one of our meetings, and they also told us that they found it very insightful and very useful and they will probably have something to say about it today.

MR. WARD: Themis, let me ask you about that. You said earlier that the methodology you will use, you expect to use that developed by IDCOR.

MR. SPEIS: As the vehicle, but then we will modify it. For example, their methodology does not include external events. We have to address the question of whether it should be modified to take into consideration external events or any other things that we think would be needed before we can adopt it as our own.

MR. WARD: Okay. So when you say you found the ACRS suggestions useful and are using them, what does that mean? Is IDCOR incorporating them in their methodology or are you figuring you are going to add these elements to it for your own use, or what? What do you mean?

MR. SPEIS: In our program during the coming

year, which is being initiated right now. We are groping, you know, how can one come to grips with a mini-analysis and not a complete PRA of every plant in the country that cost $3 or $5 million.

I think you people have provided good thoughts and insights on how one can do such a thing, and in that framework I say I found your recommendations and your conclusions very useful. In fact, some of them the approach that IDCOR will discuss later on, some of those ideas that you have in your letter are being followed and some other ones are not being followed, but we have to give the appropriate consideration to them.

As I said in the beginning of the meeting, and why are you laughing, Dr. Kerr? Did I double talk?

MR. KERR: No. I thought you were handling of that question was very astute, and I was laughing in admiration, or smiling. I wasn't laughing.

(Laughter.)

MR. SPEIS: Thank you for the compliment.

(Laughter.)

We hope that we can have detailed discussions about these areas, and I recommend that we schedule at least three subcommittee meetings this coming year. Since I have left some holes in my discussion, maybe it will be appropriate for Zoltan to come here and try to fill some of

those holes.

MR. KERR: Any questions?

(No response.)

I see no questions. Thank you, Mr. Speis.

MR. SPEIS: Thank you, Mr. Chairman.

Zoltan, you are next.

(Slide)

MR. ROSZTOCZY: I am Zoltan Rosztoczy for NRR, DST.

(Slide)

My first subject is to discuss in a little bit more detail the systematic examination of the existing plants.

As Dr. Speis already mentioned, there are four goals or four purposes to this program and accordingly the program itself is organized into four tasks to cover those four purposes.

The first one is the review and evaluation of the reference plants, which have been done by IDCOR and has also been done or is being done by RES and RES contractors.

The second part will be the review of the methodology, the simplified methodology proposed for the evaluation of individual plants by IDCOR. IDCOR is planning to submit this information early next year and following

the submittal we are going to review that.

The third one is the development of some generic guidance, guidance which can be given to the utilities and would tell them how much work they need to do and what is the minimum that needs to be done and how can they measure the acceptance of the plants when they are performing this work.

This will be published together with the approval of the IDCOR methodology so they would have in their hands both the guidance of what needs to be done and the methodology that can be used to perform the work.

And, finally, the fourth one is to put together all the information and prepare a Commission paper that would put in front of the Commission the conclusions of the severe accident program and recommend a resolution to the severe accident issue.

(Slide)

The next slide shows the information that we are expecting to receive from the various sources to support our review.

The first item, the source term methodology, as you heard yesterday, is about finished. RES has finished their part and they are issuing NUREG 0956 and IDCOR has updated the methodology, what they have submitted earlier to us, based in the discussions what we had earlier this

year, and we are supposed to receive that one this month also.

As far as the evaluation and analysis of the reference plant is concerned, the IDCOR analysis is already now in hand in one form, what we received back a year or a year and a half ago, and an update to this taking into account the resolution of the technical issues that I will discuss a little bit later, an update to this will be provided to us in October of the year. So just a couple of months from now.

The equivalent of this on the NRC side will be coming in early next year. As you heard yesterday, they are working on it, they have a firm schedule and they and expect to complete them plant by plant.

The first plant is Surry, but is not shown on my slide because there is no IDCOR analysis. So we probably will base most of our comparisons to the four reference plants.

The first plant is supposed to be finished by December and then the other four, as shown on this slide, in January, February, March and April of next year.

MR. CORRADINI: Could I ask a question at this point?

MR. ROSZTOCZY: Yes.

MR. CORRADINI: How important do you think it is

in not having a Mark II in either of your groups, a BWR Mark II plant to look at? Do you think that is not a big omission that it behaves similarly to a Mark I, or what is your feeling about that?

MR. ROSZTOCZY: At the present time where we stand, which knowingly we are still a fair distance from knowing what form these guidelines are going to take, but where we stand now it doesn't bother us too much. It doesn't bother us because we are going to look at very carefully the Mark I's and we are going to look at the Mark III's.

After we finish both of those and we have guidelines for the Mark I's and Mark III's, then we are going to compare those two and see how much of a difference you come up with between a Mark I and a Mark III.

Then once we finish that, then we will fall back and we will look at the Mark II. On the Mark II it turns out that because of Limerick we have done a fair amount of work and reviewed the PRA in terms of the Mark II and we think that there is a good chance that by looking at the Limerick work and looking at the results, what we arrived at on the Mark I's and on the Mark III's, we will be able to fill the gap for the Mark II's. So right now it doesn't look bad.

MR. CORRADINI: So you already have that

information for a specific Mark II?

MR. ROSZTOCZY: We have a fair amount of information. We will not have everything that is being done for a reference plant, but we have a fair amount and we think that will be enough to complete it so it covers Mark II's also.

If we run into some difficulties and it requires some extra work, then at that time we will have to face that.

MR. KERR: Mr. Siess.

MR. SIESS: Zoltan, will the uncertainty analysis that is shown on that schedule be limited to the uncertainties in the source term to containment or will it also include the uncertainties beyond that?

MR. ROSZTOCZY: Really, there are two forms how we are going to receive uncertainties from Research. One of them is the 1150 report that was discussed yesterday and which is represented here through the various plant analyses, and I think there is a entry saying that it will be issued next summer.

MR. KERR: I am sorry, what ---

MR. ROSZTOCZY: NUREG 1150 will be issued next summer. It will sum up all four of these plants, and in that report there will be high estimates and low estimates in addition to the central estimates. So that in itself is

an expression of uncertainty, and those estimates cover the entire spectrum from the front end to the back end.

In addition to that, there is an uncertainty study that Research is undertaking, which is being initiated now and will be completed approximately in May of '86. That is the date given there and we don't have a firm date for it yet.

MR. SIESS: Is that the one described in the handout from Morino?

MR. ROSZTOCZY: That is the handout from Morino, and that one at best is only a portion of it, but in more detail than what you can expect to see in NUREG 1150.

MR. SIESS: But that one is limited to the source term to the containment?

MR. ROSZTOCZY: That is correct.

MR. SIESS: And it says somebody else is going to do more on the containment performance and consequences, et cetera, et cetera.

MR. ROSZTOCZY: At the present time we have only these.

MR. SIESS: I want to know what was in that May '86 schedule.

MR. ROSZTOCZY: The May '86 is only the Morino program on the source term program.

MR. SIESS: Plus what you have from the

walk-throughs?

MR. ROSZTOCZY: Yes.

MR. SIESS: Okay. Thank you.

MR. CORRADINI: But that is still all inside containment? That is the one thing I didn't catch completely.

MR. ROSZTOCZY: Yes.

MR. CATTON: Morino is inside.

MR. CORRADINI: So are the walk-throughs though.

MR. ROSZTOCZY: The 1150, that goes through in the whole thing. That will show the high and the low estimates on the final product.

MR. SIESS: That is not really an uncertainty. That again is a sensitivity analysis more than an uncertainty analysis strictly speaking, although some people like me would take it as measure of uncertainty I think.

MR. CORRADINI: But what I wanted to understand though was these walk-throughs, where it stops is in the source term result, that is, you will get three walk-throughs with three different source terms and three different probability ranges of various ways in which the containment fails and times. But from then on will there be also uncertainty in the consequences? I didn't understand that there were to be sensitivity calculations in the

consequence results from those different source terms.

MR. ROSZTOCZY: My understanding would be that that there will be.

MR. CORRADINI: Oh, okay.

MR. ROSZTOCZY: What you are hearing from us today is basically we are starting to take an inventory to see what information is going to come to us on what schedule and see if this information will be enough to do our job.

Some of these items which are shown now as outstanding items, it doesn't mean they won't be done, but it just means that right now we don't have a mechanism set up yet of how are we going to receive it and when.

We expect to get more information from IDCOR on the uncertainties also. We will get an uncertainty report from them and we probably will discuss in the near future what they are going to include in their uncertainty report. We are going to show them what we are planning to do.

If the general feeling or the general consensus after that is that all of this together is not enough and more needs to be done in uncertainties, then we will spell that out in the relatively near future like within the next couple of months and then we will make appropriate requests to initiate additional work.

Once these reports are published for public

comment and then after we receive the public comments, then they will be put into final form. So that is an important part of our work and that will be in a sense the only time when we expect to get input from other sources but the industry and NRC.

Then the last item on the list is the external events, and you see two question marks there simply because right now we do not have neither from IDCOR or from our side an established approach of how external events are going to be handled.

As I understand, IDCOR is going to give some thought to this also, and we expect to hear from them on the external events. We will pull together our people involved in various external events and we will discuss it and try to arrive at a way to handle it.

(Slide)

As you heard from Mr. Speis' presentation and mine so far is we are really only in the planning stage of this program, but we can show you some tentative schedule that presently we think we might be able to work toward. This will have to be developed and have to be firmed up in the coming months.

Basically what we would be doing would be looking at each of the four plants and under those four plants we would look at the analysis and the evaluation of

the plant, we would look at the IDCOR methodology as it applies to that plant, whether it would pick up everything that needs to be picked up for that plant type, and then we would develop, we would physically write a strawman guideline for that plant type saying that the reference plant, the first plant in this group has been analyzed in detail.

The other plants which are similar plants to this do not need to do as much of an analysis as the reference plant did. Somewhat less would be enough. So we would be searching for the minimum that one ought to do for individual plants and the guidance would spell out that this is the minimum of what one ought to do for individual plants.

Once we have done this for all four of the plants, then we have to pull it together. The last task, the schedule for the last task is to pull together all this information, to pull this together and then we will be in the position to make some recommendations for NRC actions and we will have then the guidance in which probably we will have some general parts in it that apply to all plants and then probably we will have some specific parts of it that apply to certain types of plants.

We would at the same time also issue our approval of the IDCOR methodology. Experience tells us that

usually we find them acceptable with some exceptions or some additions, whatever those are that are described at the time.

And, finally, once the whole picture is together and we know now what we are recommending to be done for the existing plants, then we will be in the position to see what changes need to be done in NRC procedures and standards for the future so this type of information is properly incorporated into the NRC process. This would include things like possibly writing a new chapter for the standard review plan and maybe issuing a regulatory guide so that if there are some changes needed in the regulations then we would put those into the regulations.

MR. KERR: Mr. Rosztoczy, in the presentations yesterday, if I interpreted them correctly, and I may not have, the impression I got was that the people who have been doing this souce term work have concluded that a significant contributor to outliers may well reside in the balance of plant and that the balance of plant tends to be very different for different reactors and there is no standardized approach.

Have you begun looking at this to see, No. 1, is said observation valid and, No. 2, is there some way you can deal with that in the systematic approach?

MR. ROSZTOCZY: We have done a little bit of that

really back a year or so ago or more. As you know, originally we started out with the idea of a surrogate plant, and by doing one plant, we would be doing a review for a group of plants and we dropped that approach. We are following now a reference plant approach instead because of that reason, because we have seen a relatively large amount of variations, for example, in the balance of plant even for the same plant type. Therefore, we are saying that you must do at least a minimum amount of work for each plant and that is why there would be an evaluation for every plant by the licensee.

Currently, as Mr. Barrett's presentation later today is going to show you of what we are doing in terms of a case study, we are looking at just one sequence for one plant and trying to see what kind of difficulties we run into. Under that when we also address this we will look at some other plants and see at least for that sequence are there large variations and how should we handle them or should we address them.

MR. KERR: Thank you.

(Slide)

MR. ROSZTOCZY: I am going to discuss the four portions, the four tasks of this program, and under the first task, which was the reference review, I am going to discuss only Peach Bottom, but obviously the same thing

would be done for all the other plants.

One of the questions in front of us right now is that is there enough information on the table that we can start to do our work now, or do we have to wait until early next year when the RES evaluation of the plant will become available?

(Slide)

So we started to collect together all available information on Peach Bottom, and those are listed on the slide, and it turns out that a fair amount of information is available even though some of these are being reviewed. So we feel that we are probably at the point now when we can start our review.

We have most of the IDCOR information. We have sequence analysis and event trees at least for some of the cases for our programs and we have preliminary containment event trees. So we feel confident that we can start the work now.

The review is expected to address all important parts of the severe accident evaluation, and along these lines I think we can say that we expect to address all of the items that you had in your April 15th letter.

If for any reason we would decide to shortcut something or handle it differently, then we would expect to bring it to your attention. But right now the approach

would be that we would addressing all of those items.

We will take the calculations done by IDCOR and the calculations done by RES and see how close they are, compare them, and try to see if the differences that exist between them are within the expected range of uncertainty. As long as they turn out to be within the expected range, then we consider them just two different analyses done by two different groups of people. It doesn't necessarily have to be the same.

However, if we find then that in some cases they are further apart than the expected uncertainty would be, then we will pay some special attention and see how come we are getting calculations which are further apart than either party would have expected it to be based on the uncertainty analysis.

MR. LEE: At this stage could you give me some idea of what is the expected range of uncertainty?

MR. ROSZTOCZY: No. That is the type of information of what we expect to get from IDCOR from the uncertainty report that we are supposed to get in September, that is next month, and we are supposed to get it from Research in NUREG 1150 and also as part of this uncertainty study. So we don't have those numbers in hand yet. Everybody is talking about relatively large. So I think we are talking of orders of magnitude of

uncertainties rather than just a simple factor.

MR. LEE: I see. Some of the Crest studies indicate that perhaps we could be talking about a factor of 100 type of spread in some source term results?

MR. ROSZTOCZY: That is correct, and that is the one which is being looked at and which is being re-evaluated at the present time. So I do not know yet if that will be the number of what we finally get or it will be revised by that time, but that is what the Crest study came up with.

MR. LEE: So at least as this stage you are not surprised by an order of magnitude type of uncertainty, a factor of ten type of uncertainty?

MR. ROSZTOCZY: That is what we expect. Whether it is one order or two orders, I don't know, but those are the type of things of what we expect to see.

MR. KERR: Mr. Shewmon.

MR. SHEWMON: When you get these results and you have to compare them with something besides each other, are you going to compare risk to a safety goal or source terms to WASH-1400 or what?

MR. ROSZTOCZY: That is the part which is not decided yet, and that we hope will kind of evolve as part of the review that we are doing. It is likely that one will need some kind of a guide number, what you compare to, in

terms of maybe core melt implicated for the prevention part and maybe risk in terms of the mitigation of the accident.

But in addition to that we expect to end up with other types of requirements or criteria that can measure the acceptance. For example, if for a given sequence you find that there is one very important system that provides protection for this sequence, as long as you have that, then you are in pretty good shape. If you don't have it, then you might have problems.

Then we would in that case spell out that one ought to have the system and what are the main attributes the system should have. For example, if it should function within a certain amount of time, then spread it out. If it is supposed to have some capacity, then it would be spread out, or if it needed to have some reliability, then that would be spread out. So for the important items, there would be probably a relatively specific type of measure.

Now if somebody doesn't have this or doesn't seem to this, it doesn't mean that he is unacceptable. It simply would mean that he would have then provide more information of how is he going to take care of this problem since he doesn't have it.

MR. SHEWMON: And at this point we are still not talking about the containment. We are talking about pumps or something of that sort, or is containment one of those

items?

MR. ROSZTOCZY: Containment is one of the items. It is one of the items.

MR. SIESS: Zoltan, you said how he takes care of this problem. How do we know he has a problem without a safety goal, or is the objective simply improvement without regard to where we are?

MR. ROSZTOCZY: No. That is why I started out saying that it has to be tied to some kind of an overall goal, and if you are within that goal, then there will be no real requirement for improvement.

However, there still could be suggestions, there could be certain things brought to the attention of the owner of the plant that here are certain things what you can do to do better, but it is most likely that if they need some kind of an overall goal, then there probably would be no specific requirement.

MR. SIESS: Now if the safety goal ends up being a very, very low probability of core melt and there certainly is a move in that direction, then where do we come out of that since you start with a core melt?

MR. ROSZTOCZY: No, no, we don't start with a core melt.

MR. SIESS: If we don't have a core melt that gets out of the primary system, we don't have much of a

source term, do we?

MR. ROSZTOCZY: That is correct, but we are looking at both. We are looking at the consequences, the risk and we are also looking at the frequency of the event, the prevention of the event, and the prevention of the event is the one where the core melt would feed into. If somebody doesn't meet the core melt, that means he hasn't done enough to prevent the event. So he would have to do something more to reduce the frequency of occurrence.

MR. SIESS: But there is a trend in the safety goal discussion that the core melt is dominant. I mean there have been some suggestions of getting it down to ten to the minus five or ten to the minus six. We can't have another TMI. Is there any relationship between that and this?

MR. ROSZTOCZY: As you heard earlier in Dr. Speis' presentation, these two from now on, these two are going to be handled in the same part of the organization very closely together, one next to the other.

MR. SIESS: You mean the part up there?

MR. ROSZTOCZY: Sorry?

MR. SIESS: I said the part up there?

MR. ROSZTOCZY: No, within NRR. So whatever the safety goal comes out with, that will be factored into our work. On the same hand, if we have any important input from

here to the safety goal, we will try to communicate that to the safety goal people also. So we would expect that both of them will go out to the public hand in hand having one or the other.

MR. SPEIS: May I say something, Mr. Kerr?

MR. KERR: Certainly. Mr.Speis.

MR. SPEIS: There has been a perception that the safety goal framework was tilted more in the risk area and there wasn't equal weight given to the prevention area. If you recall, the ten minus four goal for core melt probability was a subsidiary and is still a subsidiary. So the attempt has been, at least by the comments provided by Mr. Denton to Mr. Dircks, to make sure that there is a proper balance in this area and to pay as much attention to the prevention as to the risk. I think that has been the approach and not to do more in one area than the other.

MR. SIESS: At one level that may be true. That is the first time I have heard risk placed in apposition to prevention. Usually it is prevention versus mitigation, and I have never heard risk put as an alternative to anything. I thought risk was our whole business, the health and safety of the public.

MR. KERR: That is not a question, Mr. Speis.

MR. SIESS: No. I just found it strange, and I will listen for it in the future.

MR. KERR: Please continue.

MR. ROSZTOCZY: As I mentioned earlier, we are presently doing a case study where we just selected a single sequence for one of the reactors, and we are trying to do the equivalent of this review just to get our hands wet and to try to find out what kind of difficulties and questions and problems one will run into and try to do the work.

Whatever we learn from this will be factored into the planning of this program both in terms of the sources and also in terms of the feasibility of the program.

Later on Rich Barrett is going to show you what we are doing under that case study.

(Slide.)

The second task is the review of the IDCOR methodology. I am going to say very little about this because the whole afternoon is going to be spent on IDCOR presenting to you the methodology. We expect to receive the input on this early next year. They will finish it by the end of this year, and I would assume we would receive it in January of next year.

In our review we will be paying special attention to those items that we find important in the plant reviews like detection of outliers, identifying

containment mode failures, providing guidance for operators and so on, some of the things what we feel are probably most difficult to do well, but at the same time are very important to the output. And we would issue our approval of the IDCOR methodology at the same time when we put the guidance out for the utilities.

(Slide)

The third item is the development of this generic guidelines. As I mentioned earlier, when we are going to review a given plant, then the very same people who are doing the review, the people who are fully familiar with the plant and the evaluations of the plant, they will be the ones who will be writing the first strawman guidelines.

Just exactly what the guidelines are going to look like, I don't know, but in a sense I can look at your April 15th letter almost like some mini-guidelines. It provides what sort of thing a reviewer will address. We expect to go a step further and this guidance will probably be a lot more specific, but it will go along those lines.

Once these guidelines are written, the strawman guidelines are written based on the reference plant, then we are going to look at some selected other plants within the same group to see if they are sufficiently general to handle design variations, for example, the type that Dr.

Kerr pointed out earlier in connection with the balance of the plant.

The guidelines will be reasonably general and we hope they will handle it. If we find that there are some changes needed when we look at the other plants, then we will add those to the guidelines.

We will also coordinate with other work that has been done in this area in connection with Zion, Indian Point, Limerick and so on, including the Indian Point hearing.

We will coordinate with the safety goal to see that whatever is established in terms of a safety goal that that is properly factored into this work, and we will also coordinate with our resolution in terms of safety issues, a number of which are very closely tied to some of the work we are doing.

We will review what other countries have done in terms of the severe accident and see if that provides any insight for us for the development of our requirement or our guidance.

Finally, when we have the four sets of guidelines developed for each of the plant types, then we will pull that together into one complete set. As I mentioned earlier, we expect that this final set will have some general items and that will apply to all plants and

then it would have some specific items which would apply only to a certain plant type like a BWR Mark I containment.

(Slide.)

MR. KERR: Mr. Rosztoczy, before we go to this, it appears to me that a considerable weight in dealing with severe accidents is being placed upon emergency operating procedures and their development. Is it your feeling at this point that PRAs or as an alternative the methods for analysis of plants being developed can deal with the contribution that these emergency procedures make to risk mitigation in an appropriate way or perhaps even the contribution that they may make to risk?

In terms of the emergency procedures, we are already looking at what is the fact of the source term emergency procedures, and that will be discussed by Jerry Harmon. Now are you asking about that or are you asking about any additional contribution to the emergency procedures from PRAs?

MR. KERR: Well, I am simply asking if you feel that you have a good method to deal with the contribution of the emergency procedures, which it seems to me a great deal of emphasis is being placed, for example, on a BWR ATWS?

My impression is that a considerable amount of credit has been taken in some analyses for operator

initiatives in a situation which is certainly far from normal, and there are perhaps other example that one could give. It seems to me that whatever method of analysis that one uses ought to at least give some consideration to that sort of thing.

There is in one of your slides a statement that important design features and operator guidance needed to achieve a sufficiently low risk profile will be identified, and I couldn't tell whether that referred to things like emergency procedures or whatever.

MR. ROSZTOCZY: That guidance would include everything that affects the final risk evaluation. So to the extent that emergency procedures affect the final result, it would be addressed under that, and that might include some items beyond the source term that will be discussed by Jerry. So I think the answer is yes, we intend to look at them, but at this time we don't have any statement of how important this will be or what to suggest.

MR. KERR: Do you feel you have available an approach that will give you a good indication of how important they are? Do you think you can factor it into a PRA, for example, in a reasonable way?

MR. ROSZTOCZY: We expect that when we get the NUREG 1150 from Research that one will be able to track through that evaluation of the reference plant and see

where the major contributors are coming from. So the major contribution is coming from this source or there is a large uncertainty coming from this source. Then we should be able to see the evaluation as it happens to focus on the ones we look at.

MR. KERR: So it is being specifically included in that consideration?

MR. ROSZTOCZY: Yes.

MR. KERR: Thank you.

MR. WARD: Could I ask here, Zoltan, a question. I think that is a very good question, and I think it is a difficult area. It was mentioned earlier by Dr. Speis that you are considering the comments in the ACRS letter of earlier this year, and let me just read one of the comments that was in the letter.

It says "While PRA is a useful tool for examining the contribution to risk of the various elements of a plant's physical design, it is widely accepted that the effectiveness of human performance, including that of management is a substantial influence on risk and PRA is less successful." And that was probably a kind way to put it in examining this.

(Laughter.)

"Therefore, to supplement the use of PRA methods, there should be a systematic evaluation in the

individual plants. We believe it will be necessary to develop methods of analysis in associated data bases which can properly account for both positive and negative human performance in a general sense."

What are you doing about that?

MR. ROSZTOCZY: I think it was mentioned in connection with Dr. Speis' presentation. The input that we are going to get in NUREG 1150, we have discussed to some extent operator interactions based on the PRAs. So it is going to provide the type of information that your comments start out with saying that the PRAs provide some information, but it might not be enough.

That part of the information will be in 1150. We don't know yet whether that will be enough. So we have initiated a program which is called the Accident Management Pilot Study. It is going to be done or is being done at Idaho. Because of the time limitations, it will address only one plant,it is going to be the Peach Bottom plant, and it is going to provide specific information for Peach Bottom looking at exactly the type of thing that your comment is bringing attention to.

We are supposed to get the results of this pilot study in I think it is May of next year. Once we have that information, then we can look at the type of information that came from the PRAs and, additionally, the information

from the pilot study and see whether working only with the PRAs is sufficient with some additional work or is there a need to perform a pilot study for each four of the reference plants. Obviously we have one in hand already and there would be three more left.

We hope that the one pilot study plus the additional information, what we have from NUREG 1150, might be enough. If it is not enough, then we will have to do more work at that time.

MR. WARD: I don't know what the pilot study is going to be, and I don't think what you will have in 1150 even touches on this, and that is the problem. I mean your intent is to search for outliers and you are concerning yourselves with almost exclusively the physical characteristics of the plant and of the containment system.

In fact experience seems to be telling us that the risk outliers in the operation of nuclear plants has more to do with the organization that is running the plant than it does with whether it has got a Mark I or a Mark II or a modified Mark III containment. The whole emphasis on this program seems to be on the same old stuff and you are not looking at ---

MR. KERR: I wish you had said the same old good stuff.

(Laughter.)

MR. WARD: The same old good stuff and not on any of this new good stuff which I think you just aren't giving the proper attention to.

MR. ROSZTOCZY: I am not sure the pilot study was mentioned yesterday at all, but Joe Murphy, who was the last speaker yesterday, is the one who is in charge of the pilot study, and if you want to learn more about what will be included in that and whether it needs the type of thing of what you have in mind, then maybe some discussion with him in the near future would be appropriate.

MR. WARD: Well, is there something written up? Is there a proposal or some plan?

MR. ROSZTOCZY: Yes.

MR. KERR: Mr. Speis.

MR. WARD: Maybe I should know about it, but I don't know anything about it.

MR. KERR: Mr. Speis says he has something to add.

MR. SPEIS: I think we are talking about two different types of guidelines. I think what is referred to in the ACRS letter are emergency procedure guidelines that prevent the occurrence of an accident, and I don't know if the sense of the ACRS letter is to have procedures that not only prevent accidents, but ---

MR. WARD: It is not just the emergency

procedures or analyzing them in some sort of highly quantitative way, but if you look at what happened at the Davis-Besse incident in June, you know a core damage accident was prevented there. There was a threat, but it was prevented by -- well, it is a complicated situation -- but it was prevented by some very prompt and appropriate actions on the part of the operators. There were some mistakes made, but they did in a very short period of time just the right things to keep the accident from progressing.

PRAs don't touch that sort of thing. They actions they took really weren't governed by the emergency procedures that they had and it really didn't make much difference what sort of emergency procedures they had.

MR. SPEIS: Well, I think the thing that saved the day was that the operators were properly trained and they had a good understanding of the situation that they were in and how that situation could have evolved.

MR. WARD: Right. So the real outlier in risk is a plant where the operating staff doesn't have those characteristics, and how are you looking for those plants.

MR. SPEIS: Well, let me say a few things about the whole area. First of all, IDCOR's methodology does include consideration of this element, and of course all of us know that PRAs don't properly handle this area. Some

people think that mostly they are underestimated by operators to arrest accidents, as you said in the case of Davis-Besse.

We are all hoping that since that time one of the things we would have learned was that the training of the operators in a number of situations of that sort would provide substantial improvement in this area, and I think the David Besse event has proved that proper training indeed has accomplished its objectives.

MR. KERR: I am waiting for the second place.

MR. SPEIS: I was going to say that Zoltan's discussion of this program ---

MR. WARD: Wait a minute. Let me just take one step at a time. Do you have some reason to believe that proper training as measured by whatever the NRC parameters are for proper training was vindicated at Davis-Besse? I mean we know the operators after a point performed extraordinarily well. Did those operators have good scores on NRC requal exams and was their training program accredited by INPO? I mean did you know in advance that those were highly qualified and well trained operators?

MR. SPEIS: I cannot speak to the specifics that you are talking about. I know that the operators acted properly and from I hear from my colleagues who were involved in this area the training that they had received

paid off basically.

MR. KERR: Can we stipulate that Mr. Ward and others think that this is an important area that perhaps is not receiving appropriate treatment in the present methods?

I would also guess that this may be the last time that anybody from the NRC staff will say that they read an ACRS letter and are going to do what it says.

MR. SPEIS: I take exception to that. We will keep reading your letters.

(Laughter.)

MR. KERR: Mr. Shewmon.

MR. SHEWMON: Thank you. After TMI-2 and the recent Davis-Besse episode one might get the inkling that maybe amongst the outliers would be B&W plants, but there are no B&W plants on your set of five reference plants; is that correct?

MR. ROSZTOCZY: That is correct. The reference plants do not include neither B&W nor Combustion plants. One way how we hope to get a little insight into this is, as you will hear later today, IDCOR after they developed this simplified methodology for individual plant analysis, they are going to apply it to some plants as an example to see how it works to improve the methodology if it is needed.

For that purpose they selected a B&W plant and a

Combustion plant purposely to cover this gap and we hope to get some insight to that.

MR. SHEWMON: Thank you.

MR. KERR: Mr. Rosztoczy, would this be an appropriate place for a 10-minute break?

MR. ROSZTOCZY: Well, if you give me three more minutes then I finish this presentation.

MR. KERR: Good. I will do that.

(Slide)

The last item is the preparation of the Commission paper. As you all know, the Commission has approved the policy statement and it is my understanding it is going to be in the Federal Register on August 6th, which is this coming Monday.

In addition to that, the EDO, Mr. Dircks has requested that we provide an action plan of how we are going to implement the policy statement and the action plan is due to him in November of 1985.

The Commission paper, what we are talking about here will be that paper to the Commission spelling out the staff recommendation of how to dispose of the severe accident issue. It is going to discuss the needs of what needs to be done for individual plants. It will provide the guidance that the individual utilities can use for the examination of their plants.

(Slide)

It will provide the criteria of how they can judge the sufficiency and it will also provide a time table on how much time do they have to accomplish the review.

We will also give some attention to how NRC is going to follow up on this, and some kind of an auditing might be an appropriate way of how NRC would check whether everything has been accomplished.

We expect to have this Commission paper ready to go to the Commission next fall, the fall of 1986.

MR. SIESS: Zoltan, the criteria up there in Item 2 are the ones that we discussed earlier, right?

MR. ROSZTOCZY: That is right.

MR. SIESS: Okay.

MR. ROSZTOCZY: Mr. Chairman, that completes my presentation.

MR. KERR: Thank you, Mr. Rosztoczy.

Are there questions?

(No response.)

A 10-minute break. We will start again at a quarter after.

(Recess taken.)

MR. KERR: Mr. Rosztoczy.

MR. ROSZTOCZY: Mr. Chairman, in the intermission we handed out the copies of a letter which was a recent

letter from Mr. Dircks to Cordell Reed, who is the Chairman of the IDCOR Steering Group. It relates to some of the interface, what we are doing with IDCOR at the present time and we are providing you a copy of it. This letter was issued at the end of July.

(Slide)

My next subject is the resolution of the technical issues between NRC and IDCOR.

As Dr. Speis mentioned earlier, at the end of the IDCOR presentations to NRC, there were 19 technical issues identified which needed some further interaction between NRC and IDCOR.

(Slide.)

The 19 issues are shown on the first few slides and I am not going to discuss them individually, but you can see from the slides that they are grouped into three categories, those which relate to the core heat up stage and then issues which relate to the melt progression, the fuel relocation stage and finally the third category is in the ex-vessel stage.

(Slide.)

The various issues are usually specific technical issues like hydrogen generation inside containment or really ex-vessel fission products and so on.

We have had two sets of meetings with IDCOR this

spring to discuss these outstanding issues and to arrive at some kind of a resolution to these issues.

(Slide.)

In terms of the resolution, depending on what the issue was, we have arrived at different types if resolutions.

(Slide.)

I am skipping one more slide so that I can go to the following one which discusses the agreed on changes.

The type of resolutions that we arrived at met some kind of a revision in the evaluation model, and this could be the IDCOR evaluation model or the NRC evaluation model.

The agreed-on changes on this side shows the model changes that we agreed on with IDCOR that will be done in the IDCOR model. They are going to change the fuel relocation model in their calculations. On tellurium retention they are going to include in the model what they did not have previously. They are also going to incorporate a mechanistic melt progression model in the MAAP code.

There will be an improved fission product model that will handle more chemical species than what they have had in previous calculations.

MR. KERR: What is meant by a mechanistic melt

progression model, Mr. Rosztoczy?

MR. ROSZTOCZY: Previously they simply had an assumption say that when you reach a certain temperature then the core collapses and then when there is a certain weight on the plate, the support plate, then the support plate is assumed to melt through and the vessel is assumed to melt through instantaneously. So it was a relatively simply approach in the original calculations.

We have done a calculation somewhat differently in trying to model some of those and we arrived at quite different results. So after some discussion and looking at the benefits of those and seeing the experimental data of how these might progress, they are including a more descriptive way of how the core is going to collapse and melt through the vessel, which is not instantaneous but takes some time.

MR. KERR: And whose mechanistic melt progression model will they use?

MR. ROSZTOCZY: I believe they are developing their own. I am not sure if there is any comment and maybe this afternoon you can check on that with the IDCOR people to see exactly what they have done. I think they have ordered it done and we are supposed to get the report on it next month.

MR. LEE: How would you characterize the

mechanistic melt progression model now incorporated in the MAAP code compared with those in the MARCH suit of codes?

MR. ROSZTOCZY: The approach is that in the MAAP code we are trying to understand better the physical phenomena, and then include in the MARCH code as much as it must be included in order to do independent analysis, but those are mechanistic.

We have learned some from experimental results there, too, and we have adjusted them as time went on also. So there are changes both in the IDCOR calculations and also in our calculations.

MR. LEE: Would you say the MAAP model is more mechanistic than the MARCH model?

MR. ROSZTOCZY: Originally MAAP was less mechanistic.

MR. LEE: Especially in the melt progression area?

MR. ROSZTOCZY: In the melt progression area it was less. With the new changes, I think they are probably comparable. It doesn't mean they are the same, but they are comparable in detail.

MR. LEE: Okay. Thank you.

MR. CORRADINI: Can I ask you a question about that because I am kind of curious. I don't really -- well, I guess I want to say I don't really agree with you,

because as I remember the IDCOR presentation, even though it was simply, it was physically based on why things would move, and the MARCH analysis wasn't physically based. It was simply a parameter on a certain amount of mass molten. So I am not too sure what you mean by the mechanistic meltdown progression model.

Is it being done simply to see if by putting in a more physically based model you get a different result or is it ---

MR. KERR: Is the IDCOR presentation this afternoon going to discuss or at least say something about the MAAP model?

MR. BUHL: No.

MR. KERR: Okay. Then continue, Mr. Corradini.

MR. CORRADINI: My question is if you don't know enough about it, and then my next question would be are we going to see in the future a comparison of what -- Professor Catton and I had gone to the exchange meetings and had heard about their original results. Is there going to be another meeting coming up where we see their new results with these changes as compared with the old results so that one can get an understanding if this made a difference at all or what sort of a difference it made? Maybe that is the question to ask.

MR. ROSZTOCZY: We expect to receive a report

from IDCOR in the near future, I believe this month, sometime this month, before the end of this month, which is going to spell out these changes. It is going to spell out what did they change in the MAAP code actually, and it will also provide some information of how does it influence the plant analysis.

Now the information of how it influences the plant analysis, I am not sure if it will be in this report or if it will be in the plant update report which comes in October. So in one or the other it supposed to address those, and those should be available in the relatively near future.

MR. CORRADINI: Okay. Because I was going to say if that is the most efficient way of learning about this, I would be interested in getting a copy of those reports.

MR. ROSZTOCZY: Certainly.

MR. LEE: Also, if I may ask another question, among the list of 18 technical issues that you have included in this handout, I have one specification on Issue No. 15 with regard to the containment performance. Apparently IDCOR at least up to some point assumed a leak before break approach. Can you comment on that and how that issue is going to be resolved in your opinion?

MR. ROSZTOCZY: Yes. That one is the very last item on this slide. They are going to develop a methodology

or containment failure, to predict containment failure, both the timing and also the thought of how big the hole is that cracked and what size it is. This hasn't been developed yet, as I understand, but they have a commitment to work with us and try to develop such a methodology. So once it is available, you can take a look at it and see if it does the job adequately or not.

MR. LEE: Also I thought one of the important assets of the source term approach that was presented yesterday centered around the results of the containment load working group and performance group results, and in their results I don't see that it was factored in this resolution Revision No. 15 yet.

MR. ROSZTOCZY: It will be factored in through the development of this containment methodology to try to predict how the containment is being loaded and then to try to predict how good this result is and what kind of a containment failure would it result in.

MR. LEE: That is more in the performance working group result perhaps that I characterize, but the containment load itself, I don't see that discussed in any one of these outstanding issues, the way I interpret it at least.

MR. ROSZTOCZY: This model will be using the containment load as an input to predict the failure.

MR. LEE: Right.

MR. ROSZTOCZY: What was missing from it in the past, but in this one now you would take the calculated or predicted loads on the containment, feed that into this model.

MR. LEE: How is the IDCOR model going to predict the containment load? I guess that is my question in a way.

MR. ROSZTOCZY: Dr. Speis would like to answer this.

MR. SPEIS: I am not so sure I understand your question. When you look at the 18 issues here, some of them are relating to containment loads, for example, hydrogen ignition and burning or another one dealing with core concrete interaction. So these are these issues that we see things differently on, or the issue of direct heating, for example. There were no other outstanding issues between ourselves. So I am not so sure I understand your point.

MR. LEE: Perhaps I didn't make myself clear. The way I understood from yesterday's discussions and presentations by the Research group was that essentially they start off with the containment load working group's results to arrive at a certain load together with the probabilities and so on, and then they will go to the the BMI suite of codes.

I wonder how their approach now can be compared

with the IDCOR approach in perspective perhaps?

MR. SPEIS: Well, I guess that is a different question.

Jocelyn, do you want to address that?

MR. KERR: Do you understand the question, Ms. Mitchell?

MS. MITCHELL: I think so. If I don't answer it, please ask again. The containment loads working group solved six specific standard problems. They were given sets of input of hydrogen generation rates or whatever and they evaluated using whatever. There are several methodologies of what that would mean on containment loads. Whether or not it would or wouldn't burn was an issue that as addressed by the methodology.

So that one does not go for a given sequence to the containment loads working group results to get a loading. One would go to find out an uncertainty on the spread of loading, but for a sequence you would have to solve some other problem that would give you the hydrogen generation rate for that specific sequence.

The results of those standard problems, those six standard problems, one for each plant, and the direct heating was considered, were factored into the SAR evaluation of the containment behavior that we discussed yesterday for Surry.

So that when they gave a probability of a half a percent for the early overpressure failure mode for TMLB prime, it was based not on an actual value from the containment loads working group, but on consideration of the standard problem that was solved.

Did that answer your question?

MR. LEE: Well, to some extent. Now, if I may, just to follow up a little bit. I guess what I am not clear on still is in arriving at the containment load or maximum possible load does one need to consider that similar approaches could be taken in the IDCOR approach? Is that what you are implying by the consideration of hydrogen burn and explosions and so on?

MS. MITCHELL: Right.

MR. LEE: But in the containment loads working group's analysis they didn't go through any computer code?

MS. MITCHELL: They may have, depending upon what problem they were looking at and how they chose to solve it, but they were given boundary conditions that they were all to solve the same problem. They were not to say here is a given -- Themis.

MR. SPEIS: We used all the computer codes available, plus we had some professors as members of the groups who were able to do those calculations using the slide rule, and they came up with the same results as the

computers. So we used whatever tools we had available, including hand calculations. For example, Mike Corradini was a member of the group.

MR. KERR: What is a slide rule?

(Laughter.)

MR. CATTON: They were engineering professors.

(Laughter.)

MR. LEE: Thank you.

MR. KERR: Please continue, Mr. Rosztoczy.

(Slide)

MR. ROSZTOCZY: The next slide shows some of the items which resulted in additional comparisons with experimental data.

In a number of failures what we found out was that the two groups of people, the IDCOR people and our people, have approached or pictured a certain physical process somewhat differently. The question was then which one of these is correct or can both happen or is one of them more likely than the others or is one wrong and the other one is correct.

In these cases normally what we ended up with is to compare it with additional experimental information. So we agreed in a number of cases that the models, both the IDCOR models and the ours, will be checked against experimental data to evaluate the appropriateness, and this

slide shows the various areas when we arrived to such a conclusion.

(Slide.)

MR. CORRADINI: Can I ask one question?

MR. ROSZTOCZY: Sure.

MR. CORRADINI: Was there anything that you agreed upon that the NRC codes would change after you looked as the IDCOR analysis?

MR. ROSZTOCZY: Yes, we did. I am sorry that they don't show clearly on some of these slides because the slides were originally prepared for a discussion with IDCOR which kind of summed up the commitment. That is one of the reasons.

The second one is that many of the NRC code changes were kind of in progress at the times when we had the meetings. So our people were describing what is being done to our codes to improve them and there was no additional commitment beyond finishing the work which was already ongoing. But there were a fair number of changes to our codes similar to some of these, especially in the area of comparing to these experimental results.

We have a policy that we basically compare to every new data that we are generating or what becomes available by the appropriate codes which handle the same thing. So it is kind of an ongoing thing.

MR. SPEIS: Mike, I have an example. For example, I think IDCOR contributed in some areas, for example, whether there is combustion of hydrogen in the cavity of an ice condenser, and our methodology doesn't include that anywhere in looking into that area and IDCOR's methodology does include that, as you recall.

MR. ROSZTOCZY: Then there were a few areas where we found that a somewhat better understanding of the physical phenomena as needed, and maybe the best way to achieve this we thought was through some special side studies.

One of these was the heatup of the reactor coolant system by natural circulation of the steam, and IDCOR has agreed to do an additional side study on this to see what this would result in and how would it affect either the failure of some part of the system like steam generator tubes for the heatup of part of the system which then can affect the re-evolution of the fission products.

Another area where we thought the physical phenomena had to be looked at more carefully was the aerosol plugging correlation. IDCOR is using a correlation that has been compared to some experimental data, but it does not have dependence, for example, on geometry or break sizes and so on.

So if you use this correlation, it would plug

any size break, even if it is one foot in diameter or it is a crack which is three feet wide. It would eventually plug even that. So they are looking at more carefully on what are the limitations on this correlation, what can it be used for and where do they have to stop using it.

Then the third item was that they are using an aerosol deposit correlation everywhere in the system and this very same correlation is being used in the ice beds of the ice condenser type of plants. Keeping in mind the condensation on the ice, in a somewhat different physical process we have asked them and we have discussed with them a comparison between their calculations that uses this approach and our calculations which is separately the condensation on the ice to see how the two agree and whether this treatment is appropriate for the ice beds. So we are working jointly on that study.

MR. MOELLER: Could you redo your explanation on the middle item. This is the plugging of a hole where?

MR. ROSZTOCZY: Let's say you have somewhere a leak in the containment, a crack in the containment or around the seal in the containment where there is some leaking and there is a large amount of aerosol in the containment atmosphere, and this correlation predicts when would that crack be plugged.

MR. MOELLER: Yes. Thank you.

MR. CATTON: EPRI is running some experiments, aren't they?

MR. ROSZTOCZY: That is correct.

MR. CATTON: Will that data be used?

MR. ROSZTOCZY: Yes. Pa[illegible] of the question was that the correlation was -- if you just use the correlation indiscriminately, then it could plug anything in the containment, and that just didn't appear to be realistic. So there must be some limitations, and based on the experimental data base one should be able to arrive at the limitation that is being looked at.

(Slide.)

Another set of resolutions was the performance of sensitivity studies or uncertainty studies. One question was steam generator tube rupture as a consequential event and this one depends on the other study on recirculation. If recirculation shows that the steam generator tubes could be heated up significantly as a result of the natural circulation, then it would be included in this study.

MR. KERR: Mr. Rosztoczy, are these things to be done or things that have been done?

MR. ROSZTOCZY: These were items that we agreed on to be done at the time when we had the meetings. One of the meetings as in March and the other meeting was in April I believe, and my understanding would be that about 90

percent of it has already been done as of to date and there are probably a few outstanding items.

MR. KERR: Okay. In the interest of speeding things a little, I am going to ask, if you don't mind, that people look at that and if they don't have any questions on those items, that we go to the next slide. I don't want to ignore anything that is important.

So do you want to ask about this?

MR. CATTON: Who is doing the recirculation study?

MR. ROSZTOCZY: IDCOR is doing the recirculation study.

MR. CATTON: Will the EPRI recirculation study play any role in this or is it the same one?

MR. ROSZTOCZY: In general IDCOR is working close with EPRI on some of these items. Now in this case whether is it separate study, I am not sure, but they are certainly aware of what is being done.

MR. KERR: Other questions on items on this slide?

(No response.)

Good. Please go on.

(Slide)

MR. ROSZTOCZY: This is my last slide. It just indicates that the resolution of the technical issues, what

we hope to accomplish by both of the models, both IDCOR and the NRC, will be more realistic as a result.

As I mentioned earlier, we have reached agreement on the approach to the resolution. Both of us have to do our own work. IDCOR is doing theirs and we are doing ours. IDCOR will be modifying their analytical models and they will document it in a report which is due later this month. They are also evaluating the effect of these models on the individual plants and that will be available as part of the plant update, and I believe it is due in October.

Our work, which is being done for the reference plant, will also include the appropriate changes which have been made ahead of time and those will be in the results that we are going to see in NUREG 1150 early next year.

We are going to compare then the results both of the updated research of the IDCOR results and the information what we get from Research, and our expectation is now these results in most cases will be within the uncertainty, which by that time will be also defined and in that case no additional work is needed.

If some of them are still outside of the uncertainty, then they would require further attention and then we will address them further.

That completes my presentation, Mr. Chairman.

MR. KERR: Are there any further questions?

Mr. Lee.

MR. LEE: I want to get clarified on one point. When you said there will be a comparison between the IDCOR calculations and the NRC calculations for the reference plants, the comparison will cover the entire sequence of events or set of sequence events analyzed, or is it components?

MR. ROSZTOCZY: It is going to cover the sequence of events which are reasonably similar so they can be compared one against the other.

The next presentation right after me in the case study, Mr. Barrett is going to show an individual case and you can see there some of the difficulties what we are running into. For example, you see in IDCOR analysis that they have analyzed let's say the TC sequence, and you see in the NRC analysis that the TC sequence has also been analyzed. That doesn't mean that they have analyzed really the same cut set, because really in the TC sequence maybe there are 24 cut sets and they selected a certain cut set for analysis and we selected a certain cut set for analysis, and those two can be quite different somewhere along the line. Maybe they go together up to a point, and then one assumed containment venting and the other doesn't assume containment venting, and from there on the

consequences are quite different.

So to the extent as they are comparable, we are going to compare each of the sequences that we have calculations from both sides, but there are some difficulties with that, and I think Rich will be in a better position to show you what kind of difficulties we are running into. That is one of the purposes of doing this little case study.

MR. KERR: Mr. Davis.

MR. DAVIS: Zoltan, of the 19 issues, was there ever a case where the IDCOR position would have produced an increase in risk over the NRC position? The reason I ask is that yesterday we heard that the NRC approach is to do a realistic assessment of risk and I am wondering now where we stand with respect to the IDCOR analysis?

MR. ROSZTOCZY: If I understand your question correctly, then you are wondering if there is anything in the IDCOR analysis which is more conservative or providing higher risk than the equivalent of the same thing in the NRC analysis?

MR. DAVIS: Yes.

MR. ROSZTOCZY: I really cannot give you a straight answer on that. I know in general they are coming up with more favorable results than we are coming up with, and that is kind of across the board. In some we are close

and in some we had relatively large differences at least in the past. But that in itself doesn't mean that they do not have some support of the calculation, the model, for example, for melt progression or something that they would be more conservative than we are. My guess is that there probably are some, but not many.

MR. DAVIS: Is the NRC approach really to approach realism from the conservative side in these analyses?

(Laughter.)

MR. ROSZTOCZY: No.

MR. DAVIS: Or are you really trying for the best estimate. The so-called central estimate calculation, we are really trying for the best estimate. Now when one group of people develops that, they might come up with a quite different physical picture for something to happen than the other group.

MR. KERR: I think you have answered the question.

MR. ROSZTOCZY: Why they ended up with lower, I assume one can understand that. It is not unusual in the regulatory process that the best estimate coming from the industry is somewhat lower than the best estimate coming from the us.

MR. DAVIS: I have noticed that. Thank you.

MR. KERR: Any further questions?

(No response.)

Thank you, Mr. Rosztoczy.

Mr. Barrett.

MR. SPEIS: While Mr. Barrett is walking to the podium I can say a few things about at least questions on containment loads. We have just provided the report NUREG 1079 which describes the whole work. So if you people have any questions on this subject, we might discuss them later. It is still a draft report.

(Slide.)

MR. BARRETT: In the early stages of planning for the implementation of the systematic review of operating reactors, we came to the conclusion that it would be wise for NRR to conduct in-house a case study for a representative sequence for one of the reference plants. The motivation behind this was to try to introduce an additional level of realism into the planning process.

We selected the TC sequence or the ATWS sequence for Peach Bottom because it is a sequence that is perceived to have a great deal of risk signifiance. It is a technically complex sequence and it is a sequence for which we have a great deal of information available from a widely varying source. It is also a sequence for which we expect to see some differences of opinion in how the sequence will

progress.

What I would like to do this morning is to very briefly describe for you the objectives of the case study and give you a general outline of the approach that we expect to follow.

Given the fact that we are running late, I would like to abbreviate the presentation as much as I possibly can. I think there will probably be more interest on the part of the subcommittee later on when we have some results from this study.

(Slide)

There are two major objectives for the study. The first is to use this sequence as a test bed for the development of guidelines for the systematic review of the operating plants. We want to gain some experience in analyzing and reviewing a risk significant sequence and also in understanding what some of the difficulties are in using this process, and we expect that, as Dr. Rosztoczy mentioned a moment ago, one of the difficulties will be these differences in perception of how high the risk is and what is driving the risk, the differences in perceptions among various analysts.

We want to use this of course to evaluate the effectiveness and the completeness of various approaches for the plant specific reviews, specifically of course the

IDCOR approach. And we are particularly interested in evaluating our ability to apply the reference plant results to other plants which are in the same class.

The second major objective is to support development of the task action plan that Dr. Rosztoczy mentioned a while ago. We need to define what type of information we need for this evaluation and what type of information is likely to be available and take some sort of action to close that gap wherever it exists.

We also need to get estimates of the resource requirements from NRC and NRC contractors for this effort and to get some idea of how to best use those resources.

(Slide)

The approach attempts to incorporate many of the aspects of the IDCOR approach at least in the broadest sense, and it also attempts to incorporate a number of the suggestions that were embodied in the April 15th memo from the ACRS, suggestions about the implementation program.

The first action we will take is to prepare a risk profile for the TC sequence, and we are calling it a strawman risk profile because it is going to be based on whatever information is currently available, the best information we can find. And I want to emphasize here that we are not as much interested in the numerical results at this moment as we are in the process of taking numerical

results and seeing how they can be applied to regulatory decision-making.

MR. KERR: Is strawman being used here in the three little pigs sense?

(Laughter.)

MR. BARRETT: It is being used in the sense that it is preliminary and it is being used also in the sense that we welcome suggestions on how our preliminary risk profile can be changed and improved.

When I refer to a risk profile, what I mean is we will define an event tree, an event tree for the progression of the accident to core melt and also including a containment response type of event tree, and the event tree will have various outcomes, and some of them obviously will be successes, others will be core melts and each outcome will have a different type of risk associated with it, depending on whether or not the containment fails, how it fails and when it fails, and that is basically what I mean by a risk profile.

So we will be associating a core melt frequency and estimates of risk for all of the outcomes of these event trees.

MR. KERR: In the next to the last bullet where you are going to study operator actions, and when you then get ready to try to apply this to plants generally, one

might assume that you would be able to identify the different operator actions to be expected at different plants. Can you?

MR. BARRETT: Well, I don't know. That is the purpose of the study. We want to identify those key attributes associated with a given operator action for Peach Bottom in this case and then begin to try to ---

MR. KERR: How are you going to judge what the operator actions at Peach Bottom would be?

MR. BARRETT: Let me discuss a particular example of an operator action.

MR. KERR: Okay.

(Slide)

MR. BARRETT: One of the important operator actions for this particular sequence is the action to control water level. This is an operator action to try to control the power, the reactivity of the core and therefore the power.

If he is going to control the water level, he has to have some indication of level. This is a very important attribute of this particular operator action. One plant may have a better level indication than others. Some plants may not have sufficient level indication at all. So this particular operator action could not be counted. He obviously has to have a control of his injection sources

with some indication that the operator has better control of his high-pressure injection sources than he does of his low-pressure injection sources.

MR. KERR: So you are really not considering operator action alone. You are saying that the systems may be different and the operators may be different and you will consider the whole I think.

MR. BARRETT: That is right. It is the operator action as a whole.

MR. KERR: Okay. Now how do you know what the operator action at Peach Bottom is going to be?

MR. BARRETT: Well, the operator actions for Peach Bottom for this sequence will be specified by the procedures, and based on those procedures we have detailed event trees that have already been prepared by the ASEP program.

MR. KERR: But the ASEP program didn't know about these Peach Bottom operators, or I don't see how they would. Those are particular people and they have had a particular training background, and I think we have sort of agreed informally that this may have a significant events influence on what they do.

MR. BARRETT: I think you are right. I think there could very well be variations among the operators themselves from plant to plant. I don't believe we will be

able to get a handle on that question with this particular case study, but we are very aware that there are many aspects of this implementation process that will not be touched on by this case study.

MR. KERR: Okay.

MR. BARRETT: Let me get back to the approach here. I think we have gotten a little bit ahead of ourselves, but once we have the risk profiie, we will then go on to the next step, which is to identify those key plant systems and key operator actions which we will want to examine in greater detail.

We have not yet defined what criteria we will use to get from the risk profile to this assessment of the key operator actions and key systems.

Yes.

MR. LEE: In constructing the risk profile I am still somewhat confused as to where you will be getting information on failure modes and so on. You said you will try to use all the information available, but specifically do you have some in mind?

MR. BARRETT: Yes. We have preliminary information from the ASEP program describing the event tree leading to core melt, and we also have from them preliminary estimates of the failure probabilities of these various pieces of equipment and various systems, and we

have core melt frequency estimates. They are preliminary, but nonetheless we have them, and we have had some opportunity to review them and to put into those estimates some insights that we have within NRR.

Beyond that we need to know also what the risk is, and by the risk I mean the estimates per reactor year of how many early fatalities and how many person rem and how many latent cancer fatalities, and that requires a judgment concerning the consequences given a core melt and given a particular type of core melt with a particular type of containment failure.

We don't have from the research program yet, we don't have that information. We have information of that type from the IDCOR program for this sequence, and we will be using the IDCOR information, but we will also be using information of that type from similar analyses for previous PRAs that have been reviewed by the staff. So there will be a great deal of fuzziness in those estimates.

MR. LEE: Regarding the components of information that you will be getting primarily from the ASEP program, would you have equivalent result information that you can utilize from the IDCOR study?

MR. BARRETT: I do not at this time have a detailed event tree from IDCOR. I believe, however, the IDCOR program intends to produce detailed event trees for

each one of the important sequences, but I don't believe we have those yet.

MR. LEE: Somewhere I got the impression from the response that I got from Dr. Rosztoczy earlier that through this case study one could somehow compare IDCOR results with NRC audit calculations of a kind.

MR. BARRETT: Yes.

MR. LEE: So I am still curious if you can somehow factor an IDCOR result into your case study a little bit more directly?

MR. BARRETT: We understand a great deal about the differences between the IDCOR perception of this accident and the perception of other analysts, particularly NRC contractors. We have a great deal of information about how each group perceives the progression of the accident, the frequency of core melt, the containment response, the source terms and in the case of IDCOR we have calculations as to what the consequences are. We understand those and we see major differences.

What we are trying to do with the case study is to identify where these differences make a difference, and then what can we do about it. Some of these differences won't matter and some of them will.

(Slide)

As I mentioned before, once we have identified the key operator actions and plant systems, what we want to do is to as an extent as possible we want to begin to dig into these systems and operator actions and begin to understand what it is about the plant and what it is about the procedures and the plant design that really drives the reliability of these actions and systems.

And then having done that, we want to begin to examine the variabilities among BWR Mark I designs, specific designs and try to understand how these variabilities, the major variabilities could affect the TC sequence.

With regard to that last point, let me just show you a short list of some of the major variabilities that we know about which we would want to understand and which we would want to study.

(Slide)

Here is an abbreviated list of potentially important variabilities among BWR Mark I plants. One good example, for instance, is the fact that Peach Bottom doesn't haven't have an isolation condenser, and a lot of the plants with BWR Mark I's do have isolation condensers.

We need to assess whether or not this is an important feature of the TC sequence and, if it is, how do we handle it in the systematic review of plants that have

this feature? That is an example.

MR. DAVIS: There is at least one more important variability, and I guess you are not proposing that this list is complete. Some plants have automatic feedwater coolant injection, which at least for the Millstone PRA was found to be of some significance in the prevention of core melt. And I think there also may be some differences in the suppression pool cooling systems, both in terms of capacity and reliability.

MR. LEE: Would these variabilities result in an order of magnitude difference in risk estimate?

MR. BARRETT: I don't know the answer to that yet. That is the kind of question that we want to address. In some cases we believe that it might have a minor effect and in other cases we are not certain. As I said, we are really just getting started with this study. So it is hard to say.

MR. KERR: Please continue.

(Slide.)

MR. BARRETT: We have had an opportunity to at least get started on this study, and let me just briefly run through some of the preliminary conclusions, and I emphasize the word "preliminary because we may find later on that we were misguided here based on our early results.

We have basically come to the conclusion that

this type of approach based on core melt frequency and based on risk seems to be an advisable way of going, but we have not yet begun to really deal with the nitty gritty of how you go about doing it in a real sense.

For instance, we have not yet developed, as I pointed out before, that link between the risk dominant and core melt dominant branches in an event tree and some sort of judgment as to which systems we ought to be concentrating on and which operator actions.

MR. KERR: So if one uses the current jargon you are advising that we look at the bottom line?

MR. BARRETT: Yes.

MR. SHEWMON: Would you repeat that, Bill? I heard the answer, but I didn't hear the question.

(Laughter.)

MR. KERR: I am saying using the current jargon he is advising that we look at the bottom line, the numbers.

MR. BARRETT: Well, what I am saying here is that as an assessment technique it you have a policy statement that calls for looking for a risk outliers, this is an advisable way of doing it.

MR. KERR: I wasn't trying to disagree with you. I just wanted to make sure I understood what you were saying.

MR. BENDER: The term "bottom line" has all kinds of connotations, and to just say it is a little discomforting to me. If you look at all the PRAs it doesn't turn out that the human health injury based on the methodology turns out to involve a lot of people, and if you look at something that is a factor of two more than something else, two times zero, as I have said many times, is still zero.

It seems to me if you are going to do this, then you need to give a little bit more thought to what you mean by bottom line. While Dr. Kerr I think intended to put emphasis on that consequence side of it, I am not at all sure that you can use human injury the way the PRA is presently presented as a basis for judgment. So you are going to have to think again about what you mean.

MR. BARRETT: The way I interpreted bottom line, and let me explain. We have many different criteria that we use from time to time in different applications for regulation. We use single failure criteria, for instance.

What I mean by bottom line was that rather than going to that type of a criterion, the criterion that was more directly related to severe risk and core melt frequency seemed advisable.

MR. KERR: Well, I assumed you meant look at the numbers for core melt frequency and look at the numbers for

risk. That is usually what one means by the bottom line I think.

MR. BARRETT: We certainly will have to look at the numbers. The numbers give you a great deal of guidance as to where you should be looking for problems in the plant. With no reference to the numbers at all, we really would have no guidance as to where to look for problems. We aren't going to rely overly heavily on the numbers.

MR. BENDER: I am hoping that I am not using too much of the committee's time by digging at this point just a little more. If the containment proves out to be very, very effective, then the issue of risk turns out to be whether you can have tolerable core damage or not. If the public itself is not being harmed, then the issue in some people's minds at least will be what is the financial risk. That is an important risk and it may or may not be within the NRC's purview to deal with it.

I think you are going to have to put the containment capability and the core damage probability in combination in some way. That is my conception of bottom line, but I don't know whether it is yours or not.

I think this whole question is tied up with the issue of safety goals. We have in progress an attempt to define a safety goal based on risk, individual risk and based also on core melt frequency, and also discussions

concerning the definition of containment performance objectives.

I would only say for myself that I think I agree with what you have been saying if I understand it properly.

MR. SPEIS: Mr. Chairman, can I add something to this?

MR. KERR: I don't know.

(Laughter.)

Let's try.

MR. SPEIS: Very good.

(Laughter.)

Maybe I shouldn't.

(Laughter.)

MR. SIESS: Well try.

MR. SPEIS: Well, this is a complex question. My boss was telling me yesterday that he has been to the Hill about 12 times since Davis-Besse and, as you know, not even a core melt took place there. I mean there was no damage or nothing. And yet I think we spent a substantial amount or an overwhelming amount of resources and it was just a transient. Of course, the plant is shut down and it will probably be shut down I don't know for how long. But so far what are the expenses of a plant of that size being snut down for a month or maybe more? It was June 9th, right, and we are talking about two months, and already we are talking

about what, $20 or $30 or $40 million or whatever. So where do you put the emphasis? It is a moving target of some sort and the Commission hasn't spoken yet and you people have different views and we have different views, and those guys on the Hill, you know, they have different views.

Now using our present cost benefit and other guidance and approach of doing things, it wasn't worth spending $2 to go on the Hill, you know, taking a taxi cab, as you all know. I don't know if I added anything to this.

(Laughter.)

MR. KERR: I am not going to rule on whether you added anything.

(Laughter.)

Why don't you continue, Mr. Barrett.

MR. BARRETT: I would like to point out that one of the things we have learned is that we have begun to understand some of the aspects of the implementation process that we will not be addressing with this case study, and one of the important things is that we probably will not give you very much guidance concerning external events.

With regard to our second major objective ---

MR. KERR: Does that mean external events as far as the TC sequence is concerned, or that you are just going to sort of ignore external events generally?

MR. BARRETT: No, I don't think we are going to ignore external events generally. The statement here is that as currently established, the case study as we are planning it will not specifically address external events.

MR. KERR: Is the case study a case study of the TC sequence?

MR. BARRETT: Yes.

MR. KERR: Thank you.

MR. BARRETT: With regard to the development of the task action plan, which Dr. Rosztoczy referred to earlier, we have begin to identify some of the information needs.

Yesterday when Joe Murphy was talking about the SARRP program, there was a question concerning the coupling between what SARRP was planning to provide to NRR and the kind of information that NRR needs. In general the answer was that we have a great deal of interaction on questions like that and we hope that this type of case study will help further that interaction.

In the course of the study we have found so far that the detailed event trees that we got from ASEP are very important, and we think that having that kind of information will be important for the implementation plan.

Also, we think it will be important to have explicit descriptions of support system dependencies and

systems interactions if possible. In other words, we would like to see if we can get as much detail as we can at the level of fault trees.

Finally, we think it is very important to have information about accuracy management.

Yes.

MR. SHEWMON: Does accident management start after you run out of emergency procedures, or what does accident management mean?

MR. BARRETT: I think that the way it is generally used as a term is precisely what you said. It is what you do after you run out of emergency procedures. But the way we are using it here really is that we need to have information about accident management and including the procedures.

MR. SHEWMON: Well, do you then speak to questions like whether you should always throw water on a hot core no matter where it is at any time, or is this only things about notifying the sheriff's office to make sure hospitals are ready?

MR. BARRETT: No. This is questions related to whether you have an ambiguity on whether or not some operator should turn on the sprays late in the accident or whether he should or should not throw water on the care under all circumstances.

MR. LEE: In this case study it is still not clear to me how you are going to use the corresponding source term study performed for the Peach Bottom TC sequence by your Research people.

MR. BARRETT: Eventually the way that that will be folded in, and you cannot use the source terms directly. Perhaps some people can, but to really make them useful for a study like this you have to take the source term and do a calculation of the offsite consequences.

We really don't have a good feel for just looking at a source term calculation and telling what impact that has. We don't have yet the consequence calculations form the SARRP program. When we get them we will use them in estimating the risk. There is a scheduling problem in terms of we are trying to start this program now and the information from the SARRP program will not be available quite in time for the case study.

MR. KERR: Let me see if I understand. You seem to be saying that you aren't going to use the Battelle suite of codes in your source term calculations.

MR. BARRETT: We are not going to explicitly deal with source terms.

MR. CORRADINI: How are you going to get the offsite consequences then? I am a little lost.

MR. BARRETT: The offsite consequences,

eventually we are in the process over the next year of preparing the recommendations to the Commission on how to deal with the implementation of the severe policy we will be using the full set of source term calculations from the Battelle suite of codes, the consequence calculation will be done based on those and the risk estimates that will be done as they become available for each individual plant.

For the time being we are going to have to use estimates that are available now or estimates that are available from the IDCOR program or estimates that are available from PRAs for similar plants.

MR. KERR: I guess I don't know what the case study is then. I thought the case study was going to be a redoing of the TC sequence using up-to-date information, and it is not that?

MR. BARRETT: No. I think that before we are finished with the implementation plan we will have done that. The case study is really more concerned with the process of using these data to fit them into the regulatory decision process so that the numerical results are not so important now.

Zoltan has a comment about that.

MR. ROSZTOCZY: The case study is basically being done now, like this month and next month, and addresses only this one single sequence and uses the best information

available. For example, in connection with the source term information what we are using is we are using BMI 2104, the way how it was done for the sequence when BMI 2104 was issued with the acknowledgement that finally when we will be working on Peach Bottom, the overall study on Peach Bottom, then we will have an update on that. But for the case study we are using the best available information.

MR. LEE: I still don't understand the distinction between what is presently available and the BMI 2104 source term study. I thought that those results had been available for several months.

MR. ROSZTOCZY: That is exactly what I said. That is available and it is on the table so we are going to use it. NUREG 1150 is not available and won't be available until next spring. So it has nothing to do with the case study. The case study is being done now. The case study is really just to try out on a single sequence how does the overall approach go.

MR. KERR: If you are confused, you have company.

MR. CORRADINI: Can I try to unconfuse things because the difference between how and later is a matter, as we were told yesterday, about 25 more calculations using this set of computer programs. There is a set of calculations which are part of the document of BMI 2104. Then there is going to be another set of calculations that

are going to be done in support of the SARRP program along with the containment event tree analysis. That is the difference between now and the future; is that correct?

MR. ROSZTOCZY: That is correct as far as source term is concerned. For example, if you carry this to the TC sequence, which is the only sequence looked at in the case study, you might find that the certain cut that was analyzed in BMI 2104, that is what we work with, and you might find that among the 1232 there is another sequence selected for that.

MR. CORRADINI: You used the word "cut set." Can I use it in the words that we heard yesterday so we all understand. When you use cut set, I think that it is not just the sequence, but it is the initial and boundary conditions that give you the containment failure mode. So that when you use this set of computer programs to do a calculation, you not only pick a sequence, you also pick how the containment is going to fail and you investigate that deterministic path this with set of calculations.

So that when I say that we have a set of calculations now under BMI 2104, that set of calculations is a combination of a sequence and how the containment fails for a given reactor, and that is what you have now and there will be an additional group of those sorts of calculations provided in the future as part of 1150.

MR. ROSZTOCZY: That is correct.

MR. KERR: Continue, please.

MR. BARRETT: I have completed my presentation.

MR. KERR: Okay. Mr. Davis.

MR. DAVIS: I have a brief question. When you do this base case, are you going to presume the implementation of the recent ATWS rule to the Peach Bottom plant? I believe it is modification 3A.

MR. BARRETT: I would say that the base case for Peach Bottom should assume that, yes.

MR. DAVIS: I would agree, yes. It makes a considerable difference on the probability of the accident at least from the information that I have seen.

MR. BARRETT: It does. The information we got from ASEP concerning the core melt frequencies includes cases prior to the ATWS implementation and following the ATWS implementation. One example of that, for instance, is they did two cases as to the pumping rate for the standby liquid control system. So we can examine that type of sensitivity to a certain extent.

MR. DAVIS: Thank you.

MR. KERR: Would you, and I apologize for asking you to do this, but tell me again what is the purpose of this case study?

MR. BARRETT: The purpose of the case study is

twofold, but I would say that the major purpose of it is to begin to give NRR and intuitive feel for how useful the information we are getting from IDCOR and from SARRP will be in actually planning and implementing the systematic review of operating reactors. Is the information we are getting really going to be what we need and what kind of difficulties are we going to run into when we try to use that information.

So it is more of a process type of study. We are trying to learn what we need to know and what we need to do.

MR. KERR: Thank you.

Further questions?

(No response.)

Thank you, Mr. Barrett.

That I think brings us to Mr. Hulman.

MR. HULMAN: Bob Bernaro asked me to make some specific remarks before I went through my presentation and I am going to try and do that.

First, I want to note that the information that has come out of the research program has prompted a number of actions on the part of both the staff and industry. The staff, for example, has been confronted with questions on, for example, Indian Point II last Christmastime when we were reviewing the implementation of a TMI action item on

control room habitability and found that with our conventional review process we could not conclude that they met Part 5C with respect to GDC 19.

We looked at the evolving research and decide there was no need based on that research to ask for a shutdown of the reactor.

Similarly on other cases involving control room habitability backfits Oyster Creek, Oconee and San Onofre I we have concluded that maybe it isn't necessary to backfit iodine protection requirements for control room habitability at this point and there may be something wrong with our criteria.

Bob has also asked me to tell you that we have received a number of inquiries from industry asking about how receptive we would be to requests for exemptions on such items as emergency planning.

We have also received a letter from AIF indicating that that industry group believes there are a number of opportunities for changes in practices and regulations.

Mr. Dircks has told the Commission that we intend to come to them probably next spring and tell the Commission what changes in rules and practice we see. As part of that preparation I have worked with a number of people in both NRR and I&E with Research's help to identify

things that could change and how they may change.

I point out to you that there is a NUREG in existence, NUREG 771 which identified specific regulatory guides, rules and standard review plan material that was right for change as of about 1982.

What I am going to tell you this morning is what this group has come up with.

Yesterday Dr. Siess asked for 10 commandments, and these are not 10 commandments. This is a menu, and I hope you will view it as a menu of areas of potential change. I hope you will also give us the benefit of your advice and comment as to the completeness and usefulness of the list and what ideas we have generated, and I would not even consider it the Third Tablet that got lost, Dr. Seiss, but more a menu.

(Slide)

What I am going to do, because we are running a little late, is I am going to put the last viewgraph up first to identify the 10 items on our menu very briefly and tell you that we have done some preliminary cost-benefit judgments.

We have estimated whether the changes in practice or rules are like to be increases or decreases in regulatory requirements or whether they are unknown. We have also estimated the elapsed time we think is necessary

to implement the changes.

Now I am not going to go over every one of the ten items. I am going to pick three, three that we think are really important.

You have heard No. 1 already from Dr. Rosztoczy. What I want to tell you about is, first, containment performance. I know that this area is of interest to the ACRS. I have had conversations with Dr. Kerr, I have followed ACRS's comments and we have used the information in ACRS's letter to the Commission on how to look at mini-PRAs in coming up with this judgment.

Basically today's practice is to use the fission product release assumptions to containment that are contained in TID 14844, which is footnoted in Part 100. It basically assumes the release of noble gases and iodine from a low leakage containment, but doesn't consider the fission product attenuation methods or mechanisms in containment.

We emphasize containment leakage in the way we do business today. We emphasize low leakage containment and we do not emphasize or look in detail at containment ultimate strength or the capability of penetrations in an ultimate strength capability.

The containment assumptions and evaluations that we do for licensing today, licensing new reactors and

reviewing licensing amendments assumes the instantaneous release of elemental iodine.

One of the things we have learned from research is that that is a very, very conservative assumption and possibly unnecessarily conservative. For example, on PWRs one of the guidelines we have is for the automatic injection of caustics into sprays.

One of the things we think could be changed is to do away with that guideline and not make it automatic, but we do continue to believe that the addition of caustics is necessary to control iodine later in the accident.

MR. SHEWMON: Could you enlarge on that a little bit, caustics are no good and we have learned to our chagrin that the stuff they were using up at TMI in the B&W plants is thiosulfate which is utterly disastrous. You certainly have a fair amount of solubility in water without the hydroxide. Is it really necessary, do you just like to get another factor of 10 conservatism where you think it won't cost you anything?

MR. HULMAN: Let me see if I can answer your question in the following way. We are still not sure that elemental iodine can't evolve in a core melt kind of an accident later in the accident and not earlier. We think that research has indicated that elemental iodine is unlikely to come out in large quantities early in the

accident, but later in the accident it can.

MR. SHEWMON: You are talking about some sort of an oxidation process after the stuff is in the air or suspended on the walls or something?

MR. HULMAN: And washed down into the sump.

MR. SHEWMON: Okay.

MR. HULMAN: Now the control of that elemental iodine if the containment doesn't fail we think is important, and in the methodology we have developed we think some kind of Ph control is still a good idea. It exists today in PWRs. It does not exist today in BWRs.

We think the continuance of some kind of caustic addition, and not everybody has the kind of chemical that TMI has.

MR. SHEWMON: Thank goodness.

MR. HULMAN: Yes. And in fact I will say that the staff suggested to the owners of TMI that that was not a good idea. We did not object to it, but we ---

MR. SHEWMON: They talked you out of a Ph of 8 of a Ph of 14?

MR. HULMAN: A Ph in the order of 10 or 11.

MR. SHEWMON: That is a lot of hydroxide if you are fluing it to the whole sump. As a corrosion officianado or something, I just wish you would look very hard at that because I think you are going to buy yourself grief or the

vendor grief with it and be very sure that indeed it is going to buying you a lot instead of gee whiz, why not.

MR. HULMAN: I think you are exactly right and we will look at it.

(Slide.)

With respect to what we propose to do with containment performance, we think we ought to reassess the basis for our low leak rate criteria and our testing frequency criteria. We think we should emphasize containment integrity probably on the basis of containment type.

We think that the emphasis on low-leakage containments may be relaxed, but we are still concerned about containment integrity, somebody leaving valves open and leaving hatches open and systems that are locked out. So we think some tightening of the criteria with respect to containment integrity is probably called for.

MR. KERR: The current criteria called for the containment to be closed, and how do you tighten the criteria that calls for the containment to be closed at all times in effect?

MR. HULMAN: The simple answer to that is notwithstanding the fact that the criteria calls for the containment to be closed, there have been numerous instances ---

MR. KERR: No. What you said was that you wanted to tighten the criteria I thought.

MR. HULMAN: Yes, the testing criteria. There is no testing criteria for containment integrity today.

MR. SIESS: Right now we have periodic testing for very low leak rates, and what you are saying is with more frequent testing we are looking at larger leaks. Am I right?

MR. HULMAN: A different kind of testing.

MR. SIESS: The blender test.

MR. HULMAN: I didn't catch that, Dr. Siess.

MR. SIESS: Well, I think one of the European countries calls it the blender test. After every outage or any time you have had the containment open you do something to find out whether you left a valve open.

MR. HULMAN: That is one way of looking at it. Another way might be continuous monitoring.

MR. SIESS: We have got a couple of plants that do that now and they don't get any credit for it.

MR. HULMAN: What we were talking about is reducing the frequency of testing for low leakage under Appendix J to Part 50, and possibly adding criteria for assuring that the containment is indeed closed. We have closure time criteria for valves.

MR. LEE: I am just ignorant there I am afraid.

How do you assure that the containment is closed?

MR. HULMAN: Today we have no assurance.

MR. SIESS: Well, you do on Surry. If you look at the containment event trees, they have got a .002 probabilitv of failure to isolate because Surry is subatmospheric and you can't have anything anything open and keep it subatmospheric.

MR. HULMAN: One some reactors that is true, but not on all reactors.

MR. SIESS: Well, all the subatmospherics do that. Con Yankee operates with an overpressure and they can detect a 10 percent a day leak in a week and they could detect a bigger leak a lot quicker than that. I think Yankee Roe operates with an overpressure.

MR. HULMAN: So there is capability at some reactors, but it is not universal.

MR. SIESS: But the technique is there.

MR. HULMAN: Yes, we agree.

We have valve closure times for purge and vent valves, and it is possible that they could be relaxed. We are not sure of that and we need to study it. We need to take a look at mechanistic analyses of fission product transport in the containment. We have to determine the leakage paths that may be important to risk, we want to explore the viability of monitoring containment integrity

universally and we want to develop bases for tech spec revisions.

These are the day-to-day questions that we have to resolve for operating reactors as well as for the new reactors coming on line.

MR. DAVIS: Excuse me, question. From time to time there have been some suggestions and even some calculations indicating that some leakage is good for you for some sequences. Is there any intent to examine that issue further before you impose these requirements or consider imposing them?

MR. HULMAN: Well, as you are aware there is some venting criteria available to prevent gross containment failure for BWRs.

MR. DAVIS: Right.

MR. HULMAN: One of the things that we want to look at is similar criteria to prevent in an accident gross containment failure.

MR. DAVIS: Okay. Thank you.

MR. LEE: Question. Could you use perhaps this containment performance area as an example to illustrate how the source term study that was discussed yesterday could be used?

MR. HULMAN: I think that I did, but maybe I didn't link them and let me try it again. We already have

seen from Research the information on accident timing that indicates that the release of fission products is not instantaneous with the transient, that the temperature and pressure precede, the temperature and pressure transient precede the release of fission products by at least several minutes.

Our guidelines for the addition of caustics in PWRs requires instantaneous release. That is one of the things that we have learned. That is No. 1.

MR. LEE: Can you use some of the numerical results obtained?

MR. HULMAN: Yes. What we want to do, and I have listed that at the bottom of this slide, is take a look at what kind of fission products we would generate under a number of accident conditions that would not lead to containment failure to see what kind of releases we would get with moderate and low leakage containments.

In fact, such a pilot study has already been done at Oak Ridge that indicates the contribution to risk from low leakage containments is very small and low leakage could be increased, the level of leakage could be increased without significantly contributing to risk.

So we would look at those studies and we would look at transients that would involve accidents that did not go to containment failure to see what kind of releases

we would get and what kind of risks we would get offsite and try and identify new leakage criteria.

We would use the numbers and we would use directly the models developed through ASPO.

(Slide.)

The second area I want to emphasize is emergency planning. Yesterday in a response to a direct question from Dr. Kerr Ms. Mitchell indicated that she didn't believe that the source term research was sufficient reason to change the emergency planning rule.

I tend to agree with her that it isn't sufficient, but there have been some preliminary studies done by the Office of Research, and when you add the information that is coming out of the source term research, there is added impetus for change.

The present practice in emergency planning is based on both TID-14844 and WASH-1400 fission product assumptions. We have a 10-mile plume exposure emergency planning zone and a 50-mile ingestion exposure emergency planning zone, but be aware that FEMA through a memo of understanding evaluates the state and local plans and preparedness. The staff does not.

The potential changes that we see is to correct a misconception that exists in many quarters at the state and local level, that evacuation is always required to 10

miles or greater. We think that is a misconception and we think it should be corrected.

We think that the concept of graded response that recognizes risk variations with distance and time is important. For example, it may be a good idea to evacuate any time there is a major accident to only a few miles from the reactor and suggest sheltering beyond that, immediate evacuation, prompt evacuation.

A study was started in the Office of Research on the graded response before the source term results were in hand, and based on that study there is sufficient impetus to do graded response, and the addition of the source term research would only add to that impetus.

We think we ought to consider variations in risk with reactor type and size. Today the regulations don't differentiate between a 600 megawatt reactor and an 1100 megawatt reactor, for example, nor do they differentiate between Mark I's and large dry PWRs. We think we ought to consider the differences.

MR. KERR: Mr. Hulman, I don't think I need to defend Ms. Mitchell, she can defend herself, but I want to explain a little bit what I had in mind yesterday in answering her questions. I was not trying to determine whether or not the emergency planning rule should be changed. I can think of reason for that. What I was trying

to determine was whether the work coming out of the source term reassessment would convince one to change it.

Now all of the things that you are talking about I think are valid reasons for looking at it, but none of them have anything to do with the results of the source term effort. We certainly knew all along that different reactors behave differently, and it did not take the source term research to tell us that. And you yourself have pointed out some things.

So what I was asking yesterday was what influence will the new information available from a source term reassessment have on emergency planning?

MR. HULMAN: That is what I am trying to address. By the added impetus from the source term research, my statement on impetus, what I meant was we are in a better position with the source term research to evaluate differences in risk with the size of the reactors and potentially with reactor types than we were before.

For example, on large, dry containments, the presentation on large, dry PWR containments yesterday, you were shown the fact that the source terms are lower, generally lower indicating less offsite risk.

MR. KERR: But certainly that is not anything that is new as a result of the source term reassessment.

MR. HULMAN: Lower risk.

MR. KERR: But WASH-1400 showed that, that large dries were low risk. I was looking for something -- this is not worth pursuing, but I just wanted to make the point that ---

MR. CATTON: Don't let that stop you.

MR. SIESS: It doesn't stop anybody else.

(Laughter.)

MR. HULMAN: I think that what I would like to do is try to summarize the other major area in my mind.

(Slide.)

Safety evaluations. The regulatory staff does a large number of safety evaluations, and I am going to put them in three categories.

The first category is we do screening of new safety issues that have been raised, and to do that screening we use WASH-1400 source terms. We assess the risk importance of the issue as indicated by the 50-mile population dose. We do a value impact assessment of risk reduction to total cost, both industry and NRC, to determine what resources we ought to put on it or what the prioritization of the resources ought to be. That is a screening of new issues.

We also use the WASH-1400 source term methodology for judging backfits and whether we ought to require backfitting. We use the same WASH-1400 source

terms, but we have in some cases begun to use the new source term research.

In licensing reviews, including license amendment reviews, we often use the TID-14844 assumption not only of fission product releases but other assumptions of transport deposition and biological uptake. These assumptions, as you may remember are vintage 1962, and they may be ripe for change.

(Slide)

What we have indicated are possible changes is to begin to use the new source term research in prioritizatin and in backfitting and also to use it in NEPA evaluations of accidents, including severe accidents. We intend to start to do that with the South Texas DES that is due out in October in which we hope to have a comparison of both WASH-1400 risks and risks using the new methodology out of the Office of Research.

(Slide)

For design basis accidents, and some of you have indicated that you think the staff only uses and industry only uses the TID assumptions in siting evaluations. It is true we do that, and we do that for CP's and we do that for OL's, but we also use it to determine whether the performance requirements for certain engineered safety features are adequate like the containment.

So we use TID in two contexts. We use it in the context of adequate siting and we use it in the context of adequate design of certain engineered safety features.

MR. WARD: Jerry, the design characteristics of containment that is used there is only the leak rate at design pressure.

MR. HULMAN: That is correct. We do not use a core melt accident for temperature and pressure design requirements on containment, but we do use the fission product assumptions of TID for our core melt accident for the radiological capability of that containment.

(Slide.)

We looked into our crystal ball on what we might be able to do with DBA's.

MR. WARD: It is very clear, but it just doesn't make sense.

(Laughter.)

MR. KERR: I think that was an interruption, but go ahead.

MR. HULMAN: No, I would agree with the comment, it doesn't make sense, but we do it.

We looked into the crystal ball of what we could do with DBA's with respect to fission product assumptions and we thought there were two alternatives.

One alternative is to develop new siting design

basis accidents and performance requirements for ESFS and basically come up with a new set of design basis accidents and use those new design basis accidents to generate performance criteria for ESFS.

An alternative to that is probably a better one. The alternative is to eliminate DBAs in siting. And if you remember, in 1979, and I believe it is NUREG 0625, Dan Mueller led a task force in which the conclusions and recommendations were to decouple siting from design. We think that is still a viable alternative and it should be considered.

We think that you can decouple if you set specific performance requirements for the plant and specific standoff distances for the plant and you could do away with DBA considerations for siting.

We think you might also do away with DBA considerations with respect to radiological requirements in the design if you were to establish specific performance requirements for ESFS. They may be based on accidents, but you wouldn't have to do an accident evaluation with every new CP and every new OL and every license amendment.

MR. SIESS: If you eliminated in the places you have indicated, what is left? What role is left for DBA?

MR. HULMAN: DBA could be used to establish thermalhydraulic performance requirements, operations for

emergency procedures, for example, but not with respect to the radiological role of the ESFS.

One of the difficulties the staff has continually with CP's and OL's and license amendments is the need to recalculate doses in the simplistic manner that we do so for design basis accidents. We think it could be changed and probably should be.

Beyond the design basis accidents is a question. There have been some people that have suggested that we go to a risk base approach for licensing entirely and do away with DBA's. We think that is probably too extreme, but what we do think is necessary is for the staff, ACRS and possibly the Commission to reconsider the remote siting policy that we have using the new source term, and we think that should probably be done through the risk rebaselining.

MR. SIESS: That would certainly be in the direction of a performance criteria orientation that you have policy guidance from the Commission on, wouldn't it?

MR. HULMAN: Yes.

MR. SIESS: I mean the DBA is relatively prescriptive versus risk based criteria.

MR. HULMAN: Very prescriptive and very deterministic.

MR. SIESS: But you could see problems in applying risk based criteria for licensing?

MR. HULMAN: The principal problem is uncertainty in the outcome of its use.

MR. SIESS: I think that is a problem you will find in any performance criteria.

MR. HULMAN: Yes, but if you use the risk based approach you have completely altered the way the staff and industry have worked since the early 60's, and that uncertainty may be so great that it would die a quick death.

(Laughter.)

MR. KERR: When you reconsider the remote siting policy, does that mean that you just have an open mind, or you reconsider it with the idea that things don't have to be quite so remote or that they have to be more remote?

MR. HULMAN: I think that the new source term information and the risk rebaselining afford the Commission the opportunity to consider whether they want to continue the existing policy, whether they want to change it and make it more restrictive or less restrictive, an open mind.

That summarizes my presentation.

MR. KERR: Thank you very much.

In light of the fact that it is now noon, I will not ask for questions but declare a one-hour recess.

(Whereupon, at 12 Noon, the subcommittee recessed, to reconvene at 1:00 p.m. the same day.)

AFTERNOON SESSION

(1:04 p.m.)

MR. KERR: We'll begin our afternoon session. I am told that there is an exodus from Washington this afternoon led by various Congressmen. So, you might want to take that into account in your travel plans.

Mr. Buhl, you show up as Number One on the agenda, I believe. If I'm wrong, correct me.

MR. BUHL: Yes. Are we on the air?

MR. KERR: It sounds to me as if you are. Can you hear him?

MR. BUHL: Mr. Howard, Vice President of Boston Edison, will be first.

MR. KERR: Okay, and "hug" that microphone.

MR. HOWARD: Good afternoon. We are pleased to be here today to provide some insights into the IDCOR effort. Our presentations today are directed at providing an overview of our individual plant evaluation methodology.

You may recall, the IDCOR program is sponsored by about 60 different groups now, including nuclear utilities, reactor vendors, architect-engineers, and we have some foreign participation as well. Tony will introduce the other speakers as we go along.

MR. BUHL: Thank you, Ed.

I'd like to make a few comments to hopefully put the

four presentations we have for you today in some perspective. I'd like to spend just a few moments reminding you of a bit of the background of the IDCOR program and tell you that the objective today is to focus on one of our three major 1985 objectives, namely to describe for you the individual plant methodology which we have developed and how we plan to apply that methodology.

(Slide)

IDCOR has been a nominal four-year program. As Ed mentioned, the industry shortly after the accident at Three Mile Island and with all the various severe accident issues on the table, formed a consortium called IDCOR, sponsored by some 60 electric utilities, including essentially all the nuclear utilities in the United States, plus reactor vendors, architect-engineers, as well as a number of foreign countries and supporters.

This program has been successful in my view. We have produced and provided to the NRC now some 50 separate major technical reports covering all the various issues.

We have also provided them with a technical summary report which is written primarily for the individual who wants to spend a few hours getting up to speed on about three or four feet of paper. Ed, you might want to show them that report. Just the top one, Ed, just the technical summary report. Thank you.

Hopefully, each of you has this. This is a short summary of the entire program.

By the end of 1984, we had submitted these technical reports and had many meetings with the NRC describing the results of IDCOR; answering questions, and in fact we found the staff to be very helpful during that process. In fact, we made some changes in our approach based on their feedback, and we found that feedback helpful.

The results of IDCOR have been reported rather widely throughout the technical community, and most recently we spent the better part of half a day briefing the Commissioners here at NRC on the particular conclusions of our work.

Today, we do not intend to review with you either the history of IDCOR, programmatic aspects of IDCOR, nor the technical conclusions of IDCOR.

In 1985, we have three basic missions. The first mission is to resolve the 19 so-called open technical issues which were described a bit earlier.

We have by and large completed our work on those technical issues We have a document which has been reviewed internally by the IDCOR people and by the industry participants, and it should be this day at the printer. So, we expect our report on the 19 technical issues to be in your hands very shortly, a matter of very few weeks.

We do not plan today to discuss those technical issues.

Another objective for 1985 is the so-called Source Term in Emergency Planning work we are doing. That work is underway, it's going well. It's on schedule. But again, that work is not the subject of today's meeting.

The third objective, which is the subject of today's meeting, is based on all the results not only of IDCOR but all the other technical information we have gathered over the last four years, we have been in the process of developing a set of individual plant evaluation methodology, and we are going to spend a good bit of time describing that methodology and the testing of that methodology this afternoon.

The industry feels that we have a need to get on with these individual plant evaluations. To do that, early on we selected two contractors. We selected Delian Corporation to pull together the methodology for the BWRs and the IDCOR manager for that work is Jim Carter from Energex.

We selected Westinghouse as the contractor for pulling together the PWR methodology, and Bob Henry at Fauske & Associates manages that effort.

We have developed a methodology and we are about to enter over the next six months the testing and validation phase. We are remaining open on this methodology. We purposely selected two different contractors to get the broadest

set of views we could. We recognize that the methodology you will see today is somewhat different -- and that was intentional. We are keeping an open mind in the sense that the documentation which I have on the table there just as a visual aid, just the BWR documentation, that is the process, the "how to," the walk-throughs, the systems notebooks, et cetera, et cetera, we have the documentation for BWRs displayed here.

The PWR documentation didn't show, but nonetheless, it's of the same general volume type. We will maintain the documentation for both the PWR and the BWR in draft form throughout the next six months intentionally because we want to have a lot of cross-talk between the various evaluation teams. As you will see in a few moments, these teams will be comprised of the people who know the plant best, the operators, the people at the plant as well as our own experts.

Today, we want to get your views -- and we picked up a few already yesterday and today -- but we would like to get your views as we get into this testing and evaluation phase. Hopefully, if you so desire, you will have two bites at the apple. We would intend to return after this next six months of validation which we have selected seven different plants which cover all the NSSS vendors; they include the four reference plans but they also include the MARK-II, the B&W plant, and CE plant.

At that time, it would seem reasonable to provide you an in-depth presentation on the successes, and I am sure there will be a number of lessons learned over the next six months.

Now, at the risk of great laughter, I'd like to request some patience on your part because each of the presenters has -- I think of necessity -- four or five visuals at the beginning of his presentation to try to establish the ground rules or framework within which the methodology was developed. But eventually they will get to the "how to" steps. So, if you don't see the "how to" steps in the first or second viewgraph, be a bit patient.

Also, we gave this presentation, we gave the presentation on methodologies to the staff, and what we are trying to do this afternoon is to reduce the presentation we gave to the staff in terms of time by about a factor of five. So, the presentation you are going to see today is either one-fourth or one-fifth of what it takes to go through it in detail. So that at any point if you choose more detail, we can certainly give that to you. But I just wanted you to know we are not going to be going into that kind of depth.

With that comment, I'd like to probably raise a few questions by showing you a few visuals.

We have not done everything that is in your letter, but we certainly read your letter with great interest and in

recognized some long time ago that a systematic anaLysis of each plant would be required. In fact, our approach from the outset in IDCOR was to select four reference plants. We never adopted the so-called surrogate approach which people tried with WASH-1400. In fact, at NRC it was tried with not a great deal of success. It is the idea that you can examine somehow "a" plant or a combination plant and extrapolate those results to a large family of plants.

Rather, we adopted the reference plant philosophy which says, "We will examine in great detail plants representing the typical design and type out there, and based on all those insights develop a way, if you will, to look at all the plants separately in a focused way."

Also, we mention that the ACRS commented later on the same thing, in November of 1984, recommending that an appropriate approach be developed for systematic analysis, and that's what we have been about.

(Slide)

The methodology which you will see this afternoon has been designed to test the applicability of the severe accident conclusions. You are going to see three basic areas. We have addressed core damage prevention, and we have included human performance. We have addressed containment response as a separate matter, and we are evaluating throughout the validation period by comparison to the IDCOR plants and in

fact the methodology assumes that that comparison would be in place.

(Slide)

The IDCOR methodology is generally limited to internal events. As you will see in both presentations, we do treat things like internal flooding by common location reviews, systems interaction kinds of discussions, you will see, and limited treatment of fires through common location reviews.

We did not address seismic events.

(Slide)

The methodology concentrates on plant comparisons, front-line systems, support systems, and containment responses which control fission product release. In both presentations, you will see the up-front and the containment response presentation will cover these.

(Slide)

Some questions were asked earlier about human performance. As you probably know, IDCOR did consider the role of the operator in accident management throughout the technical program. In fact, here we are incorporating information from plant operating and maintenance experience. We are going to actually be going to the as-built plant with the as-conditioned operators as part of the evaluation process.

We were evaluating and did in the IDCOR program the specific emergency procedures for operator actions that are in place, and we are evaluating the training of the operator as part of this program.

(Slide)

The reviews we have already had are shown here. We had a conceptual review and a more detailed review with the staff on the dates shown -- in March and July. We conducted a full week of reviews with the utilities of the methodology, including the owner's groups and the vendors, and we presented the methodology to the policy group of IDCOR which is a group of some 60 or 70 people. These are the members of the actual supporting organizations. They approved conceptually our going forward with this methodology; to verify this methodology; to spend the funds it takes to validate the methodology, using the seven plants I mentioned earlier.

(Slide)

These seven plants include four PWRs and three BWRs, and will involve a real-time review of the process by the industry with industry participants being involved in conducting these reviews, and the NRC staff has also indicated an interest in some level of observation during the process - hands-on kind of thing.

MR. SHEWMON: Can you tell me what those four PWRs

are, or will they come later?

MR. BUHL: I can tell you what they all are. The four reference plants we started with were Zion, Sequoyah -- let me just run through them all.

Zion, Sequoyah, Oconee, Calvert Cliffs, Grand Gulf -- I'm going to run out here any minute.

MR. CORRADINI: Susquehanna.

MR. BUHL: Susquehanna. What did I leave out? Peach Bottom. How did I leave Peach Bottom out? Those are the seven.

The methodology review process is scheduled this year. This shows the completion of the four reference plants; the completion of the plant analysis for the three additional plants. The methodology will be reviewed by the industry after it has been validated and presented to the staff and, presumably, to the ACRS and the Commissioners. We expect submittal late this year or very early next year.

That's a quick overview to try to set some framework for what you are going to hear now. I guess I would ask, are there any questions before I introduce the subsequent speakers?

MR. KERR: Yes. How are you going to deal with external events?

MR. BUHL: I thought you would never ask.

Let me try to answer that in two ways, Dr. Kerr:

First of all, we did not -- as I said -- include external events originally. The reason for that is basically historic. We recognized the importance of external events to risk, but at that time we were looking at Three Mile Island, Crystal River, a number of other accidents which had nothing to do with external events, and we are responding to a long litany of severe accident issues which have been raised by those.

We did recognize the significance of external events and we have people on the IDCOR team who participated in the PRAs Indian Point, Zion, Limerick, and so forth, those which have included detailed evaluation of external events.

We tried to develop the methodology you will hear today to be sufficiently flexible and robust such that any lessons learned can be factored in as part of the plant examination.

In parallel -- and the reason we limited our scope at the beginning is, we wanted to answer the specific technical issues. We wanted to develop a scope which we felt we could deal with and get results in.

But in parallel with IDCOR, a number of other efforts were undertaken, particularly in the seismic world and external events world.

I think I would like to call on Ed Howard to maybe

comment on the industry's views in this regard.

MR. HOWARD: Well, at the risk of saying something Tony has already said, it was a fundamental goal of the IDCOR program to define a scope that was manageable and then do our work very well through technical analysis, advance in technology get a thorough technical understanding and then proceed into regulatory action.

As Tony has said, it's clear to us that the highest priority based on operating experience needed to be to attention to internal events and how they behaved in the phenomena associated with severe accident behavior.

Phenomena for severe accident behavior had relevance even if later you look at seismic as initiators.

Then we looked at it, beyond the priority, the seismic issue in our view needed some additional technical work and advance in technology. It required quite different kinds of technical expertise and the Steering Group on several occasions revisited the subject before we moved to address seismic and has decided against it because of the level of effort and the work we currently are doing on internal events.

The industry, however -- and this group may not be aware of it -- has established a multi-million dollar jointly-sponsored effort on seismic, called the Seismic Owners' Group. It is patterned along the lines of IDCOR. It also has adopted the basic strategy to understand technology very well

and then move to its regulatory implications. That effort is, I guess, about two years old now. It is a joint utility-sponsored effort, working in cooperation with EPRI.

It is examining the basic fundamentals of seismic and how to begin to characterize the frequency, the probabilistic result on seismic intensities.

So, that program is on-going and when that technology it is done, it will provide a basis to more thoroughly examine back into the business.

MR. LEE: I might add to that, Dr. Kerr, the staff has asked us to meet and discuss this particular subject in terms of where we are now with the methodology gevelopment and the kinds of questions you have been asking for the paSt couple of days. We have discussed the need to get together and talk about that.

MR. KERR: Well, let me see if I understand what the IDCOR message has in mind. It is certainly true, as I remember, that immediately after TMI-2 there perhaps was an effort to make certain that TMI-2 is not repeated.

As things have developed, it seems to me the severe accident issue has gone beyond TMI-2 somewhat and my understanding of the current systematic evaluation program is that it is meant to look for risk outliers from whatever source one can identify and to determine if indeed plants have some outliers which should be corrected.

Now, it is my understanding that a number of recent PRAs carried out by the industry with industry-employed analysts have concluded that external events are significant contributors to risk.

Maybe IDCOR doesn't accept these results, I don't know. I haven't asked the question. It is in the light of that that I ask if you are developing a systematic program that is to look for risk outliers in plants, and if you accept that at least a number of current PRAs indicate that external events are a significant contributor, I don't see how you can ignore these.

Now, I recognize the argument that if you have an ear ache and there is no eye, ear, nose, and throat specialist available, maybe you would get an internal medicine doctor to find out what's wrong with your stomach.

Maybe you ought to accept the results of the PRAs. I must confess, I think there is good possibility --

MR. BUHL: I think I said at the outset -- so you don't say it the third time, Dr. Kerr -- we do understand those PRAs. We have the people on our teams who participate, and we recognize that these are significant risk contributors.

MR. KERR: I heard that, Mr. Buhl, and it is in the light of it that I don't understand how you can develop an evaluation program that is looking for risk and ignore something which apparently is a significant risk contributor.

MR. BUHL: Well, again let me say, the reason we did this is because we wanted to wrap our arms around something that was manageable.

The accidents that have occurred out there, experience tells us that indeed looking at the internal events, looking at the operator performance, looking at the whole process four years ago, that the technology needed to be put in place. It needed to be put in place in an integral way. So, I guess we have no apologies for that.

I don't think we are arguing with you at all that external events, seismic events, are significant risk contributors. To the extent that we could for internal flooding, for fires, we have incorporated that.

The other statement I made is that our methodology is sufficiently robust and flexible that these other kinds of lessons could be incorporated. But that's where we are today. I don't think we are arguing with you, or disagreeing.

MR. KERR: I don't mean to argue with you. I'm just trying to understand why you apparently are developing a method -- well --

MR. SHEWMON: Now that you understand it, can we go on?

(Laughter)

MR. KERR: Well, if I don't get any more interruptions, we can.

(Laughter)

MR. KERR: Are there further questions?

Mr. Buhl?

MR. BUHL: Yes. I would like to next introduce Ed Burns, who will talk about the front half, or the systems half, if you will, of the boiling water reactor methodology.

MR. BURNS: As a note in going through this presentation, I'd like to touch on the items that ACRS raised in their letter to the Chairman of the Commission this spring addressing the severe accident policy. I hope to do that in each of those items when we come across them.

(Slide)

This presentation is to give you a conceptual overview of the BWR methodology. The results of the application of this methodology to the three pilot plants which are Peach Bottom, Grand Gulf, and Susquehanna, will be presented for review when they are completed, which is targeted for the end of this year.

(Slide)

The presentation today really focuses on these four issues: What is the approach, the general philosophy that we are operating under. What's the methodology structure, how one would implement it, and what are the resources, what are the types of resources that are required.

Just as a point of perspective, I'd like to focus

on the major conclusions from the IDCOR program were threefold, addressing core-melt frequency, fission products, and risk.

(Slide)

The method that I am talking about is strictly directed towards the first bullet, which is, can we assure ourselves that on a plant-specific basis the core-melt frequency is on the same order, extremely low.

(Slice)

Some observations and conclusions that one draws from things that have happened in the past, from operating experience or from other PRAs, are that there are unique vulnerabilities on a plant-specific basis and we really are trying to ferret out what those are.

So what we need is, or what we need the method to do is to be able to provide a plant-specific approach for identifying these vulnerabilities. We need an investigative tool, one that is not a cookbook, necessarily, but one that allows enough flexibility so that the investigator can identify differences among plants.

We want to take an integrated look at the plant, a systematic way to look at it, a consistent approach, and we certainly want to identify what those significant contributors to core melt would be and, in the process of doing this, we want to make sure that the end result belongs to the plant.

We want to make sure that it's internalized as a process within the plant.

MR. MOELLER: Excuse me. On the previous chart your last conclusion at the bottom I didn't understand, or I couldn't read that. I'm sure you don't mean it the way I could read it.

That is that you will make sure that somebody establishes a method, or you do, which you can apply to each plant to be sure that the results are consistent with your conclusions.

And your conclusions being that, you know, the source term is much lower than we previously thought. What does that bottom statement mean to say? I'm sure I'm reading it incorrectly.

MR. BURNS: I think you phrased it quite well, unless I misinterpreted it. The purpose of the method is to go to each individual plant, have him perform this method, coupled with the method for source term analysis which will be described later, and in the end determine that your accident sequence frequencies are acceptable and that the source terms are either within IDCOR calculated source terms or for some reason they may be larger.

MR. MOELLER: Okay. That is not, then, the same as determining consistency with your conclusions because, are not your conclusions the three bullets?

MR. BURNS: The conclusions from IDCOR in 1984, as reflected in the technical summary report, are those bullets, yes.

MR. MOELLER: Thank you.

MR. BURNS: A very simplified overview just to give you a way to get your hands around what I want to talk about is this flow chart, which is really the key elements of it. I mean, it's to focus on the sequence evaluation, that's really where this method is.

All the pieces that go into it are modular, which means that they can be either augmented or replaced by pieces that may exist at individual utilities if they have individual reliability analysis on certain systems; if they have certain parts of PRAs done, those all can be modularized and fit into this framework. It's flexible enough to extend to any level of detail that's necessary to investigate certain perceived problems that may exist at a given plant.

But the real key and vital part of the method is, can we bring to bear all those things that we have learned to date? Can we bring;all those engineering insights that we have learned from various sources, can we bring them to bear in this project so that the individual plants can take advantage of those and see how they affect their plant?

(Slide)

As an example of the types of engineering insights

that I'm referring to, I'm talking about the BWR Owner's Group work that's going on with the NRC and has addressed many, many issues, both deterministically and in a probabilistic manner. The published PRAs clearly have identified vulnerabilities at certain plants.

All of the NRC work regarding AEOD evaluations which I found to be extremely valuable. The I&E Bulletins, USIs, generic issues. Operating experience, precursors that have occurred in our experience that are not reflected in any of those other reports, and INPO reports.

(Slide)

Just to reiterate again in words what the approach is, we are using event trees and fault trees to some level. The method actually goes to the level of functional fault trees which are system or subsystem levels, but would allow the individual plant to extend that if necessary.

The system notebooks and support system dependency matrixes are really keys to the implementation of this. Identification of what the plant looks like and how systems are interrelated are a key feature in how he ends up modeling and reflecting that model in a quantified process. So, those are key parts of this.

I think plant-specific data is very important, it's also very resource intensive to accumulate that. But the recommendation would be to use plant-specific data where it

was available.

MR. KERR: Let me see if I understand how you are going to approach this. One could interpret this as either a PRA or a mini-PRA.

MR. BURNS: Yes, sir.

MR. KERR: Is that what you have in mind?

MR. BURNS: It's not a PRA and I would not use the word PRA. But somewhere in that range, yes.

MR. KERR: For example, do you intend to try to calculate core melt frequency?

MR. BURNS: Yes, sir.

MR. KERR: But perhaps not go beyond core melt to consequences?

MR. BURNS: The coupling of this method with the method that you will hear after this, which is the source term analysis, will result in a coupled program that will have both frequency of release and source term.

MR. KERR: And you would propose to do this for each plant, or just for the representative plants?

MR. BURNS: This is a method that I am describing. IDCOR has committed to do three pilot plants -- Susquehanna, Peach Bottom, and Grand Gulf. Beyond that, I don't believe there is a formal commitment.

MR. CORRADINI: But the intent, though, is this systematic evaluation would be done for every plant. Isn't

that the intent?

MR. BURNS: That's a program question that Mr. Buhl and Mr. Howerd went through.

MR. BUHL: Yes. That's the intent if you read the Commissioners' policy statement, but it is not the responsibility of ICCOR. Our responsibility is to develop a methodology, test it against the four reference plants, additional plants, and then provide the methodology in a well-documented format, well-reviewed format, to the industry following interaction with NRC.

MR. KERR: Mr. Shewmon?

MR. SHEWMON: Back a few slides the last bullet said, "A process to make the information 'belong' to the plant owner."

Does the quotation marks around "belong" mean that you want to get the plant owner involved so that they know something about it, as opposed to legally?

MR. BURNS: It's the only way to make it worthwhile.

MR. SHEWMON: I'm not asking the philosophy, I'm asking a question of English grammar. The answer is, yes, is that it?

Okay, thank you.

MR. KERR: I hate to continue, but the idea is that you develop a method which could, given a decision beyond

this be used for the plant analysis of the kind we have discussed.

MR. BURNS: Exactly.

MR. KERR: Thank you.

(Slide)

MR. BURNS: The high-level goals that are established for this are that we can determine what the core-melt frequency is on an individual plant basis. Can we make it easily understandable at the utility management level? Can we make it such that it's easily updated when later information becomes available, and can we clearly document it.

And lastly and most importantly, is there a way to make sure that outliers can be identified?

(Slide)

Some of the bases for judgments that have gone into setting up the method are to make sure that the utility is intimately involved with the application of the method since we feel that he is the one who knows his plant the best.

Further, with the interaction with the utility it is judged that detailed system fault trees may not be necessary on all front-line systems. However, they may be necessary on support systems since there is such a wide variety among different plants.

MR. KERR: I don't understand the significance of

that item. Could you elaborate a little?

MR. BURNS: It's a resource question more than anything. It's one way to cut down the amount of resources required to apply a method to get to an understanding of outliers and core-melt frequencies.

MR. KERR: I thought I heard earlier that the method would be one which would eventually predict the core-melt frequency quantitatively.

MR. BURNS: Yes, sir.

MR. KERR: What would, then, substitute for the detailed front-line system fault tree if one were doing that?

(Pause)

MR. BURNS: I have two slides that I will use to try and address that.

(Slide)

The first one is a very over-viewish type slide. Essentially, everything on this slide is part of this methodology, with the exception of system fault trees which include individual component failure rates and the application of specific failure rates on a component level or a sub-component level.

There will not be an army of fault tree people doing fault trees on systems as part of this method. Inferences from other PRAs, inferences from fault trees that already exist and quantification of those systems will be used in

place of that.

MR. KERR: Okay. You are saying if they understand that system well enough --

MR. BURNS: Yes, sir.

MR. KERR: -- and also understand other PRAs well enough, they can extrapolate.

MR. BURNS: Yes, sir.

MR. KERR: Okay, I understand.

MR. BURNS: In general for support systems.

MR. CORRADINI: Can I ask a question about that still, though? I am trying to think on the practical level. I am trying to think to myself, how sophisticated of an employee would I need at the utility because this methodology, again we go to the use, the end-users of this. This methodology would be used directly by the utility people; right?

MR. BURNS: That's right.

MR. CORRADINI: So, what sophistication do you need at the utility level for someone that would have an intersection of the two things you just required. One, to have an intimate knowledge of the plant and, two, to understand PRAs?

MR. BURNS: I will talk about the plant evaluation team that I think is necessary later.

MR. CORRADINO: Okay.

MR. BURNS: The question you raise is certainly a very good one. The way we have chosen to address this

question, in addition to selection of the people who form the plant evaluation team, is to reduce those items that one would learn from doing fault trees, that have been learned in the past and that have been learned from operating experience. Reduce those to a set of questions.

So, in place of an army of fault treers doing fault trees, we have a set of questions that are asked about each plant system.

I think I left off in the middle of this slide with, what you end up with, a set of needs. What set of needs do you end up with when you make these observations?

Reiterating, we do need a consistent-structured framework. We want it to be investigative in nature. We need to quantify sequences, I think, as a measure, a relative measure at least, of plant performance, and we need the method to be able to be part of the utility's process.

(Slide)

It has to accept plant-specific data, include precursors, and variations and support-system arrangements.

(Slide)

So much for the philosophy background approach. What does the method consist of? What's the scope, the flow of information, and what are the modules that one includes?

In terms of scope, we have talked a little bit about what the scope is thus far. It's focused on internal events.

However, it does include internal floods, interfacing LOCA, common-mode failures in the support systems. It is judged to be easily capable of expansion to a Level 1 PRA if that is judged to be necessary. It addresses all GE BWRs and those support systems that are identified there.

(Slide)

The modules that go into the method on a very high level basis, again, involve a set of initiators. We need to choose what kinds of accident sequences we are searching for, sequence initiators, and then follow those initiators through the plant to see what either direct dependencies or random dependencies may occur that could aggravate the situation at a given plant.

MR. KERR: In your nomenclature is fire considered external or internal?

MR. BURNS: External, sir.

Once the initiators are identified, we evaluate what the effect on the support systems is in a probabilistic manner, including the functional dependencies. Then, from that, we may decide to add to the list of initiators if there are unique support system failures that create situations that require further detail. For those support system states that are included, we go directly to front-line system event trees which assess, what are the critical safety functions in the plant and how do they respond given that boundary

condition.

Finally, we've been in those sequences in the end to try and define whether there are similar types of core-melt sequences. We are struggling to find a balance between the amount of resources that we have available and the level of detail.

(Slide)

For the initiators, we are using basically information that is available from studies that have been done by EPRI and the NRC for anticipated transients, PRA results that have been generated, and operating experience.

The four general types of categories, transients, LOCAs, ATWS-type events and other low-frequency sequences, are really expanded into sort of typical types of anticipated transients. The LOCAs -- and as I mentioned before, interfacing LOCA is included under that category, ATWS -- for all of the anticipated transients and all of the other low-frequency and LOCA events, we consider failures of reactivity insertion.

In addition to that, there are low-frequency transients such as support system failures and other things like reference line downs, cooler failures and internal flooding that are addressed explicitly.

(Slide)

The support system event trees have this general

character and generally address this level of detail, addressing availability of off-site power, DC buses, service water, and room cooling.

Given that one of these system fails, then another front-line system event tree determines what the effect in a functional basis, what are the critical safety function effects of those failures.

(Slide)

The purpose of this slide is just to identify the level of detail, not to read it particularly. In other words, we are looking at not two sequences and we are not looking at 500 sequences per initiator, we are looking at 10, 15 types.

MR. CORRADINI: May I ask a question about this?

MR. BURNS: Sure.

MR. CORRADINI: So then you generate a generic event tree, give it an initiator, and then require the person or team to fill out the event tree with the branch-point probabilities?

MR. CORRADINI: And then at each branch-point probability, instead of requiring a detailed fault tree, you have some sort of top question -- top box question that you want answered and then --

MR. BURNS: There is a top-level functional event tree that finds the interrelationship among systems that may exist.

MR. CORRADINI: But instead of doing a fault tree at that point, you require the people to answer a series of questions.

MR. BURNS: Or do a fault tree. They could do a fault tree.

MR. CORRADINI: If they had the time.

MR. BURNS: If they had the time, or maybe they already have it done.

(Slide)

The functions that are addressed are reactivity control, pressure control, coolant make-up -- that is high pressure depressurization and low pressure -- and containment control, temperature and pressure. Those are the functions that are addressed on a front-line system basis.

(Slide)

So, once we get done evaluating the sequences and assigning quantified values, we need to identify what are the end states that we are searching for.

The end states that we are searching for is core melt, but core melt in terms of what is the coincident effect on containment; what is the coincident effect on the primary system, and what's the coincident core status, what power is it at.

(Slide)

Just to elaborate just slighty on that subject, there

currently in this method are four, five identified core-melt sequences, end states, that are bent together. Those events that cause a loss of RPV coolant inventory; those events that involve loss of containment heat removal; those events involving a breach in the primary system; ATWS type events that involve containment breach prior to core melt, and isolated LOCA events outside containment.

MR. MOELLER: Now, are those tied -- I'm two slides back, I guess -- when you called them the front-line functions? I was trying to tie your last slide, I guess, into that.

I see -- well, reactivity is not there, unless it's --

MR. BURNS: Reactivity control?

MR. MOELLER: Tell me a little bit about this one.

MR. BURNS: Let me put this up just briefly.

(Slide)

This is the event tree we are looking at. Across the top are functions. What are the critical functions, front-line system functions that we are worried about. Each of these are reflected on this next slide.

MR. MOELLER: Failure in one can lead to a potential failure in the next, is that it?

MR. BURNS: Not necessarily. That's part of the process of the event tree, whether that's true or not. It may only increase the likelihood of a failure at the next node. So, there is always the possibility. It may directly cause a

failure; it may increase the probability of a failure, or may have no effect on the next node.

MR. MOELLER: And I guess when you said containment control and you listed temperature and pressure --

MR. BURNS: Yes, sir.

MR. MOELLER: -- by the words "containment control" you mean if temperature and pressure go too high it's out of control. I guess that's the way I should read it?

MR. BURNS: Many of these functions are derived directly from the symptom-based procedures and the systems available to address each of those. Each of these items are considered to be important in determining if there could be a core melt associated with it, a failure.

Containment temperature and pressure control are, is the containment temperature so high that it could cause adverse effects on mitigating systems and therefore result in core melt.

MR. MOELLER: Well, now, where would radiation level in containment be listed, or is that just simply something that occurs along with temperature and pressure?

MR. BURNS: This addresses core melt, this method right here addresses core melt. So, it does not address questions of high radiation resulting from core melt. This is how you may get to a core-melt situation, not what you would do then.

MR. SHEWMON: But in a different vein, if we focused on that containment control temperature, pressure might rupture the vessel but high radiation levels in it would not.

MR. MOELLER: Okay. In that light, I understand. I see the point now.

MR. BURNS: That completes my summary of what the key elements of the method are. Now I would like to examine how one would implement the method on an individual plant basis.

The key elements as I see them are the formation of the team -- a very important part; picking who the members of the team are. That is probably one of the crucial steps to the success.

Next, to define what the plant looks like, what is the plant? What are the dependencies that are important and is there any data to characterize the reliability of systems within the plant?

MR. MOELLER: Excuse me. What are the criteria, then, for picking the team?

MR. BURNS: The team as it's identified in this method is, one person from operations, one person from engineering, some guy who understands the lingo so that we don't get bogged down in that, and a licensing person could be of benefit.

(Slide)

The individual tasks to implement this method are outlined in the report. What I would like to do is focus on three, four, and five for today which is just discussed very briefly; the dependencies and how those are treated, and the use of the event trees. Then also to focus on Task 7 which is quantification -- just very briefly -- hopefully to give you a flavor of what that's about.

MR. CORRADINI: Could I ask a question here? It's kind of a little bit off track but -- this is kind of like a mini-PRA. You don't like those words, but it isn't a mini-PRA?

MR. BURNS: I don't like those words.

MR. CORRADINI: Okay. What would you term it?

MR. KERR: How about a "compact?"

(Laughter)

MR. CORRADINI: My question would be something like this, do you think that the insights gained in this would help the plant operators in a different area other than core melt?

MR. BURNS: I think there is no doubt that the side benefits from this exercise can be dramatic in terms of their understanding of the plant and their understanding of severe accidents from a procedural standpoint and from a maintenance standpoint.

MR. CORRADINI: I'm more curious about reliability of

maintenance. So, given that, how much of a cost savings do you infer to the plant people in doing this versus a Level 1 PRA which would basically just do the first level of PRA for the accident frequencies?

MR. BURNS: I don't have an answer for that.

MR. CORRADINI: The reason I ask that question is, if the benefits outweigh the costs, would it not be smarter for them just to simply do a PRA, the first level of PRA, to just go through the accident sequences to see the reliability of their various systems?

MR. BURNS: I can give you my personal opinion. I can't give you an IDCOR.

MR. CORRADINI: I'll take your personal opinion.

MR. BURNS: My personal opinion is that it's very difficult to convince some utilities that such a thing is necessary and that a Level 1 PRA is very resource intensive if you do it right. And even if you do it right, maybe you don't get the plant people to do it. Maybe you get a contractor to do it, which defeats the purpose of what we were just talking about.

MR. BUHL: I think, if I could add to that, I think it's important that you recognize at the outset if you can get the plant people to do this hands on. What we did not want to set up was a process whereby somebody decides that we just want to do this thing, let's call in a bunch of consultants

and do something.

So, we tried to put together a methodology unlike just hired someone or participating with someone on a Level 1 PRA, a methodology which would really focus on the lessons we have learned from the work we have been doing for the last four years and the work that lots of other people have been doing.

MR. KERR: Mr. Bender?

MR. BENDER: The question I want to raise is akin to the one that just came up.

I can appreciate the approach you are taking as being one which is closer to being manageable in the sense that it's a small enough problem so a few people can understand it.

I would perceive it as useful partially to give the utility a better handle on emergency management, that is, where to develop better procedures and that sort of thing. Is that your perception, or is it something else?

MR. BURNS: That's definitely where I see the biggest benefit, along with his perception of how he treats his safety systems and non-safety systems.

MR. BENDER: Okay.

(Slide)

MR. BURNS: Just to touch briefly on what the dependent failure evaluation consists of, I'm going to try to

give you a little flavor for the level of detail. These are the types of dependencies that you might run across that you would be worried about, and this is how they are treated in this method.

In terms of functional dependencies, those dependencies that follow from failures of either front-line or support systems, those are treated in event tree. I really think that is one of the better ways to treat that problem.

Support system dependencies are, again, treated both in event trees and in dependency matrixes which tie together fault trees at the fault tree level.

Human dependencies among systems are treated in terms of maintenance and in terms of accident response, are treated both within the fault trees and they are treated in the event trees in some very rare cases.

MR. CORRADINI: Can I ask one question here? Is it the methodology provides to the user the event trees, or does he have to formulate the event trees for his specific plant?

MR. BURNS: The event trees are provided for what we have considered to be the three principal types of different plants.

(Slide)

How do I implement this? How do I get to the point where I can do something? I need to define what is the building blocks that I am going to assemble for the model, and

those are defined in terms of the systems that I need and in terms of how I would model those.

Support system effects are included in the event tree models. As I mentioned before, really one of the hearts of this process is to include insights that have been identified, either from IDCOR or from other operating experience. There is an entire set of questions addressing each system. It was done on a system basis and those questions are coupled together in terms of functional fault trees which bring the questions together at a higher function level which is like high-pressure injection.

(Slide)

Maybe it would be better to look at this. If these are the event trees, high-level fault trees exist on a system and subsystem basis, and these are quantified on a base-line basis for a given plant, and then a differencing method is used to identify whether the engineering insights that exist and applied on a plant-specific basis affect those quantification numbers.

If they do affect them, it allows the guy some judgment as to what the change in those numbers might be.

(Slide)

The types of functional fault trees that exist, for example, are for high pressure injection, the types of systems that are addressed are CRD, HPCI, RCIC, SLC, feedwater,

are the types of systems that are available to get high-pressure coolant into the primary system.

Then there are, in this selected case, there are detailed fault trees of HPCI and RCIC to go along with this, considered one of the primary methods of maintaining coolant inventory.

(Slide)

To quantify those models, we are using the engineering insights. They are really focused on identifying any differences among plants, differences from the base plant. We use a top-level set of questions and they are posed on an "If,then." If your plant is like this, then you should do this.

(Slide)

The nodal questions address issues such as, what is your operating experience with the systems? How many trains of the system do you have? What's the power to the systems? What support systems are necessary for it to operate? What's the location of controls that are required? What's the procedures that you have in place for that system and how do you train on that system?

What kind of maintenance do you do in the tech specs, and what are the limits, the operating limits, of the system?

As I said, those questions are arranged in a series of appendixes that address each functional node, and within

those nodes each system.

MR. BENDER: Excuse me. It sounds like a lot of detail for a couple of people in the utilities. What is your assessment, is it a lot of detail? Have I overstated the problem?

It seems to me for two guys, one from engineering and one from operations, to know all that needs to be done to do this is going to take a hell of a lot of digging or a lot of really smart pecple. Would they know enough, two people?

MR. BURNS: I think, as I said, we need to have somebody who understands the lingo to get them over that barrier.

MR. BENDER: I'm not talking about the lingo now. I'm really talking abcut the plant design.

MR. BURNS: The plant design is a very difficult piece of the puzzle that needs to be drawn together. And you are right, it can vary among plants but in general it is a resource-intensive job to bring that all together. That's right.

MR. BENDER: I'm not trying to discourage you from doing it, but I think that's been the hang-up on the PRAs, that you have to be a lot smarter than people think they are when they start.

MR. BURNS: That's definitely true.

MR. BENDER: I'll just leave it as a caution because you will work your way out of it.

(Slide)

MR. BURNS: Just as an example of the types of questions, if we were to examine HPCI and RCIC, one of the hundred or so questions that are asked on a maintenance tech spec type of question is, do you allow on-line maintenance of those systems, and what is the outage time that is allowed by the tech specs.

Given the answers to those, we can adjust what the unavailability of the system is in the quantification for the event tree evaluation of sequences.

(Slide)

Okay, I think I am ready to talk about end point, what do we get when we end this project? When you finish a plant you hope to know what the core-melt frequency is. If it's significantly different than other results, if it's significantly different than IDCOR, I think that's an important point and the conclusion from that may be, you need to do more analysis.

The conclusion may be you need to do something. That's what you do with the results. But that is one of the results that we are focusing on.

(Slide)

One of the more important results also is, are there

any sequences that have been identified in this process that are significantly different than those that have been identified previously.

IDCOR has examined a lot of sequences and has come to the conclusion that there are a select number of sequences that can be grouped together because of their transport phenomena, because of their effects on containment and their source-term effects.

What the plant-specific analysis should result in is, is that true on a plant-specific basis.

(Slide)

Also a major conclusion is, are there any sequences that are significantly out of line with what you expect or have identified previously.

(Slide)

In conclusion, then, we are focusing on a realistic, plant-specific core-melt frequency method. We are trying to use insights we have learned from IDCOR and operating experience to help us in this process. It is not a PRA. Hopefully, it's sufficiently clear to be usable as a communication vehicle.

Also, it's intended to identify on the order of 90 percent of the outliers that could exist at a plant. It is expandable to a Level 1 PRA, and it's easily updated to modular form if later information becomes available.

MR. KERR: Are there questions? Mr. Bender.

MR. BENDER: There are two points. One, I understood when I listened to the regulatory staff this morning -- I suspect you have heard the presentation -- that this methodology includes something called "uncertainty analysis," or maybe it's "sensitivity analysis," or maybe it's both.

When you made the point earlier today that if the result matches up with the IDCOR results, then you are probably okay. And if it does not, you may have to do something or you may have to do more analysis.

I guess I would be inclined to say that at the least you need to do a sensitivity analysis, no matter what the result is. I won't argue for an uncertainty analysis, I think that's meaningless.

But would you do that?

MR. BURNS: That's not currently in the method, but that's a very good suggestion. It's a point estimate evaluation right now.

MR. BENDER: All I'm saying is, if it turned out, in the sequence analysis it turned out that the critical thing was that you had to get power to certain pieces of equipment within a certain time frame, I would want to know what difference it would made it it were twice that length of time, for example.

MR. BURNS: I agree.

MR. KERR: How far along is this toward completion?

MR. BURNS: The method is complete. The application in the pilot plants is just beginning.

MR. KERR: We have asked earlier about whether particular methods can take appropriate account -- whatever that is -- of human performance, and perhaps even differences in human performance in various plants.

What is your view of that as far as this method is concerned?

MR. BURNS: I think the methcd offers the opportunity to include characterization of operator response. And as far as the procedures go, determining what the operator's actions are and its functional effects on what systems are available or not available, I think that it can do that.

The quantification of that, on the other hand, is another question. The quantification of such events is really beyond, I think, the state of the art. Things we have been using traditionally are the Swain things and NREP. So, those are really very crude. They are useful only as a benchmark.

MR. KERR: I think they are beyond the state of the art, too. I got the impression from some comments made earlier that perhaps people thought they could indeed take into account

differences in performance amont different crews. I'm not sure that is what I should have concluded.

MR. BURNS: We certa ly would like to do that, but there is no practical way to do that.

MR. KERR: I have no idea how to do it, either. But it concerns me a bit because I think that's likely to have a significant influence on risk, and I think we don't really know how to deal with it.

MR. BURNS: Yes, sir. Well, one of the ways that this method tries to deal with that is, it tries to force the question of, what is the training at the plant. It tries to ask in very specific cases where it's been found to be important before, do you train him to do this, or do you train him not to do this?

If you train him not to do something, then that should be in a quantification. I mean, you shouldn't give him a high likelihood of success.

MR. KERR: That's a good point. Do you intend then, perhaps, to look at, for example, simulator training for at least the person who does the analysis?

MR. BURNS: Yes.

MR. KERR: Mr. Davis?

MR. DAVIS: I want to add an additional comment. It seems to me like just the application of the method to the plant and getting the plant personnel involved, will bring

them up to a level of awareness about these potential sequences that hopefully will help smooth out the operator's response, improve it, and bring the crews up to some level that will give us more comfort about the ability to handle it.

MR. KERR: It just occurs to me how to deal with this. You assume there is a significant correlation between the performance of this two or three-man crew and the rest of the personnel. So, you then find out how long it takes them to perform this analysis. And if it takes "x" days they are doing pretty good, or "x-plus 10," they are not so good.

Thank you, Mr. Burns.

MR. BUHL: Our next speaker is Mike Hitchler who will give you a very similar review of our PWR systems work.

MR. KERR: I assume he'll rub out the first six slides that are the same in the twc presentations. So, we can stipulate those.

MR. BURNS: Yes.

(Pause)

(Slide)

MR. HITCHLER: What I would like to do is to really focus in on more of the application. I want to give you a flavor of what the method is and also what type of work product we are going to be using to aid the analysis teams in performing their analyses.

The key word here is that we have a very structured process, just as Ed has mentioned earlier, in which we either ask questions or require that certain types of analyses be done and a certain format for doing that analysis is required.

So, I will be discussing about the PWR individual plant evaluation methodology during this discussion. We are going to be talking about the approach that we chose.

MR. KERR: Would you be willing to start on page 6?

(Laughter)

MR. KERR: I mean, that other is important but it says the methodology approach includes the following components. Unless this confuses your presentation, which I don't want to do. I guess it does.

MR. HITCHLER: I'll start on Item 6, if I can make a couple quick comments --

MR. KERR: All right.

MR. HITCHLER: -- without using slides.

One of the kay points in the analysis methodology is saying that we are screening for outliers, which means that we want to guarantee that the method is as robust as possible and to try to minimize any kind of biasing we are using.

Therefore, the method has been geared to providing the same segments in the analysis as you would have in a Level 1 PRA. Not the detail, the same segments. You start screening for those things.

The other aspect is that we want to guarantee that the process is continuous. That we recognize that there is a vast number of differences in the PWRs, three types of vendors, five to eight types of AEs. So, the potential for coming up with a unique configuration is extremely hight.

Therefore, the method has to be extendable to be able to do unique analysis combinations. And that is really one of the key items.

(Slide)

Slide 7 is, we want to guarantee that the tool that we are using is practical and that also the tools give us a high degree of confidence when we screen for these outliers.

The key words in terms of the method we used in deriving this practical tool is the use of a concept called templates or building blocks in the analysis. And the fundamental basis for this is saying that all plants can be analyzed, you can divide the plant into smaller and smaller pieces until you find recognizeable identical components between plants.

So, the templates become these modules that are similar for a large class of the plants. Now, this can vary from plant to plant tremendously.

So, what we have done here is that the first step was to provide a base line even for the IDCOR plants. We are not going to prejudice our thinking that that design is

correct or other plants are correct. We prefer to actually rebaseline these plants and have chosen the kinds of modules we want to analyze.

MR. CORRADINI: May I ask a question at this point? This sounds like the method used here is, although it has the same goal, is different than the method used for the BWRs; is that true?

MR. HITCHLER: Yes. There are variations. There are the same areas we are looking into.

MR. CORRADINI: But, I mean, the goal is core-melt frequency, dominant accident sequences, reliability of systems, et cetera. But the details of the method are different; correct?

MR. HITCHLER: Yes.

MR. CORRADINI: Are the methods tied to the type of reactor?

MR. HITCHLER: That's one of the objectives we have in terms of this implementation program.

MR. CORRADINI: So that I couldn't take your method and use it on a BWR?

MR. HITCHLER: No, I didn't say that.

MR. CORRADINI: Have you ever thought of verifying or validating the usefulness of this method versus the other method by switching the methods on plants?

MR. BUHL: Yes. Let me comment, if I could. I made

the point at the outset, we purposely selected two contractors and that there were differences, some basic differences.

What we want to do is to test both of these and have a great deal of cross-talk or cross-over as we go along. Yes, we had clearly talked about taking one and applying it to the other. It is something to think about.

MR. CORRADINI: It seems like a logical thing to test if your method is really useful. You would take the one you are using for the PWR and use it on the BWR, and vice versa, and see what the results are, with the same common team.

MR. KERR: We will note that. Mr. Bender?

MR. BENDER: I may be drawing an inference that may be incorrect. But it seems to me the fact that Westinghouse has been successful in drawing up a fairly good set of emergency procedure guidelines that go along these lines makes this kind of approach a fairly easy one to use. Is that an incorrect inference?

MR. HITCHLER: That's correct.

MR. BENDER: It may not be available for all the plants.

MR. HOWARD: The PWR methodology is consistent with the emergency procedure guidelines developed for the BWR, too. So, they have some training benefits.

MR. KERR: Mr. Hitchler, I want to compliment you for one of the more direct answers we have gotten all day.

(Laughter)

MR. HITCHLER: I'll try to maintain that.

(Slide)

In terms of the method we are also including -- we have looked for variations that may exist for equivalents of these bases. The quick example I will give you is how the model cross-connects between sister units in plants. That's an easy one.

We have developed templates for initiating events, event and fault logics, and even data templates that incorporate all these variations.

We have also recognized that we don't want people blindly using these building blocks, so we have developed applicability check lists to see when a template is valid, in other words, how close to a fix is close enough.

We have also provided rules for modifying templates. We recognize there may be small variations where it may be worthwhile just to upgrade the module to some extent.

And finally, rules to combine these templates into a final module or model, so there is quantification.

(Slide)

As I said, we are essentially using all the building blocks they use in a standard Level 1 PRA. And I guess the term that we have been using is saying that the difference between the Level 1 PRA and what we are using here is that we

know when to truncate the analysis, at what point can we get the kinds of insights that we really feel we need in terms of these kinds of assessments.

So, really, you see all the basic features in a Level 1 PRA here. We have divided the analysis into four basic areas. The four basic areas are initiator template assessments; accident sequence development, which is the support state, and the front-line system or event tree portions. The systems analysis or the fault tree sections, and then finally data, plant-specific operating data.

We have also provided applicability tests with each one of these. That are specific things that the people have to go through, and I'll go through that in a minute.

(Slide)

This shows the actual implementation stages. As you can read, basically the steps are strictly that you collect data and then you go into your templates and you verify the initiator grouping templates are correct; the event trees are correct, and then you start factoring in plant-specific information.

On the initiators the question would be, we have given you seven basic initiators to look at. Here is the rule that could invalidate that kind of grouping on initiators. Verify that you don't have unique things, and I will go into a couple of examples in a minute.

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Here we are saying, go out and find out exactly how your plant has been performing. So, there are very specific rules and very specific work products that must be derived for each one of these steps, that define that the work is not done until you have documented what your assessment was and the basis for that assessment.

(Slide)

I would like to go in, now, into a couple of examples as to what each one of these four segments look like, and not into very much detail, just to give you a flavor what the methodology uses.

This is the accident sequence initiator section. As I said, the minimum amount of analysis required is to perform seven assessments on initiators. I have seven categories.

What this does is say, you've now got to prove that these seven are valid. In terms of that proof, we have done a couple of things. We divided into three types of categories, and I'll give you a quick example on each of these.

The first category is frequent transients, the things we see every day or every months in plants, loss of feedwater, those types of events.

We have defined a grouping. We have also defined in that grouping where there may be trouble spots. For example, on loss of feedwater -- excuse me, on reactor trip. A typical

question is, does reactor trip result in a loss of feedwater every time. Then there will be rules where to put the categories.

In terms of the quantification of the frequencies, we are using the EPRI document. But we are also requiring when to use the generic data, if you do an update using your plant-specific data. We have provided a method to weight your plant-specific operating experience.

The reason why you need that is that we recognize that there is a whole series of plants that only have a year, three years, of operating experience; that the data is totally unrepresentative of what you would expect in the longer terms. But we don't want to throw that out. So, a weighting process has been provided in the documentation required.

We have defined another path here in terms of infrequent transients. Infrequent transients would be transients such as loss of a support system; for example, loss of all of your service water or a type of steam break or feed break.

We are not requring that a specific event tree analysis be required, but we are providing to show that you have covered these kinds of scenarios in other analyses. The example I would give would be in the loss of service water. You must derive a frequency for that loss of service water, but

your next step is then to find out if the effects of a loss of service water and the frequency is bounded by your loss of off-site power; and it follows that kind of a flow.

Another area is to find out from a feed-line break standpoint, will a feed-line break destroy your entire aux feedwater given a certain break location. If it would, then we are requiring an actual event tree analysis. So, that's the type of thing.

In rare events we are saying that we are going to provide you with LOCA frequencies. We don't feel it's worth trying to derive the extremely rare event frequencies.

We are requiring, though, that a specific V sequence type calculation be done for every plant, and the method is provided as to how to calculate that.

MR. DAVIS: Excuse me. Do you mean by that a calculation of whether or not the V sequence rupture would occur if you lost two check valves, or whatever valve arrangement you have?

MR. HITCHLER: Well, there are two parts in the calculation. The first part is to screen to see if there are any other sources of a V sequence in the plant, in other words, an assessment of penetrations and whether or not there is something non-standard in terms of your plant design. That's the qualitative portion.

The second portion is in terms of what you said,

rules for doing ar actual calcualtion of a double rupture of check valves.

MR. DAVIS: And the consequences of that.

MR. HITCHLER: Yes. And if the consequences can be significant.

MR. DAVIS: Do you supply the methodology to do that analysis, or do you depend on the owner to handle it?

MR. HITCHLER: We supply the equations and the data. In other words, one of the key things here is trying to find what the rate is for a gate valve. It has never happened, so it's worthless for us to say find the data. We are providing the actual data for those kinds of things.

MR. DAVIS: Well, if I can pursue this just a bit. The interfacing systems LOCA is a peculiar case because the IDCOR analysis for Zion indicates that it won't happen, even if the valves rupture. At least it won't happen in the conventional sense that has been used in PRAs. Instead of a pipe rupture, you get a pump seal LOCA which is a very small break and the consequences are fairly negligible.

On the other hand, in a plant like Millstone 3, which was done by Westinghouse incidentally, the PRA, the V sequence is the number-one contributor to the exclusion of all others in terms of early death risks.

Now, I think the plants are both designed to the same pressure on the low pressure side and I'm wondering how

you are going to handle this problem if you ask the plant to analyze the accident and then if you give him all of the input that's needed, it may be biased toards the Zion analysis.

Here you have sort of a threshold thing. If you use a conservative analysis, you are going to get the rupture. If you don't, you won't. And that will chan ge the whole mix of the accident sequences.

MR. HITCHLER: There are two parts of it, and that's exactly why I went through a very prescriptive way to do the analysis.

First of all, the original Zion analysis and the Millstone analysis are virtually the same or very similar. Where the difference came about was when IDCOR started doing a specific calculation to show exactly how the phenomena progress, in other words, where the locations were.

The frequencies for the V sequence for the plant could still be actually the same, you've got the same method. So, we are really talking about the second set, the source terms that were developed. So, the frequencies would come on very similar.

But you are right, that is exactly why we decided not to give people the option on what assumptions to make in terms of data, or the method in calculating the results because we are really looking for differences here. It is not just Zion and Millstone, it exists on virtually every period that

has been done.

MR. DAVIS: So, what you will do is have a consistent analysis. And then, of course, the next question is, is it right? Is the information you are giving them to do the analysis valid? I think that is something that needs to be carefully looked at, of course.

MR. HITCHLER: I have a high degree of confidence that the method is -- I haven't seen an error at this point and it's been reviewed in a lot of detail. But it's clear to have us to know which way the results would change on a consistent basis.

MR. KERR: Mr. Bender?

MR. BENDER: Just one point having to do with the sharpness you have, which you call accident sequence initiators are carefully reviewed.

One point on this is to update the plant-specific operational frequency. And I guess if I were going to be plant specific about it, I would say that the biggest variable is maintenance control.

Can you say anything about how that gets fit into this picture? Maintenance mistakes contribute most to the operational malfunctions, and that's really what this thing looks at.

MR. HITCHLER: Well, there are two parts on that. One is in terms of the initiator we are talking about how

many spurious trips you get; in plant operating data, we get it there.

In terms of maintenance, in terms of systems failing, that comes about in the fault evaluation and I'll get into where that is factored in.

MR. BENDER: I had only been thinking in terms of this matter of plant-specific operating frequency. That is a function of the operational skill.

MR. KERR: It might come out of the data.

MR. BENDER: I'm not optimistic about the amount of data that you can have on a plant that has operated for a year.

MR. KERR: Indeed, he said that, that if it's only been operating for a year they are using a weighting factor which will not give a great deal of weight to that.

MR. BENDER: I have said enough.

MR. HITCHLER: Well, a quick thing on that weighting factor. What we have done is, we performed an analysis for trip reduction work and tried to identify what type of learning curve actually exists -- this isn't the MP-2230 or 2330 work. It's a separate thing. It shows at what point do four-loop plants or three-loop plants really start to have some lessons learned, feedback.

At what point they start to learn appears to be at about five years. In other words, at what point you really

start to stabilize operating conditions. What we did, we took those curves and derived a weighting function which is very crude but essentially gives you that kind of a benefit. In other words, you don't want to put in those 20 trips you are going to have that first year of operation, it's ludicrous, nor at ten years do you really feel that you need to deal with generic data any longer, your plant has stabilized.

MR. BENDER: I guess my perception goes something like this: Some of these plants are engineered in a less than desirable way, and they have lots of hardware in them that has bugs in them. And those bugs make people fiddle around in the system more than those that are engineered more carefully.

I kind of thing that an approach of developing an understanding of where the problems are going to arise, you are going to have to crank that in during the analysis. It may be very difficult to translate one plant to another without some thoughts about that.

MR. HITCHLER: Well, just to respond to that. We found that in general all plants fit into either a winner and yoy stay a winner. Where you have problems, then those problems seem to go on for a while. I think that is what you are getting at, is that kind of thing. They tend to fall in two classes but it takes a about five to seven years to

really start to identify whether or not you are going to have something systematic out there.

MR. BENDER: All right. Black and white may be okay. I think there is a lot of gray out there.

MR. HITCHLER: Well, I agree.

(Laughter)

MR. HITCHLER: These are the seven analyses that are going to be required in terms of the initiators. You must arrive at initiating one frequency for these categories in terms of the transients and essentially broken them into transients with feedwater available after the trip, and transients without main feedwater available after the trip. Then, finally, loss of offsite power.

(Slide)

In terms of what really happened, my estimation is that there will probably be about ten transients that will be analyzed for a plant.

(Slide)

In terms of what is usually called support systems and event trees. We are going to enter there from the initiators, the standard techniques. The first step is going to develop a functional event tree.

We provide a template you should be using for all plants, for all three types of PWRs. That is similar to what Mr. Barnes mentioned, we are dealing with functions here.

reactor trip, inventory control, decay heat removal, and we are also analyzing the containment functions here.

The next step is once you have chosen which template is applicable to you, you then go back and find out what systems within your plant can be used to satisfy thise kinds of functions such as inventory control.

We provide lists of what are typical for all PWRs. That is essentially just picking out what may be out there.

Now, what is next done is to actually develop a support state model which I think is really where we are going to most likely find these outliers.

(Slide)

As part of this support state development program we've got these steps in the process, and let me just give you a couple examples what will happen. Essentially, the process in defining support -- interactions is going to be exactly the level that you would go into for a Level 1 PRA. We just don't feel there is any way to get around this, and the BWR approach has the same kind of emphasis.

Our basic working tools for this are going to be to develop a system dependency matrix and an impact vector. Let me just give you an example of what that looks like.

(Slide)

We feel that this is the best way for the plant personnel to get a feel for what is going on. A system

dependency matrix looks like this. In the previous section, we made up a lit of all of the front-line systems or systems that may be available in the plant that may be important to accident mitigation, which are listed on this side.

Up here, we list all of the support systems that may have interactions, and all you do is just go down here and just find out where the interactions may exist.

MR. DAVIS: Is that a complete matrix, or just an example?

MR. HITCHNER: That's an example.

MR. DAVIS: Okay because I don't see lube oil, or lube oil cooling, or some other things there.

MR. HITCHNER: Well, the lube oil tends to be -- from that standpoint, this will be complete. For example, the high pressure safety injection system will have lube oil. That will be a part of the front-line system. But the reason we show a component cooling water "x" here -- I hope -- is that you may need cooling water to cool that lube oil. So, that is where the interface would exist.

Or else, if it is an air-cooled lube oil system at another plant, it may just reject heat to the room. In that case, you would be dealing really with the service water chilling system. We show those kinds of interactions whether they are direct or indirect.

MR. MOELLER: Excuse me, on the chart, is it only

an "x" if one is dependent on the other?

MR. HITCHLER: If you have a direct or indirect dependency, which means that the system would fail within the mission time if you didn't have this available.

MR. MOELLER: Well, help me with, I guess, understanding. If you go down on the left column to instrument air system, or go down to HVAC system, then you come across and there is an "x" with the service water system, that's one example.

Okay, HVAC, you come across, there is an "x" under the service water system.

MR. HITCHLER: Right.

MR. MOELLER: Now, if you go across on service water system, you know, two lines up, there is no "x" on HVAC.

MR. HITCHLER: That's because the service water system is not dependent on the functioning of HVAC.

MR. MOELLER: But the HVAC is --

MR. HITCHLER: This plant has self-cooled pumps.

MR. MOELLER: Okay, that's what I needed to understand.

MR. HITCHLER: So, that's an example. That is not necessarily true for all plants. In fact, a lot of plants do need oil chillers.

MR. MOELLER: Sure. I understand it now.

MR. DAVIS: There are some that you are not sure about. There are some that may operate without HVAC or they may not. In that case, you'll have to do some kind of an analysis, I guess; is that right?

MR. HITCHLER: Exsctly. The method says, if you are not sure, put an "x".

(Laughter)

MR. HITCHLER: Now, the second part is to say, really, how good is your training orientation, then, which is really where I think you are going to find the outliers. Once you define where there may be depencencies, start going back and seeing if it is a plant that has three trains, some functions. For example, aux feed is a good example, there is an A, B, and C-type function.

This just tells you what systems may be functioning given that you have a certain combination of support systems. This is a busy slide here, I apologize for it.

(Slide)

But what the intent here is, that you come up with this matrix from the other analysis that gives you a train orientation. When you come over here, based on the method, we have rules for saying, you can't look at 32 support combinations, or a hundred, or two-hundred. That is too much for anyone to really recognize.

So, we give rules in saying, really, mostloss of

support function puts you into some kind of a simplified states. In other words, a loss of one train of component cooling, or one train of service water, or one power train essentially gives you a life-type function.

So, we are saying you really need to look at about six or eight ways in which the plant can reconfigure itself, given that you had an accident. You will start seeing what kinds of trains that you lose or function that you lose and can reconfigure the plant.

(Slide)

In terms of a system analysis, here is where the real savings are in terms of getting the insights in using the templates.

What I am showing here in terms of the accident sequence or systems modeling is what is going to be our basic process. What you can do here is, you can look at -- any time you are developing fault trees, you essentially start at the top here. You develop system level fault trees which essentially just say I have one out of two success criteria.

You then develop node level fault tree modules which tell you do you have any flow splits or power splits that may be unusual.

So then you do segment level fault trees which just say how many pumps and valves will have to be lined up in certain configurations.

What really burns up a lot of your time in terms of fault tree analyses is when you have to get down in here into the component level where you have to start to get into the individual relays, individual lumped wire terminals, things like that. That comes out here.

In terms of the in-core analyses, we are saying you truncate at this point if you can pass our applicability test. And what it says here is that every plant will derive these trees under very specific rules, and let me give you an example of how big these trees are.

Here is a system level tree. Very simple logics. I don't know if I have a copy in there or not.

Here is a node level tree and, by the way, I realize it's a lot of information and so what I have here is four copies that go into detail which I'm not going to go through. It also has these figures on it.

And then, finally, here is a large-scale segment level tree. What we are saying here in terms of this derivation is that for every system you are going to derive essentially three logic models. Each one of these logic models tends to be about a page, or a quarter of a page long. The idea here is just to structure people's thinking along certain lines.

(Slide)

Now, in terms of how you use the method once you have

structured this under the rules I passed out, we divide the world into plants with PRAs and plants without PRAs. No two PRAs have ever been done alike. So, one of our applicability tests is to say, how do you get the world to say, "Well, how good is yours? What kind of pedigree do you have on your system's qualification?

In terms of the models we provide, we give you that test. For a plant with a PRA we are suggesting that you derive these three, again. You then come down here and you do a comparison, and within the method we provide an IDCOR template saying that here is the level of detail that you should have gone down to to gain the insights that we are looking for, and compare your plant, how far that plant went down in detail.

They are plants that go down in further detail of what we are talking about here. But what you do is, you get a feel for what the pedigree is. You go down here and if you make it down to this point we are essentially saying two things: Your model has been found consistent with the IDCOR level of detail that we require and, even more important, you have a valid set of fault trees that other plants may want to use.

For plants without a PRA we are saying we follow this flow path.

(Slide)

In this flow path we are saying the same thing, the same basic process. You are going systems node, segment level fault trees. But what you do is, we have been building up a library of valid templates. The repository of that library we are suggesting be with the Owners' Groups. You can go out here and start finding matches from the template libraries to use on your plant.

The key point here is that we recognize some plants may have unique configurations. If they have those unique confirugations, all you do is, instead of using the template plants or surrogate plants, you go over here and we provide you the component level nodules, we just plug them in and do our final qualification. So, the process is continuous as to detail in meeting these tests.

So, at this point we have gotten down to the point where we actually have models that are valid that will present the as-built plants, where you have modified fault trees from other plants to make your models applicable.

(Slide)

The final segment in this approach is saying that no two plants are operated alike, that their operating experience may differ significantly. What we have come down to here is saying that we must do a test for what kind of operating data is appropriate for this plant and how to factor in plant-specific operating experience.

There are two phases in it. First of all is try to get a feel for how you define "generic." There are roughly six to nine generic data bases. We have ruled for how to pick a generic data base.

There is IREP here, there is design and Oconee-type data base, a rule for which one you should choose. We also provide a basis for how to collect data and how to limit the amount of data collection to what is meaningful. You don't want to do a seven man-year data assessment because it just doesn't give you that much pay-back.

There is a limited set of component data you should be collecting. We provide a specific set of data sheets to fill out for those limited components and actually how to calculate the values.

(Slide)

The final point is, how does the plant specific -- or the utility decide whether to use a generic data base or the plant-specific operating experience, which is the most meaningful?

So, we have provided an applicability test.

MR. DAVIS: It's not one or the other, is it? Generally, you combine these with a technique and come up with one that considers both. Is that what you mean?

MR. HITCHLER: That is what you would want to do but, remember, we are dealing with templates here we would

like to use, what is built up from other plants.

Also, there is a ground rule that we have imposed on us, in that at no time we have to use a computer to do your quantifications.

So, we have come up with essentially essentially an update curve for applicability. And what this says is, collect data as we prescribed. Find out what components you are dealing with. Find out what the whether the generic base should be the mean or approximately the mean, and what the error band should be or the upper bound should be.

Select the applicability curve. Then plot your plant-specific data on this curve. And this curve will tell you what to use.

Now, let me go through a quick couple of examples. Let's say you have very little operating experience at this point and a high number of failures. Let's say we have only five demands -- we are up in this area here. If you are up in this area, it just says that you don't have enough statistics to really justify anything. If you did a -- update, you would not see a change. So, just use the generic data.

If you would plot out here, it says that you are not just unlucky, there is something probably going on out there. You've got statistically valid data at this point. There is enough out there to say that what's happening here

means that you should go out there and take a look at what's happening.

If you plot down here, you win because you've got good practices, you've got enough data on hand for these kinds of components to say that you could use either the generic number and bound the problem or use your plant-specific numbers.

MR. KERR: Either that, or poor recordkeeping.

MR. HITCHLER: It could be either way. In this case we would say, use the generic data base.

(Slide)

This would just show what the final result would be. As part of the documentation we would be requiring that you provide these kinds of plots and also document your results in terms of this kind of a tabulation -- what the component was; what the generic data base was you used, and what the number was; what was your plant-specific data, and that will give the test that you are talking about. If we see something ridiculous in here, that says we've got very bad data collection.

And then, finally, you select which data piece you want and you refer back to the figures you are using in plotting this. It is a very quick and dirty way to get that kind of sudden insight and also provides you the documentation to see how faithful people are to using the

method.

(Slide)

The final step here, which is the most important, is the third degree of freedom in terms of the data base. We said we want to use as much of what people have used in the past as possible. We've got a similar system to Zion, we have shown it is configured essentially the same. You just do not have to requantify the Zion tree using using your plant-specific data.

Now, the Zion analyses or the fault analyses quantified using an updated set of data. So what you do is, you just use the same process I talked about before, but the first thing you have to do is say, "I used a template from Zion. What is Zion's data compared to the generic data base and what is my data compared to Zion and that data base?"

So, it's essentially a double check, going through the same forms that we went through a minute ago.

MR. KERR: Any questions?

MR. DAVIS: Westinghouse has developed a data base that they apply to PRAs, which is proprietary. Are you going to use that as part of your generic data base?

Incidentally, that data base doesn't agree with IREP in some notable cases.

MR. HITCHLER: There are variations.

MR. DAVIS: The thing I am worried about is,

eventually the NRC may take this methodology and apply it. If there are some proprietary elements of it, that might create some problems in the application.

MR. HITCHLER: Well, the data base we would be using here saying, when you select your generic data base you are going to be selecting the generic data base that was used for Zion or Oconee, IREP, or even the Millstone-3 data base.

MR. DAVIS: Which is proprietary.

MR. HITCHLER: Yes. And when one is running these tests, one can check these. Now, if there is a question on that, then I guess we are going to have to wait until we get into an actual application of this.

The variations that I have seen in terms of IREP versus the the Westinghouse data base, they show that sometimes you win and sometimes you lose.

MR. DAVIS: That's right,

MR. HITCHLER: We have been using the Westinghouse data base in terms of the containment sway pumps, for example. You win in terms of some of the gate valve numbers. So, it's that kind of a thing and generally you find that all those differences kind of wash out unless there is really something systematically wrong at the plant where you see an order of magnitude or two orders of magnitude in variation. That is really what we are screening for here.

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MR. BENDER: I do not think this question was within Dr. Kerr's category, that it can be answered "yes" or "no."

But your suggestion about Zion is a good reference plant reminds me that Zion is part of a class of plants engineered by Sargent & Lundy. Another class of plants is engineered by Bechtel. Another class is engineered by Gilbert, Stone & Webster -- I'm just picking a few.

MR. HITCHLER: Well, there are 14 classifications for Westinghouse plants alone.

MR. BENDER: I'm just sorting through my mind whether the character of engineering that is in those plants can be fitted some way into this data base. There is more to it than you might imagine because most of these organizations do things in a certain way and the data base stood if they followed similar practices.

If they don't follow similar practices, it is very dangerous to use the data base. I think that somewehre along the way you will have to address that matter.

MR. HITCHLER: Well, we have to some extent done that. We have recognized that is exactly why you may have to use the Millstone-3 data base. The most significant variations seem to occur, in my experience, in terms of Stone & Webster configurations versus the rest of the industry. That is not because they are bad, it's just that

it's a different philosophy in terms of containment protection that tends to impose certain types of benefits and debits.

So, we are taking that into account in the method. That is in fact why we feel that in some cases you have to go into more detail than I would like to on some parts of the model.

MR. KERR: Are there further questions? Thank you, Mr. Hitchler.

I want to declare a ten-minute break at this point.

(Whereupon, a 3 o'clock p.m. a ten-minute recess was taken.)

MR. KERR: We are ready to go.

MR. BUHL: The next speaker is Marc Kenton who will take about the PWR source terms that are in the program.

MR. KENTON: I guess everybody has to go through this initiation.

(Slide)

MR. KENTON: I'm going to talk about our methodology for assessing the containment response for PWRs.

This is a brief outline of what I am going to discuss. First, where we are coming from. Why we wanted to develop such a methodology. Talk about an important part in developing a methodology, namely understanding what controls the fission product releases so that you know what to zero in on when you look at different plants.

Our objectives in developing the methodology characterize the types of differences we see between plants. We call them scenario differences and parameter differences, and I'll explain what that means.

I talk about how we are going to extrapolate reference plant analyses to plants that are similar to the reference plants and I give a list of the scenarios and parameters I mentioned and then tell you where we are going.

(Slide)

This is basically where we are coming from. We think taking large dries, for example, that there is a large class of large dries that look sufficiently similar that one ought to be able to do analyses on a few of them and extrapolate the results to other ones.

As it says, when we have relatively small differences -- and part of this project is to figure out how small is small -- we are going to use sensitivity analyses to extrapolate the results from reference plants to these similar plants.

We will also determine when in essence this process breaks down in the sense that you really need to do a more detailed analysis. In that case, we recommend that people do standard computer analyses on those plants, in the IDCOR program, MAP analyses.

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To develop a containment response methodoloty, it's important to understand what controls the releases. Now, most PWR containment failure sequences fail the containment late in the sense that there is sufficient time between vessel failure and containment failure, such as fission products that get released from the primary system around the time of vessel failure have settled out.

There are some cases, however, where containment failure is early. In that case, the most important single aspect is primary system retention of fission products, and there we think we can make fairly generic conclusions because from the standpoint of primary system retention most PWRs look similar.

It goes without saying that the degree of primary system retention is sequence dependent, however.

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There are also a few containment features that are important. Obviously, if you have some active safeguards available to scrub fission products -- like an ice condenser or safety-grade van coolers -- that those can be very influential in cutting down the release of fission products to the environment.

The other feature that is very important in understanding the fission product release when containment failure is early is the debris configuration when it comes out, where

does it lie with respect to water pools? In other words, if the debris is under water, then whether it's coolable or not, you might expect a lot of fission product scrubging.

If it's under water and it's coolable, then you would not expect a lot of fission product release from the interaction with the concrete in any case.

(Slide)

Now, as I said, in most cases we find that containment failure is late and as I said, what I mean by that is that the sometimes large release of fission products directly from the primary system to the containment atmosphere settled out. That's the definition of late. In that case, the only way to get a significant source term is to essentially release fission products later in the sequence, and there are two ways that can happen.

You can release fission products due to concrete attack. So, it's very important to understand, again, whether the debris is submerged on the one hand, and if it's coolable on the other hand at the time of containment failure.

The other way you can release fission products is to revitalize them from the primary system. In many of these sequences you retain a large fraction of the cesium iodide, the cesium hydroxide in the primary system and they generate a lot of heat. If the temperatures get up above --

in round numbers -- 900, you start facing the potential that you revitalize a significant fraction of them, and those will be available for release when the containment does fail.

That dominated some of the source terms in the earlier IDCOR PWR analyses, but it looks like it is part of this effort that all the PWRs we have surveyed tend to lose heat from the primary system to the containment much more effectively than we have credited in the past. One can go to plants and find actual data where they do heat balances on the primary system and you find that they are much leakier than we assumed in previous analyses.

So, this specter, if you will, has become much diminished in importance.

(Slide)

So, in this large class of sequences where the containment failed, the situation is the following: Usually, the cesium iodide and cesium hydroxide releases are small if you credit realistic primary system heat losses.

Tellurium releases can be significant. The best understanding now on tellurium is that it gets bound up with unoxydized zircalloy when it is released from the fuel pellets and gets released later during core-concrete attack.

Well, it is not uncommon that you will have the debris come out and quenched and then boil all the water away,

if it's a station blackout, and you may find that tellurium gets released near the time of containment failure. So, that tends to increase the releases somewhat.

MR. MOELLER: Do you happen to know the critical organ for tellurium? I mean, if you inhale it or ingest soluble tellurium, what does it expose, predominantly?

MR. KENTON: I should know that because I just asked somebody last week. I can't remember.

MR. KERR: Please, continue.

MR. KENTON: So, except for these cases -- well, in fact in the vast majority of cases we have analyzed, we are actually dominated by noble gases when the containment failure is late.

MR. DAVIS: Excuse me. I thought there was a concern over the low volatile fractions for late containment failure, like lanthenum, barion, strontium, and I thought these things could dominate if you were to assume some of the releases calculated by the Sandia calculations.

MR. KENTON: Right.

MR. DAVIS: Is it IDCOR's position that those releases are not realistic and they won't be used in this evaluation?

MR. KENTON: We have done our own analysis which is still on-going, I should add, as part of one of these other three phases in IDCOR '85, namely the issue resolution phase.

We have done analyses that are similar to the kinds of things that have been reported elsewhere, where they got high releases. Our preliminary conclusion is that when you consider a wider range of compounds that can form, in particular, I believe, medisilicates, that much of this potential for release goes down.

There are other differences between the analyses having to do with the way the debris temperatures are calculated, for one thing, that a lot of these releases are non-volatile. In fact, they always depend on achieving fairly high temperatures which we generally don't see in our analyses.

So, I will say that our conclusion so far is that those releases of those non-volatiles don't seem to be risk important.

MR. DAVIS: But it's still an outstanding issue that hasn't been resolved.

MR. KENTON: That's correct.

MR. DAVIS: And likely will not be resolved by the time you are finished with this effort.

MR. KENTON: Well, I won't prejudge. It is something that --

MR. DAVIS: Well, you are going to finish this by the end of the year, is that right?

MR. KENTON: That's right. That is something that

remains to be discussed. Our resolution of that issue remains to be discussed with the NRC, I guess, in the near future.

MR. DAVIS: Thank you.

MR. KENTON: In other words, this hinges on the phenomenology IDCOR has developed, that is sort of an input to it. So, that is why I didn't mention that particular release mechanism.

MR. BENDER: I'd like to get a little bit more flavor about this tellurium released at the time when containment might fail.

When you say it will come out under some circumstances at the time of containment failure, are we talking about coming out abruptly, coming out over a period of time?

You are shaking your head. Tell me what it is.

MR. KENTON: No, I understand the question.

MR. BENDER: Okay.

MR. KENTON: Well, it depends on several factors. The release rate from the concrete tends to be fairly rapid. So, what you do is, you have a reasonable concentration of tellurium in the containment atmosphere, then what is the question? Well, if it comes out a few hours before the containment is going to fail, then it really hinges on things like, for example, how much inert aerosol do you make during concrete attack during that period.

The tellurium comes out typically when you get aggressive concrete attack and many people, among them Sandia, have predicted a relatively high concentration of inert aerosol produced at the same time, which tends to scrub the containment atmosphere effectively.

We have not credited that in most of our analyses, basically because we have an uncertainty about some of these trace elements in the various concretes that are responsible for these intert aerosols.

So, it is a question, really, of how effectively you remove the tellurium from the containment; when is containment failure with respect to the release of tellurium, and then how big is the containment hole. You have to resolve all of those issues separately to be able to define it.

In the IDCOR best estimate calculation where we have assumed leak before break, then the tellurium release is slow and typically is on the order of a percent or two of the inventory.

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So now we convinced ourselves that a simple methodology was possible because we think we understand what controls the releases. And these are the objectives we set for developing the methodology. We wanted it to be easy to use. Essentially sufficiently detailed to figure out if the kinds of releases we got from the IDCOR reference plants characterize

a new plant without necessarily getting tremendous precision.

We believe the proper place for detailed phenomenological uncertainty studies are on the reference plants rather than re-doing them for all the other plants.

We are going to try and zero in on key parameter differences and representative sequences.

(Slide)

The differences between plants that we have to characterize we think of as being two classes. There are what we call scenario differences which are just day-and-night differences with the way a sequence progresses. Usually in the PWR case, at least, due to some key design feature, for example, in a plant like Zion, if you have a high pressure failure, typically you predict that the debris that is dropped into the cavety at time of vessel failure gets blown out of the cavity into the lower compartment due to the high pressure gas and water that comes behind it.

There are a lot of other PWRs where the cavity design is such where you wouldn't expect that. So, that is a day-and-night difference between the way two sequences progress.

Now, on the other hand, there are what we call parameter differences which are sort of more mathematically smooth, if you will. Maybe the area available for concrete attack in one case is twice what it is in another case.

(Slide)

When we have two plants where we expect the same scenario, the same sequence of events, to occur, we propose the use of that formula there which one can show is exactly true in the limited small parameter variation. Namely, you perform one-at-a time variations on the key geometrical parameters and you can then extrapolate in a straight-forward way to a new plant that has different parameter values.

So, the key thing is, when does that procedure break down. Well, so far the experience is that it works for non-trivial differences in parameter, but eventually it does go awry.

So, our key thing here is to figure out what class of plant can we use this procedure on. And when we can one key place where it does break down is where a parameter variation gets large enough so that the sequence events change. So we have to be alert to that.

(Slide)

So the procedure we have come up with is the following: For dominant sequences, we perform these one-at-a time variations to get these first order sensitivity coefficients to tell us how much the bottom line depends on the various geometrical parameters.

We also have to re-do this whole procedure when the scenario is different and then, when it is clear that a new

plant has the same scenario and is sufficiently close, we can use the formula I just showed you to extrapolate the results. Otherwise, we just go back and re-do the computer analysis.

(Slide)

This is a tentative list of all the scenarios which is based on looking at all the IDCOR members' PWR containment design. It looks like all ice condensers, for all intents and purposes, look similar. And then there are various other cases -- I won't read them all -- basically having to do with, where does the debris go and where does the water go.

I think about the most important parameters that we have to account for, what we did was zero in on those phenomena that seemed to control the releases and focus on those parameters that are going to influence those phenomena and which do indeed change when you look at different plants. This is tentative and I'm sure we will add more parameters to this as we get into the analysis itself. A list of some of these parameters should seem to be very important.

(Slide)

So where we are going, we are going to pick representative sequences that will test the various aspects, the various phenomena on which these containments respond. We will figure out these sensitivity coefficients for all these various scenarios, for all the parameters that we have

identified as important, and then maybe the most important step, we are going to take all these sensitivity coefficients and scenarios and apply them to two relatively different plants than ehe ones we derived these coefficients from, namely Oconee and Calvert Cliffs, and see how well we do extrapolating the results.

Then, we are also going to determine criteria which a guy will have to confront which will tell him when essentially you can't guarantee that this procedure is sufficiently accurate and where he needs to just go off and do the analysis from suqare one.

MR. DAVIS: Question. You didn't say anything about the V sequence and I'm curious to know as to whether or not you have evaluated the prospects for that break being under water in any other plant but Surry.

MR. KENTON: Well, one thing, we didn't do Surry. The two plants that we considered were Zion and Sequoyah, in neither one of which it looked like the break would be under water.

As I understand it, auxiliary building designs vary all over the map, and we have not made any more extensive study of the various designs to find out how many of them fall into the class where it is under water.

I guess as far as the V sequence itself goes, it at this point is an open issue. The Zion releases where the

break was not under water were very small, essentially due to extremely long residence times in a big auxiliary building.

MR. DAVIS: Well, part of the reason was because you didn't get a pipe rupture, you got a pump --

MR. KENTON: We had the seal sensitive to that break size, that's quite right. That influences the resident time among other things.

So I guess all I can say right now is, we are reserving judgment on whether we will have to do the same kind of procedure. If we do, essentially we will do the same thing but focused, instead, of the auxiliary building maybe, rather than the containment.

MR. DAVIS: Thank you.

MR. KERR: Are there other questions?

Thank you, Mr. Kenton.

MR. BUHL: Our last speaker, Dr. Kerr, is Jeff Gabor. He will talk about the BWR source term assessment.

MR. KERR: I take it, since they weren't mentioned, that you conclude that your results agree well with those that the staff expects to get from their methodology.

MR. BUHL: Is that a comment or a question?

MR. KERR: Well, since it wasn't mentioned, I just assumed there was no basic disagreement. I would assume that if there were wide divergences, somebody would say something about this.

MR. BUHL: Well, let me say two things. One is, preceding this methodology there is a large set of technical issues, and you have heard what those were this A.M. at least. Those, we are working with the staff to converge.

Second, it's my understanding that the staff is not independently developing this whole set of methodology but rather going to review the work we are doing, comment correct and what not and we will hopefully be able to utilize that. But I don't think that there is a direct --

MR. KERR: No, but the staff is developing a fairly significant -- at least in terms of volume -- method for calculating source terms.

And in this, I think, we are not getting the detail here that we get from the staff on estimating or calculating source terms.

MR. GABOR: I will discuss the BWR containment response methodology.

(Slide)

The BWR treatment is identical to the PWR treatment, so there is no need for me to go through the steps that Mark took you through on defining the accident scenarios and the parameter variations, and how these will be utilized to extrapolate the reference plant results onto other plants being analyzed.

What I will focus on is to point out the things in

a boiling water reactor that tend to control fission product releases. The objectives, of course, are the same. We will first pick our sequences just like the PWR approach. Once we have sequences, we will look at variations in those, the scenario variations that Mark spoke of.

We will move on to look at parameter variations and calculate the sensitivity coefficients, which will then allow us to extrapolate to other plants.

Again, the focus is going to be on tryuing to show or trying to find out, determine if a specific plant can be categorized using the IDCOR referenece plant results.

(Slide)

My outline is similar to Mark's. I am going to discuss the sequences, some scenario variations, and then I will take a look at an example of scenario variations by looking at various containment types. I will discuss the parameter variations and then to the plan of attack.

Finally, I have some current results showing you some of the importance of several of these in this case operator reactions on fission product releases.

(Slide)

Mr. Burns showed some sequences for the BWR up-front analysis, and he came up with five major classes. What I have done for the containment analysis is break that down or to combine a couple of those such that I end up with three

classes which are consistent with his.

They mainly represent cases where the containment is intact at the time of core melt or at the time of vessel failure. That would be the first class.

The second class would be those sequences in which the containment was breached prior to core melt.

Then, last, the interfacing LOCA with early core melt.

Examples of those could be, for the first case where we have the containment intact at the time of core melt, a station blackout sequence, a large or small LOCA sequence. We realize that there are differences in some of the timings of release and there are differences in the distribution of fission products. But again, all in all, when you look at all the sequences in Group 1, they all have a core melt, a period of time, and then containment failure. So they all tend to look similar in fission product releases.

In the second group I have lumped together the ATWS or TC sequence with the TW. Again, they both have the containment breached at the time of core melt. The major difference between those two sequences and Group 2 is timing, and we will definitely be aware that there is a difference in timing.

And then the last case, interfacing LOCAs, are the V sequence.

(Slide)

Again the seauence definition tells us two things. It defines the i itiators and it also tells us something about the timing of the initial fission product release from the fuel.

(Slide)

The BWR characteristics that tend to control fission product releases are shown on the next slide here. I won't go through every one of these, but I will discuss number one and the next couple of viewgraphs show some examples of this, number one being core debris distribution. They are among the MARK I, II, and III. There are some plants that will have the debris spread out on the pedestal and drywell floor. There are other containment types that would allow the debris to drain into the suppression pool.

Again, this kind of a variation would change the order of events or the order of key events in the sequence and therefore those cases have to be analyzed and fission product releases assessed for each one of those.

Containment failure locations. Thirdly, the wet-well venting. That is an important issue and it will be looked at for all containment types, and you can see the other list there.

(Slide)

Looking at debris distribution in a little more

detail, I included a couple of slides to show so far in the IDCOR program the differences we found among BWRs, and here I am looking at the MARK I containments.

There could be a potential for MARK I containments, in this case like Peach Bottom, to have the debris pretty much spread out on the drywell and pedestal floor.

MR. CATTON: Did you include the possibility of breach right beneath that pipe that goes into the --

MR. GABOR: Right here?

MR. CATTON: I understand that once you melt through the metal, you have a path outside. The pipe is not cast in concrete.

MR. GABOR: I think that from what I have heard, that is somewhat plant specific, depending on what kind of fill they have down there and the kind of gap that they have in the shell.

One thing that we have done in the earlier IDCOR work as part of our uncertainty analysis is look at what effect that would have on fission product releases. Based on some work that was done at Sandia, we analyzed a case in which we varied the time or, in this case, the temperature at which the drywell was assumed to fail. We looked at the differences in fission product releases for those cases and found very little.

Again, we found differences in timing but not really

major differences in the amount of fission product that got out.

The current plan is to not focus on phenomenological uncertainties. That was handled before and there is a place for that. This task is to basically compare plants and see if a given plant acts any differently than, say in this case, Peach Bottom would.

MR. CATTON: For this case. To me that would be a major difference and you could breach very early. I would think this would fit into your little table where you note differences or something.

MR. GABOR: Again, we note differences in timing of containment failure, and that would definitely control the timing, containment failure.

MR. CATTON: I would put it almost at the time of vessel failure.

MR. GABOR: Possibly for a sequence like TC or TW where the containment was already breached, we may have a release that already takes care of that. That is one thing we are going to try to do, have enough release bins that we can categorize variations like this.

The bottom picture shows a case where the debris could be held up in the pedestal.

(Slide)

MARK IIs have probably a wider variation in debris transport. One thing I might add is what we have done in the

issue resolution report where the issue resolution task was to categorize all the cavities, geometries in PWRs, that same thing is being done now for generic applicability or for source term assessment for boiling water reactors and it is on-going right now.

What we have found so far is that you can pretty much boil the MARK IIs down into these three categories. There are MARK IIs where the debris could spread out on the pedestal and drywell floor and via the downcomers in the drywell drain into the suppression pool.

There are MARK IIs where there could be the potential for a path for debris to drain directly under the vessel itself.

And then the bottom picture shows the case where -- it looks somewhat like a MARK I -- where the material is actually held up and does not drain into the suppression pool. So, release fractions will have to be calculated for each one of these scenario types.

(Slide)

And then the MARK III is straight forward with the exception of possibly some material being distributed, dispersed out into the drywell at vessel failure. The majority of the material is going to be localized down into the pedestal region below the vessel.

Again, those are the types of things that will change

the order of key events in the sequence and demand that we look at them as a variation and assess the fission product releases for those various cases.

(Slide)

The parameter variations, as Mark Kenton pointed out before, those things may not change the order of key event. A note I put at the top here is that these variations might not be important for every sequence, they might not be important for every containment type.

I won't go through this list. One thing at the bottom I will touch on just for an example. On the secondary containment we found that there could be some sensitivity to how the ventilation system in the reactor building operates. Some systems have fire dampers, some don't. The type of isolation for the ventilation system can be different between reactor buildings, and we will definitely look at those variations when we analyze these plants.

(Slide)

So, where we are going is to pick a couple sequences from classes of sequences, and I have chosen the TC and the station blackout to represent the spectrum. The methodology is flexible enough such that we can add new sequences if we find great variations. We will finalize our scenarios and we will calculate the sensitivity coefficients. That will then allow us to extrapolate our results to the other

plants. We will re-evaluate the reference plants, and in this case Susquehanna will be evaluated as a reference plant, as a MARK II reference plant.

Then, as mentioned before, we will decide just where a plant or when a plant would fit inside of the range that we have set out or, in other words, what plants can be applied to the reference plant result.

(Slide)

Along the lines of trying to decide or trying to evaluate how important some of these operator actions or phenomena could be, there have been a few studies that we have done as part of IDCOR.

The top one was done as part of the Task 23 work where we analyzed the MARK I, assuming that we vented the wetwell in some cases and not in the others. Of course, venting the wetwell is going to avoid the containment over-pressure failures. It is going to help maintain suppression pool scrubbing, and it could give us something in the neighborhood of a factor of a hundred or more reduction in the releases as a result of suppression pool scrubbing. So, it is an important operator action.

Drywell sprays again has an impact on the fission product removal in the containment. It can serve to cool the debris if it is out on the floor and, of course, drywell sprays in conjunction with some sort of containment heat

removal for certain sequences could prevent containment failure altogether.

Somebody touched on this aerosol plugging business this morning for cases where there is a very small pressure differential between the containment and the outside world, and there are very small -- fairly small -- leakage paths developed. Aerosol plugging will help maintain suppression pool scrubbing and, by doing that, it is going to give us something in the neighborhood of a factor of ten or more reduction in the release for the specific sequence.

That's the end of my presentation.

MR. KERR: Are there questions?

Mr. Lee?

MR. LEE: What aspects of this analysis could be potentially affected as you go through generically trying to resolve the differences between an -- methodology and IDCOR methodology?

MR. GABOR: I don't think I understood the question.

MR. LEE: Some of these items that you like to single out for analysis, in trying to count the differences between plants, may it become more important, less important -- depending upon some of these outstanding technical issues -- how they are resolved. Am I correct?

MR. GABOR: MOst of the features of a BWR that tend

to control fission produce releases are things such as suppression pool scrubbing, venting of the wetwell, containment sprays, a lot of operator action type things.

I don't think they are dependent on technical issue resolution. The plugging issue might be. Again, the technical report on issue resolution is going to be passed out in the next few weeks and we feel that in that report we have laid out a good methodology, or a good technical basis for calculating plugging of the containment.

MR. BUHL: If I might inject, I think your question points out one of the reasons we want to get on with this issue resolution, one of the reasons we are pressing to close that because, as you note, some of these issues could in fact impact the validation of the methodology, the methodology itself.

So, it's in our great interest to close those technical issues.

MR. KERR: Are there further questions? Thank you, Mr. Gabor.

Do any of you haVe any further comments or questions, those of you around the table? Mr. Buhl?

MR. BUHL: Dr. Kerr, we appreciate the opportunity to show you what we are doing today, and we certainly -- at least at this point -- are enthusiastic about getting on with the job and doing the methodology validation on the seven

plants, and hopefully by the end of the year we will be able to tell you how successful we were, and hopefully we can get on with looking for these outliers in a broader way.

MR. KERR: Mr. Howard, any further comments?

Mr. Rosztoczy?

MR. ROSZTOCZY: Yes, Mr. Chairman, I would like to make a few closing comments on the staff's behalf.

I would like to comment on two issues where you expressed some concern today during the course of the meeting. The first one is the external events.

We are planning to look into this issue. We are going to decide what consideration to give to this issue and what approach to follow on this issue. We would like to discuss these items with you at our next meeting probably in December.

The second comment led to the treatment of human factors in the evaluations. We have also heard some concern in that area and we are going to look into those. We are going to incorporate it in our work as it is appropriate.

The third item is kind of a request soliciting your comments in that other area. You heard this morning Jerry Harman's presentation on the potential changes in the regulations based on the source term.

We have also received a letter from an Atomic Industrial Forum subcommittee that have looked at the same

issue, and they have prioritized some areas that they consider are appropriate for some kinds of changes. We will be discussing that with the Atomic Industrial Forum in the coming months.

We would like to solicit your comments on the ten items that were in Jerry's presentation with respect to potential changes in those ten areas. And if we could get those comments somewhere in the near future, like in the next few months, we would appreciate it.

MR. KERR: I think we have tentatively planned on asking for a presentation of some of the source term work and that sort of thing at the September meeting. If that is soon enough, that is the schedule that I would probably try to work toward.

I am reluctant to ask the committee as a whole to comment on those ten issues without having at least some staff presentation. So, unless September is too late, I would not propose to consider that issue at the meeting next week.

Is September soon enough for comment?

MR. ROSZTOCZY: September would be fine, even if it's within the next few months it would be all right.

MR. KERR: It is my own view that we ought to say something fairly soon about external events simply because I think there will be a considerable -- I don't know about a

majority but I'm sure there are strong views on the committee that external events have to be considered in some fashion. I don't think we have a strong feeling about the appropriate methodology. Indeed, when we talked about a systematic review program, we certainly -- although we do appreciate the staff reading our letters, I think that letter was meant to be not a recipe as much as it meant to be a list of suggestions of things that we considered important.

I would expect, indeed I will certainly report to the committee at the August meeting that at least so far as I can tell, the present plans seemed not to emphasize or maybe even not to consider external events in the systematic review. I think the committee may want to comment on that. I will suggest that it give serious consideration, at least to comment.

MR. ROSZTOCZY: The statements that we have made today were that we are looking into what approach to follow to include it, and we were unable to present it to you. We think that we will sort this out in the coming months, and we will be able to give you a complete plan in December.

MR. KERR: Okay. Do any of our consultants or the remaining faithful committee member have any comments at this point?

MR. DAVIS: I had one, Dr. Kerr, that I think has some implications on the external events. If one examines the

trend in bottom-line PRA results -- and I recognize there is a dispute over how meaningful those are -- it seems to me there is a couple of important things that come out.

One of them is that the risks of both early and latent fatalities has been trending downwards from WASH-1400, and in fact at least for the large dry PRAs which seem to be the most numerous there is substantial margin between the results and the safety goals.

On the other hand, the core melt probabilities have been going in the other direction, and in fact there are some, several PRAs, now showing core melt probabilities above the safety goals.

In my mind, there are two implications to this. If in fact the safety goals have some validity and if the PRA results have some validity, then one might conclude from this that we should be paying more attention to the prevention side of the problem because it appears that is where things are becoming a problem, just comparing these results with the safety goals.

I don't see that emphasis in the NRC's program, but I recognize you have to work both sides.

The other implication is, to me anyway, that this means that external events may not be so important because they don't contribute to core melt probability generally, and even though they may be dominant contributors to risk, the

overall risk is extremely low and one might conclude they are so low as to not be of significant concern.

Now, I recognize when I say this that the PRAs I am talking about have made some assumptions about source terms not all of which are reflected in what we have seen in the NRC's new methodology, and there is, I am sure, some dispute over whether the source terms are valid that have been used in these PRAs.

But notwithstanding these problems, it seems to me if these trends are valid and if the safety goals are valid, there are at least two implications in the results, and I would like to hear any other comments along those lines that people might have who have looked at the PRAs and have some feelings in this area.

MR. KERR: Thank you, Mr. Davis. Does anybody else want to comment? I think those comments were significant.

I also should emphasize that I guess I have some skepticism about the contribution, or at least the uncertainty in the contribution of seismic events to core melt or to risk.

Nevertheless, a significant number of PRAs do show this, and it seems to me that if one is going to develop a method for systematic analysis, one either has to take the position that those results are not very meaningful, or else one has to deal with them. Fire is another one, and I assume -- I never quite know whether it's internal or external. I'm not

sure what an external fire is.

But as much effort as has been spent on Appendix R compliance, it seems to me to ignore this just does not make sense. It ought to at least be demonstrated as unacceptable or maybe no effect, but I don't think it ought to be ignored.

And flooding, external flooding, it seems to me, is in the same category. I do not see how you can ignore it. It may be easy to treat -- well, that is enough. I have said enough on that today.

Mr. Bender?

MR. BENDER: I can't stand it not to offer two sentences at this stage.

(Laughter)

MR. BENDER: On the seismic business I think we have to think in terms of the point of departure for the designs that involve relatively low seismicity, where the seismic contribution is small compared to other structural considerations. An incremental increase may not make all that much difference because it doesn't have the fraction of the loading that's associated with the seismic effect. It is just not large.

I think you have to look at it for the places where the seismic increment is very large initially, then I think you got a good bit more attention to what the implications might be of changing the seismicity or misevaluate it.

Hopefully, we have always urged on the conservative side. But I am not at all sure that I know that much about the selection of parameters that are being evaluated to be certain that is the case.

On the fire protection side which you have mentioned, my intuitive judgment is that we have spent a lot of money correcting nits and haven't changed the fire potential much. The probabilistic analysis may bear out the fact that we have overreacted to some concerns that may not be correctable in the manner in which we try to correct them.

I am not unknown for my criticism of Appendix R, so I'm obviously prejudiced in that present viewpoint. But nevertheless, if you look at the corrective measures, they only improve things in certain locations and the average improvement may not be large. I think when we start looking at these things in some kind of quantitative sense, we may find out that the improvements are not overwhelming.

That may mean that in the future we may look at fire protection as just one.

MR. KERR: Thank you. Mr. Lee, do you have anything to add to this wisdom?

MR. LEE: No.

MR. KERR: Let me thank all of you for your participation and patience today. The meeting is adjourned.

(Whereupon, at 4:01 p.m., the subcommittee adjourned.)

CERTIFICATE OF OFFICIAL REPORTER

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

Name of Proceeding: Subcommittee on Class 9 Accidents

Docket No.:

Place: Washington, D. C.

Date: Friday, August 2, 1985

were held as herein appears and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission.

(Signature) Mary C. Simons

(Typed Name of Reporter) Mary C. Simons

Ann Riley & Associates, Ltd.

NRR STAFF PRESENTATION TO THE ACRS

SUBJECT: POTENTIAL LICENSING USES OF SOURCE TERM RESEARCH

DATE: AUGUST 2, 1985

PRESENTER: L. G. (JERRY) HULMAN

PRESENTER'S TITLE/BRANCH/DIV: CHIEF, ACCIDENT EVALUATION BRANCH
DIVISION OF SYSTEMS INTEGRATION, NRR

PRESENTER'S NRC TEL. NO.: 492-7880

SUBCOMMITTEE: SEVERE ACCIDENT

10 GENERAL AREAS OF REGULATORY OVERSIGHT

DEPENDENT UPON ACCIDENT SOURCE TERMS

BACKGROUND & CURRENT PRACTICE

POSSIBILITIES & CHARACTER OF POTENTIAL CHANGES IN PRACTICE

PRELIMINARY COST/BENEFIT ASSESSMENT

SCHEDULE FOR IMPLEMENTATION PROPOSED

AREA 1

SEARCH FOR RISK OUTLIERS TO USE SOURCE TERM RESEARCH
TO IMPLEMENT SEVERE ACCIDENT POLICY

- O IDCOR METHODOLOGY DEVELOPMENT
- O NRC REVIEW
- O INDUSTRY APPLICATION

AREA 2

CONTAINMENT PERFORMANCE

PRESENT PRACTICE

- O TID-14844 LOCA DOSE ASSESSMENT WITHOUT KNOWN FISSION PRODUCT ATTENUATION MECHANISMS ASSUMING RELEASES OF ONLY NOBLE GASES & IODINE

- O CONTAINMENT LEAKAGE EMPHASIZED, NOT CONTAINMENT ULTIMATE STRENGTH

- O INSTANTANEOUS ELEMENTAL IODINE ASSUMPTIONS FROM TID-14844 CONTROLS CURRENT PRACTICE.

- O DBA LOCA THAT RESULTS IN FEW OR NO FUEL FAILURES USED TO ESTABLISH DESIGN TEMPERATURE & PRESSURE. AEROSOLS NOT CONSIDERED

POTENTIAL CHANGES - SHORT TERM*

- O REASSESS BASES FOR LOW LEAK RATES & TESTING FREQUENCY WITH EMPHASIS ON CONTAINMENT INTEGRITY & CONTAINMENT TYPE

- O CONSIDER ADMINISTRATIVE CONTROLS OR PENETRATION GUIDELINES TO IMPROVE DETECTION OF CONTAINMENT BREACHES

- O CONSIDER TESTING REQUIREMENTS FOR CONTAINMENT BREACHES

- O MODIFY CLOSURE TIME CRITERIA FOR VALVES PENETRATING CONTAINMENT

* BASES FOR CHANGES WILL REQUIRE

1) MECHANISTIC ANALYSES OF FISSION PRODUCT TRANSPORT
2) DETERMINATION OF LEAKAGE PATHS IMPORTANT TO RISK
3) EXPLORE VIABILITY OF MONITORING INTEGRITY
4) DEVELOP BASES FOR TECH SPEC REVISIONS

AREA 3

ENVIRONMENTAL QUALIFICATION OF EQUIPMENT

BACKGROUND & PRESENT PRACTICE

- O TID-14844 BASED SUBSTANTIAL CORE-MELT RADIATION LEVELS
- O TEMPERATURE & PRESSURE CONDITIONS CONSISTENT WITH A LOCA PRODUCING ONLY A FEW % FUEL FAILURES
- O TMI INFORMATION BEING EVALUATED
- O SOME BEYOND DBA SURVIVABILITY BEING IMPLEMENTED THRU H_2 RULE

POTENTIAL CHANGES

- O UNKNOWN, BUT TO BE STUDIED IN TERMS OF:
  1) EQUIPMENT FUNCTION
  2) POTENTIAL MARGINS
  3) RELATIVE CONTRIBUTIONS TO RISK
  4) TMI INFORMATION
  5) CHEMICAL & PHYSICAL FORMS AND QUANTITIES OF FISSION PRODUCTS AND NON RAD AEROSOLS

AREA 4

EMERGENCY PLANNING

PRESENT PRACTICE

- O TID-14844 & WASH-1400 BASED
- O 10 MILE PLUME EXPOSURE EPZ AND 50 MILE INGESTION EXPOSURE EPZ
- O FEMA EVALUATES STATE AND LOCAL PLANS AND PREPAREDNESS

POTENTIAL CHANGES

- O CORRECT MISCONCEPTION THAT EVACUATION ALWAYS REQUIRED TO 10 MILES OR FURTHER
- O USE CONCEPT OF GRADED RESPONSE THAT RECOGNIZES RISK VARIATIONS WITH DISTANCE & TIME
- O CONSIDER RISK VARIATIONS OF REACTOR TYPE & SIZE

PROPOSED ACTIONS

O DRAFT REVISIONS TO 10 CFR 50 BASED UPON NEW SOURCE TERM INFORMATION CONSIDERING 3 ALTERNATIVES

1) PLANT CLASSIFICATION BASED UPON APPARENT RISK PROFILE

2) SITE SPECIFIC EMERGENCY PLANS

3) GRADED RESPONSE

O REVISE GUIDANCE DOCUMENTS (I.E., FEMA/NRC NUREG-0654, NUREG-1082)

O COORDINATE WITH EPA ON POTENTIAL CONFLICTS WITH PROTECTIVE ACTION GUIDES

AREA 5

ACCIDENT CONSEQUENCES & INDEMNIFICATION

PRESENT PRACTICE

- O ONSITE PROPERTY DAMAGE INSURANCE REGULATED THROUGH 10 CFR 50.54(W)
- O OFFSITE INDEMNIFICATION UNDER PRICE/ANDERSON
- O E.N.O. DETERMINATION CRITERIA (10 CFR 140) SET WELL BELOW CONSEQUENCES OF MANY SEVERE ACCIDENT RELEASES
- O NEPA EVALUATIONS OF ACCIDENTS

POTENTIAL CHANGES

- O DETERMINE IMPACT OF RESEARCH ON PROPOSED AMENDMENTS TO ONSITE REQUIREMENTS, REVIEW NUREG/CR-2601, AND PROPOSE RULE CHANGE IF NECESSARY
- O CONSIDER ADVISING CONGRESS OF CHANGES IN OFFSITE RISK PERCEPTION IF WARRANTED
- O USE NEW METHODOLOGY IN FUTURE NEPA REVIEWS (STARTING WITH SOUTH TEXAS OL REVIEW)

AREA 6

AIR FILTRATION & OTHER FISSION PRODUCT ATTENUATION SYSTEMS

PRESENT PRACTICE

- O FOR ACCIDENTS IODINE ASSUMED TO BE PRIMARILY I_2, BUT ROUTINE RELEASES OBSERVED TO BE PRIMARILY CH_3I.
- O PWRs HAVE SPRAY ADDITIVES FOR I_2 CONTROL OF INITIAL RELEASES AND SUBSEQUENT RE-EVOLUTION FROM SUMPS.
- O BWR SUPPRESSION POOLS & CONTAINMENT SPRAYS ARE PRESENTLY NOT CREDITED WITH FISSION PRODUCT ATTENUATION
- O INSTANTANEOUS FISSION PRODUCT RELEASE ASSUMED.

POTENTIAL CHANGES

- O ELIMINATE NEED FOR AUTOMATIC INJECTION OF CAUSTICS IN CONTAINMENT SPRAYS AT PWRS, BUT CONTINUE TO REQUIRE CONTROL OVER SUMP PH

- O CREDIT BWR CONTAINMENT SPRAYS AND SUPPRESSION POOLS

- O DO NOT BACKFIT ELEMENTAL IODINE FILTER GUIDANCE & DEVELOP REPLACEMENT GUIDANCE FOR IODINE, OTHER FISSION PRODUCTS & AEROSOLS IN BOTH ROUTINE AND ACCIDENTAL RELEASES.

AREA 7

ACCIDENT MONITORING & MANAGEMENT: ONSITE AND OFFSITE INSTRUMENTATION

PRESENT PRACTICE

- O MONITORS FOR TID-14844 RADIATION LEVELS OR GREATER (REG. GUIDE 1.97)
- O OFFSITE MONITORING INSTRUMENTATION REQUIRED

POTENTIAL CHANGES

- O REASSESS INSTRUMENTATION REQUIREMENTS REQUIRED TO FOLLOW COURSE OF ACCIDENTS
- O REASSESS OFFSITE INSTRUMENTATION NEEDS BECAUSE OF CHANGES IN TIMING & FISSION PRODUCT MIX TO DETERMINE ADEQUACY OF 10 CFR 140
- O EVALUATE EVOLVING RESEARCH ON ACCIDENT MANAGEMENT

AREA 8

OFFSITE CONTAMINATION & RECOVERY

PRESENT PRACTICE

- O PRESENTLY BASED UPON WASH-1400
- O INCLUDES HEALTH EFFECTS, PROPERTY DAMAGE, CROP INTERDICTION, EVACUATION AND DECONTAMINATION COSTS, & USES OF KI
- O USED TO ASSESS PREVENTION & MITIGATION FEATURES
- O INFLUENCES PUBLIC OPINION

POTENTIAL CHANGES

- O HAS INFLUENCED POLICY ON USE OF KI
- O POTENTIALLY LOWER LEVELS OF OFFSITE CONTAMINATION, FOR PLANTS LIKE SURRY, BUT WE DON'T KNOW ABOUT OTHERS

POTENTIAL CHANGES

O REASSESS DESIGN BASIS ACCIDENT METHODOLOGY. FOUR ALTERNATIVES:

1) MAINTAIN STATUS QUO BASED ON CONSIDERATION OF CONSERVATISMS

2) MODEST CHANGES TO TID-14844 RELEASE ASSUMPTIONS

3) RESTATE DBA

A) DETERMINISTICALLY USING THE PRESENT TYPE OF DOSE ACCEPTANCE APPROACH

B) ESTABLISH ESF PERFORMANCE CRITERIA FOR ESFS

4) USE OF RISK BASED APPROACH

O BACKFITS ON EXISTING PLANTS, OR ADDED SAFETY FEATURES ON NEW DESIGNS, LIKELY TO BE LESS COST-EFFECTIVE.

AREA 9

SAFETY EVALUATIONS

PRESENT PRACTICE

- O FOR SCREENING NEW SAFETY ISSUES STAFF USES WASH-1400 SOURCE TERMS IN ASSESSMENTS OF

  1) RISK IMPORTANCE AS INDICATED BY 50 MILE POPULATION DOSE

  2) VALUE/IMPACT OR RATIO OF RISK REDUCTION TO TOTAL COST (INDUSTRY AND NRC)

- O FOR ASSESSING BACKFITS USE MORE DETAIL IN VALUE/IMPACT ASSESSMENTS, BUT IN SOME CASES USING NEW SOURCE TERM INFO

- O LICENSING REVIEWS, INCLUDING AMENDMENTS, OFTEN USE TID-14844 ASSUMPTIONS OF NOT ONLY FISSION PRODUCT RELEASES, BUT OTHER ASSUMPTIONS OF TRANSPORT, DEPOSITION & BIOLOGICAL UPTAKE

AREA 10

SITING

PRESENT PRACTICE & BACKGROUND

- O TID-14844 WITH LOCA, SUBSTANTIAL CORE MELT, AND NO CONTAINMENT FAILURE COUPLES SITING & PLANT DESIGN THRU EVALUATIONS OF

  1) EXCLUSION AREA BOUNDARY

  2) LOW POPULATION ZONE

  3) PERFORMANCE CRITERIA FOR CERTAIN ESFS

- O CORE MELTS WITH CONTAINMENT FAILURE INFLUENCED REMOTE SITING, SUPPORTED BY WASH-1400

- O EXCLUSION AREA DISTANCES OF 0.4 MILES & 500 PEOPLE/SQ MI TO 30 MILES PROPOSED IN 1975

- O 1979 RECOMMENDATION TO DECOUPLE SITING & DESIGN (NUREG-0625) THROUGH RULEMAKING

- O 1980 RULEMAKING INITIATED, BUT SUSPENDED IN 1981 PENDING EVALUATIONS OF SOURCE TERMS & SAFETY GOALS

POTENTIAL CHANGES

1. DBA

   O DEVELOP NEW SITING DBAs & PERFORMANCE CRITERIA FOR ESFs

   O ELIMINATE DBAS FOR SITING EVALUATIONS & REPLACE WITH REQUIREMENTS FOR MINIMUM COMPLIMENT OF ESFS WITH SPECIFIC PERFORMANCE CRITERIA & A MINIMUM SET OF SITE CHARACTERISTICS

2. BEYOND DBA

   O RECONSIDER REMOTE SITING POLICY USING NEW SOURCE TERMS INFO THRU RISK REBASELINING

ENCLOSURE 3

PRELIMINARY BENEFIT-COST SUMMARY OF AREAS TARGETED FOR SOURCE TERM RELATED CHANGES

REGULATORY AREA	COSTS	BENEFITS	CHANGE IN REGULATORY REQUIREMENTS*	IMPLEMENTATION TARGET
1 IDCOR-NRC Staff Search For Risk Outliers		TO BE DETERMINED		
2 Containment Performance				
Near Term	Low	High	D/I	1-2 years
Future	Unknown	Unknown	D/I	U
3 Equipment Qualification	Moderate to High	Moderate to High	D/I	2-3 years
4 Emergency Planning	Moderate	High	D	1-2 years
5 Accident Consequences & Indemnification	Unknown**	Unknown**	U	1-2 years
6 Air Filtration & Other Fission Product Attenuation Methods	Low	High	U	1-2 years
7 Accident Monitoring & Management Onsite & Offsite Instrumentation	High	High	U	1-2 years
8 Offsite Contamination & Recovery	Low	High	D	1-3 years
9 Safety Issue Evaluations	Moderate	High	U	1-2 years
10 Siting	Moderate	High	D	2-3 years

* Increase (I), Decrease (D), Unknown (U)
**Depends on Congress

NRR STAFF PRESENTATION TO THE
ACRS

SUBJECT: SEVERE ACCIDENT CASE STUDY
PEACH BOTTOM - ATWS

DATE: AUGUST 2, 1985

PRESENTER: RICHARD J. BARRETT

PRESENTER'S TITLE/BRANCH/DIV:
NUCLEAR ENGINEER/REACTOR SYSTEMS BRANCH/DIVISION OF SYSTEMS INTEGRATION

PRESENTER'S NRC TEL. NO.: 49-27591

SUBCOMMITTEE: CLASS 9 ACCIDENTS

OBJECTIVES

- o TO SUPPORT DEVELOPMENT OF GUIDELINES FOR SYSTEMATIC REVIEW OF OPERATING PLANTS

  - GAIN EXPERIENCE WITH REVIEW OF A RISK-SIGNIFICANT SEQUENCE AND IDENTIFY DEFFICULTIES IN THE PROCESS

  - EVALUATE THE EFFECTIVENESS AND COMPLETENESS OF PROPOSED APPROACHES FOR PLANT-SPECIFIC REVIEWS

  - STUDY THE APPLICABILITY OF REFERENCE PLANT RESULTS TO OTHER PLANTS IN THE CLASS

- o TO SUPPORT DEVELOPMENT OF THE TASK ACTION PLAN

  - DETERMINE WHAT INFORMATION IS AVAILABLE, AND WHAT ADDITIONAL INFORMATION IS NEEDED

  - ESTIMATE THE RESOURCE REQUIREMENTS (NRC STAFF AND CONTRACTORS), AND LEARN HOW TO UTILIZE THOSE RESOURCES EFFICIENTLY

APPROACH

- PREPARE A "STRAWMAN" RISK PROFILE FOR THE PEACH BOTTOM ATWS EVENT
  - COLLECT PRELIMINARY INFORMATION ON THE ACCIDENT SEQUENCE, CONTAINMENT RESPONSE, OFFSITE CONSEQUENCES
  - DEVELOP AN EVENT TREE, INCLUDING CONTAINMENT FAILURE MODES
  - FOR EACH EVENT-TREE BRANCH, ESTIMATE CORE MELT FREQUENCY AND RISK
- BASED ON THE RISK PROFILE, IDENTIFY KEY PLANT SYSTEMS AND OPERATOR ACTIONS
- STUDY THE KEY SYSTEMS AND OPERATOR ACTIONS TO IDENTIFY ATTRIBUTES WHICH DETERMINE THEIR RELIABILITY
- ASSESS THE APPLICABILITY OF THE PEACH BOTTOM RISK PROFILE TO OTHER BWR MARK I PLANTS

ASSESSMENT OF SYSTEMS AND OPERATOR ACTIONS

- OPERATOR ACTION; CONTROL WATER LEVEL
  - LEVEL INDICATION
  - CONTROL OF INJECTION SOURCE
  - PROCEDURES/TRAINING
  - HUMAN FACTORS CONSIDERATIONS

- SYSTEM FUNCTION; STANDBY LIQUID CONTROL
  - DETERMINISTIC VIABILITY
  - ACTUATION LOGIC
  - MAINTENANCE/TESTING
  - SUPPORT SYSTEM DEPENDENCIES
  - SYSTEM INTERACTIONS
  - EQUIPMENT QUALIFICATIONS

POTENTIAL IMPORTANT VARIABILITIES
AMONG BWR PLANTS

- ISOLATION CONDENSERS
- MOTOR DRIVEN FEEDWATER PUMPS
- SAFETY VALVES VENTING TO THE DRYWELL
- SLC INJECTION LOCATION
- REACTOR COOLANT LEVEL INSTRUMENTATION

PRELIMINARY CONCLUSIONS

- DEVELOPMENT OF GUIDELINES FOR REVIEW OF OPERATING PLANTS
  - APPROACH BASED ON CORE MELT FREQUENCY AND RISK ESTIMATES APPEARS TO BE ADVISABLE
  - NEED TO DEVELOP CRITERIA FOR RANKING THE KEY PLANT SYSTEMS AND OPERATOR ACTIONS
  - ACCOUNTING FOR DESIGN VARIATIONS AMONG PLANTS WILL BE AN IMPORTANT ASPECT OF THE GUIDELINES
  - EXTERNAL EVENTS ARE NOT EXPLICITLY TREATED
- DEVELOPMENT OF TASK ACTION PLAN
  - INFORMATION REQUIREMENTS HAVE BEEN IDENTIFIED
    - DETAILED EVENT TREES FOR DOMINANT REFERENCE PLANT SEQUENCES
    - EXPLICIT DESCRIPTIONS OF SUPPORT SYSTEM DEPENDENCIES, SYSTEMS INTERACTIONS
    - ACCIDENT MANAGEMENT INFORMATION

PRELIMINARY CONCLUSIONS (CONT'D)

- RESOURCE REQUIREMENTS
  - INTERDISCIPLINARY TEAM APPROACH REQUIRED

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

JUL 22 1985

Mr. Cordell Reed, Chairman
IDCOR Steering Group
Atomic Industrial Forum, Inc.
7101 Wisconsin Avenue
Bethesda, Maryland 20814-4805

Dear ~~Mr. Reed:~~ Cordell

I am pleased to report that on June 27, 1985, the Commission voted to approve the severe accident policy statement. It should appear in the Federal Register shortly and we will be simultaneously publishing the companion document, NUREG-1070. This policy statement is a revision of the "Proposed Commission Policy Statement on Severe Accidents and Related Views on Nuclear Reactor Regulation" which was published for comment on April 13, 1983 (48 FR 16014), and also serves as notice of withdrawal of the advanced notice of proposed rule-making, "Severe Accident Design Criteria," published on October 2, 1980 (45 FR 65474). One of the issues which this policy statement addresses, and which is of primary interest to IDCOR, is the resolution of safety issues related to reactor accidents more severe than design basis accidents and the path which the Commission intends to follow to accomplish this. The path approved by the Commission in this policy statement is basically the process that has been the basis for the NRC and IDCOR technical interactions in the last few years.

With the publication of the NRC's severe accident policy statement, it is worth summarizing its principal points and how they affect current and near term NRC/IDCOR interactions:

- "On the basis of currently available information, the Commission concludes that existing plants pose no undue risk to public health and safety, and sees no present basis for immediate action on generic rule-making or other regulatory changes for these plants because of severe accident risk."

- " ....the Commission plans to formulate an integrated systematic approach to an examination of each nuclear power plant.......for possibly significant risk contributors that might be plant specific and might be missed absent a systematic search. Following the development of such an approach, an analysis will be made of any plant that has not yet undergone an

appropriate examination and cost-effective changes will be made, if needed, to ensure that there is no undue risk to public health and safety."

We at NRC, and you in industry, have now spent a considerable amount of time and resources developing independently the technical basis needed to address these severe accident issues and to begin the process of translating this research and related technical information into an effective closure process of regulatory decisions.

With the shift of the NRC/IDCOR interaction to the regulatory closure process, we will be also shifting the focus of this work from research to regulatory applications. We are just now reorganizing the Office of Nuclear Reactor Regulation (NRR) into a structure which we expect to be particularly conducive to the orderly closure of the severe accident issue. The new NRR Division of Safety Review and Oversight will be the focus of contact with IDCOR and will be responsible for implementing the review and closure, drawing on other parts of the organization (including the Office of Research) as needed.

Over the last 20 months the NRC and IDCOR staffs have been having intense discussions of all the important issues related to severe accidents. From these deliberations 19 outstanding technical issues were identified for further discussion. It is my understanding that these discussions have now taken place (NRC/IDCOR staff meetings of 3/26/85 and 4/30/85) and that an agreement has been reached between our staffs on the approach to resolution of these remaining 19 issues. We acknowledge the importance of the IDCOR technical program to the progress that has been made in resolving these issues. Resolution of these issues is an important and necessary step for the successful development of the methodology needed for individual plant analysis; this brings me to the next point which I want to discuss with you.

One of the items summarized earlier from the severe accident policy is the need to examine all existing plants for significant risk contributors or vulnerabilities to severe accidents and the development of an appropriate methodology to accomplish this without undertaking the performance of a full scope PRA and the associated expenditure of significant resources. Your program is making substantial contributions in this area to the resolution of the severe accident issue in a cost/effective way. I understand that your proposed methodology for generic applicability has been discussed with the NRC staff on 4/26/85 and in much greater detail on 7/16/85 and has been received favorably by the NRC staff. I understand that in the next six months you will fine tune this methodology by pilot application to a number of nuclear power plants and submit it formally to the staff by early next year.

I hope that this methodology will be the important vehicle for closure of the severe accident issue. The upcoming interactions with the ACRS and the

additional interactions between our staffs should further strengthen it and make it the tool that can finally be accepted for this purpose.

The IDCOR effort in this area has set an example of excellence. You can be assured that we will commit the necessary NRC staff resources to continue the NRC/IDCOR dialogue and bring it to a successful completion. Your continued substantial efforts and contributions, especially those of our technical staffs, are essential to that success.

In my April 12, 1985 letter to you, I discussed the status of our source term re-evaluation activity, as well as the schedule for the severe accident regulatory implementation process. I understand that my staff briefed you on all of these items at the last NRC-IDCOR management meeting which took place on July 7, 1985. As my staff told you, we are defining all the activities and issues to the extent practical and developing schedules associated with these efforts. I will keep you informed on a periodic basis of all issues and activities relating to the closure of the severe accident issue. We look forward to our continuing and productive interactions with the IDCOR program on these important matters.

Sincerely,

Bill

William J. Dircks
Executive Director for
Operations

NRR STAFF PRESENTATION TO THE ACRS

SUBJECT: RESOLUTION OF NRC/IDCOR TECHNICAL ISSUES

DATE: AUGUST 2, 1985

PRESENTER: ZOLTAN R. ROSZTOCZY

PRESENTER'S TITLE/BRANCH/DIV: CHIEF, RESEARCH AND STANDARDS COORDINATION BRANCH, DST, NRR

PRESENTER'S NRC TEL. NO.: 492-4221

SUBCOMMITTEE: CLASS 9 ACCIDENTS

NRC/IDCOR TECHNICAL ISSUES

I. CORE HEATUP STAGE

ISSUE #1 - FISSION PRODUCT RELEASE PRIOR TO VESSEL FAILURE

ASSUMED TEMPERATURE FOR BEGINNING OF FUEL RELOCATION

MODELING OF IN-VESSEL RELEASE OF FISSION PRODUCTS

Te RETENTION IN-VESSEL

ISSUE #2 - RECIRCULATION OF COOLANT IN THE REACTOR VESSEL

RECIRCULATION PATTERNS OF STEAM CAN AFFECT THE CORE HEATUP RATE, STRUCTURAL TEMPERATURES AND DEPOSITION OF FISSION PRODUCTS IN THE REACTOR COOLANT SYSTEM.

ISSUE #3 - RELEASE MODEL FOR CONTROL ROD MATERIALS

IDCOR MODEL ALLOWS THE CONTROL ROD MATERIAL TO MELT, RUNOFF AND FREEZE, THUS IT IS NOT A SOURCE OF AEROSOLS. BMI MODEL IGNORES THE POTENTIAL FOR RUNOFF.

ISSUE #4 - FISSION PRODUCT & AEROSOL DEPOSITION IN THE REACTOR COOLANT SYSTEM

UNCERTAINTIES IN THE PREDICTIVE CAPABILITY ARE LARGE. THE VALIDITY OF THE EMPIRICAL AEROSOL MODEL USED BY IDCOR IS OF CONCERN.

NRC/IDCOR TECHNICAL ISSUES

(CONTINUED)

II. MELT PROGRESSION AND FUEL RELOCATION STAGE

ISSUE #5 - MODELING OF IN-VESSEL H_2 GENERATION

SIGNIFICANT DIFFERENCES IN MODELS WHEN CLADDING MELTS AND SLUMPS AND FLOW CHANNELS BEGIN TO BLOCK. LARGE DIFFERENCE IN PREDICTED H_2 PRODUCTION.

ISSUE #6 - CORE SLUMP, CORE COLLAPSE AND REACTOR VESSEL FAILURE MODELS

IDCOR ASSUMES INSTANTANEOUS SLUMPING OF THE CORE, FAILURE OF THE LOWER SUPPORT PLATE AFTER A FRACTION OF THE CORE IS MOLTEN AND IMMEDIATE VESSEL FAILURE AFTER FAILURE OF THE PLATE.

ISSUE #7 - ALPHA MODE CONTAINMENT FAILURE BY IN-VESSEL STEAM EXPLOSIONS

CAN AN ENERGETIC MOLTEN FUEL/COOLANT INTERACTION OCCUR, PRODUCE A MISSILE AND BREACH THE CONTAINMENT?

NRC/IDCOR TECHNICAL ISSUES

(CONTINUED)

III. EX-VESSEL STATE

ISSUE #8 - DIRECT HEATING OF CONTAINMENT BY EJECTED CORE MATERIAL

MOLTEN MATERIAL EJECTED FROM THE VESSEL UNDER PRESSURE COULD BE SWEPT OUT OF THE REACTOR CAVITY INTO THE CONTAINMENT AND CONTRIBUTE TO THE RAPID HEATING OF THE CONTAINMENT ATMOSPHERE.

ISSUE #9 - EX-VESSEL FISSION PRODUCT RELEASE

NRC MODELS ALLOW FOR THE PRODUCTION OF VOLATILE OXIDES AND HYDROXIDES OF REFRACTORY FISSION PRODUCTS DURING THE CORE/CONCRETE INTERACTION PROCESS.

ISSUE 10 - EX-VESSEL HEAT TRANSFER MODELS FROM MOLTEN CORE TO CONCRETE/CONTAINMENT

NRC ANALYSES INVOLVE MORE HEAT GOING INTO CONCRETE ATTACK, MORE RAPID PRODUCTION OF NON-CONDENSIBLE GASES, MORE RAPID PRESSURIZATION OF CONTAINMENT, BUT LOWER ATMOSPHERE TEMPERATURES.

ISSUE #11 - REVAPORIZAITON OF FISSION PRODUCTS IN THE UPPER PLENUM

A LARGE FRACTION OF FISSION PRODUCTS RELEASED FROM THE CORE CAN BE DEPOSITED ON STRUCTURES. THE DECAY HEAT OF THESE MATERIALS WILL HEAT THE STRUCTURES, AND CONTRIBUTE TO THE REVAPORIZATION OF THE FISSION PRODUCTS. UNCERTAINTIES OF MODELS ARE LARGE.

ISSUE #12 - DEPOSITION MODEL FOR FISSION PRODUCTS IN CONTAINMENT

THE EMPIRICAL CORRELATION USED BY IDCOR FOR AEROSOL SETTLING SHOWS NO PARTICLE SIZE DEPENDENCE AND LACKS COMPARISONS TO EXPERIMENTAL DATA.

ISSUE #13A - AMOUNT AND TIMING OF SUPPRESSION POOL BYPASS

IN THE IDCOR ANALYSES RELATIVELY LARGE, CONSTANT DECONTAMINATION FACTORS ARE USED, BYPASS IS IGNORED UNDER THE ASSUMPTION THAT OPENINGS WOULD BE PLUGGED BY AEROSOLS.

NRC/IDCOR TECHNICAL ISSUES

(CONTINUED)

ISSUE #13B - RETENTION OF FISSION PRODUCTS IN ICE BEDS

IDCOR USES THE STANDARD DEPOSITION MODELS OF STEAM CONDENSATION AND AEROSOL DEPOSITION. EXPERIMENTAL VERIFICATION IS NEEDED.

ISSUE #14 - MODELING OF EMERGENCY RESPONSE

IN THE IDCOR ANALYSES THE POPULATION IN THE EVACUATION ZONE IS REMOVED AT A GIVEN RATE WITHOUT RECOGNITION OF A STRAGGLER POPULATION THAT IS SLOW TO EVACUATE OR REFUSES TO EVACUATE.

ISSUE #15 - CONTAINMENT PERFORMANCE

CONSIDERABLE UNCERTAINTY EXISTS AS TO HOW RAPIDLY LEAKAGE WILL GROW, THE MODE BY WHICH A CONTAINMENT WILL FAIL AND THE LOCATION AT WHICH FAILURE WILL BE INITIATED.

NRC/IDCOR TECHNICAL ISSUES

(CONTINUED)

ISSUE #16 - SECONDARY CONTAINMENT PERFORMANCE

THERE ARE LARGE UNCERTAINTIES IN THE PREDICTION OF SECONDARY CONTAINMENT PERFORMANCE. CONTAINMENT FAILURE MODE AND ITS IMPACT ON THE SECONDARY BUILDING, POTENTIAL FOR HYDROGEN DEFLAGATIONS TO OCCUR, AND THE MODES OF LEAKAGE AND FAILURE OF THE SECONDARY BUILDING ARE MAJOR CONTRIBUTORS.

ISSUE #17 - HYDROGEN IGNITION AND BURNING

IDCOR MODELS PREDICT CONTINUOUS BURNING ESSENTIALLY IN ALL CASES. THE NRC TREATMENT TENDS TO PREDICT A NUMBER OF DISCRETE BURNS, ALLOWS THE BUILDUP OF HIGHER HYDROGEN CONCENTRATIONS AND LEADS TO HIGHER CONTAINMENT PRESSURES.

ISSUE #18 - ESSENTIAL EQUIPMENT PERFORMANCE

SO FAR NEITHER IDCOR, NOR NRC HAS ASSESSED THE EXPECTED PERFORMANCE OF EQUIPMENT ASSUMED TO FUNCTION IN THE VARIOUS SEVERE ACCIDENT SCENARIOS. DISPLAY INSTRUMENTS NEEDED FOR OPERATOR ACTIONS SHOULD BE INCLUDED IN THE ASSESSMENT.

Resolution of Technical Issues

The agreed on resolutions will accomplish the following:

- Make both the NRC and the IDCOR analytical models more realistic
- Compare models with experimental data and revise models, if needed
- Study phenomena that might have a significant effect on plant evaluations
- Perform sensitivity/uncertainty studies
- Check whether qualification of equipment for design basis events is sufficient to support the assumed performance of these equipment during severe accidents.

Agreed-On Changes in the IDCOR Model

- A revised fuel relocation model
- A Te retention Model
- Mechanistic melt progression model in the MAAP code
- Improved fission product model (more chemical species, chemical and thermal equilibrium)
- Develop containment strain methodology for failure and likely failure size

Comparison of IDCOR Models with Data

- In-pile data on control rod material release

- ORNL out-of-pile core melt release experiments with B_4C control rods

- Applicable data on aerosol deposition

- Available experimental data on in-vessel hydrogen generation

- TMI accident information on hydrogen generation

- Prototypical data on corium dispersal from the cavity including direct heating of containment atmosphere

- Core-concrete interaction data from Sandia and from the Beta facility

Better Understanding of Physical Phenomena

- Potential heat-up of RCS components by natural circulation of superheated steam

- Review of the aerosol plugging correlation including potential limitations on the correlation

- Discussion of the applicability of the aerosol deposition model to predict fission product retention in ice beds

Sensitivity/Uncertainty Studies

- Accident analysis with consequential rupture of steam generator tubes - will be done only if coolant recirculation study warrants it

- The overall uncertainty analysis should take into account the uncertainty associated with corium dispersal

- Parametric studies on the revaporization of fission products (time delays, release rates)

- Comparison between IDCOR analysis and CONTAIN results for a selected accident sequence to assess differences due to the aerosol deposition model

- Analysis of the stuck open vacuum breaker case both ways: (1) using the plugging correlation, and (2) assuming no plugging

- Uncertainties in containment failure mode will be considered in source term calculations

- NRC and IDCOR will define and calculate a standard problem to assess differences in the hydrogen ignition and burning models

<u>FOLLOW-UP ON TECHNICAL ISSUE RESOLUTION</u>

- AGREEMENT HAS BEEN REACHED ON THE APPROACH TO RESOLUTION
- IDCOR WILL MODIFY THE ANALYTICAL MODELS AND DOCUMENT THE CHANGES
- IDCOR WILL EVALUATE THE EFFECT OF THE INDIVIDUAL CHANGES
- IDCOR WILL REVISE THE REFERENCE PLANT ANALYSES TO REFLECT THESE CHANGES
- NRC IS PERFORMING AUDIT CALCULATIONS FOR THE REFERENCE PLANTS WHICH WILL INCLUDE THE CHANGES
- NRC WILL COMPARE THE REVISED IDCOR REFERENCE PLANT ANALYSES WITH THE AUDIT CALCULATIONS
- BOTH IDCOR AND NRC WILL EVALUATE THE UNCERTAINTIES OF THE CALCULATIONS
- DIFFERENCES BETWEEN IDCOR AND AUDIT CALCULATIONS WHICH ARE OUTSIDE OF THE ESTIMATED UNCERTAINTY BAND WILL RECEIVE FURTHER ATTENTION

NRR STAFF PRESENTATION TO THE ACRS

SUBJECT: SYSTEMATIC EXAMINATION OF EXISTING PLANTS

DATE: AUGUST 2, 1985

PRESENTER: ZOLTAN R. ROSZTOCZY

PRESENTER'S TITLE/BRANCH/DIV: CHIEF, RESEARCH AND STANDARDS COORDINATION BRANCH, DST, NRR

PRESENTER'S NRC TEL. NO.: 492-4221

SUBCOMMITTEE: CLASS 9 ACCIDENTS

SYSTEMATIC EXAMINATION OF EXISTING PLANTS

THE PROGRAM HAS FOUR TASKS:

1. REVIEW AND EVALUATION OF THE FOUR REFERENCE PLANTS (IDCOR & NRC ANALYSES).

2. REVIEW THE IDCOR METHODOLOGY PROPOSED FOR THE SYSTEMATIC EXAMINATION OF EXISTING PLANTS.

3. DEVELOPMENT OF GENERIC GUIDELINES AND PROCEDURAL CRITERIA FOR THE PREVENTION AND MITIGATION OF SEVERE ACCIDENTS.

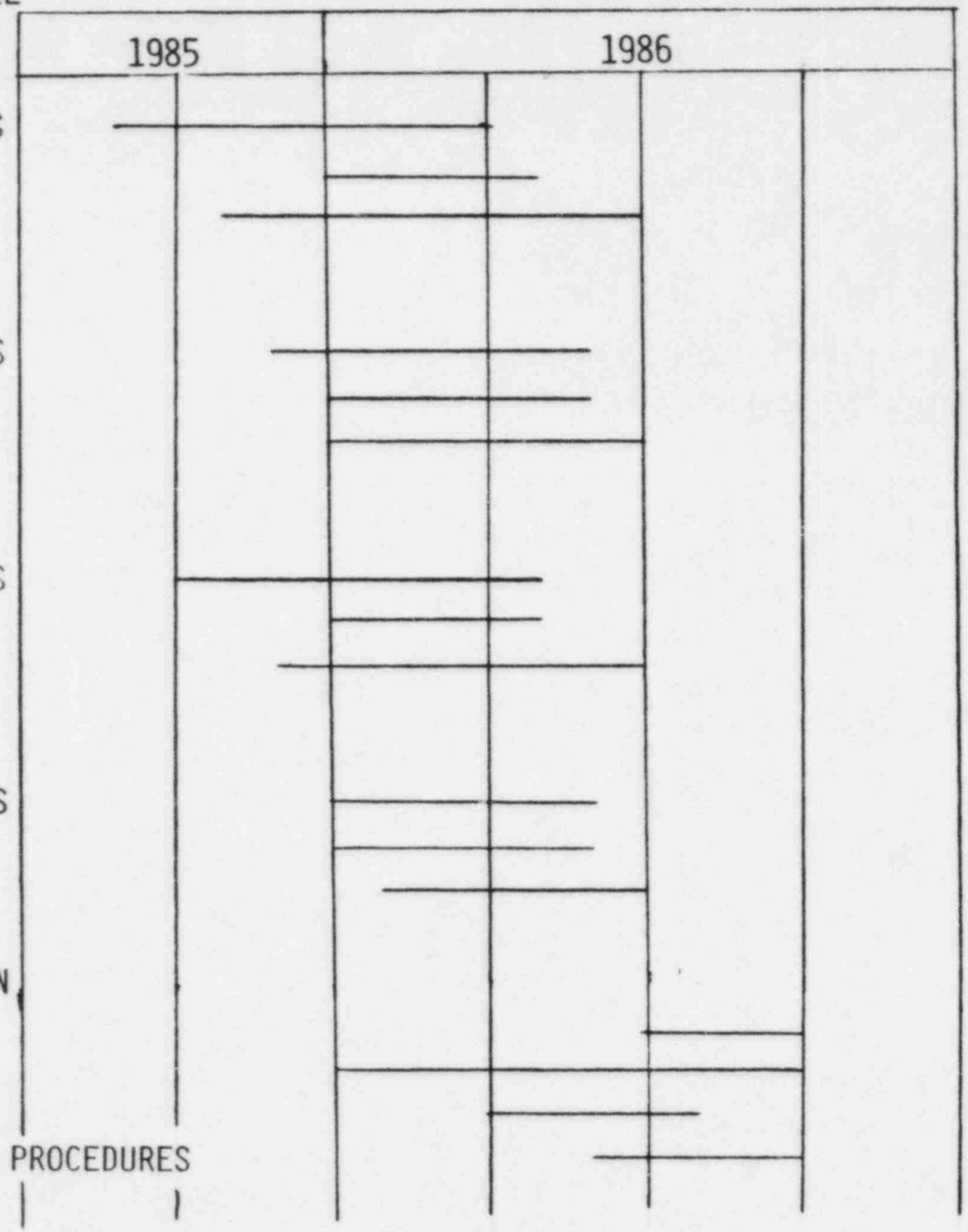
4. PREPARE RECOMMENDATIONS FOR COMMISSION CONSIDERATION ON THE RESOLUTION OF THE SEVERE ACCIDENT ISSUE.

INCOMING INFORMATION

AN EXTENSIVE AMOUNT OF INFORMATION HAS BEEN GENERATED ON SEVERE ACCIDENTS DURING THE PAST FEW YEARS. THE INFORMATION IS BEING SUMMARIZED BY BOTH, THE INDUSTRY (IDCOR) AND NRC, AND WILL BE AVAILABLE FOR OUR REVIEW ON THE FOLLOWING SCHEDULE:

	IDCOR	NRC
SOURCE TERM METHODOLOGY	AUG. 85	AUG. 85
REVISED REFERENCE PLANT ANALYSES		
PEACH BOTTOM	OCT. 85	JAN. 86
SEQUOYAH	OCT. 85	FEB. 86
GRAND GULF	OCT. 85	MAR. 86
ZION	OCT. 85	APR. 86
UNCERTAINTY ANALYSIS	SEP. 85	(MAY 86)
POTENTIAL IMPROVEMENTS IN PLANT DESIGN AND OPERATION	—	APR. 86
METHODOLOGY FOR EXAMINATION OF EXISTING PLANTS	JAN. 86	—
ACCIDENT MANAGEMENT STUDY	—	APR. 86
PUBLIC COMMENTS ON SOURCE TERM METHODOLOGY	—	NOV. 85
PUBLIC COMMENTS ON PLANT ANALYSES, UNCERTAINTIES AND POTENTIAL IMPROVEMENTS	—	(NOV. 86)
EXTERNAL EVENTS	?	?

TENTATIVE SCHEDULE



PEACH BOTTOM
- REVIEW AND EVALUATION OF PLANT ANALYSES
- REVIEW OF IDCOR METHODOLOGY
- DEVELOPMENT OF GUIDELINES AND CRITERIA

GRAND GULF
- REVIEW AND EVALUATION OF PLANT ANALYSES
- REVIEW OF IDCOR METHODOLOGY
- DEVELOPMENT OF GUIDELINES AND CRITERIA

SEQUOYAH
- REVIEW AND EVALUATION OF PLANT ANALYSES
- REVIEW OF IDCOR METHODOLOGY
- DEVELOPMENT OF GUIDELINES AND CRITERIA

ZION
- REVIEW AND EVALUATION OF PLANT ANALYSES
- REVIEW OF IDCOR METHODOLOGY
- DEVELOPMENT OF GUIDELINES AND CRITERIA

RECOMMENDATIONS FOR COMMISSION CONSIDERATION
- RECOMMENDED NRC ACTIONS
- GUIDELINES AND CRITERIA
- APPROVAL OF IDCOR METHODOLOGY
- RECOMMENDED CHANGES IN NRC STANDARDS & PROCEDURES

PEACH BOTTOM REVIEW AND EVALUATION

- CURRENTLY AVAILABLE INFORMATION:
  - IDCOR ANALYSIS OF THE TW, TC, TQVW AND S_1E SEQUENCES
  - SASA ANALYSIS OF SELECTED BROWNS FERRY SEQUENCES
  - SEQUENCE EVENT TREE FOR THE TC SEQUENCE
  - PRELIMINARY CONTAINMENT EVENT TREE FOR THE TQUV SEQUENCE
  - SOURCE TERM CALCULATIONS FOR THE AE, TC AND TW SEQUENCES (BMI-2104)

- REVIEW WILL ADDRESS:
  - EVALUATION OF ACCIDENT LIKELIHOOD
  - SELECTION OF DOMINANT SEQUENCES
  - ANALYSIS OF DOMINANT SEQUENCES
  - CONSIDERATION OF COMMON MODE FAILURES AND SYSTEMS INTERACTIONS
  - ACCIDENT MANAGEMENT CONSIDERATIONS
  - CONTAINMENT LOADING AND PERFORMANCE
  - SOURCE TERM CALCULATIONS
  - ACCIDENT CONSEQUENCE AND RISK ANALYSES
  - UNCERTAINTY OF CALCULATIONS

PEACH BOTTOM REVIEW AND EVALUATION (CONTINUED)

- IDCOR CALCULATIONS AND NRC AUDIT CALCULATIONS WILL BE COMPARED. DIFFERENCES ARE EXPECTED TO BE WITHIN THE UNCERTAINTY BOUNDS OF THE CALCULATIONS. LARGE DIFFERENCES AND QUESTIONABLE RESULTS WILL BE INVESTIGATED.

- EMPHASIS WILL BE ON POTENTIAL LARGE CONTRIBUTORS TO RISK TAKING INTO ACCOUNT THE UNCERTAINTIES OF THE CALCULATIONS.

- SPECIAL ATTENTION WILL BE PAYED TO RISK DOMINANT OUTLIERS IN PLANT DESIGN AND OPERATION. A LIST OF OUTLIERS FOUND UP TO DATE WILL ALSO BE CHECKED AGAINST PEACH BOTTOM.

- IMPORTANT DESIGN FEATURES AND OPERATOR GUIDANCE NEEDED TO ACHIEVE A SUFFICIENTLY LOW RISK PROFILE WILL BE IDENTIFIED AND GROUPED ACCORDING TO IMPORTANCE.

- A JUDGEMENT WILL BE PASSED ON THE SUFFICIENCY OF THE PEACH BOTTOM DESIGN AND OPERATION WITH RESPECT TO SEVERE ACCIDENTS.

- WE ARE PRESENTLY PERFORMING A CASE STUDY FOR ONE OF THE PEACH BOTTOM SEQUENCE TO TEST THE FEASIBILITY AND SUPPORT THE DEVELOPMENT OF THIS APPROACH.

REVIEW OF IDCOR METHODOLOGY

- IDCOR HAS DEVELOPED METHODOLOGY FOR THE SYSTEMATIC EXAMINATION OF EXISTING PLANTS.

- THE METHODOLOGY WILL BE APPLIED FIRST TO THE FOUR REFERENCE PLANTS, THEN TO THREE ADDITIONAL PLANTS WHICH DID NOT HAVE PRAs AND HAVE NOT YET BEEN EVALUATED FOR SEVERE ACCIDENTS.

- THE IDCOR METHODOLOGY, TOGETHER WITH THE SAMPLE APPLICATIONS, WILL BE SUBMITTED FOR NRC REVIEW IN JANUARY, 1986.

- IN THE REVIEW OF THE IDCOR METHODOLOGY SPECIAL ATTENTION WILL BE PAID TO THE METHODOLOGY'S ABILITY TO:

    - DETECT OUTLIERS
    - IDENTIFY POTENTIAL COMMON MODE FAILURES
    - PROVIDE GUIDANCE FOR OPERATING PROCEDURES
    - ASSESS CONTAINMENT PERFORMANCE

- IT IS OUR GOAL TO APPROVE THE IDCOR METHODOLOGY TOGETHER WITH THE ISSUANCE OF THE GUIDELINES.

GENERIC GUIDELINES AND PROCEDURAL CRITERIA

- NRC'S PLANT REVIEW AND EVALUATION WILL BE LIMITED TO THE FOUR REFERENCE PLANTS.

- BASED ON THE REVIEW OF EACH OF THE REFERENCE PLANTS STRAWMAN GUIDELINES AND CRITERIA WILL BE DRAFTED FOR THE FOUR PLANT TYPES BY THE INDIVIDUALS INVOLVED IN THE PLANT REVIEWS.

- SELECTED PLANTS OF THE SAME TYPE (FOR EXAMPLE, BWRs, WITH MARK I CONTAINMENT) WILL BE EXAMINED AGAINST THE STRAWMAN CRITERIA TO JUDGE THE SUFFICIENCY OF THE CRITERIA.

- PREVIOUS DECISIONS ON SEVERE ACCIDENT RELATED ISSUES SUCH AS REVIEW OF THE ZION, INDIAN POINT, MILLSTONE 3, GESSAR AND LIMERICK PRAs, THE INDIAN POINT HEARING, DEVELOPMENT OF THE SAFETY GOAL, AND RESOLUTION OR CURRENT STATUS OF UNRESOLVED SAFETY ISSUES, WILL BE REVIEWED FOR INSIGHT AND CONSISTENCY.

- TREATMENT OF SEVERE ACCIDENTS BY OTHER REGULATORY AUTHORITIES, LIKE THE FRENCH SEVERE ACCIDENT PROCEDURES, WILL BE EXAMINED.

- THE FOUR SETS OF STRAWMAN GUIDELINES AND CRITERIA WILL BE COMBINED INTO A FINAL SET OF GUIDELINES AND CRITERIA.

COMMISSION PAPER ON THE RESOLUTION OF SEVERE ACCIDENT ISSUES

- o THE COMMISSIONS SEVERE ACCIDENT POLICY STATEMENT WILL BE ISSUED ON AUGUST 5, 1985.

- o THE STAFF WILL PREPARE AN ACTION PLAN FOR THE IMPLEMENTATION OF THE COMMISSION'S SEVERE ACCIDENT POLICY. THE ACTION PLANT WILL BE SUBMITTED TO THE EDO BY NOVEMBER 1985.

- o FOLLOWING COMPLETION OF REFERENCE PLANT EVALUATIONS, DEVELOPMENT OF ACCIDENT PREVENTION AND ACCIDENT MITIGATION GUIDELINES AND PROCEDURAL CRITERIA, AND REVIEW OF THE PROPOSED IDCOR METHODOLOGY, THE STAFF WILL PREPARE GENERIC RECOMMENDATIONS FOR THE RESOLUTION OF SEVERE ACCIDENT ISSUES.

- o THE STAFF RECOMMENDATIONS WILL ADDRESS:

  (1) WHAT NEEDS TO BE DONE BY INDIVIDUAL LICENSEES WITH RESPECT TO SEVERE ACCIDENTS. IT WILL SPECIFY THE EXTENT OF REVIEW AND EXAMINATION NEEDED AND APPROPRIATE DOCUMENTATION REQUIREMENTS.

(2) CRITERIA TO BE USED TO JUDGE THE SUFFICIENCY OF THE DESIGN AND OPERATION OF THE PLANT. ACTION TO BE TAKEN IF THE CRITERIA ARE NOT MET.

(3) SUGGESTED TIME TABLE FOR THE REVIEW.

(4) THE FORMAT OF THE REQUEST, FOR EXAMPLE, GENERIC LETTER.

(5) PROPOSED NRC ACTIONS TO ASSESS COMPLIANCE WITH THE REQUEST.

(6) PROPOSED FOLLOW-UP ACTIONS: REVISIONS IN SRP, REG. GUIDES AND RULES; CONFORMATORY RESEARCH NEEDED.

NRR STAFF PRESENTATION TO THE ACRS

SUBJECT: IMPLEMENTATION OF THE SEVERE ACCIDENT PROGRAM

DATE: AUGUST 2, 1985

PRESENTER: THEMIS P. SPEIS

PRESENTER'S TITLE/BRANCH/DIV: DIRECTOR, DIVISION OF SAFETY TECHNOLOGY, NRR

PRESENTER'S NRC TEL. NO.: 492-7517

SUBCOMMITTEE: CLASS 9 ACCIDENTS

INTRODUCTION

- o THE RECENTLY ISSUED POLICY STATEMENT SETS THE GOALS FOR THE IMPLEMENTATION PROGRAM. IT CONTAINS THREE MAJOR ACTION ITEMS:

  - SYSTEMATIC EXAMINATION OF EXISTING PLANTS
  - ISSUANCE OF GUIDANCE ON THE ROLE OF PRAs
  - AMENDMENT OF NRC REGULATIONS AS APPROPRIATE

- o WITH RESPECT TO THE SYSTEMATIC EXAMINATION OF EXISTING PLANTS THE POLICY STATEMENT STATES:

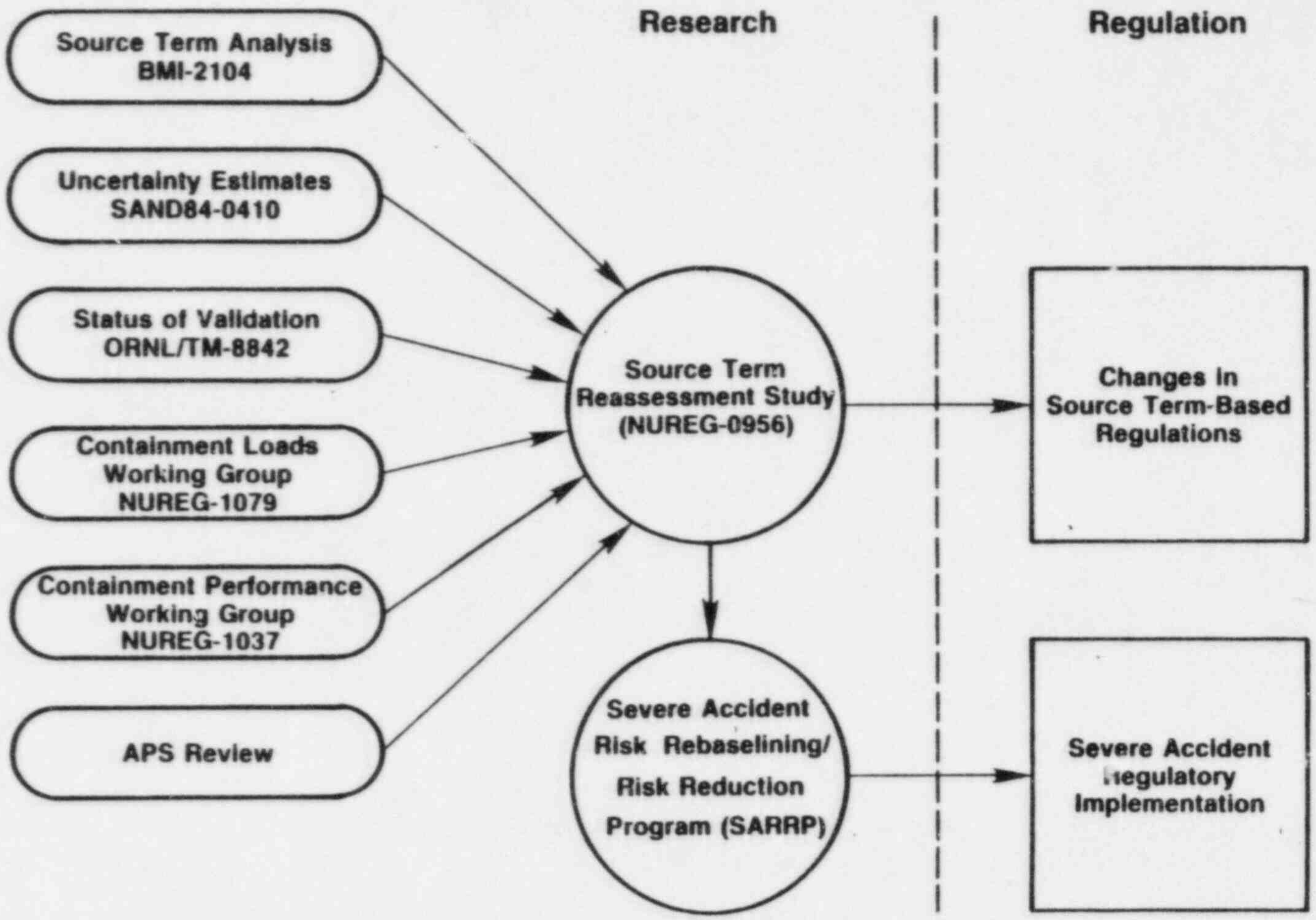
  "...THE COMMISSION PLANS TO FORMULATE AN INTEGRATED SYSTEMATIC APPROACH TO AN EXAMINATION OF EACH NUCLEAR POWER PLANT...FOR POSSIBLE SIGNIFICANT RISK CONTRIBUTORS...THAT MIGHT BE PLANT SPECIFIC AND MIGHT BE MISSED ABSENT A SYSTEMATIC SEARCH."

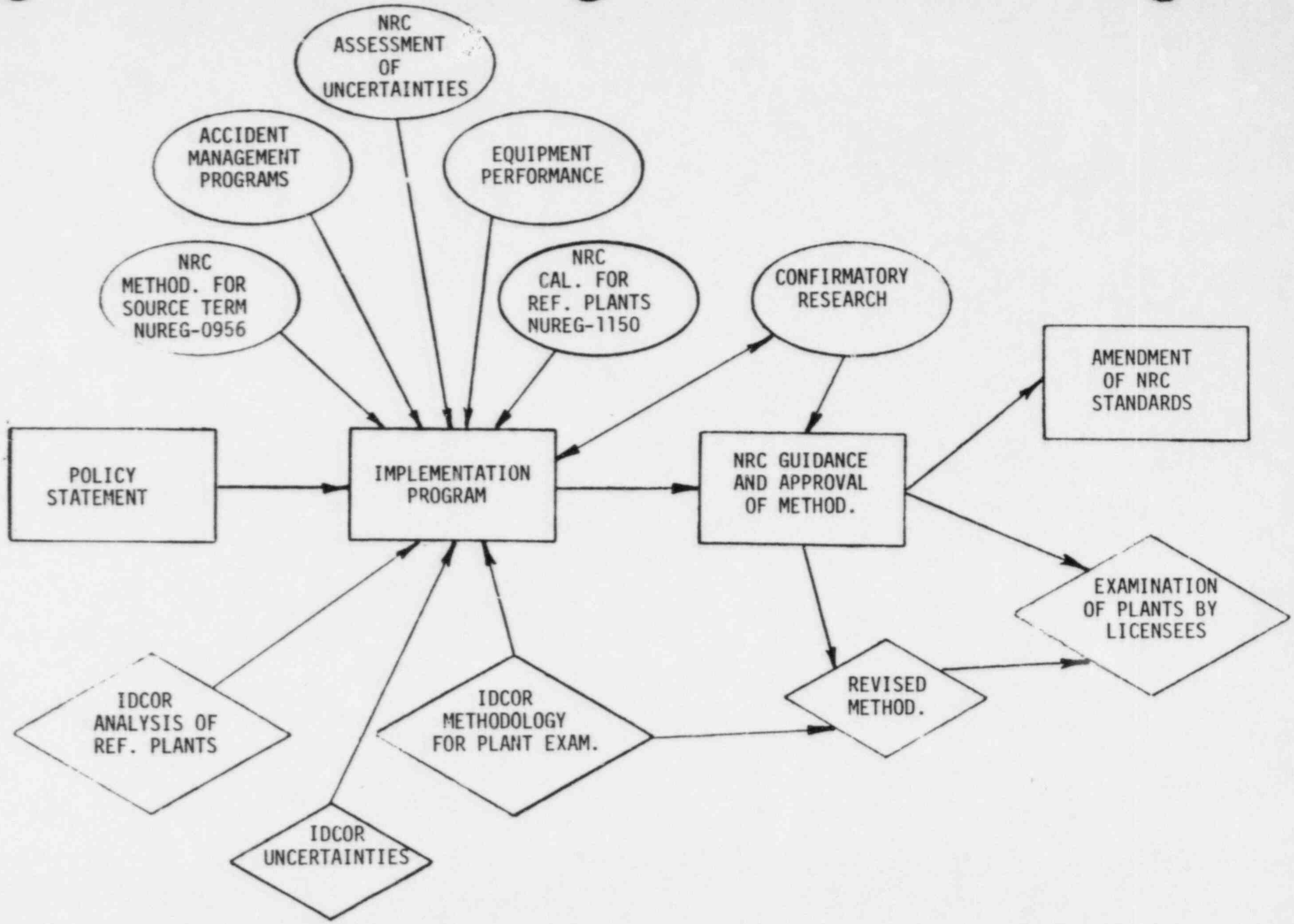
"DURING THE NEXT TWO YEARS, THE COMMISSION WILL FORMULATE A SYSTEMATIC APPROACH, INCLUDING THE DEVELOPMENT OF GUIDELINES AND PROCEDURAL CRITERIA, WITH AN EXPECTATION THAT SUCH AN APPROACH WILL BE IMPLEMENTED BY LICENSEES..."

- NRR IS CURRENTLY BEING REORGANIZED. THE NEW STRUCTURE IS EXPECTED TO BE CONDUCIVE TO THE ORDERLY CLOSURE OF SEVERE ACCIDENT ISSUES.

- DEVELOPMENT OF THE IMPLEMENTATION PROGRAM WILL REQUIRE FREQUENT INTERACTIONS BETWEEN NRC AND INDUSTRY, ALSO BETWEEN ACRS AND THE NRC STAFF.

Program Relationships





NRC
ASSESSMENT
OF
UNCERTAINTIES
ACCIDENT
MANAGEMENT
PROGRAMS
EQUIPMENT
PERFORMANCE
NRC
METHOD. FOR
SOURCE TERM
NUREG-0956
NRC
CAL. FOR
REF. PLANTS
NUREG-1150
CONFIRMATORY
RESEARCH
AMENDMENT
OF NRC
STANDARDS
POLICY
STATEMENT
IMPLEMENTATION
PROGRAM
NRC GUIDANCE
AND APPROVAL
OF METHOD.
EXAMINATION
OF PLANTS BY
LICENSEES
REVISED
METHOD.
IDCOR
ANALYSIS OF
REF. PLANTS
IDCOR
METHODOLOGY
FOR PLANT EXAM.
IDCOR
UNCERTAINTIES

INDUSTRY PARTICIPATION

- o FOLLOWING THE TMI ACCIDENT AN INDUSTRY GROUP WAS FORMED TO STUDY POTENTIAL SEVERE ACCIDENTS IN EXISTING NUCLEAR REACTORS. THE PROGRAM WAS NAMED IDCOR, INDUSTRY DEGRADED CORE RULEMAKING.
- o IDCOR HAS EVALUATED THE PERFORMANCE OF FOUR REFERENCE PLANTS WITH RESPECT TO SEVERE ACCIDENTS, DOCUMENTED THE RESULTS AND ALSO PRESENTED THEM TO NRC IN THE FORM OF A SERIES OF TECHNICAL MEETINGS.
- o AS A RESULT OF THESE MEETINGS 19 OUTSTANDING TECHNICAL ISSUES WERE IDENTIFIED FOR FURTHER DISCUSSION. AN AGREEMENT HAS NOW BEEN REACHED ON THE APPROACH TO RESOLUTION OF THESE ISSUES.
- o IDCOR IS PRESENTLY DEVELOPING METHODOLOGY TO BE USED FOR THE SYSTEMATIC EXAMINATION OF INDIVIDUAL PLANTS. THIS METHODOLOGY WILL BE PRESENTED TO YOU LATER TODAY.
- o DURING THE NEXT FIVE MONTHS IDCOR WILL PERFECT THE METHODOLOGY AND WILL DEMONSTRATE ITS USEFULNESS BY APPLYING IT TO THE FOUR REFERENCE PLANTS AND TO THREE OTHER PLANTS WHICH DID NOT HAVE A PRA.
- o FOLLOWING NRC REVIEW AND APPROVAL, THE IDCOR METHODOLOGY IS EXPECTED TO BE USED FOR THE SYSTEMATIC EVALUATION OF EXISTING PLANTS BY THE LICENSEES.

INDUSTRY PARTICIPATION

(CONTINUED)

- IDCOR'S CURRENT CHARTER EXPIRES AT THE END OF 1985. FOR THE TIMELY RESOLUTION OF THE SEVERE ACCIDENT ISSUES IT IS IMPORTANT THAT AN ORGANIZED INDUSTRY GROUP BE AVAILABLE TO HANDLE NRC/INDUSTRY INTERACTIONS.

RES ANALYSES OF THE REFERENCE PLANTS

- A METHODOLOGY FOR THE CALCULATION OF SOURCE TERMS BASED ON CURRENT UNDERSTANDING AND KNOWLEDGE HAS BEEN DEVELOPED BY NRC/RES. THE METHODOLOGY IS DOCUMENTED IN NUREG-0956, WHICH WILL BE ISSUED FOR COMMENT ON AUGUST 7, 1985. ISSUANCE OF THE FINAL VERSION OF THIS REPORT IS EXPECTED BY JANUARY 1986.

- NRC/RES WITH THE HELP OF THE NATIONAL LABORATORIES IS PRESENTLY PERFORMING AUDIT CALCULATIONS FOR FIVE REFERENCE PLANTS: THE FOUR IDCOR REFERENCE PLANTS AND SURRY, A WASH-1400 PLANT.

- THE RES EVALUATION OF THE REFERENCE PLANTS WILL ADDRESS SELECTION OF ACCIDENT SEQUENCES AND THEIR FREQUENCIES, ACCIDENT SEQUENCE ANALYSIS, SOURCE TERM CALCULATIONS, CONTAINMENT EVENT TREES AND CONSEQUENCE CALCULATIONS. A RISK PROFILE WILL BE PROVIDED FOR EACH REFERENCE PLANT INCLUDING HIGH, LOW AND CENTRAL ESTIMATES. THE EVALUATION WILL ALSO DISCUSS POTENTIAL PREVENTIVE AND MITIGATIVE FEATURES.

- HOWEVER, THE RES EVALUATION WILL BE BASED ON INTERNAL EVENTS ONLY, WILL NOT ADDRESS ACCIDENT MANAGEMENT, AND WILL PROVIDE ONLY A LIMITED, PARAMETRIC ASSESSMENT OF COMMON MODE FAILURES.

- RESULTS OF THE REFERENCE PLANT ANALYSES WILL BE AVAILABLE TO THE IMPLEMENTATION PROGRAM ON A PLANT BY PLANT BASIS. SURRY AND PEACH BOTTOM WILL BE THE LEAD PLANTS. THE RESULTS FOR ALL FIVE PLANTS WILL BE DOCUMENTED IN NUREG-1150, WHICH WILL BE ISSUED FOR PUBLIC COMMENT IN MID 1986.

SYSTEMATIC EXAMINATION OF EXISTING PLANTS

o THE GOALS OF THIS PROGRAM ARE:

(1) REVIEW BOTH THE IDCOR AND RES ANALYSES PERFORMED FOR THE REFERENCE PLANTS, RESOLVE DIFFERENCES AND PASS A JUDGEMENT ON THE ADEQUACY OF THESE PLANTS WITH RESPECT TO SEVERE ACCIDENT RISKS;

(2) REVIEW THE IDCOR PROPOSED METHODOLOGY AND PASS A JUDGEMENT ON THE ACCEPTABILITY OF THIS METHODOLOGY AS THE MAIN TOOL FOR THE SYSTEMATIC REVIEW OF EXISTING PLANTS;

(3) USE THE INSIGHT AND EXPERIENCE GAINED FROM THE REFERENCE PLANT REVIEWS, FROM THE REVIEW OF THE IDCOR METHODOLOGY, FROM THE REVIEWS OF STANDARD PLANTS AND FROM OTHER RELATED PROGRAMS TO DEVELOP GENERIC GUIDELINES AND PROCEDURAL CRITERIA FOR THE PREVENTION AND MITIGATION OF SEVERE ACCIDENTS;

(4) PREPARE A RECOMMENDATION FOR COMMISSION CONSIDERATION ON THE RESOLUTION OF THE SEVERE ACCIDENT ISSUE FOR EXISTING PLANTS.

o CURRENTLY WE ARE IN THE PLANNING STAGE OF THIS PROGRAM. OUR PRESENTATIONS TODAY WILL PROVIDE YOU WITH A STATUS REPORT. WE EXPECT THAT THE COMPLETION OF ITEMS 1 THROUGH 3 WILL TAKE APPROXIMATELY ONE YEAR. THE RECOMMENDATIONS TO THE COMMISSION ARE EXPECTED TO BE READY BY THE END OF 1986.

INTERFACE WITH ACRS

- o IN AN APRIL 15, 1985 LETTER TO THE CHAIRMAN, ACRS PROVIDED A DESCRIPTION OF THE SPECIFIC ELEMENTS FOR A SYSTEMATIC APPROACH TO THE EXAMINATION OF EXISTING PLANTS.

- o WE FOUND THE ACRS SUGGESTIONS VERY USEFUL AND WE ARE USING THEM. OUR PROPOSED APPROACH WILL ADDRESS THE ELEMENTS MENTIONED IN THE ACRS LETTER.

- o FOR THE COMING YEAR, WE RECOMMEND 3 MEETINGS WITH THE SUBCOMMITTEE ON REGULATORY IMPLEMENTATION. AT THESE MEETINGS WE WILL INFORM YOU OF OUR PROGRESS AND WE WOULD LIKE TO SOLICIT YOUR SUGGESTIONS AND COMMENTS.

IDCOR INDIVIDUAL PLANT EVALUATION IPE METHODOLOGY

ANTHONY R. BUHL
ENERGEX

PRESENTED TO

ACRS SUBCOMMITTEE ON CLASS 9 ACCIDENTS

AUGUST 2, 1985

ACRS HAS RECOMMENDED A SYSTEMATIC ANALYSIS OF EACH PLANT FOR "OUTLIERS"

ACRS LETTER DATED JULY 18, 1984

"IN OUR VARIOUS MEETINGS WITH THE NRC STAFF WE HAVE DISCUSSED THE DESIRABILITY OF FORMULATING SOME SYSTEMATIC APPROACH TO AN EXAMINATION OF EACH NUCLEAR POWER PLANT NOW OPERATING OR UNDER CONSTRUCTION FOR POSSIBLE SIGNIFICANT RISK CONTRIBUTORS (SOMETIMES CALLED "OUTLIERS") THAT MIGHT BE PLANT SPECIFIC AND MIGHT BE MISSED ABSENT A SYSTEMATIC SEARCH."

ACRS HAS RECOMMENDED A SYSTEMATIC ANALYSIS OF EACH PLANT FOR "OUTLIERS"

ACRS LETTER DATED NOVEMBER 6, 1984

"OUR LETTER OF JULY 18, 1984 RECOMMENDED THAT "AN APPROPRIATE APPROACH" BE DEVELOPED FOR SYSTEMATIC ANALYSIS OF EACH PLANT NOT PREVIOUSLY ANALYZED. WE DO NOT RECOMMEND A FULL-SCALE PRA FOR EACH PLANT."

THE IDCOR IPE METHODOLOGY IS DESIGNED TO TEST THE APPLICABILITY OF SEVERE ACCIDENT CONCLUSIONS ON INDIVIDUAL PLANTS

- ADDRESSES CORE DAMAGE PREVENTION CAPABILITY INCLUDING HUMAN PERFORMANCE
- ADDRESSES CONTAINMENT RESPONSE EFFECT ON SOURCE TERMS
- EVALUATES BY COMPARISON TO IDCOR REFERENCE PLANT AND GENERIC DATA USING ENGINEERING INSIGHTS

THE IDCOR IPE METHODOLOGY IS GENERALLY LIMITED TO INTERNAL EVENTS

- TREATS INTERNAL FLOODING BY COMMON LOCATION REVIEW
- LIMITED TREATMENT OF FIRES THROUGH COMMON LOCATION REVIEW
- DOES NOT ADDRESS SEISMIC EVENTS
- DOES NOT ADDRESS SABOTAGE

THE IDCOR IPE METHODOLOGY CONCENTRATES
ON PLANT COMPARISONS OF:

- FRONT LINE SYSTEMS
- SUPPORT SYSTEMS
- CONTAINMENT RESPONSES CONTROLLING FISSION PRODUCT RELEASE

THE IDCOR IPE TREATS HUMAN PERFORMANCE BY:

- INCORPORATING INFORMATION FROM PLANT OPERATING AND MAINTENANCE EVENT REPORTS
- EVALUATING PLANT SPECIFIC EMERGENCY PROCEDURES FOR OPERATOR ACTIONS THAT WOULD BE TAKEN DURING SEVERE ACCIDENT CONDITIONS
- EVALUATING ACTUAL TRAINING GIVEN THE OPERATOR

THE IDCOR IPE HAS BEEN DEVELOPED

- CONCEPT REVIEWED BY NRC STAFF MARCH 26 AND JULY 16
- REVIEWED BY UTILITIES, OWNERS GROUPS, AND VENDORS MARCH 4, MAY 2, AND JULY 8-11
- CONCEPTUALLY APROVED BY IDCOR POLICY GROUP JULY 24, 1985

THE IDCOR IPE METHODOLOGY WILL BE TESTED
ON 7 PLANT TYPES BY END OF 1985

- 4 PWRs AND 3 BWRs - 4 IDCOR PLANTS AND 3 ADDITIONAL PLANTS
- REAL TIME REVIEW OF THE PROCESS BY INDUSTRY AND NRC STAFF PLANNED

THE IDCOR IPE METHODOLOGY REVIEW PROCESS IS SCHEDULED FOR COMPLETION DURING 1985

- 10/31 COMPLETION OF REFERENCE PLANT ANALYSES
- 11/30 COMPLETION OF THE PLANT ANALYSIS FOR THE THREE ADDITIONAL PLANTS
- 12/15 METHODOLOGY SUBMITTED TO IDCOR STEERING AND POLICY GROUPS FOR ACCEPTANCE
- 12/31 PRESENTATIONS TO NRC STAFF, ACRS, AND NRC COMMISSIONERS
- 12/31 SUBMITTAL FOR NRC REVIEW AND CONSIDERATION IF ACCEPTED BY INDUSTRY

IDCOR IPE METHODOLOGY WILL SATISFY THE SYSTEMATIC EVALUATION GOALS OF THE POLICY PAPER

- METHODS TREAT THE POINTS RAISED IN THE APRIL 15, 1985 ACRS LETTER TO THE NRC CHAIRMAN EXCEPT SEISMIC
- THERE ARE NO MAJOR TECHNICAL DIFFICULTIES WITH THE METHODS DEVELOPED
- THE METHOD DOES NOT REQUIRE EXTENSIVE PRA EXPERTISE
- THE METHOD CAN BE IMPLEMENTED IN A PRACTICAL TIME FRAME

BWR

ACCIDENT SEQUENCE EVALUATION

METHODOLOGY

BWR

INDIVIDUAL PLANT EVALUATION

(IPE)

METHODS DEVELOPMENT

FOR

ACCIDENT SEQUENCE EVALUATION

E.T. BURNS

AUGUST 2, 1985

PRESENTATION

BY

IDCOR

TO

ACRS

2-T-60-004

OVERVIEW

ACCIDENT SEQUENCE EVALUATION

- o APPROACH: PHILOSOPHY
- o METHODOLOGY STRUCTURE: WHAT IS IT
- o IMPLEMENTATION: HOW TO USE IT
- o RESOURCES

BACKGROUND

THE IDCOR PROGRAM CONCLUSIONS:

- o ACCIDENT SEQUENCE FREQUENCIES INVOLVING SEVERE ACCIDENTS ARE EXTREMELY LOW.
- o FISSION PRODUCT SOURCE TERMS ARE LIKELY TO BE MUCH LESS THAN HAS BEEN CALCULATED IN PREVIOUS STUDIES.
- o THE RISKS AND CONSEQUENCES TO THE PUBLIC OF SEVERE ACCIDENTS ARE SIGNIFICANTLY BELOW THOSE PREDICTED BY PREVIOUS STUDIES AND MUCH SMALLER THAN THE RISK LEVELS INCORPORATED IN THE NRC INTERIM SAFETY GOALS.

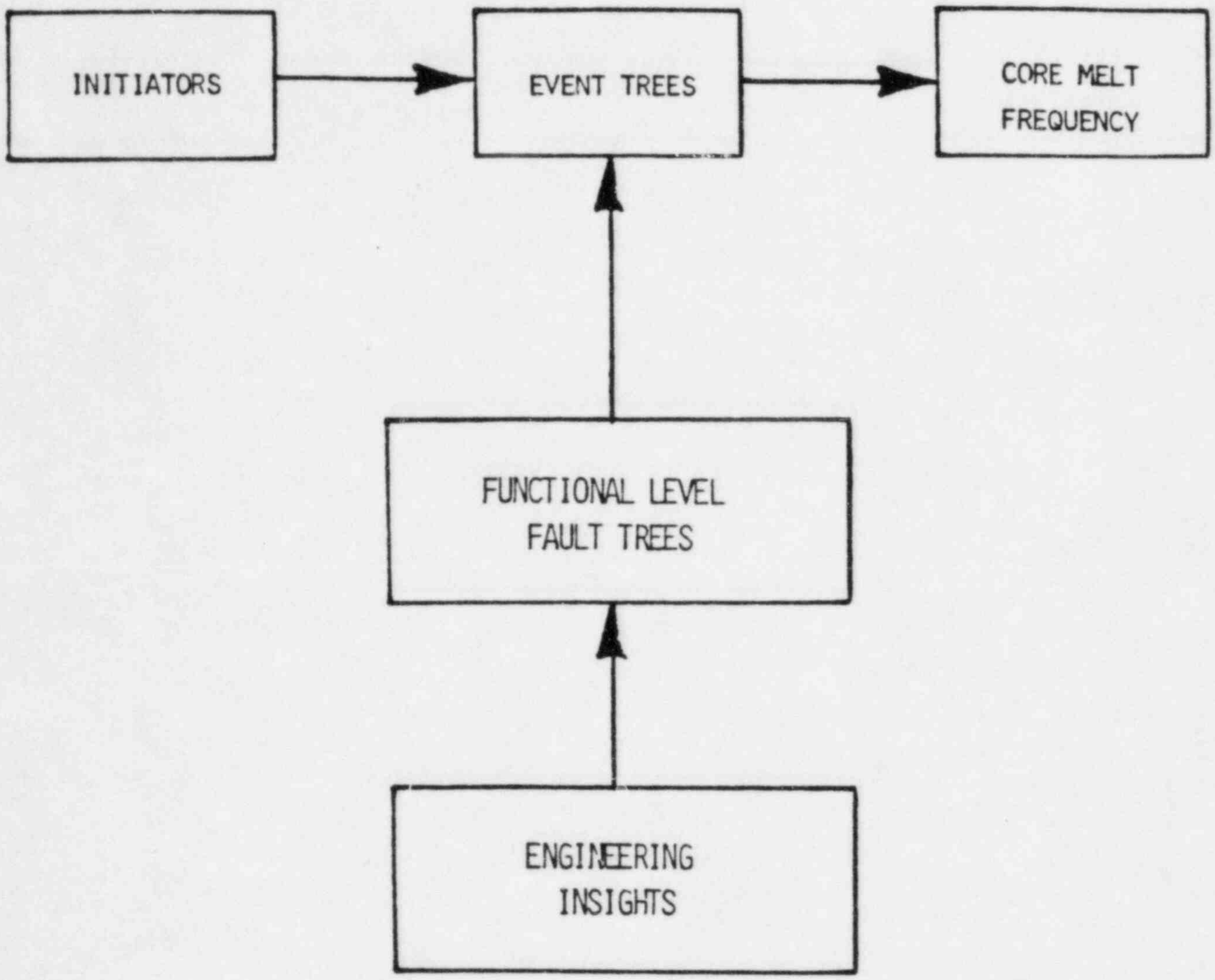
THE PURPOSE OF IDCOR 1985 IS TO ESTABLISH A METHOD WITH CAN BE USED BY EACH PLANT TO DETERMINE CONSISTENCY WITH IDCOR CONCLUSIONS.

OBSERVATION

- SOME PLANTS HAVE EXHIBITED UNIQUE VULNERABILITIES AS DETERMINED BY OPERATING EXPERIENCE OR PLANT SPECIFIC ACCIDENT SEQUENCE INVESTIGATIONS.

THE INDIVIDUAL PLANT EVALUATION METHOD PROVIDES:

- o A PLANT SPECIFIC APPROACH TO IDENTIFYING VULNERABILITIES.
- o AN INVESTIGATIVE TOOL.
- o AN INTEGRATED LOOK AT THE PLANT.
- o A SYSTEMATIC REVIEW OF NECESSARY FUNCTIONS FOR SAFE OPERATION.
- o A METHOD TO IDENTIFY SIGNIFICANT CONTRIBUTORS TO CORE MELT.
- o A PROCESS TO MAKE THE INFORMATION "BELONG" TO THE PLANT OWNER.



ELEMENTS OF
INDIVIDUAL PLANT EVALUATION METHOD

A MAJOR INPUT TO THE BWR IPE METHOD IS THE IDENTIFICATION OF ENGINEERING INSIGHTS FROM

- BWROG WORK
- PUBLISHED PRAs
- NRC
  - -- AEOD EVALUATIONS
  - -- I&E BULLETINS
  - -- USIs
  - -- GENERIC ISSUES
- OPERATING EXPERIENCE
- INPO

APPROACH

OF

BWR ACCIDENT SEQUENCE EVALUATION METHOD

- USE EVENT TREES AS FRAMEWORK FOR ACCIDENT SEQUENCES.
- USE FAULT TREES AS FOCAL POINT FOR PLANT SPECIFIC DESIGN/PROCEDURAL INFORMATION.
- USE SYSTEM NOTEBOOKS AS THE REFERENCE SOURCE.
- USE SUPPORT SYSTEM DEPENDENCY MATRICES TO ASSIST IN THE MODELING IMPORTANT INTERACTIONS.
- USE AVAILABLE DATA TO QUANTIFY THE MODELS. (PLANT SPECIFIC IF POSSIBLE).
- USE ENGINEERING INSIGHTS TO PROBE AREAS WHERE QUANTIFICATION OF THE MODEL NEEDS TO BE CHANGED.

GOALS OF THE APPROXIMATE METHOD

THE INDIVIDUAL PLANT ACCIDENT SEQUENCE EVALUATION METHODOLOGY ESTABLISHES A CONSISTENT RISK FRAMEWORK AND BOTH INVESTIGATES AND GENERATES ENGINEERING INSIGHTS.

- o ESTABLISH A REALISTIC BASELINE CORE MELT FREQUENCY EVALUATION OF EACH PLANT
- o BE SCRUTABLE AND USABLE WITHIN UTILITY MANAGEMENT
- o BE EASILY UPDATED WHEN LATER INFORMATION BECOMES AVAILABLE
- o PROVIDE CLEAR DOCUMENTATION
- o IDENTIFY POTENTIAL ACCIDENT SEQUENCE OUTLIERS

CONSIDERATIONS AFFECTING THE COMPLEXITY OF THE MODEL

OBSERVATIONS

- o UTILITY IS THE ONE WHO KNOWS THE PLANT BEST
- o DETAILED FRONTLINE SYSTEM FAULT TREES UNNECESSARY IF PLANT PERSONNEL INVOLVED

NEEDS

- o NEED A CONSISTENT, STRUCTURED FRAMEWORK
- o NEED INVESTIGATIVE TOOL TO IDENTIFY POTENTIAL DEPENDENCIES
- o NEED A METHOD THAT WOULD ALLOW QUANTIFICATION OF SEQUENCES
- o NEED A METHOD WHICH WILL ALLOW THE UTILITY TO IMPLEMENT ON A SELF SUFFICIENT BASIS - INTERNALIZE THE PROCESS.

CONSIDERATIONS AFFECTING THE COMPLEXITY OF THE MODEL ISSUES (CONTINUED)

- NEED A METHOD THAT WOULD ACCEPT PLANT SPECIFIC DATA
- NEED A METHOD WHICH CAN INCLUDE PRECURSORS
- NEED A METHOD WHICH CAN INCORPORATE PLANT SPECIFIC VARIATIONS IN SUPPORT SYSTEM ARRANGEMENTS AND IMPACTS

IPE

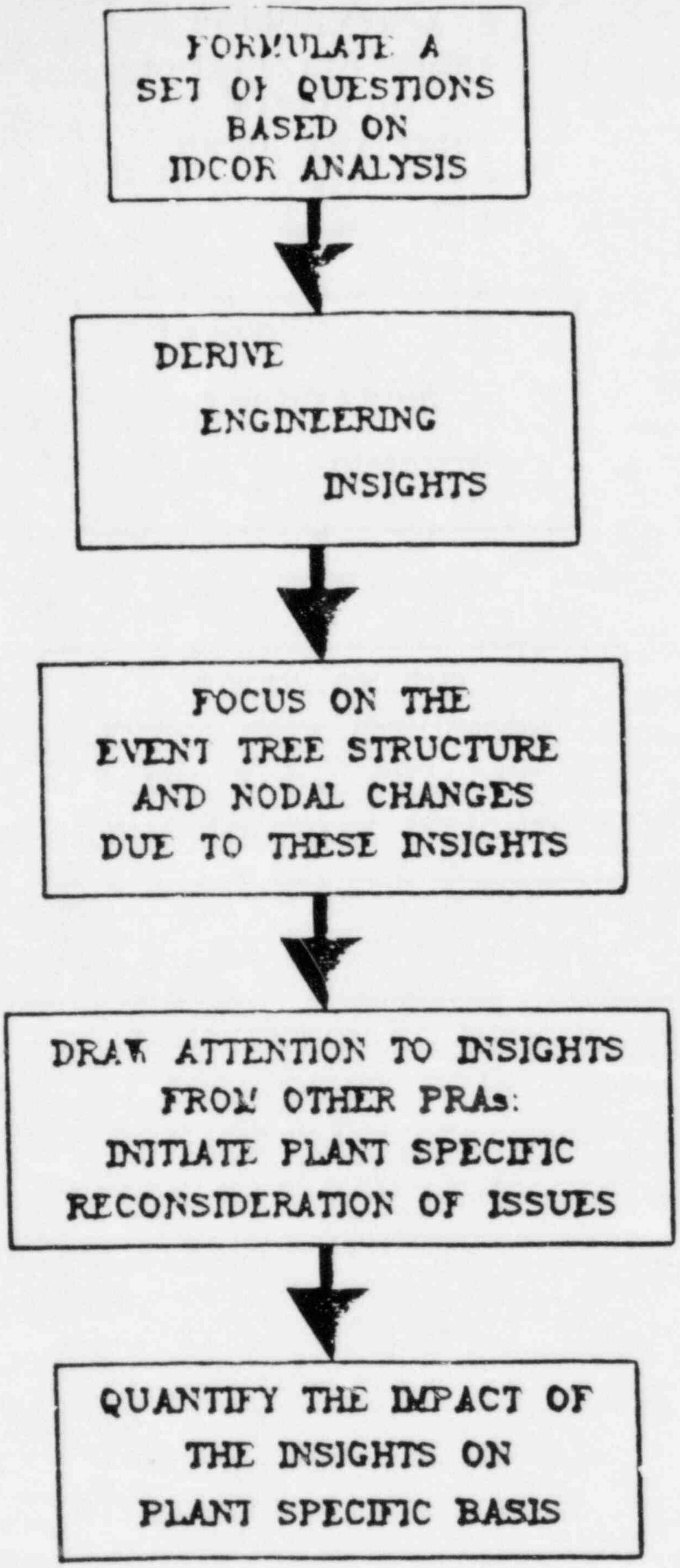
METHOD:

- SCOPE
- INFORMATION FLOW
- INITIATORS
- EVENT TREES
- ACCIDENT SEQUENCE END STATES

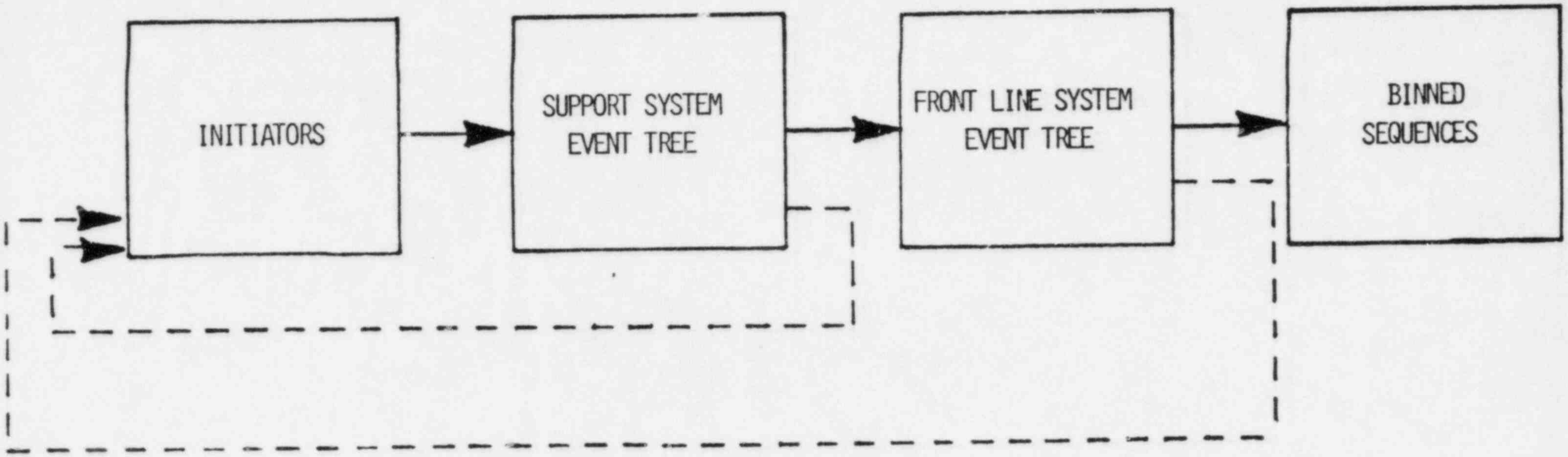
SCOPE

- "INTERNAL" EVENTS
  - INCLUDES INTERNAL FLOODS
  - INTERFACING LOCA
  - COMMON MODE FAILURES IN SW/AC/DC POWER
- APPROXIMATE METHOD CAPABLE OF EXPANSION TO LEVEL 1 PRA
- ALL GE BWRs
- SELECT SUPPORT SYSTEMS ARE EXPLICITLY ADDRESSED:
  - ROOM COOLING
  - SERVICE WATER
  - AC POWER
  - DC POWER
  - INSTRUMENT AIR/N_2

  AND PROVISION IS MADE FOR ADDITIONAL SUPPORT SYSTEM DEPENDENCIES



OVERVIEW OF APPROACH



FLOW OF INFORMATION
ACCIDENT SEQUENCES
&
END STATES

DATA FROM SEVERAL IMPORTANT SOURCES ARE USED TO ESTABLISH INITIATING EVENTS

- o USE RESULTS FROM SPECIFIC RISK ASSESSMENTS
- o REVIEW EPRI NP-2230 AND NUREG/CR-3862 (DRAFT)
- o CONSIDER PLANT OPERATING HISTORY AND PLANT-UNIQUE FEATURES

↓

RESULTS

FOUR GENERAL CATEGORIES

- -- TRANSIENTS AND MANUAL SHUTDOWNS
- -- LOCAs
- -- INITIATORS COUPLED WITH FAILURE TO SCRAM
- -- OTHER LOW FREQUENCY TRANSIENT EVENTS

THE EXPANDED CATEGORIES OF
BWR INITIATING EVENTS ARE:

o TRANSIENTS

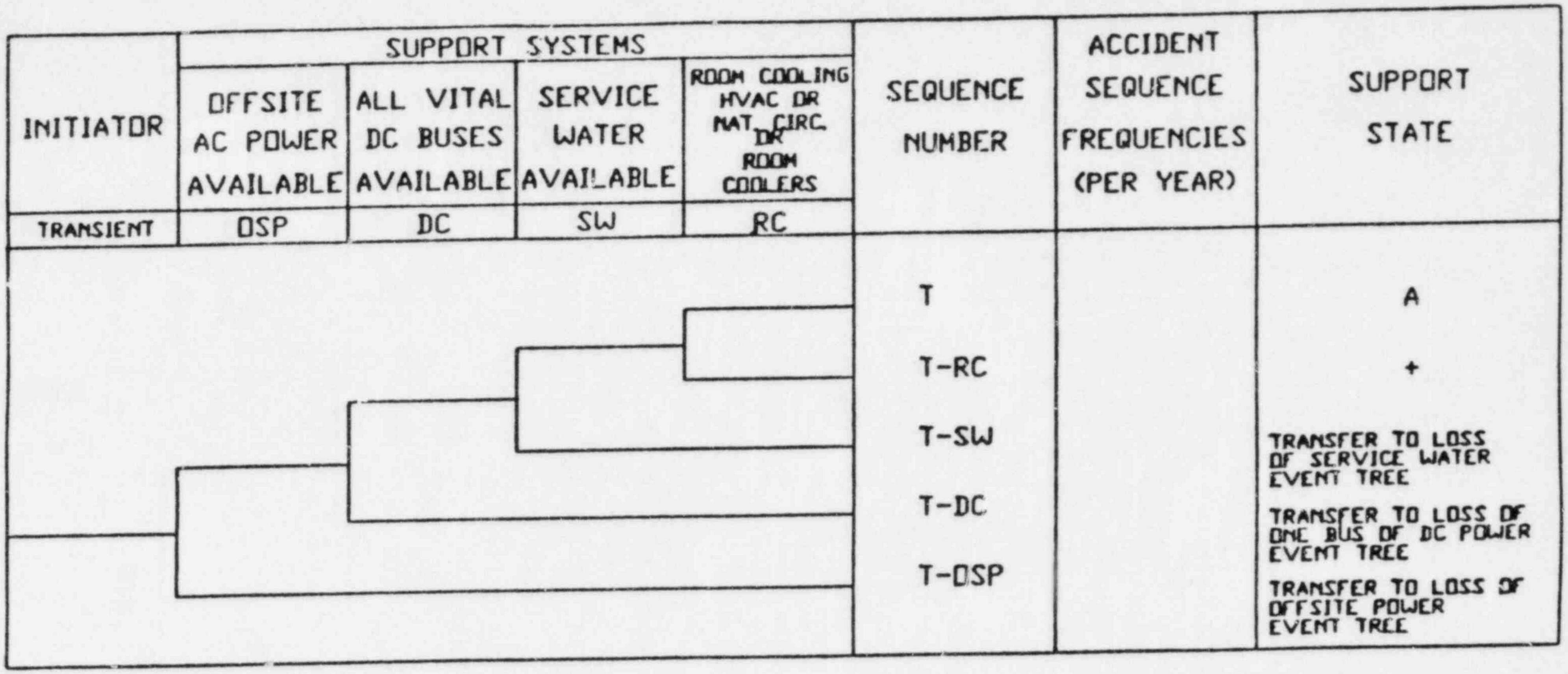
- TURBINE TRIPS
- ISOLATION EVENTS (MSIV CLOSURE)
- LOSS OF CONDENSER
- LOSS OF FEEDWATER
- LOSS OF OFF-SITE POWER
- INADVERTENT OPENING OF RELIEF VALVES (IORV)
- SLOW, CONTROLLED MANUAL SHUTDOWNS

o LOCAs

- LARGE ($\geq$ 4" DIAMETER)
- MEDIUM ($\geq$ 1" DIAMETER), < 4" DIAMETER)
- SMALL ($\geq$ 1" DIAMETER)
- BREACH OF RPV IN EXCESS OF ECCS CAPABILITY
- INTERFACING LOCA

THE EXPANDED CATEGORIES OF
BWR INITIATING EVENTS ARE:
(CONTINUED)

- o INITIATORS COUPLED WITH FAILURE TO SCRAM
  - ALL TRANSIENTS AND LOCAs, COUPLED WITH CONDITIONAL FAILURE TO SCRAM
- o OTHER LOW FREQUENCY TRANSIENTS
  - LOSS OF DC POWER BUS
  - REFERENCE LINE LEAK
  - DRYWELL COOLER FAILURE
  - LOSS OF SERVICE WATER
  - LOSS OF INSTRUMENT AIR
  - INTERNAL FLOODING



+ NEGLIGIBLE

EXAMPLE - APPROACH UTILIZES EVENT TREES FOR INVESTIGATION OF ACCIDENT SEQUENCES: SUPPORT STATE EVENT TREE TYPICAL

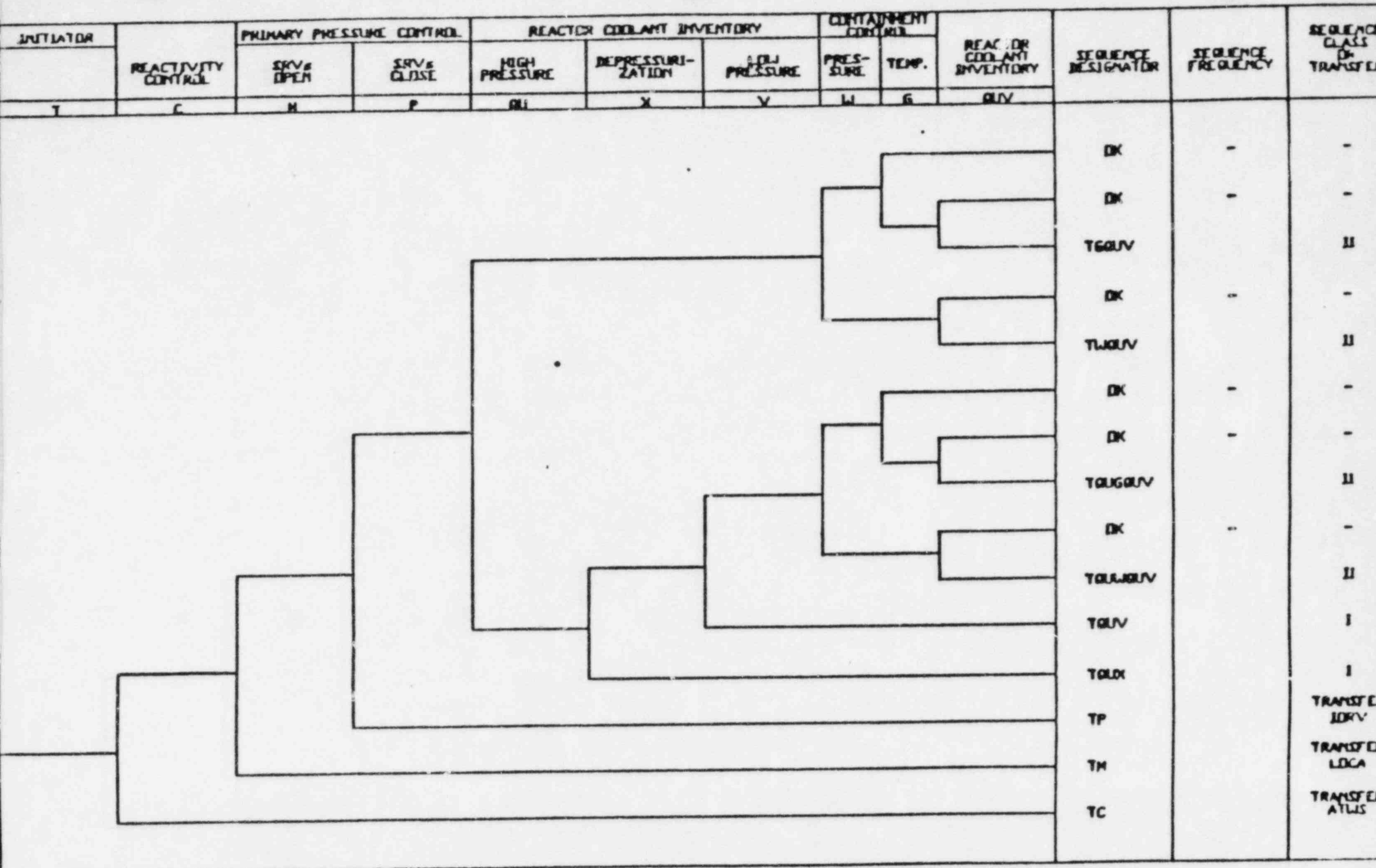


Figure 4.1-2 General Transient Event Tree

FRONTLINE FUNCTIONS EXAMINED IN
THE EVENT TREES

- o REACTIVITY CONTROL
- o RPV PRESSURE CONTROL
  - RELIEF
  - SORV
- o COOLANT MAKE UP
  - HIGH PRESSURE
  - DEPRESSURIZATION
  - LOW PRESSURE
- o CONTAINMENT CONTROL
  - TEMPERATURE
  - PRESSURE

THE IPE METHOD

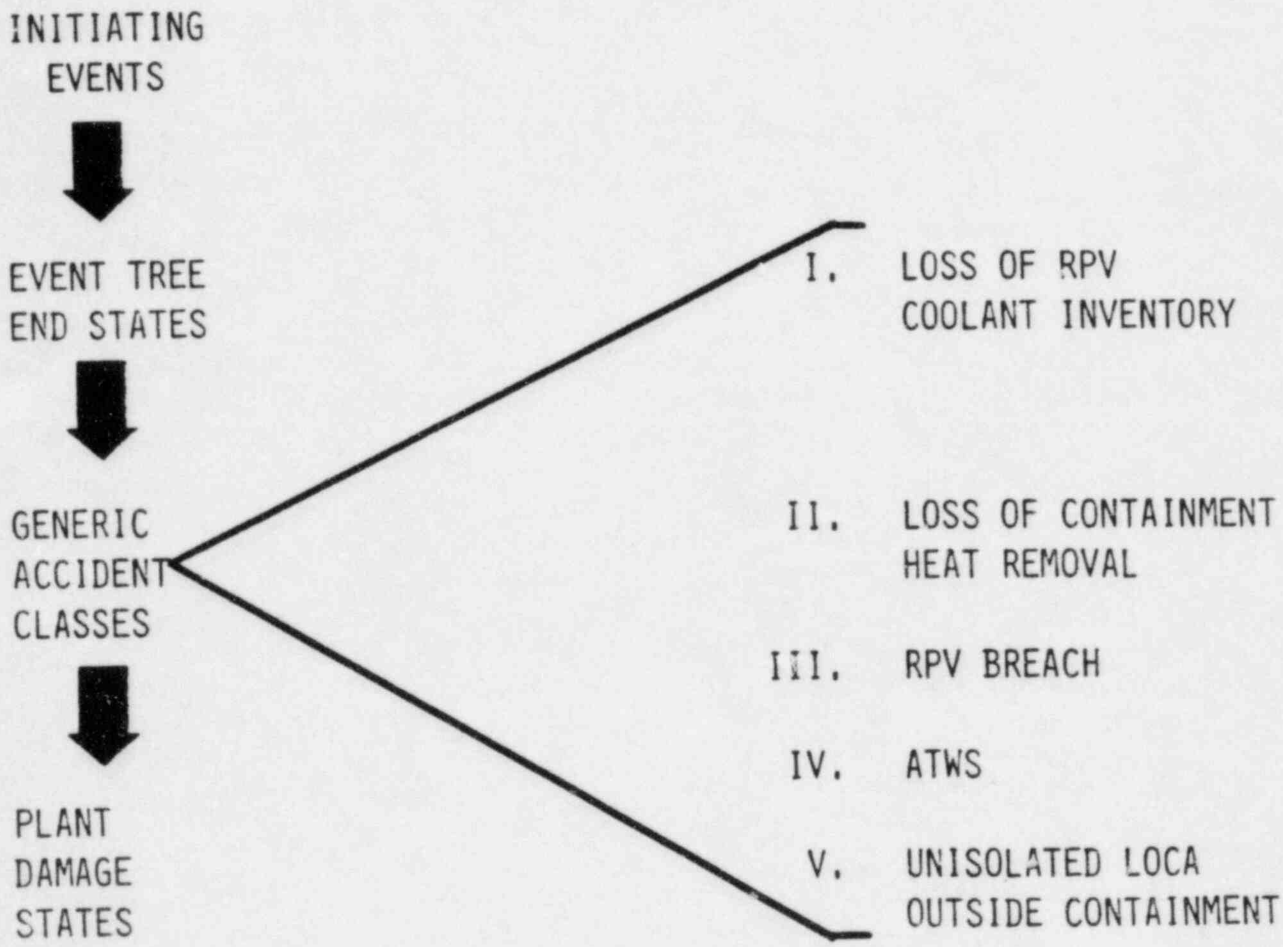
CHARACTERIZES THE TYPES OF CORE MELT SEQUENCES (BINNING)

- CONTAINMENT STATUS (TEMPERATURE, PRESSURE, INTEGRITY)

- RPV STATUS (INTEGRITY)

- CORE STATUS (POWER OR NOT)

BINNING OF ACCIDENT SEQUENCES

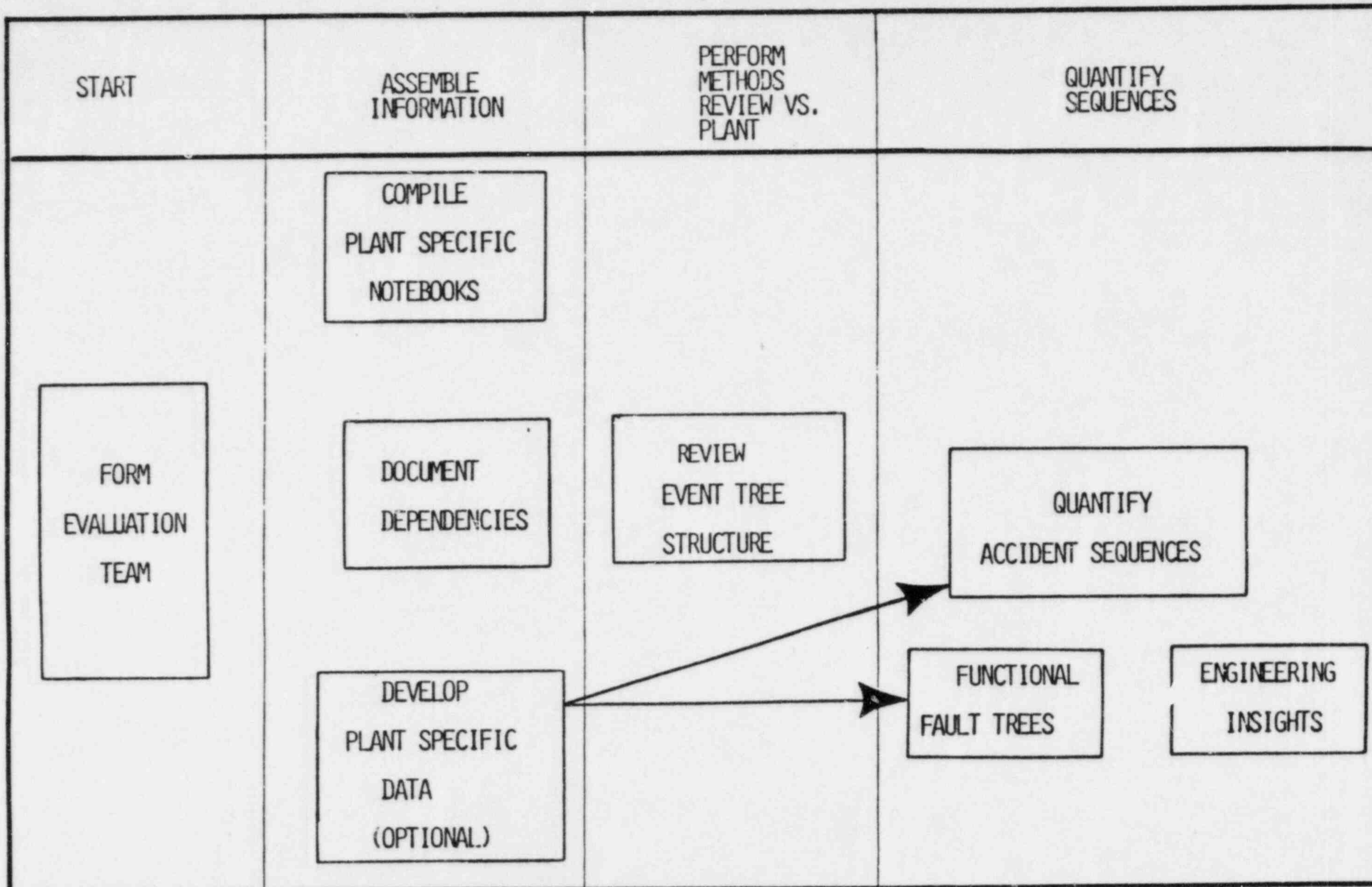


IMPLEMENT

THE

METHOD

STEPS IN THE IMPLEMENTATION OF THE METHOD



DETAILED ENGINEERING LEVEL SEQUENCE EVALUATION

o RESOURCE REQUIREMENTS FOR IMPLEMENTATION: UTILITY PERSONNEL PARTICIPATION WILL BE REQUIRED FOR IMPLEMENTATION ON EACH PLANT. THE PERSONNEL ASSUMED AVAILABLE TO IMPLEMENT THE PROGRAM INCLUDE THE FOLLOWING:

- OPERATION
- ENGINEERING
- PRA (TERMINOLOGY ONLY)
- LICENSING (OPTIONAL)

STEPS IN PERFORMANCE OF THE BWR IPE METHODOLOGY

o	TASK 1	FORMATION OF EVALUATION TEAM
o	TASK 2	COMPILATION OF SYSTEM NOTEBOOKS
o	TASK 3	DOCUMENTATION OF DEPENDENCIES (SUPPORT SYSTEMS)
o	TASK 4	REVIEW OF INITIATING EVENTS
o	TASK 5	REVIEW OF EVENT TREES

STEPS IN PERFORMANCE OF THE BWR IPE METHODOLOGY (CONTINUED)

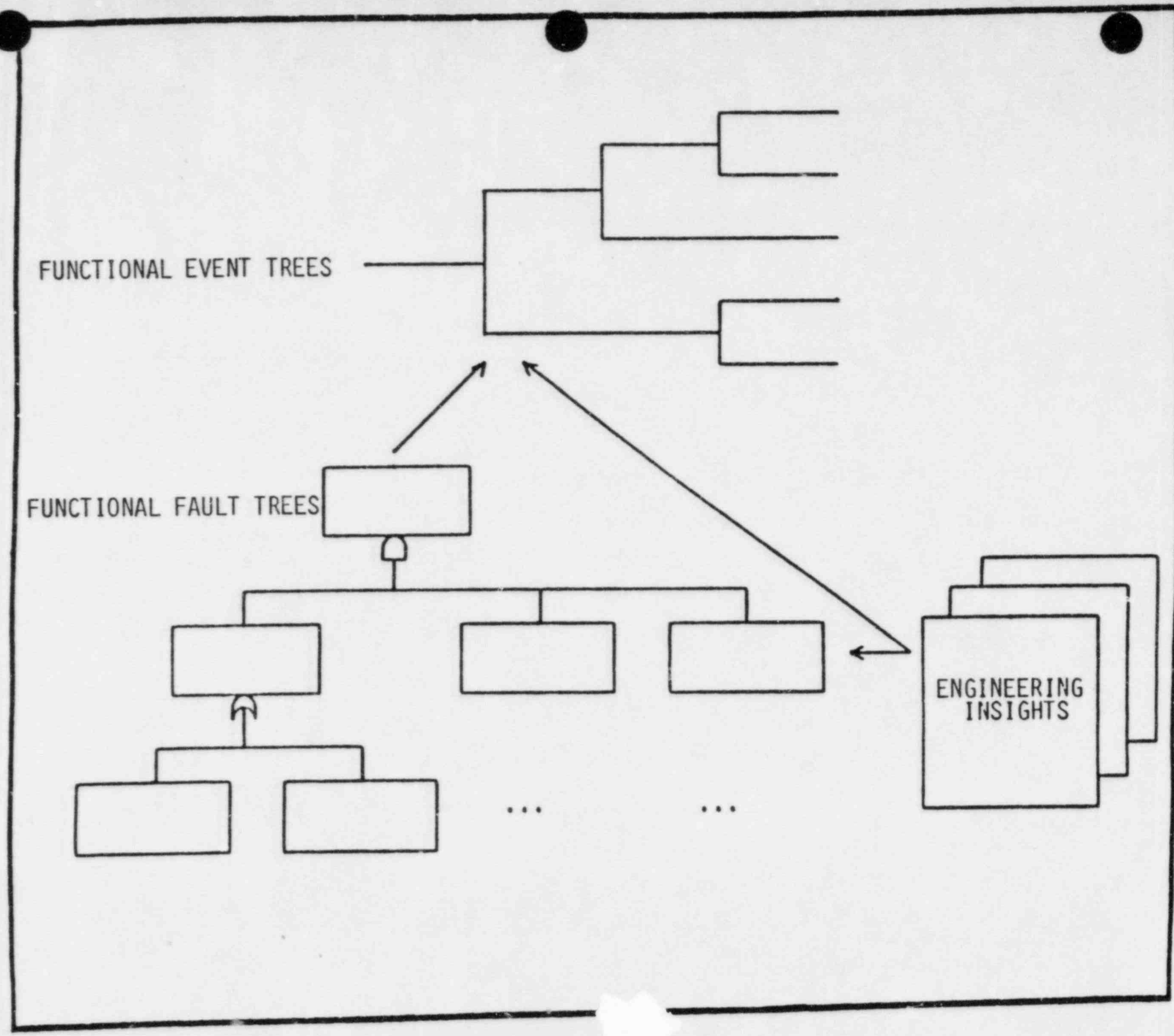
- o TASK 6 — DEVELOPMENT OF PLANT SPECIFIC DATA
- o TASK 7 — QUANTIFICATION
- o TASK 8 — CONSEQUENCE BINNING
- o TASK 9 — COMPARISON OF PLANT SPECIFIC RESULTS WITH IDCOR RESULTS
- o TASK 10 — REPORT
- o TASK 11 — INCORPORATION OF COMMENTS

DEPENDENT FAILURES
ARE INCLUDED
EXPLICITLY IN THE METHODOLOGY
(TASKS 3, 4 & 5)

DEPENDENCY	TREATMENT
FUNCTIONAL	EVENT TREES
SUPPORT SYSTEMS	EVENT TREES AND DEPENDENCY MATRICES
HUMAN	MAINTENANCE, ACCIDENT RESPONSE
INTERCOMPONENT	COMMON CAUSE
SPATIAL	FLOOD; INTERFACING LOCA; ROOM TEMPERATURES

EVENT TREE IMPLEMENTATION

- DEFINE THE COMPOSITION OF THE BUILDING BLOCKS NECESSARY FOR EACH NODE
- INCORPORATE SUPPORT SYSTEM EFFECTS VIA SUPPORT STATES
- DEFINE THE IDCOR INSIGHTS TO BE APPLIED IN ASSESSING EACH NODE
- USE PLANT SPECIFIC MODELING TO CHOOSE A REPRESENTATIVE NODAL CONDITIONAL PROBABILITY (SEE APPENDIX FOR GUIDANCE).
- QUANTIFY EVENT TREES
- SUM SEQUENCES BY POTENTIAL ACCIDENT SEQUENCE TYPE
- COMPARE WITH IDCOR RESULTS


FUNCTIONAL EVENT TREES
FUNCTIONAL FAULT TREES
ENGINEERING INSIGHTS

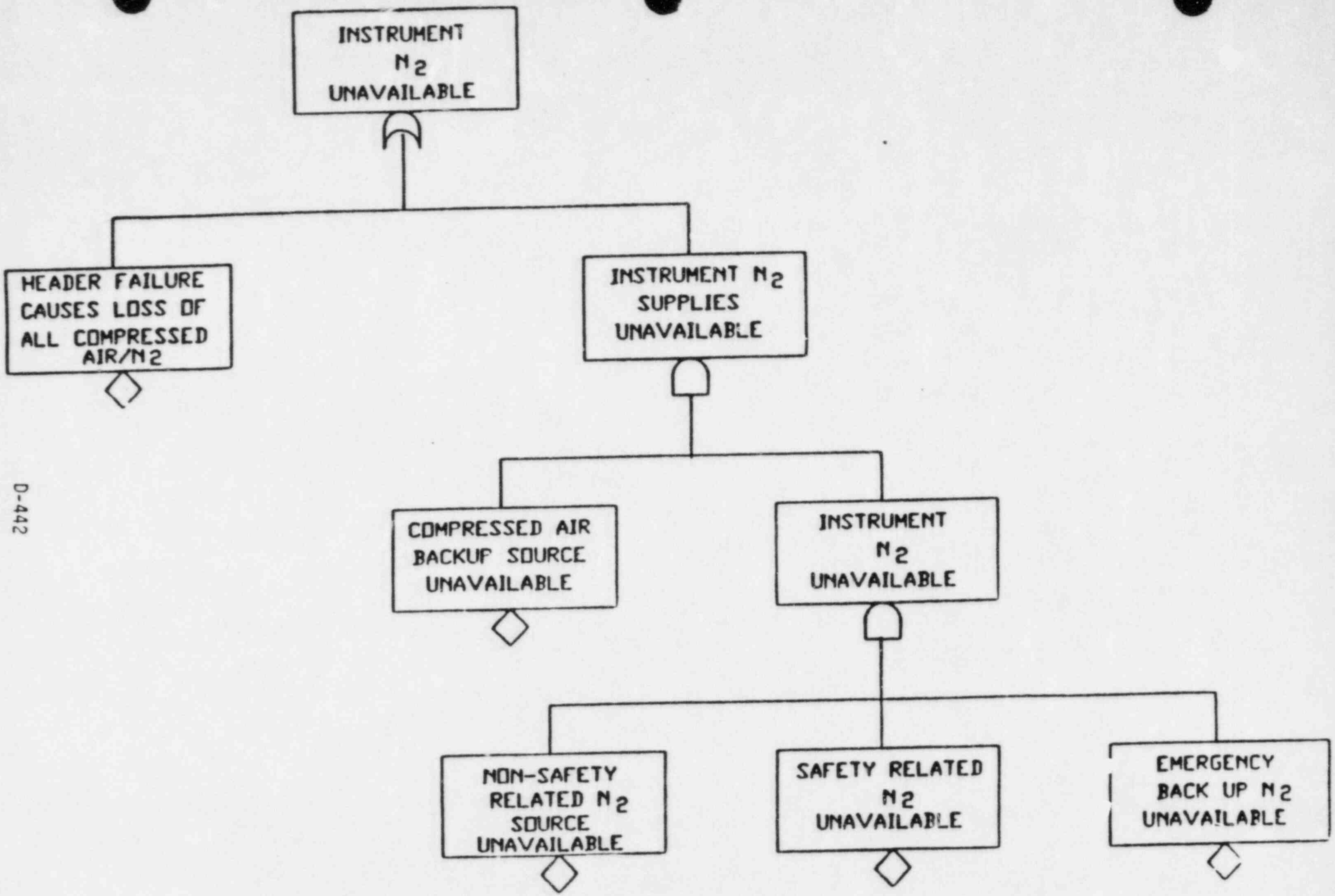
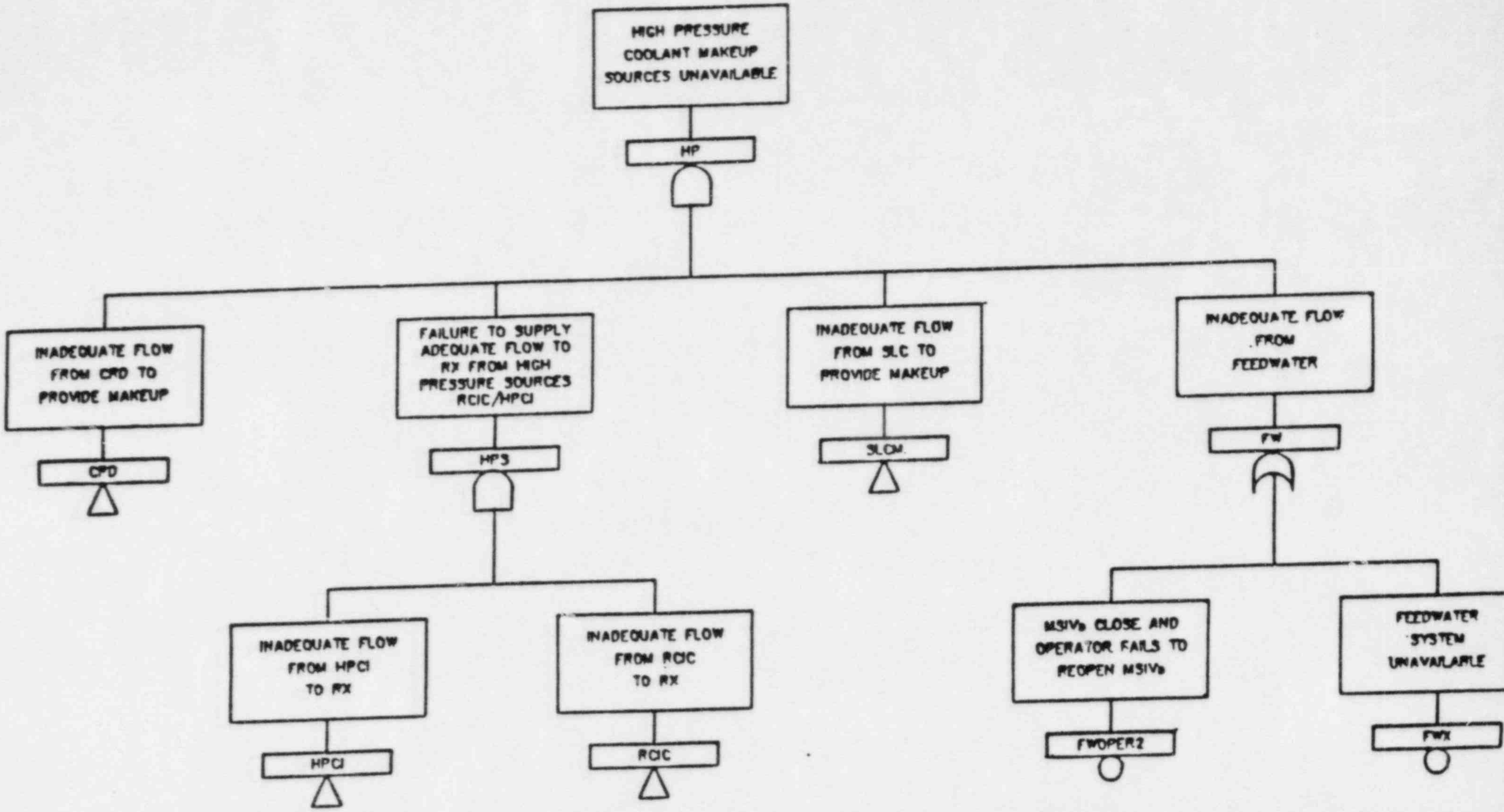


Figure D.9.5-4 Functional Fault Tree for Unavailability of Instrument Nitrogen



EVENT TREE NODAL FUNCTION

EVENT TREE NODAL QUESTIONS

OBJECTIVES:

- DETERMINE APPLICABILITY OF GENERIC MODEL TO SPECIFIC PLANT.

- FOCUS ATTENTION ON DIFFERENCES.

PROCEDURE:

- USE TOP LEVEL QUESTIONS TO IDENTIFY PLANT SPECIFIC DIFFERENCES.

    - o QUESTIONS POSED IN TUTORIAL "IF - THEN" FORMAT

    - o ANSWERS DIRECT ANALYST TO MODELING CHANGES

        - IN FAULT OR EVENT TREE STRUCTURES
        - IN UNAVAILABILITIES (QUANTIFICATION)
        - IN USES OF RESULTS

- USE DETAILED QUESTIONS TO SUPPLEMENT TOP LEVEL, AND TO GAIN ADDITIONAL INFORMATION ABOUT PLANT OPERATIONS.

NODAL QUESTIONS
FORMAT

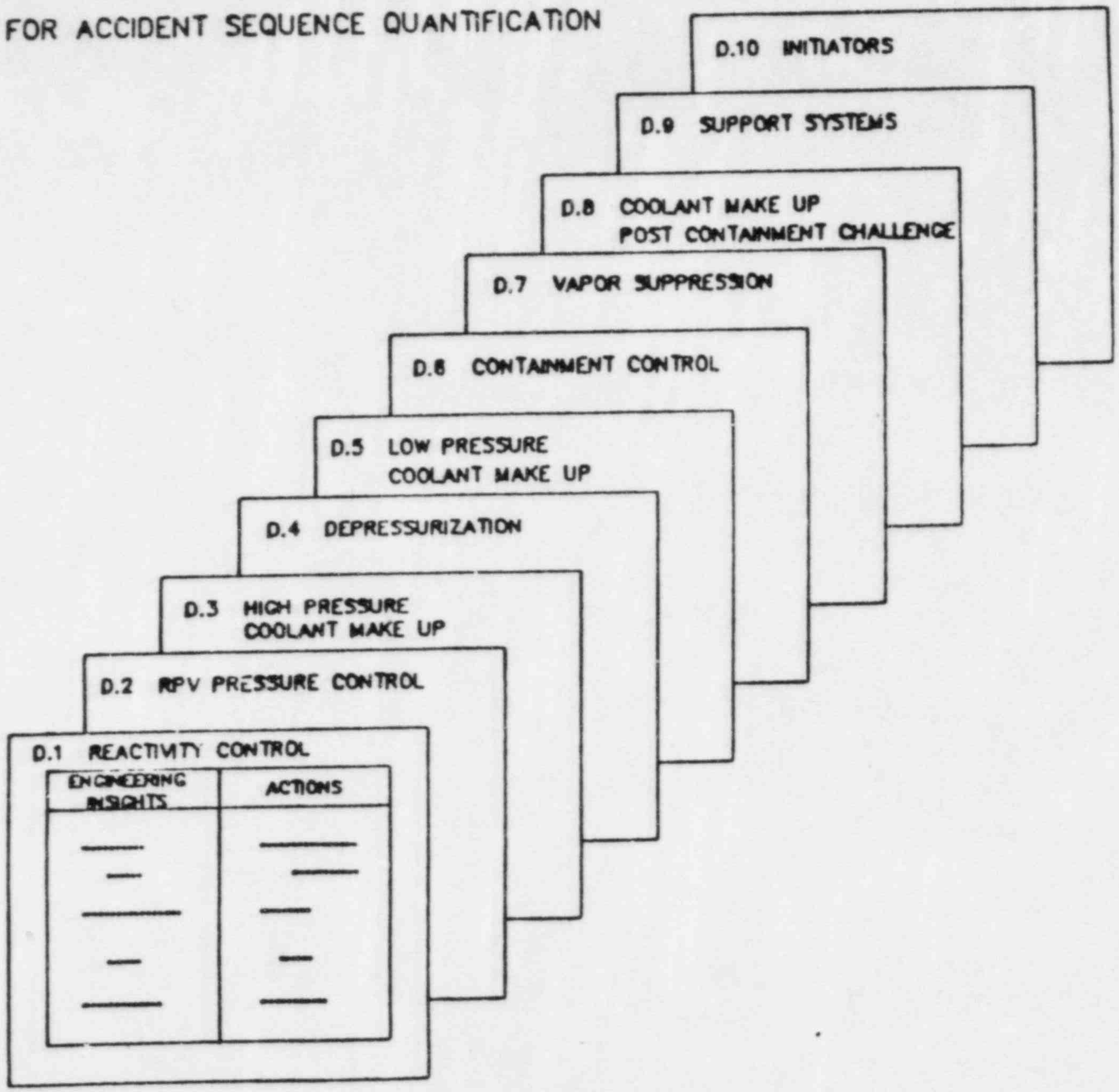
FUNCTION: HIGH PRESSURE COOLANT INVENTORY MAKEUP

SYSTEM: HPCI/RCIC

- OPERATING EXPERIENCE
- NUMBER OF TRAINS
- POWER
- SUPPORT SYSTEMS
- LOCATION
- CONTROLS
- OPERATING PROCEDURES/TRAINING
- MAINTENANCE
- TECHNICAL SPECIFICATIONS
- LIMITS

BWR ENGINEERING INSIGHTS

FOR ACCIDENT SEQUENCE QUANTIFICATION



EXAMPLE QUESTIONS: MAINTENANCE/TECHNICAL SPECIFICATIONS

TOP LEVEL - "HPCI/RCIC: DO YOU ALLOW ON-LINE PREVENTIVE MAINTENANCE?

IF NO - WHAT IS ALLOWED OUTAGE TIME?

<u>MAINTENANCE UNAVAILABILITY</u>

IF 3 DAYS - USE 0.01

IF 7 DAYS - USE 0.015

IF 14 DAYS - USE 0.020

IF YES - USE MAINTENANCE UNAVAILABILITY FROM WASH-1400" = .07

COMPARISON OF INDIVIDUAL PLANT RESULTS WITH IDCOR

- CORE MELT FREQUENCY
- TYPES OF SEQUENCES
- UNCERTAINTIES
- SAFETY GOAL
- OUTLIERS
- THRESHOLD FOR ACTION

CORE MELT FREQUENCY

RAISE QUESTIONS IF THE PLANT SPECIFIC APPLICATION OF THE BWR METHODOLOGY RESULTS IN SIGNIFICANTLY GREATER CORE MELT FREQUENCY THAN IDENTIFIED IN IDCOR.

SEQUENCE TYPES

IDCOR AND PREVIOUS

BWR PRAs HAVE

IDENTIFIED CERTAIN

TYPES OR CLASSES

OF ACCIDENT SEQUENCES

ENSURE THAT THE

PLANT SPECIFIC INVESTIGATION

IDENTIFIES UNIQUE VARIATIONS

OUTLIERS

IDENTIFY ACCIDENT SEQUENCES WITH HIGHER THAN ANTICIPATED FAILURE FREQUENCES, OR FREQUENCIES WHICH FAR EXCEED OTHER PLANT SPECIFIC ACCIDENT SEQUENCES.

SUMMARY OF
THE METHOD

- o DEVELOPED TO CALCULATE A REALISTIC PLANT SPECIFIC CORE MELT FREQUENCY
- o BASED ON INSIGHTS FROM PAST PRAs AND IDCOR
- o IS NOT A PRA
- o IS USABLE FOR COMMUNICATION TO MANAGEMENT
- o IDENTIFIES POTENTIAL OUTLIERS
- o EXPANDABLE TO A LEVEL 1 PRA
- o IS EASILY UPDATED IF INFORMATION BECOMES AVAILABLE IN THE FUTURE, E.G. PLANT SPECIFIC DATA

IDCOR METHODOLOGY FOR PERFORMING PWR INDIVIDUAL PLANT EVALUATIONS

M. J. HITCHLER
MANAGER, PLANT RISK ANALYSIS
AUGUST 2, 1985

OVERVIEW OF PWR INDIVIDUAL PLANT EVALUATION METHODOLOGY

- APPROACH UTILIZED
- METHODOLOGY STRUCTURE
- HOW METHODOLOGY IS IMPLEMENTED
- RESOURCE REQUIREMENTS

IDCOR OBJECTIVES FOR DEVELOPING AN INDIVIDUAL PLANT EVALUATION ARE:

- PROVIDE A METHODOLOGY FOR ASSESSING THE APPLICABILITY OF IDCOR REFERENCE PLANTS' RESULTS TO OTHER PWRS
- PROVIDE A METHOD FOR CONSISTENTLY SCREENING FOR THE IMPACT OF OUTLIERS

THE IPE METHODOLOGY PROVIDES A CONSISTENT RISK FRAMEWORK BY:

1. APPLYING ANALYSIS AND METHODS APPLIED CONSISTENTLY FOR ALL PWRS

2. GENERATING DOCUMENTATION CONSISTENT IN FORMAT AND DETAIL

3. CLEAN DOCUMENTATION

4. ANALYSIS CAN BE UPDATABLE AND EXTENDED BY UTILITY

THE METHODOLOGY PLACES EMPHASIS ON WHAT HAS BEEN IMPORTANT SUCH AS:

- V SEQUENCE
- RECIRCULATION
- SUPPORT SYSTEMS
- BLACKOUT

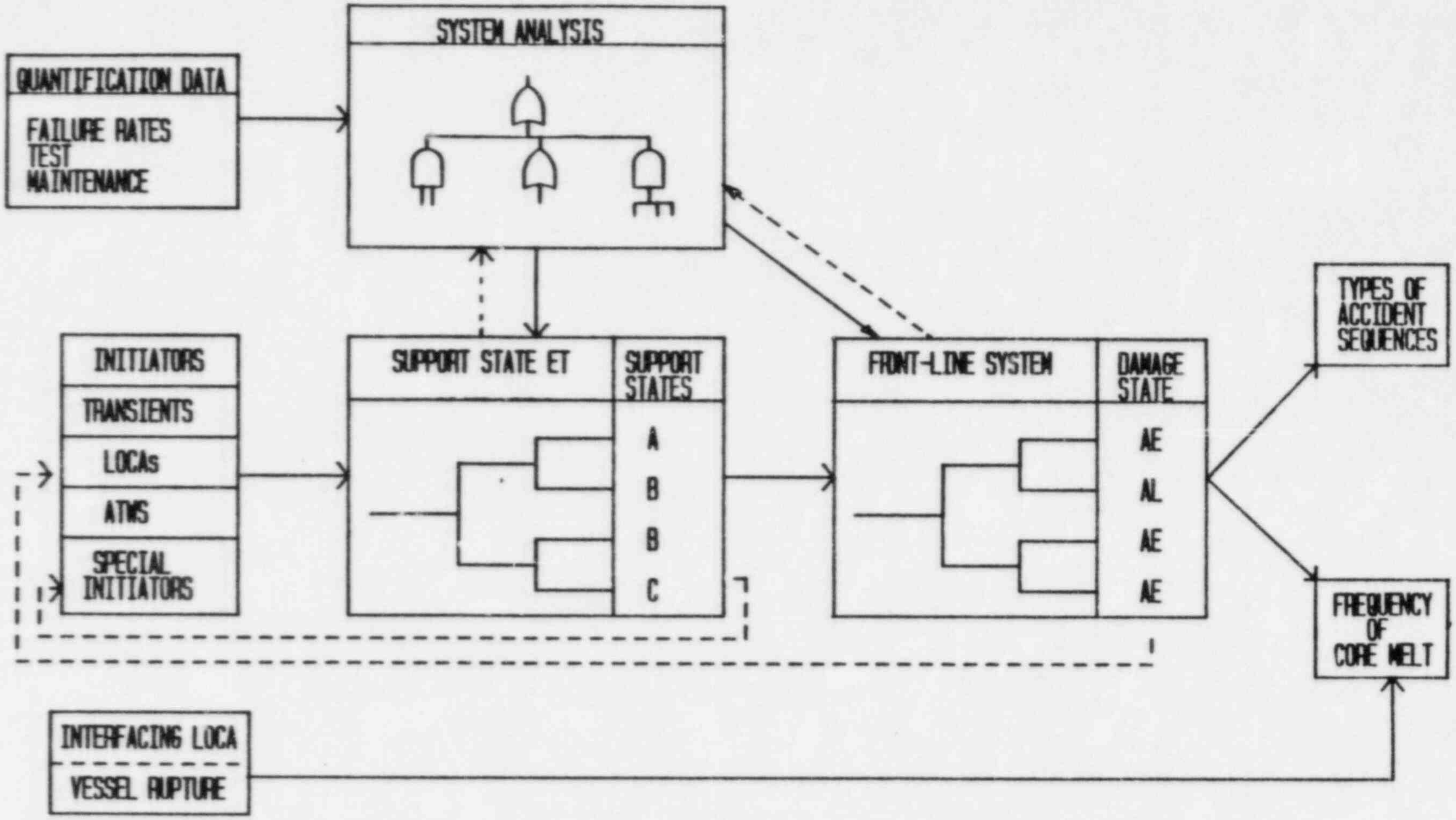
THE METHODOLOGY APPROACH INCLUDES THE FOLLOWING COMPONENTS:

- INITIATING EVENTS
- EVENT LOGICS
- SUCCESS CRITERIA
- SUPPORT FUNCTIONS
- FAULT LOGICS
- FAULT DATA

THE APPROACH USED TO DEVELOP A PRACTICAL TOOL IS:

- PROVIDE BASELINE (IDCOR)
- IDENTIFY VARIATIONS OR EQUIVALENCES TO BASE
- DEVELOP IE/EVENT/FAULT LOGIC TEMPLATES
- APPLICABILITY CHECKLIST FOR USE OF TEMPLATES
- RULES FOR MODIFYING TEMPLATES
- COMBINE TEMPLATES INTO MODULE
- QUANTIFY REBASELINED MODEL

PLANT SPECIFIC IMPLEMENTATION FLOW DIAGRAM



THESE ARE THE STEPS REQUIRED TO IMPLEMENT THE METHODOLOGY

COLLECT INFORMATION

VERIFY INITIATOR GROUPINGS

QUANTIFY INITIATOR PLANT SPECIFIC FREQUENCIES

DEVELOP ACCIDENT SEQUENCE MODELS

DEVELOP SYSTEM ANALYSIS MODELS TO SEGMENT LEVEL

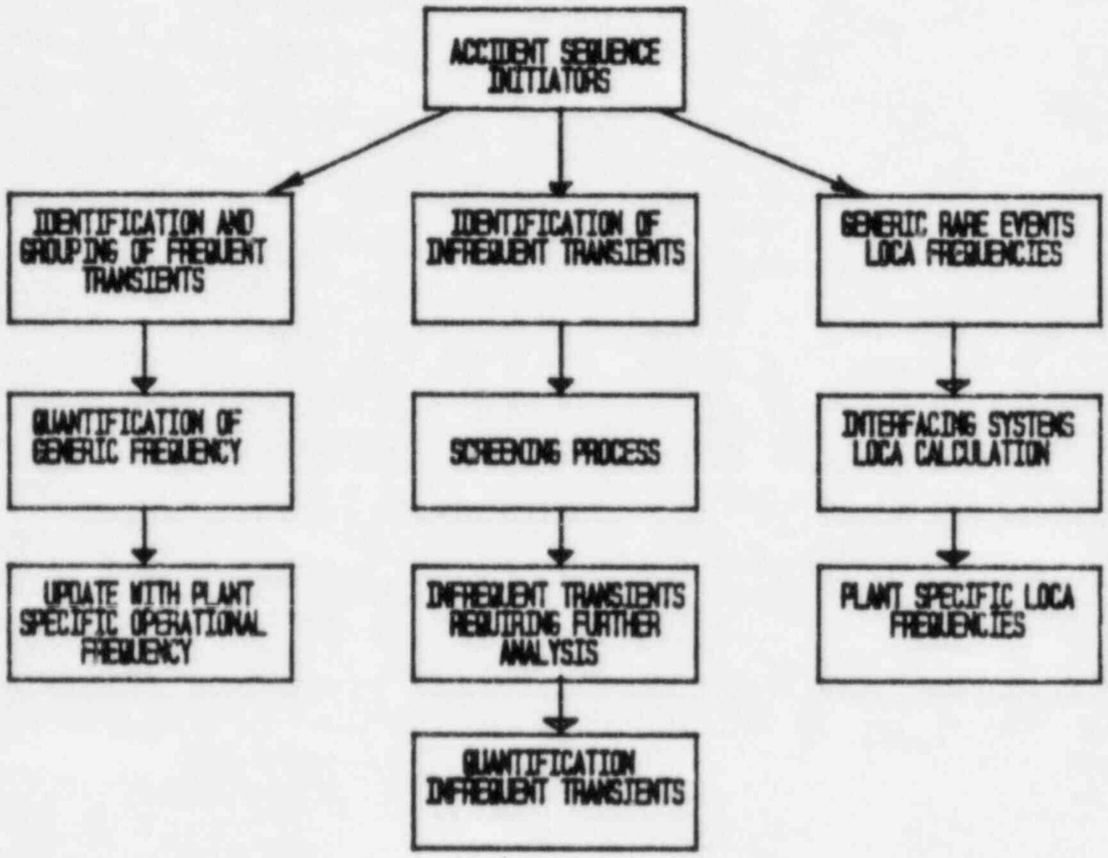
IDENTIFY PLANT OR COMPONENT TEMPLATES

SELECT GENERIC DATA BASE AND VERIFY VALIDITY OF PLANT SPECIFIC DATA

QUANTIFICATION OF SYSTEM AND MODELING

COMPARISON OF THE RESULTS WITH THE IDCOR REFERENCE PLANTS

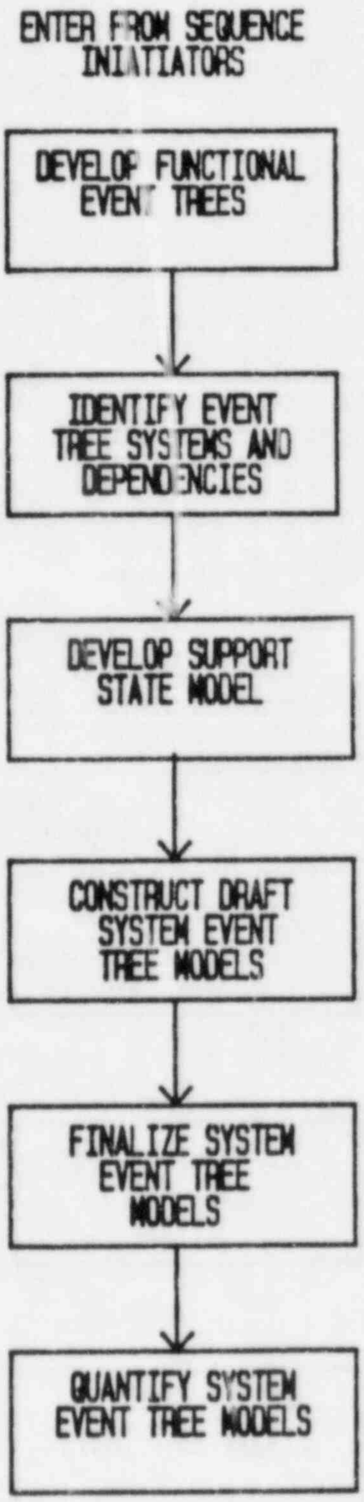
ACCIDENT SEQUENCE INITIATORS ARE CAREFULLY
REVIEWED FOR PLANT SPECIFIC CONSIDERATIONS



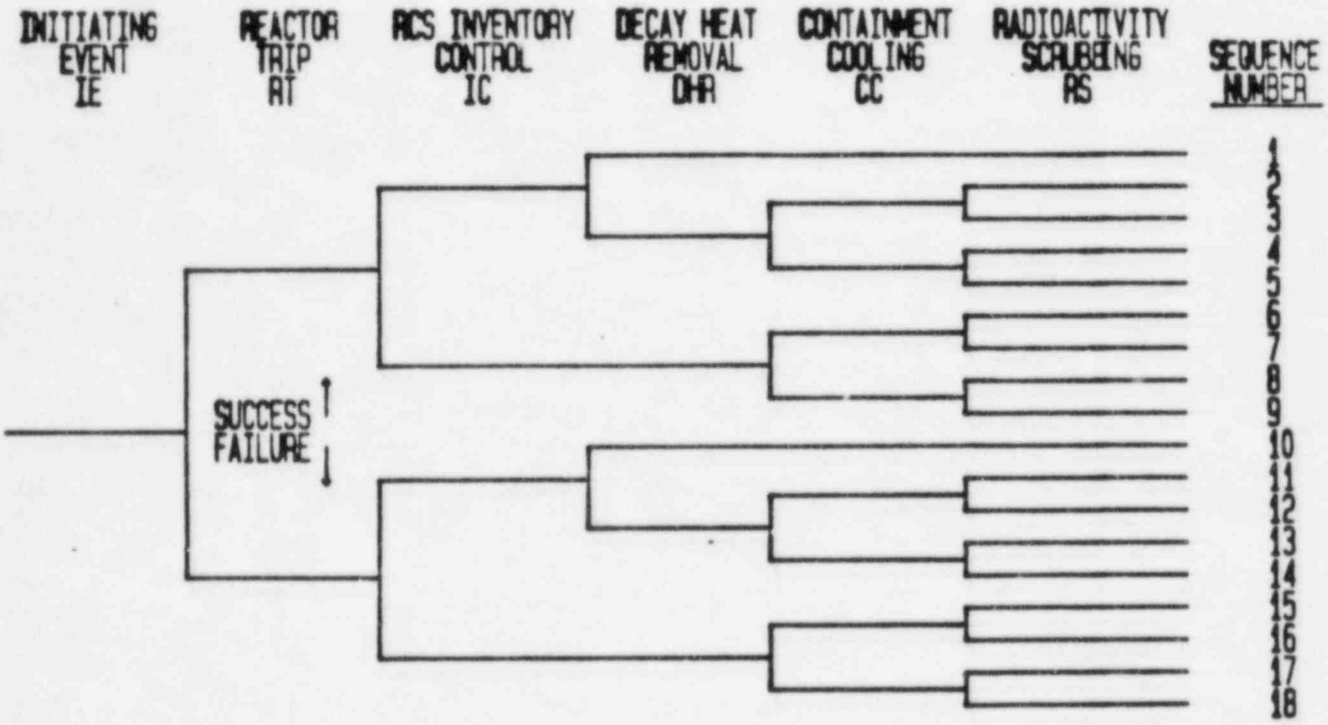
ALL PWRS WILL ANALYZE THE FOLLOWING SET OF INITIATORS

- LARGE LOCA
- MEDIUM LOCA
- SMALL LOCA
- INTERFACING SYSTEMS LOCA
- TRANSIENT WITH MAIN FEEDWATER AVAILABLE
- TRANSIENT WITH MAIN FEEDWATER UNAVAILABLE
- LOSS OF OFFSITE POWER

SIMPLIFIED ACCIDENT SEQUENCE MODELING FLOW DIAGRAM



DEVELOP FUNCTIONAL EVENT TREE MODELS



PLANT FUNCTIONAL EVENT TREE

FOR LOSS OF COOLANT ACCIDENTS

A SUPPORT STATE MODEL IS DEVELOPED USING THE FOLLOWING STEPS:

IDENTIFY POTENTIAL SUPPORT SYSTEMS

CONSTRUCT SYSTEM DEPENDENCE MATRIX & IDENTIFY MAJOR SUPPORT SYSTEMS

IDENTIFY DOMINANT SUPPORT SYSTEM OPERATING STATES

DEVELOP A SUPPORT STATE EVENT TREE MODEL

DEFINE PLANT SPECIFIC SUPPORT STATES

QUANTIFY SUPPORT STATE PROBABILITIES

CONSTRUCT SYSTEM DEPENDENCE MATRIX

	Engineered Safety Features	Integrated Control System	Electric Power - Offsite AC	Electric Power - Onsite AC	Electric Power - Onsite DC	Component Cooling Water	Service Water System	Instrument Air System	HVAC System
Engineered Safety Features			X	X	X				X
Integrated Control System			X	X	X				X
Electric Power - Offsite AC									
Electric Power - Onsite AC	X				X		X		X
Electric Power - Onsite DC		X	X	X					X
Component Cooling Water			X	X			X		
Service Water System	X		X	X					
Instrument Air System			X		X				
HVAC System			X	X			X		
Auxiliary/Emergency Feedwater	X	X	X	X	X				
High Pressure Safety Injection	X		X	X	X	X			X
Low Pressure Safety Injection	X		X	X	X	X			X
High Pressure Recirculation	X		X	X	X	X			X
Low Pressure Recirculation	X		X	X	X	X			X
Chemical Volume & Control System		X	X	X	X	X			
Main Feedwater System		X	X	X	X			X	
Main Steam System		X						X	
Condensate System			X	X	X			X	
Accumulators/Core Flood Tanks									
Containment Fan/Coolers	X		X	X	X	X		X	
Containment Spray System	X		X	X	X	X			X
Recirculation Spray System			X	X	X	X			X
Quench Spray System	X		X	X	X	X			X
Ice Condenser System			X	X		X			
Turbine Bypass System		X			X				
Reactor Protection System			X	X	X				X
PZR Power Operated Relief Valves					X				

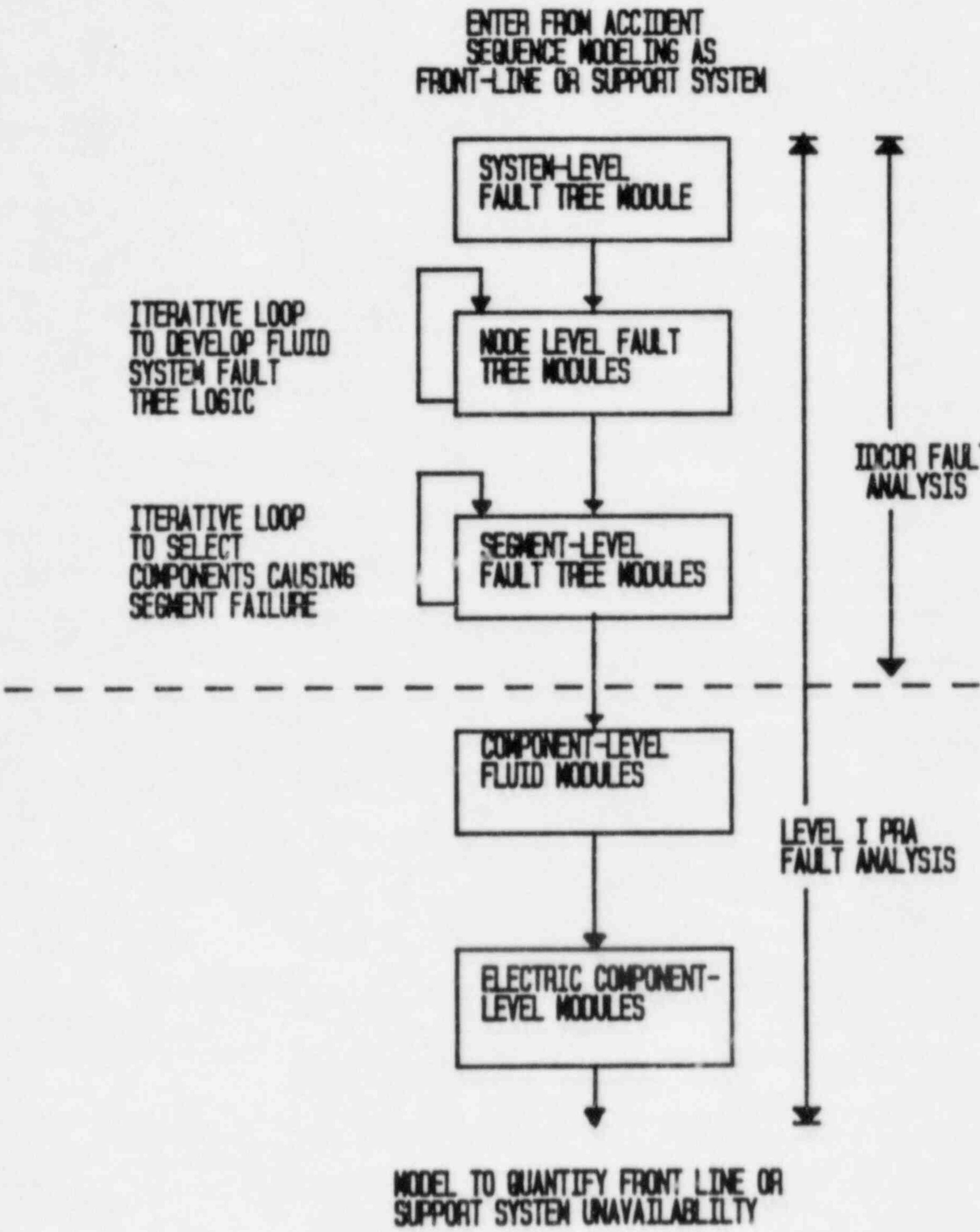
IMPACT VECTOR ANALYSIS

Support Systems Operational State Combinations	Emergency Buses	ESF Actuated Trains	Component Cooling Trains	Safety Injection Trains	Recirculation Trains	AFW/EFW Trains A+B Motordriven C Turbinedriven	Containment Spray Trains	Containment Cooler Trains	Simplified Support State
1	A+B	A+B	A+B	A+B	A+B	A,B+C	A+B	A+B	1
2	A+B	A+B	A	A	A	A+C	A	A	2
3	A+B	A+B	B	B	B	B+C	B	B	2
4	A+B	A+B	-	-	-	C	-	-	3
5	A+B	A	A+B	A	A	A,B+C	A	A	2
6	A+B	A	A	A	A	A+C	A	A	2
7	A+B	A	B	-	-	B+C	-	-	3
8	A+B	A	-	-	-	C	-	-	3
9	A+B	B	A+B	B	B	A,B+C	B	B	2
10	A+B	B	A	-	-	A+C	-	-	3
11	A+B	B	B	B	B	B+C	B	B	2
12	A+B	B	-	-	-	C	-	-	3
13	A+B	-	A+B	-	-	C	-	-	3
14	A+B	-	A	-	-	C	-	-	3
15	A+B	-	B	-	-	C	-	-	3
16	A+B	-	-	-	-	C	-	-	4

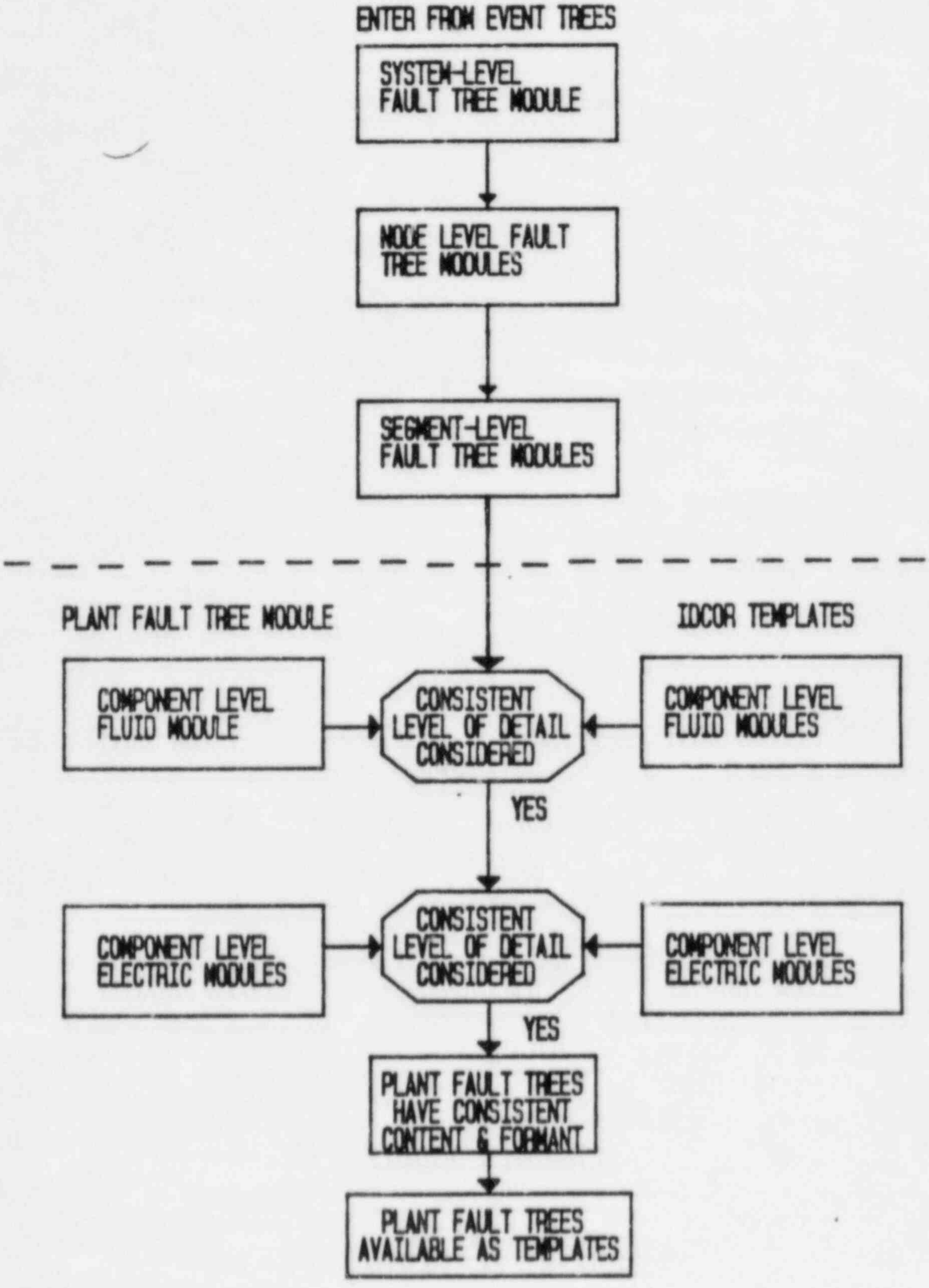
Offsite AC Available/Offsite AC Unavailable

17	A+B	A+B	A+B	A+B	A+B	A, B+C	A+B	A+B	5
18	A+B	A+B	A	A	A	A+C	A	A	6
19	A+B	A+B	B	B	B	B+C	B	B	6
20	A+B	A+B	-	-	-	C	-	-	7
21	A+B	A	A	A	A	A+C	A	A	6
22	A+B	A	-	-	-	C	-	-	7
23	A+B	B	B	B	B	B+C	B	B	6
24	A+B	B	-	-	-	C	-	-	7
25	A+B	-	-	-	-	C	-	-	7
26	A	A	A	A	A	A+C	A	A	6
27	A	-	-	-	-	C	-	-	7
28	A	-	-	-	-	C	-	-	7
29	B	B	B	B	B	B+C	B	B	6
30	B	B	-	-	-	C	-	-	7
31	B	-	-	-	-	C	-	-	7
32	-	-	-	-	-	-	-	-	8

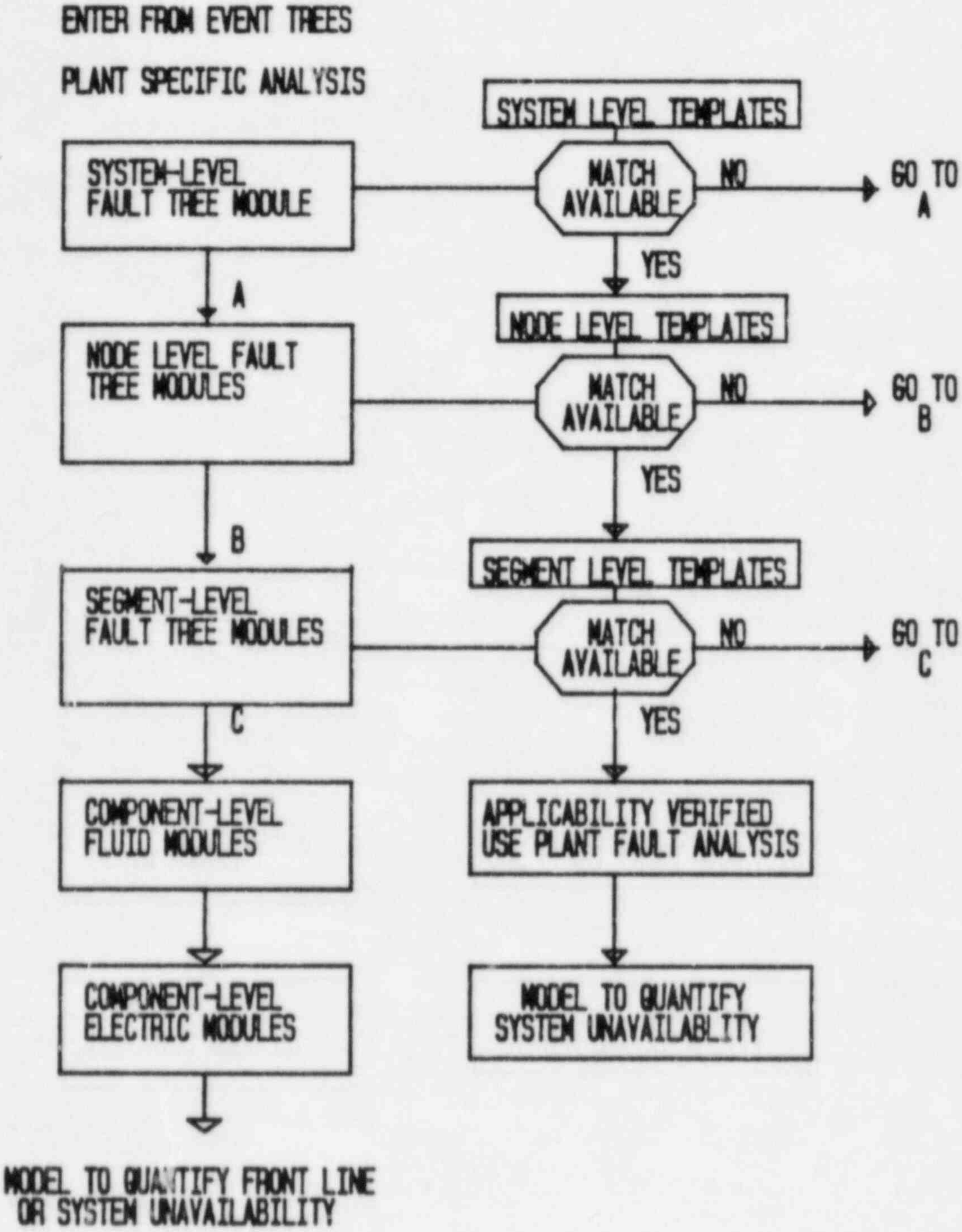
SYSTEM ANALYSIS FLOW OVERVIEW



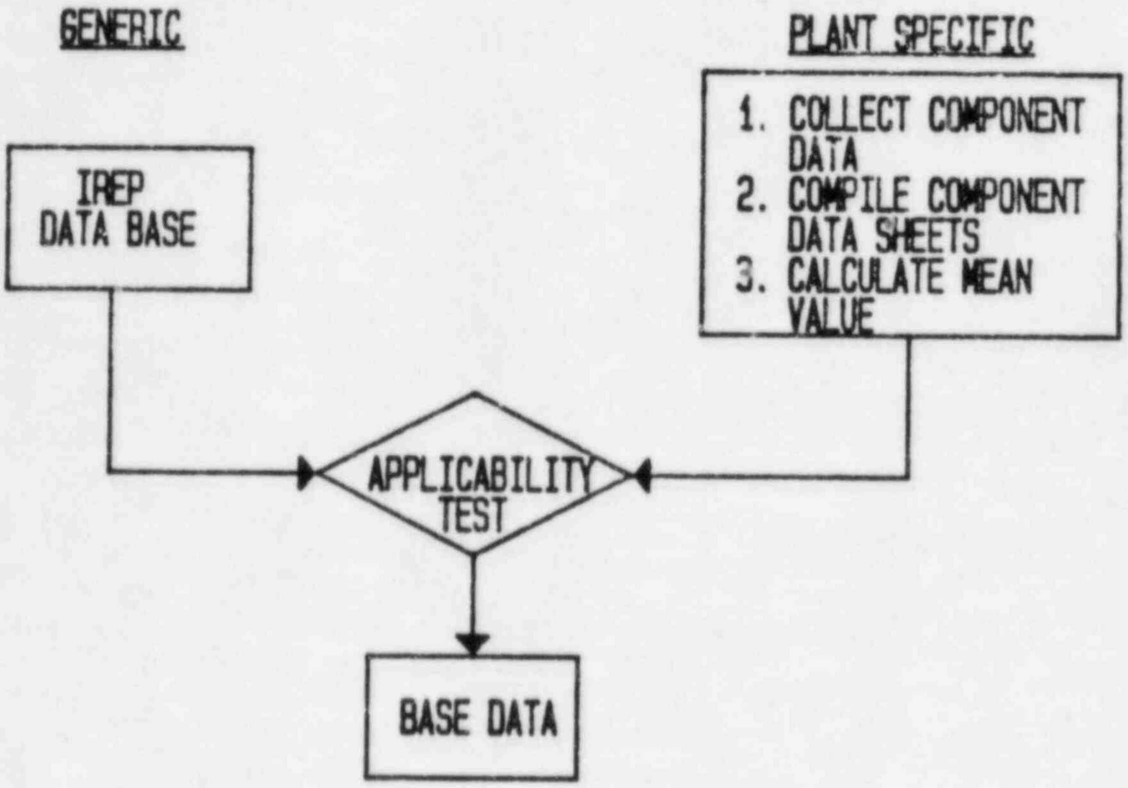
SYSTEM ANALYSIS FLOW FOR PLANTS WITH A PRA



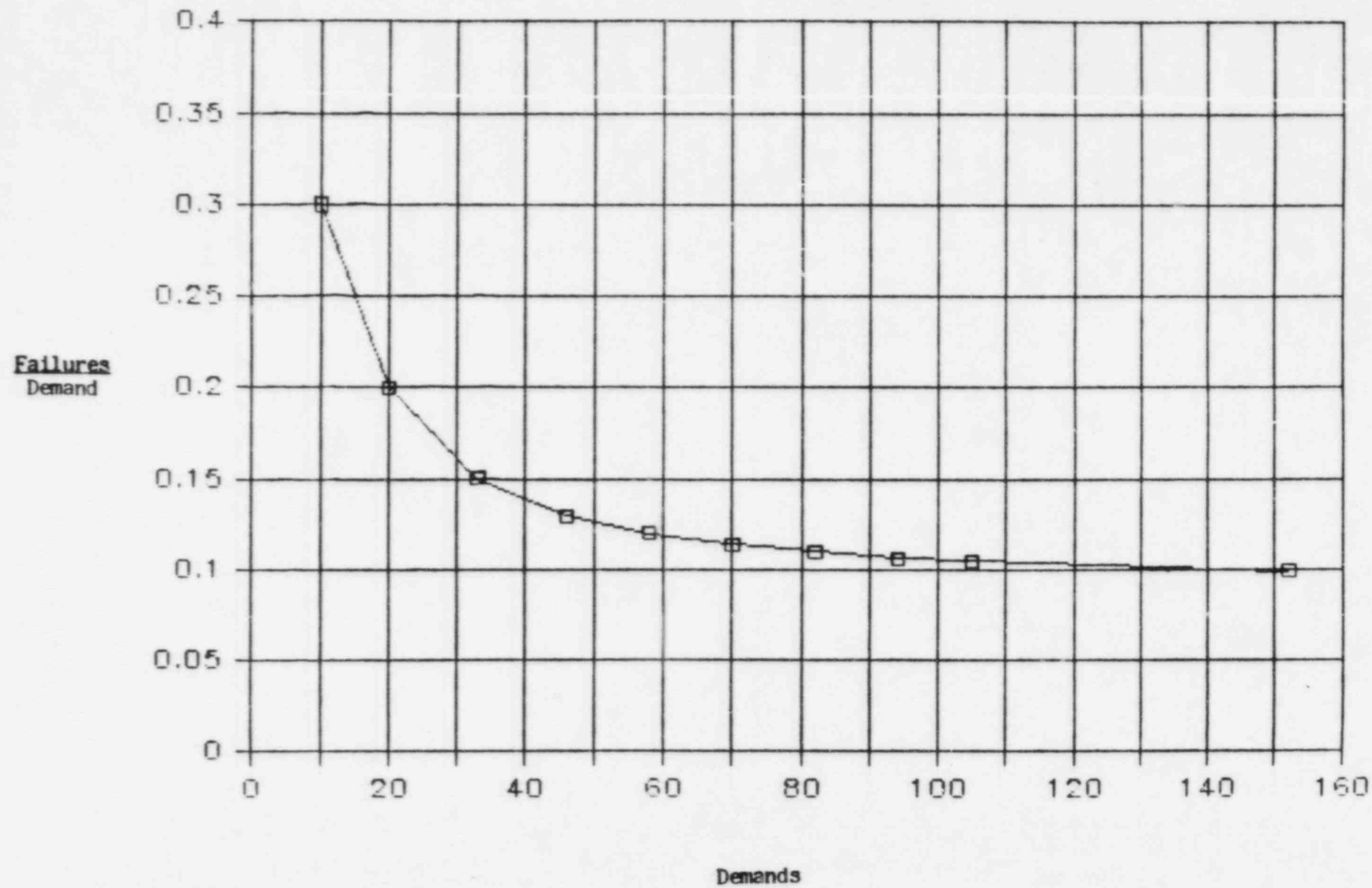
SYSTEM ANALYSIS FLOW FOR PLANTS WITHOUT A PRA



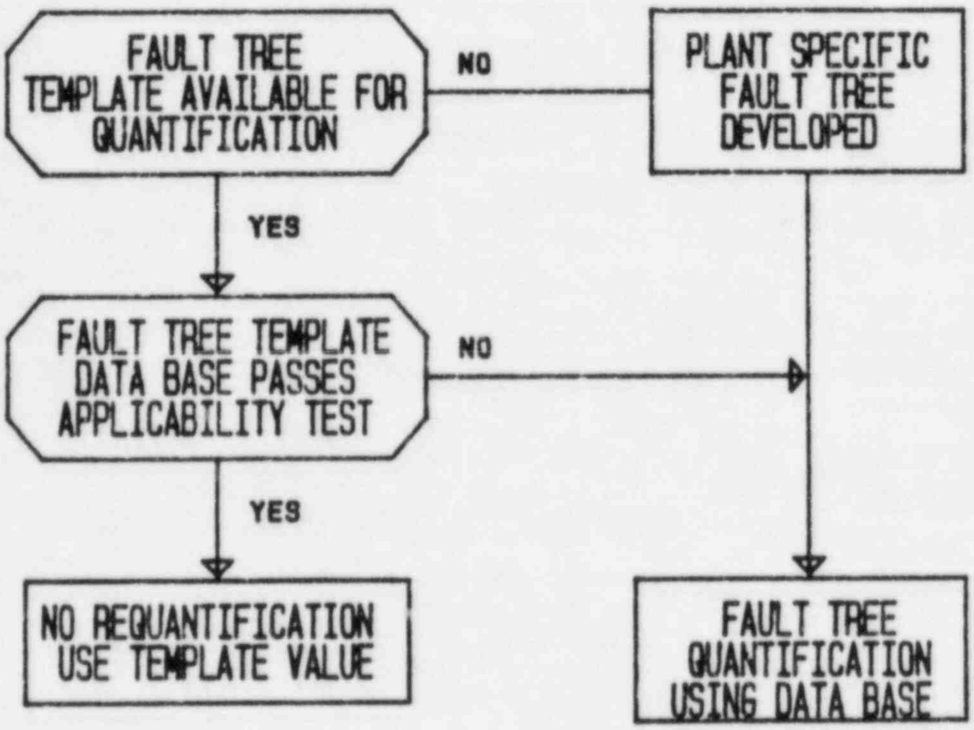
DATA APPLICATION FLOW DIAGRAM



Data Applicability Test for Mean of 4E-2/D and
Upper Bound of 9E-2



TEMPLATE DATA APPLICATION FLOW DIAGRAM



PWR GENERIC APPLICABILITY
CONTAINMENT RESPONSE METHODOLOGIES

Marc A. Kenton
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Presentation to ACRS Subcommittee on
Class 9 Accidents
Washington, DC

August 2, 1985

<u>OUTLINE</u>

1. Generic applicability methodology development principles

2. What controls fission product releases from PWRs?

3. Methodology objectives

4. Types of differences between plants: scenarios and parameters

5. Extrapolating reference plant analyses to similar plants

6. PWR scenarios

7. PWR parameters

8. Plan of attack

GENERIC APPLICABILITY METHODOLOGY DEVELOPMENT PRINCIPLES

1. Many plants have containment designs which are sufficiently close to the IDCOR reference plants that little additional analysis should be necessary.

2. Differences in source terms for these plants due to small differences in geometrical parameters will be assessed using sensitivity analyses.

3. Sensitivity analyses will also be used to determine those plants where there is the possibility of increased source term due to such factors as significantly earlier containment failure. Criteria will be established to detect such plants, and computer analyses (i.e., MAAP) will be recommended.

WHEN CONTAINMENT FAILURE IS EARLY, PRIMARY SYSTEM RETENTION IN PWRs IS PARAMOUNT ISSUE

- Fairly generic conclusions can be drawn because of similarity of primary system designs. The importc uncertainties for a given sequence are phenomenolc il.

- Results sequence dependent.

WHEN CONTAINMENT FAILURE IS EARLY, A FEW CONTAINMENT FEATURES ARE IMPORTANT

1. Any active safeguards for fission product scrubbing?

   Applicable Plant Features: Ice condenser, sprays, fan coolers.

2. Debris configuration and relationship to water pools.

   Applicable Plant Features: Factors influencing potential for debris dispersal and the interaction of debris and the containtment atmosphere, cavity-lower compartment geometry.

   Implications: Ex-vessel fission product release, scrubbing by water pools, direct containment heating.

A FEW PLANT FEATURES GOVERN RELEASES IN PWRs WHEN CONTAINMENT FAILURE IS LATE

1. Debris submerged and coolable at containment failure?

   Implications: Affects timing of containment failure, post failure aerosol residence times, release of fission products from the debris, containment and primary system temperatures.

2. Primary system temperatures limited (ultimate temperatures $\leq$ 900K)?

   Implications: Revolatilization at containment failure.

   Resolution: All PWRs surveyed have sufficient primary system heat losses to limit revolatilization.

WHEN CONTAINMENT FAILURE IS LATE

- Often noble gases dominate

- Tellurium releases are sensitive to the timing and rates of concrete attack and may be significant

- CsI and CsOH releases are typically small for realistic primary system heat losses

OBJECTIVES IN DEVELOPING SOURCE TERM METHODOLOGY

- Easy to use by personnel unacquainted with severe accidents
- Sufficiently detailed to determine if the releases for a plant are adequately characterized by the appropriate IDCOR reference plant
- Phenomenological uncertainties are better left to reference plant uncertainty studies
- Treat key plant differences
- Treat representative sequences

DIFFERENCES BETWEEN PLANTS

- "Scenario" differences - gross differences in the way a sequence progresses due to differences in design (e.g., debris dispersal occurs or it doesn't).

- "Parameter" differences - "smooth" differences between plants (e.g., one plant has twice the cavity area of another).

MATHEMATICAL SENSITIVITY THEORY PROVIDES GUIDANCE FOR EXTRAPOLATING REFERENCE PLANT RESULTS TO SIMILAR PLANTS

1. Analysis shows that for a similar sequence-of-events ("scenario") in two plants any "figure-of-merit" R is given <u>exactly</u> by

$$R_{plant2} = R_{plant1} + \sum_j \frac{dR}{d\alpha_j} \delta\alpha_j$$

in the limit that the parameter differences between the plants $\delta\alpha$ are small.

2. Experience shows that for even fairly large parameter variations this holds approximately. At the very least, one can distinguish important from trivial parameters.

3. One must be alert to detect sequence definition or parameter changes large enough to change the scenario. Scenario changes alter the sensitivity coefficients $dR/d\alpha$.

EXTRAPOLATING REFERENCE PLANT RESULTS TO SIMILAR PLANTS

1. For dominant sequences, perform one-at-a-time variation in important geometrical parameters to obtain sensitivity coefficients $dR/d\alpha_j$.

2. Also investigate gross differences between plants which could lead to scenario changes (e.g., plants with no lower compartment curb vs. those with a curb). Recompute $dR/d\alpha_j$ for these other scenarios.

3. When it is clear that an analyzed scenario applies to a new plant, approximate the new plant's releases using the linear formula. Otherwise, MAAP analyses may be necessary.

CATEGORIZATION OF PWRs IN HIGH PRESSURE SEQUENCES ("SCENARIOS")

- All ice condensers (look similar)
- No debris dispersal, large curb which traps water outside cavity
- No debris dispersal, no curb
- Debris dispersal
- Debris disperses upwards to refueling pool
- Plants with operational fan coolers and coolable debris geometry (handled in text)

TENTATIVE LIST OF IMPORTANT PARAMETER DIFFERENCES BETWEEN PLANTS UNDERGOING THE SAME SCENARIO

- Containment volume, failure pressure, and nominal core thermal power
- Initial ice mass (ice condensers)
- Cavity natural circulation flow areas
- Area undergoing concrete attack
- CO_2 (calcium carbonate) content of concrete
- Inert aerosol production by concrete

PLAN OF ATTACK

- Pick sequences (proposed: TMLB, S2HF)
- Finalize scenarios and associate with different cavity designs
- Determine sensitivity coefficients for important parameters; include any additional parameters found to be important
- Re-evaluate reference plants, Oconee and Calvert Cliffs
- Determine criteria (e.g., interval between vessel failure and containment failure) for evaluating applicability of reference plant sensitivity analyses to other plants.

BWR GENERIC APPLICABILITY
CONTAINMENT RESPONSE METHODOLOGIES

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Presentation to
ACRS Subcommittee on Class 9 Accidents
Washington, DC

August 2, 1985

OUTLINE

- Sequence Selection for BWR Containment Analysis
- Scenario Variations
- BWR Containment Designs
- Parameter Variations
- Plan of Attack
- Current BWR Results

SEQUENCE SELECTION FOR CONTAINMENT ANALYSIS

3 Major Classes

1. Early or late core melt with containment intact
2. Early or late core melt with containment breached
3. Interfacing LOCA with early core melt

Examples

1. Station Blackout (TQVW)
   Loss of All Injection (TQUV)
   Large LOCA (AE)
   Small LOCA (S_1E)
2. ATWS (TC)
   Loss of Containment Heat Removal (TW)
3. Interfacing LOCA (V)

SCENARIO VARIATIONS

1. Core Debris Distribution
   a. Pedestal and drywell
   b. Suppression pool

2. Containment Failure Location
   a. Drywell
   b. Wetwell

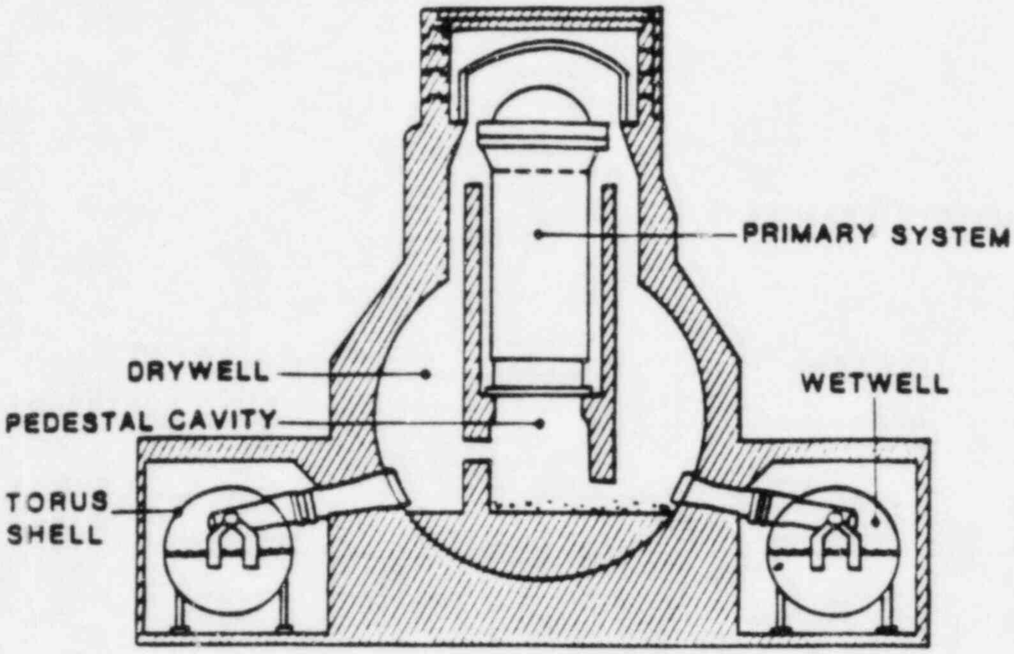
3. Wetwell Venting
   a. Available
   b. Not available

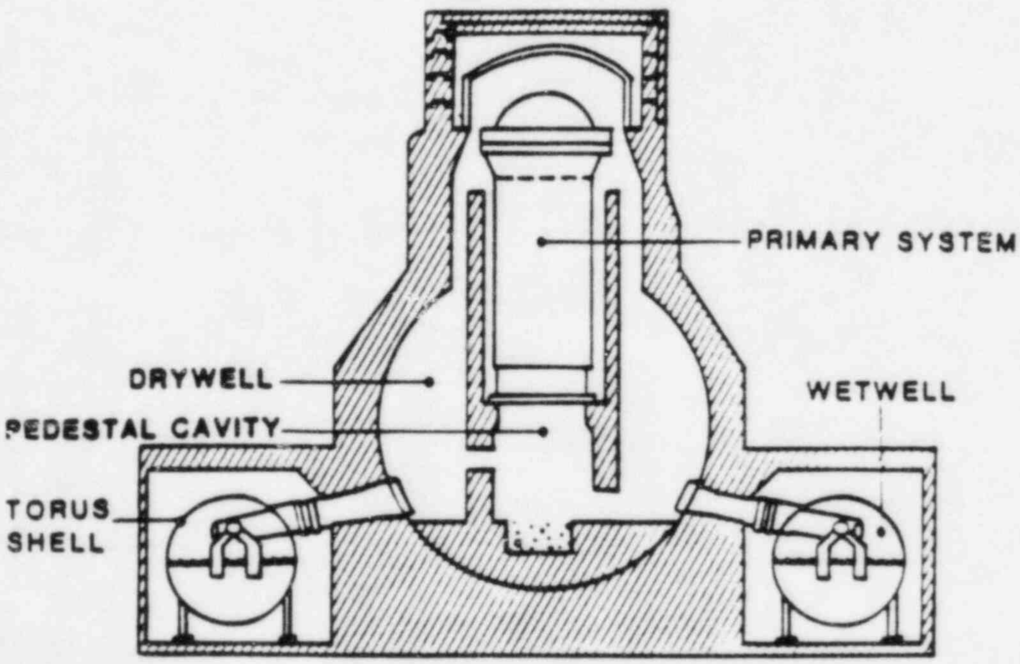
4. Drywell Sprays
   a. Available
   b. Not available

5. Reactor Building Sprays
   a. Available
   b. Not available

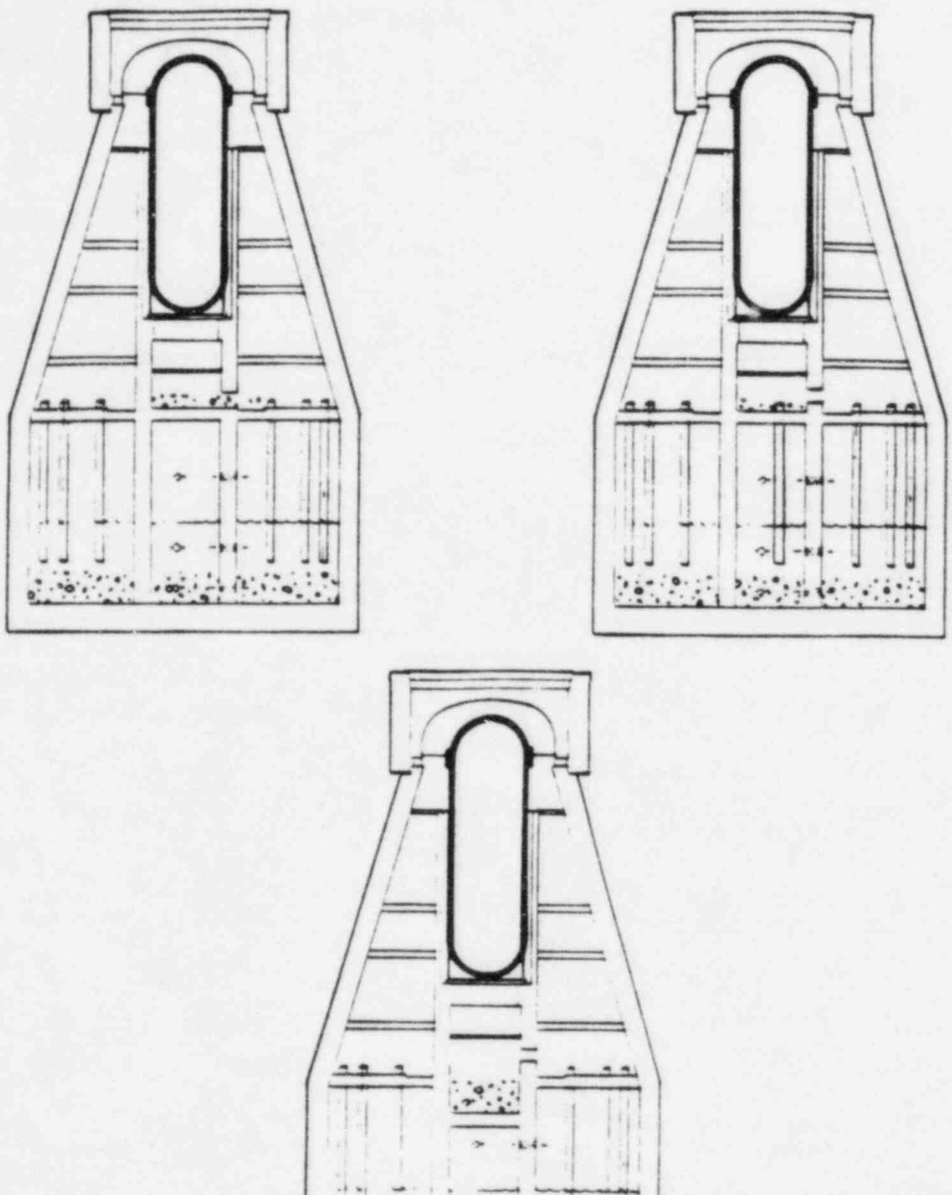
6. Mark II Suppression Pool Bypass
   a. Occurs Due to Melt Progression
   b. Does Not Occur Due to Melt Progression

POSSIBLE DEBRIS DISTRIBUTION FOR MARK I CONTAINMENTS

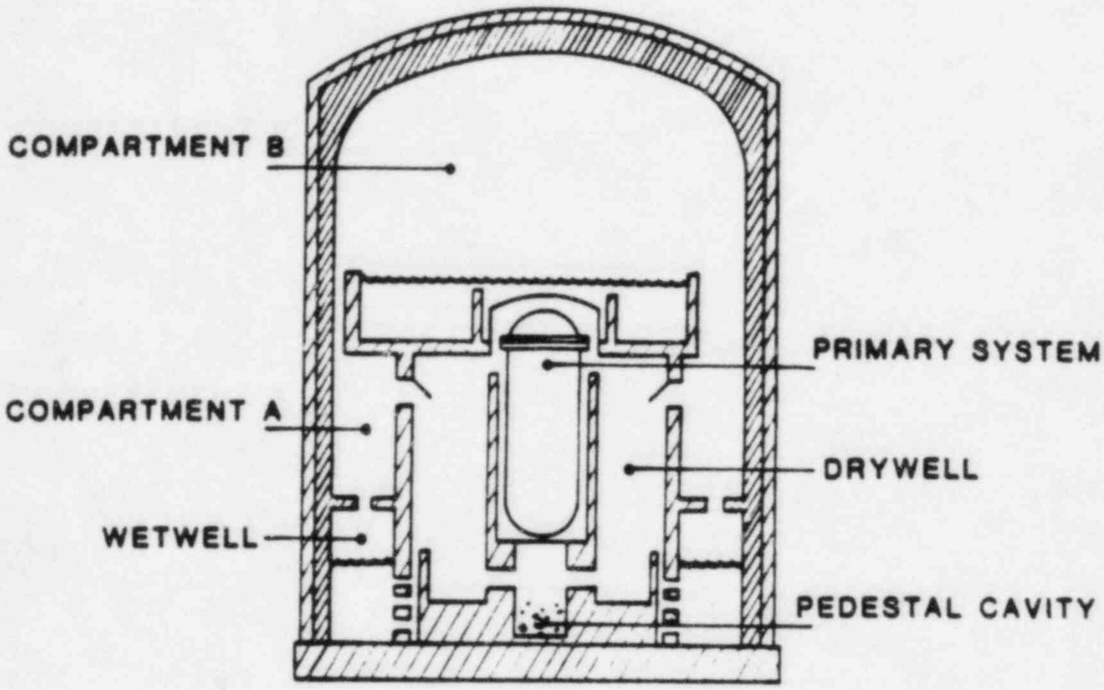




POSSIBLE DEBRIS DISTRIBUTION FOR MARK II CONTAINMENT DESIGNS



DEBRIS DISTRIBUTION FOR MARK III CONTAINMENT DESIGNS



PARAMETER VARIATIONS

(The Importance of Each for a Specific Containment or Scenario May Vary)

Primary System

- Vessel insulation type, bulk or reflective
- Non-insulation heat losses

Containment

- Pedestal sump volume
- Concrete composition
- Failure pressure

Secondary Containment

- Volume (residence time)
- Sedimentation area
- Impingement area
- Ventilation system flow rate and isolation parameters
- Circulation between building and refuel floor

PLAN OF ATTACK

- Pick sequences (proposed: TC, TQVW)
- Finalize scenarios and associate with different containment designs
- Determine sensitivity coefficients for important parameters; include any additional parameters found to be important
- Re-evaluate reference plants and Susquehanna
- Determine criteria (e.g., interval between vessel failure and containment failure) for evaluating applicability of reference plant sensitivity analyses to other plants.

CURRENT BWR RESULTS

Wetwell Venting

- Avoids containment overpressure failure
- Helps maintain suppression pool scrubbing
- Factor of ~ 100 or more reduction in release for certain sequences

Drywell Sprays

- Removes airborne fission products
- Cools core debris
- Possibly prevents containment failure

Aerosol Plugging

- Helps maintain suppression pool scrubbing
- Factor of ~ 10 or more reduction in release for certain sequences

SIMPLIFIED P&ID's/ONE-LINE DIAGRAM

- O CONSTRUCTED FROM DETAILED DESIGN P&ID's AND ONE-LINE DIAGRAMS
- O CONSTRUCTED FOR FRONT-LINE AND SUPPORT-SYSTEMS
- O ATTENTION GIVEN IN DEVELOPMENT TO ANY POINT OF MAIN PROCESS WHERE FLUID (POWER) FLOW SPLITS, COMBINES OR IS DIVERTED
- O ANALYSIS INFORMATION OBTAINED INCLUDES -
  - + MAIN PROCESS FLOW PATHS - SOURCE TO OUTPUT
  - + COMPONENTS ACTIVATED BY "S" OR "ESFAS" SIGNAL
  - + COMPONENT IDENTIFICATION AND PRE-ACCIDENT ALIGNMENT OF COMPONENTS
  - + COMPONENTS LOCATED INSIDE AND OUTSIDE CONTAINMENT BUILDING
  - + REFERENCE TO INTERFACE SYSTEM
- O USED AS ANALYSIS INPUT TO DEVELOPMENT OF RELIABILITY BLOCK DIAGRAM AND FAULT TREES

RELIABILITY BLOCK DIAGRAM

- o DEVELOPED USING SIMPLIFIED P&ID's AND ONE-LINE DIAGRAMS
- o CONSTRUCTED FOR FRONT-LINE AND SUPPORT SYSTEMS
- o ATTENTION GIVEN IN DEVELOPMENT TO SEQUENTIAL AND REDUNDANT MAIN PROCESS FLOW PATHS
- o OPERATOR ERROR, TEST AND MAINTENANCE OUTAGES, INTERFACE SYSTEM AND AUXILIARY SYSTEM NOT INCLUDED IN DEVELOPMENT
- o RELIABILITY BLOCK DIAGRAMS ILLUSTRATE COMPONENTS REQUIRED FOR SYSTEM SUCCESS
- o ANALYSIS INFORMATION OBTAINED INCLUDES -
  - + MAIN AND PARALLEL PROCESS SUCCESS PATHS
  - + SEQUENTIAL FUNCTION OF COMPONENTS WITHIN SYSTEMS
  - + COMPONENTS CAUSING DIVERTED FLOW
  - + COMPONENT IDENTIFICATION
- o USED AN ANALYSIS INPUT TO DEVELOPMENT OF FAULT TREES
  - + CAN BE USED AS MODEL TO OBTAIN SYSTEM RELIABILITY VALUE BASED ON HARDWARE FAULTS

FAULT TREE QUANTIFICATION

- O GENERIC AND PLANT SPECIFIC DATA BANKS (IREP, OCONCE, ZION) USED TO QUANTIFY BASIC EVENT FAULT PROBABILITY
- O IREP CALCULATION METHODS USED TO DERIVE FAULT PROBABILITIES FOR HARDWARE FAILURE AND FOR TEST AND MAINTENANCE OUTAGES
- O NUREG/CR-1278 (SWAIN AND GUTTERMANN) USED TO DERIVE HUMAN ERROR FAULT PROBABILITIES
- O NUREG/CR-2814, "PROBABILISTIC SAFETY ANALYSIS PROCEDURES GUIDED" USED IN PARAMETRIC STUDY OF COMMON CAUSE (DEPENDENT) FAILURES
- O TOP-EVENT FAULT TREE-HAND QUANTIFICATION
  - * FAULT TREE AT MODE-LEVEL OF DEVELOPMENT QUANTIFIED TO OBTAIN PIPE SEGMENT MINERAL CUTSETS
  - * PIPE SEGMENT CUTSETS QUANTIFIED BY SUBSTITUTION OF COMPONENT FAULTS IN PIPE SEGMENT
  - * "RARE EVENT APPROPRIATION" USED TO QUANTIFY SERIES COMPONENTS IN PIPE SEGMENT
  - * QUANTIFIED PIPE SEGMENT CUTSETS SUMMED TO OBTAIN SYSTEM FAILURE PROBABILITY

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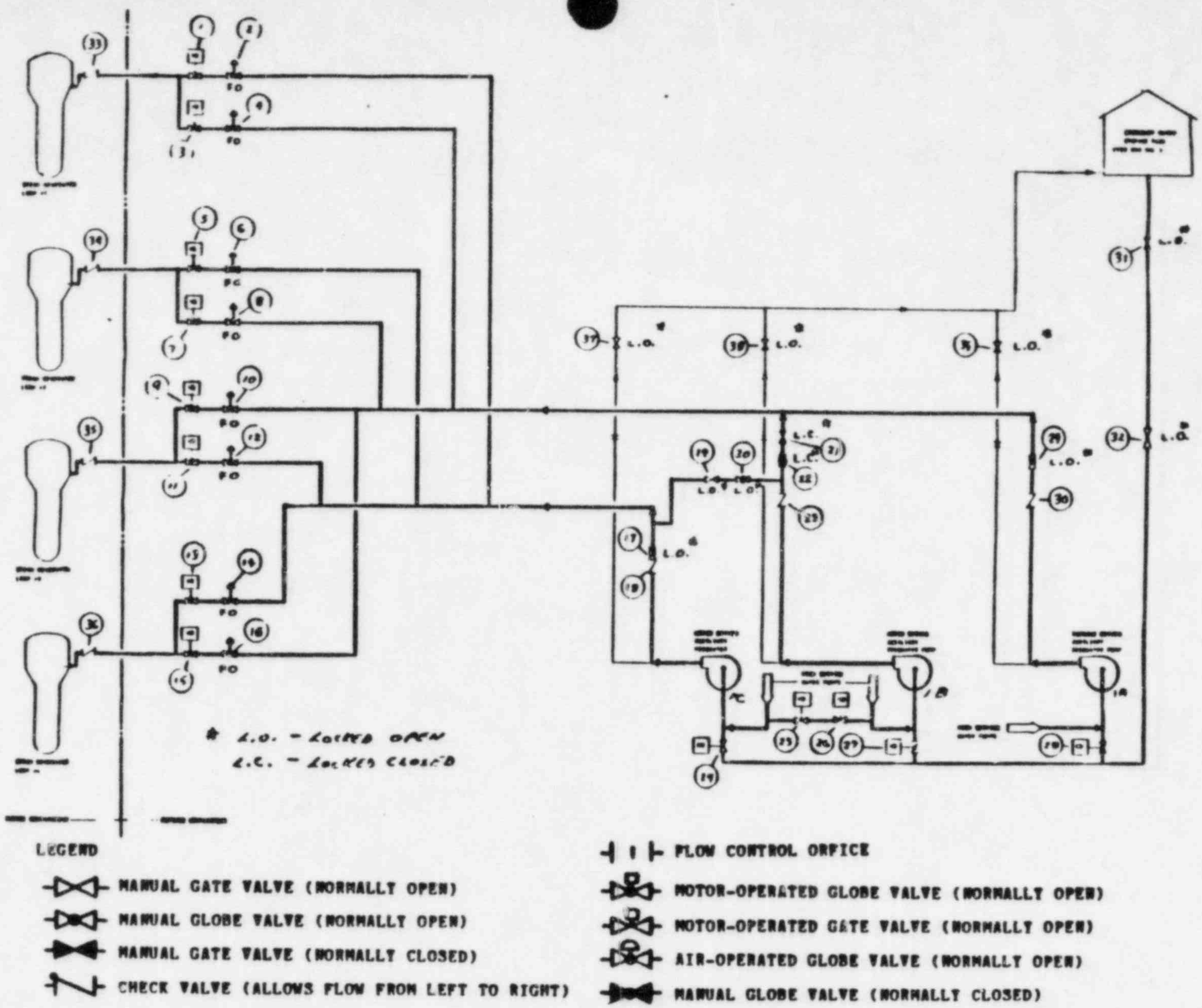

FIGURE 2.3-2

SIMPLIFIED P&ID ZION AUXILIARY FEEDWATER SYSTEM
(REFERENCE - ZION UPDATED FSAR)

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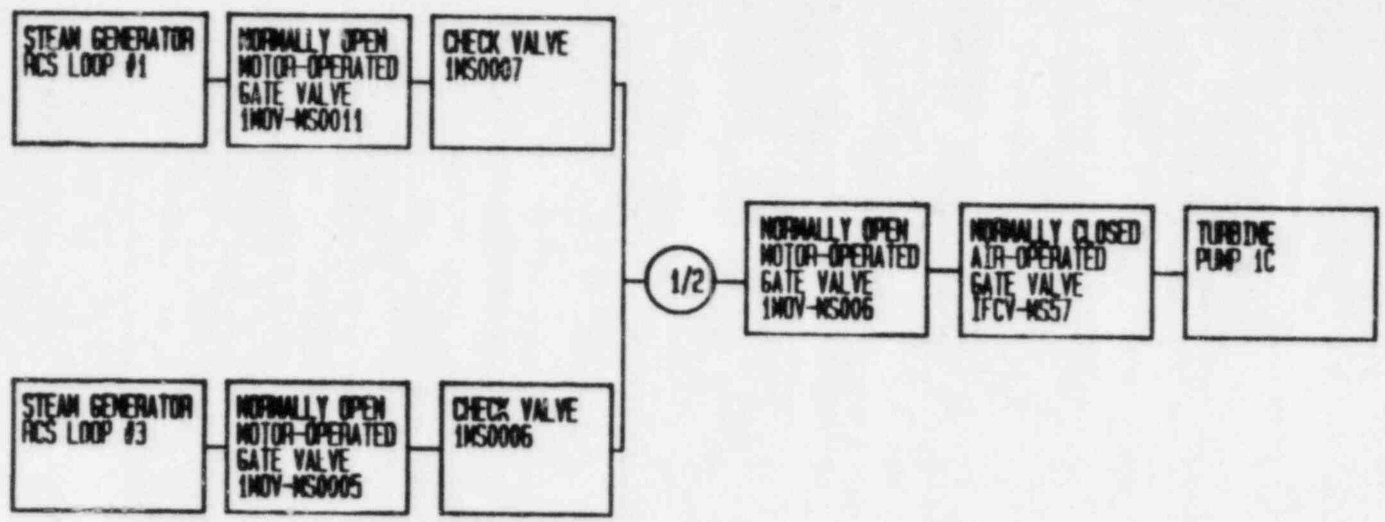
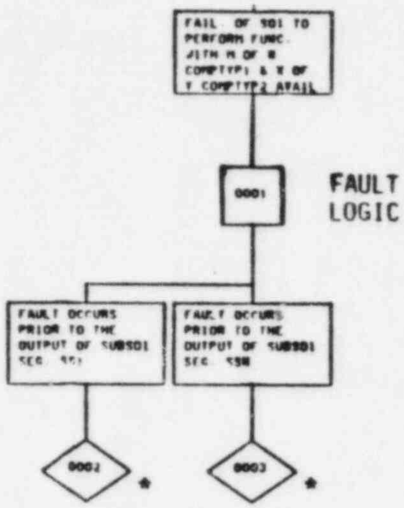


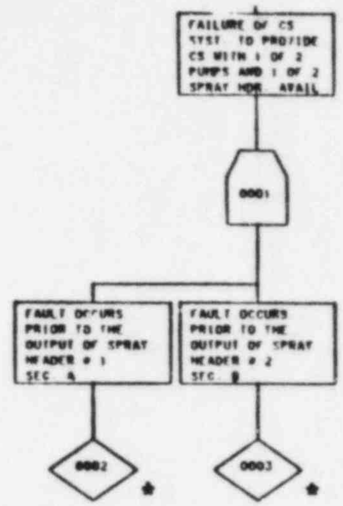
FIGURE 2.3-5A

STEAM SUPPLY TO TURBINE-DRIVEN AUXILIARY FEEDWATER PUMP 1C RELIABILITY BLOCK DIAGRAM

A. GENERIC



B. SPECIFIC



* FURTHER FAULT TREE DEVELOPMENT REQUIRED BY USING NODE-LEVEL MODULES

SOI (SYSTEM OF INTEREST)	=	CONTAINMENT SPRAY (CS)
PERFORM FUNCTION	=	PROVIDE CONTAINMENT SPRAY
M OF N	=	1 OF 2
X OF Y	=	1 OF 2
SUBSYSTEM-OF-INTEREST	=	SPRAY HEADER # 1
SUBSYSTEM-OF-INTEREST	=	SPRAY HEADER # 2
SS1 (SYSTEM SEGMENT-1)	=	A
SSN (SYSTEM SEGMENT-N)	=	B
FAULT LOGIC	=	"AND" GATE (A*B)

SYSTEM-LEVEL MODULE FOR A FLUID SYSTEM
WITHOUT TREE DEVELOPMENT
FOR COMMON CAUSE FAULTS

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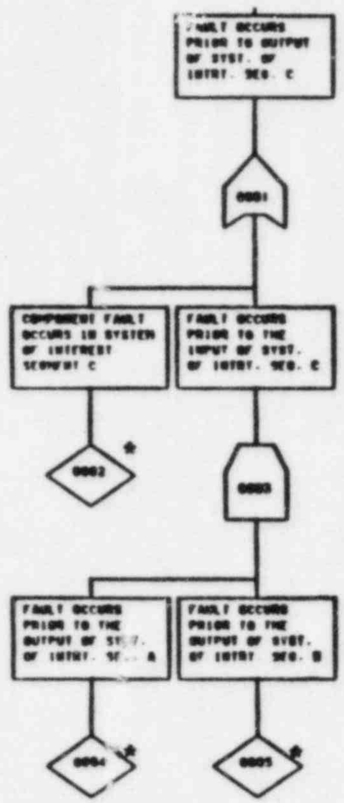


SYSTEM OF INTEREST (SOI) = AS DEFINED BY SYSTEM LEVEL-MODULE

OUTPUT SEGMENT (OPS) = C
INPUT SEGMENT #1 (IP1) = A
INPUT SEGMENT #2 (IP2) = B

* FURTHER FAULT TREE DEVELOPMENT REQUIRED BY USING SEGMENT-LEVEL MODEULES

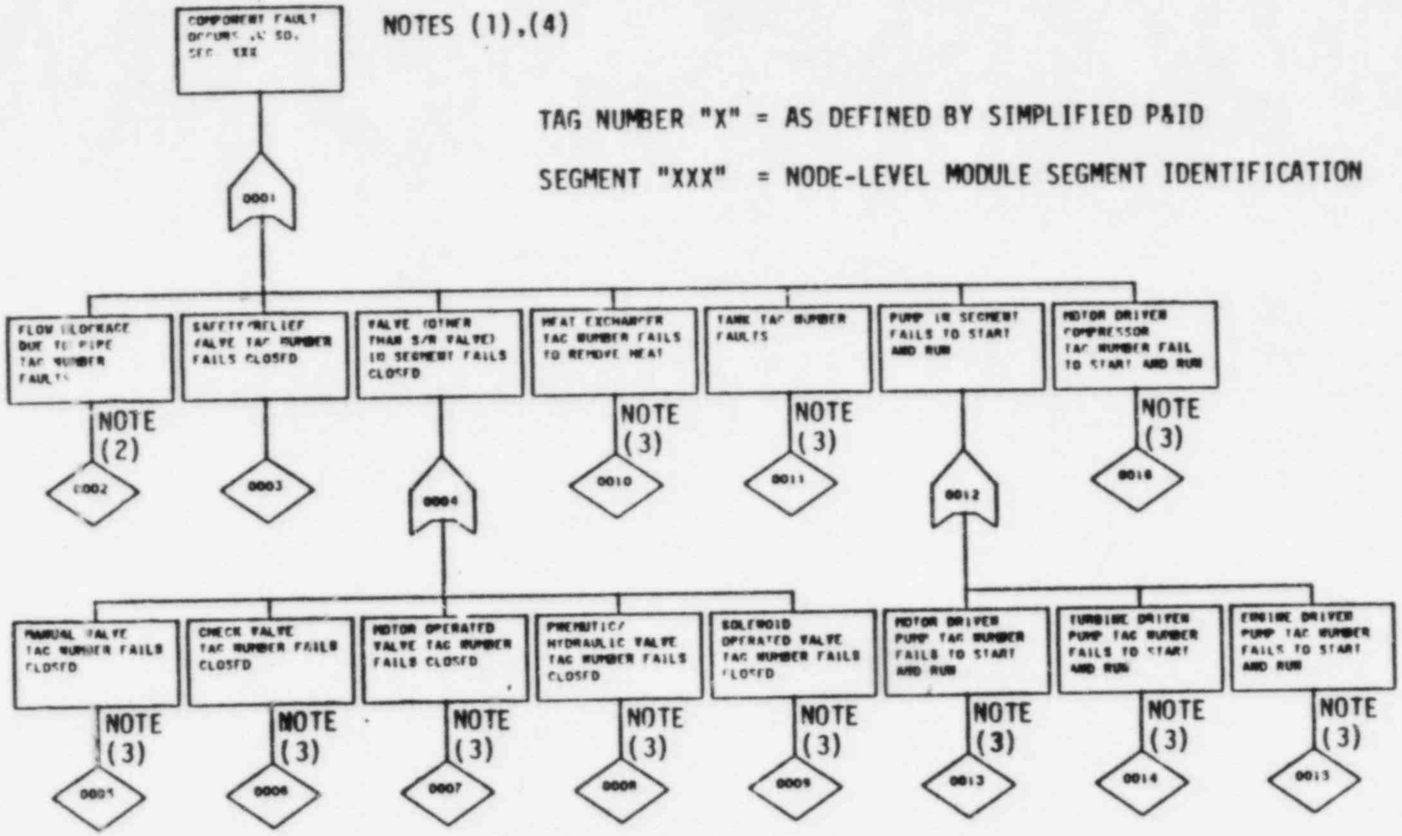
FAULT TREE NODE-LEVEL MODULE
NETWORK CONFIGURATION RULE #1

DRAFT

NOTES (1),(4)

TAG NUMBER "X" = AS DEFINED BY SIMPLIFIED P&ID

SEGMENT "XXX" = NODE-LEVEL MODULE SEGMENT IDENTIFICATION



NOTES:

(1) ANALYST TO CHOOSE COMPONENT FAULTS TO BE INCLUDED IN DEVELOPMENT OF SEGMENT-LEVEL MODULES FOR INDIVIDUAL PIPE SEGMENTS PREVIOUSLY DEFINED BY NODE-LEVEL MODULES

(2) FLOW ORIFICE AND STRAINER PLUGGING AND HEATER FAULTS TO BE INCLUDED IN FAULT PROBABILITY

(3) FURTHER FAULT TREE DEVELOPMENT USING COMPONENT-LEVEL MODULES REQUIRED TO QUANTIFY FAULT PROBABILITY

(4) ADDITIONAL COMPONENT FAULTS MAY BE ADDED BY THE ANALYST AS THE NEED ARISES

FAULT TREE SEGMENT-LEVEL MODULE
ACTIVE COMPONENTS. LOSS OF FUNCTION