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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

FLUID DYNAMIC SUBCOMMITTEE MEETING

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITEE ON REACTOR SAFEGUARDS
FLUID DYNAMIC SUBCOMMITTEE MEETING

Holiday Inn
Park Room
282 Almaden Blvd
San Jose, California

Thursday, July 29, 1982

The meeting of the Subcommittee on Fluid Dynamics was convened at 8:30 a.m.

PRESENT FOR THE ACRS STAFF:

P. Boehnert
M. Plesset, Chairman
J. Ebersole
H. Etherington
J. Ray
S. Bush
K. Garlid
J. Catton
V. Schrock
Z. Zudans

ALSO PRESENT:

Present for the NRC and Industry:
M. Fields
J. Kudrick
W. Butler
H. Townsend
M. Davis
T. McIntyre
J. Richardson
J. McGaughy
S. Hobbs

PROCEEDINGS

8:35 a.m.

CHAIRMAN PLESSET: The meeting will come to order.

This is a meeting of the Advisory Committee on Reactor Safeguards Subcommittee on Fluid Dynamics. I am M. S. Plesset, Subcommittee Chairman.

Other ACRS members here today are Doctors Ebersole, Etherington and Ray. We also have in attendance ACRS consultants Doctors Bush, Garlid, Catton, Schrock and Zudans.

The purpose of the meeting today is to discuss the potential safety concerns regarding the GE pressure suppressant tank design and particularly the Mark III containment.

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

Paul Boehnert to my right is a designated federal employee for this meeting.

The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register on Wednesday, July 14, 1982.

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

It is requested that each speaker first identify himself or herself and speak with sufficient clarity and volume so that he or she can be readily heard. The receipt of all written statements from members of the public but we will receive no requests for time to make all statements from members of the public.

I think we can go right directly into the subject of this meeting. As you know, there have been some questions raised regarding some features, details, I might say, of the Mark III containment by Mr. Humphrey and the Staff has had some meetings with him on the subject and the ACRS is quite concerned that these be resolved because the question of the full power operating licenses are under consideration.

And there are other Mark III containment now being considered in this country. And the matter so has some urgency.

Now, I'm hoping -- this is now addressed to the ACRS members here and to our consultants -- that you will come to some general conclusions regarding these concerns by the end of this meeting because the ACRS is concerned with this, would like to have a brief discussion of it at our next full committee meeting early in August.

So with that in mind, I hope you will pay close attention. We've received a lot of material on the subject and you may have made up your minds on some of the questions; I have made up my mind. I won't tell you what the decision is. You may learn a lot more today and tomorrow on the questions that have been raised.

So, let me call on Mr. Humphrey to make some comments.

Mr. Humphrey, would you come up and being, please.

While he is getting ready, I might tell you there are a few points that are somewhat interesting that come to my mind as a result of Mr. Humphrey's comments. One is intrusion into the space above the wet well and what this effect has on the impact velocity on structures above the projection. If you can think of two limits, suppose the projection went all the way across the air space, there would be no impact whatever. That's one limit.

If it had zero penatration, it would be the same as if there was nothing there. So the question is does the curve have a little peak in between, or maybe a big peak. I have made up my mind and I hope that the Staff has made up its mind on this question. That's an interesting point. The Staff has a lot of high-power theoreticians at their disposal. Maybe they can find out what those people think.

The other question is -- that's kind of interesting -- is the discharge from the residual heat removal system into the wet well. And I am interested in how this compares with the SRV discharge which has a clutcher on it. That's an interesting point and surely one that can be easily answered. But these are two fairly interesting and important questions the Staff will elucidate on, I'm sure, fairly soon.

Very well, Mr. Humphrey, would you begin?

MR. HUMPHREY: Yes, of course. I want to thank you for inviting me here to make a few overview remarks on various issues that have come up related to the Mark III containment.

As shown on the agenda, since there's going to be a number of very substantial presentations made today, I think the most productive thing I can do is try to provide an overview and maybe put some of these things in context as a framework then for the later discussions.

Along that vein, I would like to spend a few minutes discussing some of the technical background on these issues, which involves both the earlier work that was done on the Mark I containment program, and then later work that's been done as part of the Mark III design.

Then the last few weeks, I've been trying to put these -- there are a number of issues, at least as they've been described. I think there's a total of about 66 or 70, and I tried to put these in focus in terms of a matrix. And I presented this at a owners group meeting that was held last Thursday, and I think it's helpful as a way to understand how these various issues and effects all fit together.

Then finally, I would like to spend just a few minutes and make what I think is an overall assessment of maybe where we are right now.

(Slide presentation.)

When I came to work at General Electric, one of the first assignments I had was to work on the Mark I program. I think history has shown that the Mark I's have been very reliable plants. Some of these have been operating for 10 years and they've got, I think, an enviable record of safe and reliable operation.

However, about six years ago, it was discovered that there were a number of hydrodynamic phenomena that had not been fully incorporated in the original design. And as a result of that understanding, the Mark I program was initiated and the Mark I owners spent several years -- I guess that's winding up right now -- working with the Staff to try to evaluate these additional phenomena.

That was a very successful program. The Mark I program fully resolved all those outstanding issues. However, in working on the program, it turned out a lot of the resolutions that were possible were limited because these plants had been operating for 10 years. Had this information been available in the design phase or early in the operating phase, a lot of the solutions -- more solutions would have been available and the costs would have been lower.

So what I learned from that program is that when you have a new containment design, what you want to do is diligently pursue all the -- pursue an early understanding and resolution of all the interfaces -- and there's usually a lot of them.

So proceeding then from the Mark I program -- first of all, I might comment a little bit on understanding. I think that's a key here. Really, that's what I'm trying to help provide, is an understanding of these various issues. In the Mark I program, one of the things that was identified was that pool swell had not been fully incorporated in the design. Once we understood the phenomena of pool swell, specifically for instance the torus up and down loads, we understood that the magnitude of those loads was a very strong function of the pressure in the drywell when the vents cleared. Then it occurred to us that a very simple mitigation of that was to slightly pressurize the drywell, put the water down in the downcomers initially, and then should a DBA occur, the loads would be much less.

And so here was an area where once we understood the phenomena, there was a relatively simple fix available. So after working on the Mark I program, I was offered the position as containment lead system engineer, which really related primarily to Mark III. The Mark I program was essentially winding down and the Mark II efforts had been pretty well completed. So my efforts as lead system engineer were primarily directed at the Mark III design.

I want to say I was impressed in working on Mark III that there's been over -- over a 10-year period, a lot of very good testing and analysis. I think that it's fundamentally a sound product. It has been well-engineered. And then I guess you ask yourselves if that's true, what are we doing here today. And I guess maybe there are three points I'd like to bring up in that regard.

First of all, Mark III is a very significant evolution in BWR containment design. It's quite different than the earlier Mark I and Mark II containments. It offers a number of very significant advantages. However, in many cases, these advantages -- because they are different -- then have introduced interfaces that didn't exist in the earlier plants and that maybe have not been thoroughly evaluated.

For instance, the drywell inside primary containment, I think, is a significant advantage. It provides another fission product barrier. However, because it's not a primary containment and is relatively leaky, it raises some issues in terms of how you handle leakage, either before an accident or when the -- when you'll get a scram, or after an accident in terms of heating up the wetwell that did not need to be looked at in that detail in the Mark I and II designs because the bypass leakage was much lower.

The main vents are all encased in concrete and so are the SRV discharge lines. And that certainly is an advantage. Although a break in one of these lines would be a very unlikely event, putting them all in concrete is certainly a very positive design approach.

However, in Mark II then that has introduced the potential of flow down the sleeve between the SRV line and the pool that hasn't been evaluated.

Mark III has a large containment volume. This is excellent in terms of a large margin for short-term pressurization. However, it makes the long-term controlling and then means things like pool stratification that were second in order in a Mark I and II design because of the large high-pressures for short-term pressurization, then now maybe become important. So the assumptions that were built into the code and just carried through into the Mark III design maybe need to be reevaluated and that some effects that -- that earlier were second order now may be first order.

The second point here is that the Mark III, because it is a much more complex system -- it's a working containment. There's a lot of equipment inside the containment that was formerly in secondary containment. And therefore, there are just -- in addition to any new design that has a lot of new interfaces, the Mark III design has more interfaces, that any new product just needs to be thrashed out to make sure that they all -- all the design and assumptions and tech specs and everything all fits together.

Finally, probably a reason why we're here is that the primary interface between General Electric and the industry was in -- via GESSAR and the Stride design. I think this was an excellent program. It ensured that if the Stride plants had gone to completion, that there would be a plant that General Electric would have engineered not only the reactor, but also the nuclear island, and ensured that for that design all the interfaces fit together.

However, number one, Stride was not the lead plant so that this information, if anything came up late in the design, would not have necessarily been factored into some of the lead plants. And number two, this information was primarily a one-way street. It was information from GE to the industry. To my knowledge, there was no well-organized program for GE to review the other requisition plants' designs and provide comments. Because, of course, there are many ways to design a Mark III. The Stride design isn't necessarily the only way or even the best way in certain areas.

But there's a lot of expertise in the area of hydrodynamic loads that needs to be considered in developing a containment design and it appears that because there was not a program to make sure that that technology was transferred to the other customers and architects and engineers doing the design, that there may be some design features in other Mark III containments that have not fully incorporated all these effects.

As we got into the FSAR stage of the Stride design, as happens in almost any engineering endeavor -- look at the shuttle or whatever -- when you do a prelimiary design, you can iron out maybe 90, 95 percent of the details but you can never get that last 5 percent until you finally sit down and do the final design.

And we sat down and worked through the FSAR and worked on GESSAR II and the tech specs, a number of issues and interfaces came up that needed to be resolved. And these I could categorize in a couple of broad areas.

One of them is design features and changes that had missed some important interfaces. I think GE has a very good program with their ECA to try to look -- every time there's a design change, you try to look at every interface that you can think of. And I think this is rigorously pursued, but you can never catch them all. And in the final design, it is identified that there were still some interfaces that had been missed.

The second point has to do with the analysis as I pointed out earlier. There are standard codes for containment analyses. And typically these originated in Mark I days and have been pretty much been carried through and improved as we have proceeded along. But assumptions that were built into those codes sometimes were appropriate for Mark I and II and may not by fully appropriate for Mark III. And so there's an area of interface.

A third area -- we didn't start writing tech specs for Chapter 16 until about two years ago. The main thrust had been to design the plan, not worry about what parameters you needed to control to operate it or what their limits should be or even necessarily all the details of the instrumentation that you would need to have to measure these parameters. And so that work was very much still in progress in the spring.

And finally, there were inevitable disconnects between GE and the architect/engineer. And this is true in any design. And these are the kind of things you need to work your way through. As containment LSE, I helped point out many of these and other people came up with a number of them and many of these were being worked on in the Stride program.

Well, this spring, as you all know, TVA decided to cancel or at least defer for a signficant period of time that effort. And so that work that was being funded under Stride basically was mothballed and stopped. And so the resolution of these issues, which of course may not have come out in tim even if it had been pursued to completion to benefit some of the earlier operating plants, at least would have been completed, but at this point it was being -- when I left -- was being stopped.

What I see then as our near-term objectives are, one, we want to try to understand all these interfaces. Now, most of these are interfaces that were pointed out on the Stride design, although, as we've worked our way into this in the last couple of months, some additional interfaces have come out. We want to try to get them all out on the table so we can understand them. I am convinced once we understand them we can resolve them.

The second thing we want to do is we want to avoid any unexpected plant events. For instance, we don't want to have a transient that floods the drywell. Now, I'm sure that maybe we can do analyses to show that such an event would not be expected to cause a pipe to break, but it's not the kind of event that the operator is expecting and it's not the kind of event that the public is expecting. And so if it is a possibility, we at least want to analyze and we want the operator then not to panic if he has such an event and the water pours into the drywell. It's something that he knows is a potential occurrence.

We want to come up on the learning curve and have as much knowledge of all the things that can potentially happen as possible.

A third objective, I think, is to minimize the impact on plant start-up and operation. I think one of the most successful things in the Mark I program is that consistent with preserving the health and safety of the public, we were able to keep the plants running. This required a lot of good effort on the industry's part and a lot of work on the Staff's part. But I think -- I don't see any reason why we can't pursue that same type of approach in the Mark III. I think that once we understand these issues, there's no reason why we can't minimize any impact on plant operation.

And finally, I think we want to provide maximum flexibility for the industry to provide any changes that are needed, whether they are procedure changes or design modifications. One of the things that I pointed out earlier in the Mark I program that limited the approaches was that the plants had been operating for, in many cases, 10 years. And this physically, some of the things you might want to do early in the design just were not possible in that situation.

So the earlier we know about these things, the earlier we can address them and the more conveniently with minimum impact.

As we work our way through these various issues, now I'm getting into the area where I'm going to try to organize these various issues and put them in some context, I think, that would be a little easier to understand.

First of all, for each one of these issues, we need to ask ourselves what is the issue, what are the potential effects -- often there are several effects that are caused by a given design feature or procedure. We need to ask ourselves how they can combine with other effects. Often these effects are interrelated and one effect may affect pool temperature and another effect may affect pool temperature under certain conditions, and we need to ask ourselves that, under what conditions these effects may combine. And so an effect that might be second order may add two or three other effects that then become first order.

At that point, then we need to determine how significant are they. Do we have tests, do we have analyses, what can we use as a tool then to help us understand how significant these various effects are. What acceptance criteria do we need. And there I think that the Staff will be in a major role in terms of we were talking about some of these effects. Would this be part of the design basis. Is it -- is this the kind of scenario that we need to apply to the design or is this an unlikely event. Those are the kind of things that we need to sort through.

And finally then, is -- does the current design or the design as modified meet the acceptance criteria. If it does, we simply document. If it's not, then we need to loop back with a procedure change or modification or whatever, so we can end up with a success path here.

What I endeavored to do, there have been, as I mentioned, I think over so many issues listed and in their present form they were just sort of hanging out there in space, which I think maybe gave more reason for concern than if you put them down in a matrix so that you can understand them. And what I tried to do here was break up these in terms of is this an issue, and then what containment effect does that issue relate to.

DR. EBERSOLE: What does the "X" mean?

MR. HUMPHREY: What I did here in this matrix, where the -- I used the letter from MPL to the Staff dated June 8 in terms of the numbering system. I felt that's the last thing we need right now, to renumber all these and get people confused. So I left that numbering system. And where the issue as described -- and that's the middle. And I think MPL did a good job. I think that I might describe some of these issues slightly differently but I think that they did a good job with taking each one of these and trying to articulate what the various effects were.

That's where I put these numbers in. Now, the X's don't necessarily indicate a new issue. What the X's may indicate is that the description was a description of the issue rather than the effect, in which case it was a description of the issue then that would spawn a couple of X's that wouldn't have a number in it. However, some of these X's, for instance, are effects that may not have been mentioned in that letter. Some of them, for instance this one here, I think, is a mitigator. I think that the flow down the SRV line sleeve will introduce a bubble into the pool before the main vents clear. It will be a small bubble and it may not be a significant effect but I think the thrust there would be to tend to mitigate pool swell in an open pool.

So what I've tried to do here -- and this is preliminary, but I've tried to go through here and take each one of these issues and try to put either an X -- or if an effect has already been described, put that number there, of anything that this particular issue could affect.

So that was a long answer to your what are the X's. The X's may mean that the issue has already been described, but it also may mean that this is an effect that was not mentioned in that letter. We get into that later.

So I have -- I've taken all of those 66 issues and effects and tried to matrix them. So this is a multi-dimensional table, if you will. I've mentioned three of the dimensions and the fourth one here is I've tried then to go through and determine whether this -- these issues are design features, whether they're procedures, or whether they are due to analysis assumptions because how we approach each one of these may depend on that. So that's what the D's and A's and P's over here on the side are.

So this is an attempt then to bring all these various effects in focus. If you want to know what do pool encroachments affect, you can walk across horizontally. If you want to know what are the things that could possibly affect pool temperature response, then you can go down vertically. And so depending on what you are interested in, this at least provides a mechanism to try to evaluate these.

I have been asked a number of times how can we either prioritize these or how we can get a hold of them even better. I just mentioned one of the ways to categorize them, or by source. I think it's difficult to prioritize these issues at this point because I think a lot of it will depend on the plant unique design. And to some extent, it's going to take some further analysis to determine, for instance, if effects can combine. It might make them more important than if they would not combine.

What I've tried to do here is list -- as you can see, I listed six areas. That's not to indicate that I think that the others are insignificant, but if I had to pick the top six, those were the ones that I felt were maybe the most important. And then I went through my table and -- let's see, some of the six are interface issues and some of them are effects. You can see that that covers many of the important interfaces that are listed. That doesn't say that the other ones are not important, but by looking at these six areas, it covers most of the important areas.

In conclusion, my overall assessment of the situation is as follows:

First of all, naturally it's disconcerting to all of us that we've got this many potential open issues this late in the product cycle. However, as I look at these, I don't see any of them that are threatening to the basic fundamental design of the Mark III containment. I think it's fundamentally a sound containment. I think that all of these interfaces, if work needs to be done on them for a given plant, should be resolvable by procedure changes or minor design modifications. I don't anything as even major in the Mark I program where we had to address pool swell and there are some major, very major structural changes -- I won't say very major but some very significant ones to the plants. I don't see anything of that magnitude.

I guess as a last point, these are issues that came up on the Mark II design for Stride. So first of all, we need to determine their applicability for the other Mark III's. But I don't expect very much roll-back on the earlier plants, specifically the Mark I's. I think the Mark I program was a very thorough program and resolved all the issues that certainly can be identified at that time. The only things like the new emergency procedure guidelines have a procedure for controlling vessel level. Well, that's occurred since the Mark I program. Of course, that affects all VWR's, but even there I think that's primarily going to be a Mark III effect and I don't see that as having a very significant effect on Mark I's, because they're high-pressure designs and whether or not you get another atmosphere air carry over the long term is probably not going to influence the -- what loads are controlled.

Are there any questions?

CHAIRMAN PLESSET: Well, the only question, Mr. Humphrey, that they may want to do in a more organized way, unless you want to do it in a more consistent way? So I think we'll leave it that way and thank you for your presentation and thank you for being well within the time allotted.

Let me remind the Subcommittee up here at the table that to me it seems that the problem is, is there any reason for not allowing three plants immediately of concern, Grand Gulf, Clinton and Perry? Any reason for not allowing these plants to go to full power? I don't think we're concerned with this low power test license. That's no concern to us. And so that's our concern and hopefully we can come to a positive answer to that, at least to forward to the full Committee at the end of this meeting.

I want to delineate the problem a little bit. That's what I think is our concern, Grand Gulf, Clinton and Perry. Is there any reason that they should not be allowed to go to full power?

Now, in a way Mr. Humphrey has given us some reassurance with his last few comments, but I think we have to go beyond that. Those were general remarks, and we'll have to go through those today and tomorrow.

Now, let's go on to our agenda and, Jack, do you want to take over the NRC?

MR. KUDRICK: I believe Dr. Butler would like to ---

CHAIRMAN PLESSET: Oh, fine. Dr. Butler, glad to see you, go ahead.

DR. BUTLER: Thank you. My name is Walt Butler. I'm chief of the containment systems branch, NRR, and I just have a few introductory remarks I'd like to make that would provide the NRC Staff's perspective on these issues.

The NRC attention to the so-called Humphrey issues began two months ago, in May, soon after Mississippi Power & Light's receipt of the letter from Mr. Humphrey. There are some 68 issues which can be grouped into 21 technical areas. Although the issues were identified in conjunction with Mr. Humphrey's prior work on GE's Mark III Stride program, many of them apply to the Mark I and Mark II containments as well.

The Staff has completed a preliminary assessment of these issues and has laid out what it considers an appropriate program for dealing with them. Licensing boards have been notified. Letters designed to obtain relevant information from owners of all Mark I's, Mark II's and Mark III's have been issued.

We intend to assure that the necessary attention to these issues is provided by all owners of the affected facilities in a timely manner.

Now, on the basis of a preliminary assessment of these issues, it is the Staff's view that, one, many of the issues involve a level of engineering detail which is beyond that customarily considered in the Staff's safety reviews.

Two, most of the issues do not appear to have major safety significance.

Three, of the 21 technical areas, 2 appear to warrant some relatively immediate attention. These are, one, the local effects of encroachments located above the suppression pool in the Mark III containments; and, two, use of the RHR system in the steam condensing mode.

Now, the intensity and scope of the Staff's review program is based on the results of the preliminary assessment just summarized. We intend to describe our review program and to discuss each of the issues as they apply to the various containment designs. In this regard, we would like for the Subcommittee to give consideration to the following three points:

It would appear most efficient if the Subcommittee's review of these Humphrey issues were done in an approach similar to that adopted for the pool dynamic loads. By this, we mean that the detailed reviews be done in the Subcommittee with only an overview of the issues presented to the full ACRS.

Two, we would ask that the Subcommittee provide the Staff with its views on the specific issues dealing with the effects on structural encroachments -- excuse me, issues dealing with the effects of structural encroachments over the suppression pool. We understand that certain scoping studies on this issue have been done by General Electric. From these results, GE has concluded the effects to be inconsequential. The same results, when examined by Mr. Humphrey, has led him to conclude otherwise. The Staff needs to develop its own conclusions on this matter and would welcome comments from the Subcommittee.

Finally, we would ask that the Subcommittee provide the Staff with its views on the adequacy of the program that we will be describing for resolving these issues.

And with that, I'd like to now turn the session over to Jack Kudrick, who will provide additional overview background on the issues and relate them to the different designs.

CHAIRMAN PLESSET: Thank you, Dr. Butler.

Tape 2

MR. KUDRICK: I'd like to thank the Subcommittee for giving us the opportunity to discuss the concerns that have now been known as the Humphrey concerns. As I believe everybody realizes, they are rather detailed in nature and we believe, as a staff, that it's very appropriate for this Subcommittee to hear our approach since you have all been involved throughout the development of the pool dynamic loads which also is a very detailed program and I think this -- the knowledge will complement now the information that we will be talking about today and tomorrow.

What I'd like to do is reiterate what we believe the meeting objective to be. First of all, as we get into the details of the various programs, it will become apparent that we are not yet at final closure on all of the issues, but I would like to indicate that in many areas we would consider the closure to be confirmatory in nature. We have had rather extensive discussions with General Electric and MP&L. There are areas where additional information is needed for closure and I think that will become fairly clear during the presentations.

We'd also like to include within the discussion today consideration of where we feel the concerns are relative to the Mark I's and II's. We have done an initial scoping evaluation of all concerns and to various degrees we believe that there is some level of applicability to the Mark I's and II's and, as Dr. Butler has indicated, we have taken steps to notify the boards, which is a matter of routine, on all issues.

Secondly, we have asked the individual owners and owners group to provide us with a schedule for their response.

To date, I'd like to indicate that almost exclusively our efforts have been directed specifically to Grand Gulf, for two reasons. One, Grand Gulf is the lead Mark III plant.

And secondly, that the concerns evolve directly as a result of Mr. Humphrey's association with the Stride package, so they were born out of a Mark II design. We believe that they are most applicable to the Mark III design.

I would now like to reiterate where we believe we are relative to the safety and significance of those concerns. Based on all of our discussions that we've had to date, we have not uncovered any serious design deficiencies that we feel will merit any design modifications as a result of the concerns. We believe there is needed a better understanding of some of the issues and possibly analyses and/or tests may be necessary to finally close on all of the issues, but we haven't found any significant design concerns. And I'd like to emphasize that. And that involves I's, II's and II's.

I would now just like to quickly summarize the method of presentation that the Staff will be making over the next three-quarters of a day. Briefly, what I would like to do is before we bore into the Humphrey concerns, since we have been involved with the Subcommittee on Fluid Dymanic Loads, I'd like to give you a very brief status report of where we stand on the Fluid Dynamic Load Program for Mark II, I's and II's. We have more or less closed on that issue and if it's all right, Dr. Plesset, I'd like to insert that into the program.

Following that, we would like to give an overview of where we believe we are relative to the resolution of the various issues and not necessarily get bogged down into the detail of the specific issues because, as you can well appreciate, looking at that matrix that Mr. Humphrey showed, that if you concentrate on individual items or concerns, you kind of get lost as to where we stand on the overall picture from the perspective of the entire design.

Once we have established the overall program, I believe then it would be appropriate to get into a little more depth of review and that is to categorize the individual concerns and to then identify the specific resolution approach for each of the general categories and classify the level of effort that we fully believe is necessary for resolution.

This will be followed by detailed presentations by MP&L, Grand Gulf, General Electric, Perry and Clinton, which I won't go into any more detail on at this time.

If I may, I'd like to depart from the Humphrey concerns for a few moments and briefly bring the Committee up to date on where we stand on pool dynamic loads. I just listed the last three meetings we've had with either the ACRS Subcommittee or the full Committee relative to pool dynamic loads. And the furtherest back I go is September 25-26 meeting when we had our last significant pool dynamic meeting with the Subcommittee meeting. At that time, we indicated that we still needed closure on four specific loads to complete our program. And those were in the area of pool velocity, bulk impact, froth impact and submerged drag loads. All other loads have been closed as of that time.

Because of the schedule -- or possible schedule of conflicts with Grand Gulf and the full Committee, we then went into a plant unique review on those four specific areas for Grand Gulf and we so indicated in October 15 at the full Committee with Grand Gulf, that we had closed on a plant unique basis three of the four remaining areas of review. And we still had froth impact to close on.

That closure finally came in January 22 of '82 when we had our last Subcommittee meeting where we presented to the Subcommittee a generic closure report on all pool dynamic loads associated with Mark III's.

We also took the opportunity at that time to indicate the implementation program that was underway on the Mark I program. I'd like to report that nothing really has changed since that last report on the Mark I program. They are proceeding in an orderly fashion to implement all the necessary changes to their design.

On the Mark II program, we addressed the issue of the vacuum breaker steam condensation loads, which had been raised by the Subcommittee as a potential concern. And basically what it involved was the possibility of chattering of the vacuum breakers during the steam condensation phase of the transient.

At that time, we had isolated the concern to just those plants that had vacuum breakers directly on the downcomers and we had indicated to the Subcommittee that all of those plants had committed to close the vacuum -- to close the downcomers to eliminate that concern relative to the chattering of the vacuum breakers. And we felt that was a closure at that time.

The Mark II owners group had proposed a complete program and total evaluation of that particular concern and they included a task to also evaluate the effect of the vacuum breaker performance during pull swell.

Since January 22 meeting, we have had several meetings with the Mark II owners relative to the vacuum breakers, and I'd like to bring you up to date on where we stand on it right now.

Based on conservative analyses that were made by the owners group, they found that there was a potential overstress condition on the vacuum breakers during pool swell. And that was a generic concern that involved all plants having vacuum breakers either on the downcomer or on the divider deck itself. And basically it was a concern that was raised as the pool swell proceeds upward; it compresses the wetwell airspace and gives you a reverse differential pressure between the wetwell and the drywell, thereby opening the vacuum breaker.

The design pressures that were developed during the pool dynamic program were like 5-1/2 PSI max differential pressure. When they took this conservative design value and they calculate it with the response of the valves, they found that there was a possible overstress condition on one class of valves, Anderson & Greenwood valves. The other type of valve, the GPE valve which LaSalle & Zimmer have, I believe, the preliminary calculations indicated there were no overstress conditions.

Based on those preliminary calculations, tests were conducted at the Anderson & Greenwood facility and they did indeed show the possibility of overstressing based on preliminary tests. Modifications were proposed and recently new tests have been conducted that indicate that the valve will function with the modifications. At the present time, all of the plants that utilize the Andarson & Greenwood valves have made the necessary modifications to demonstrate operability of those valves during pool swell. There's a final closure report that we will be getting in the future relative to the actual test data and the actual analyses that have been performed on the valves, but our preliminary conclusion is that corrective action has been taken on those valves and it's sufficient to proceed in licensing.

Relative to the GPE valves, preliminary evaluations have been conducted on the stress analysis that concluded that the valves were functional. There have been some questions raised. As a result of those questions, LaSalle has committed to performing similar-type tests for their vacuum breaker valve and those tests should be completed by November.

I believe that more or less brings the Committee now up to speed on the vacuum breaker problems relative to the Mark II's.

DR. EBERSOLE: Mr. Kudrick, may I make a comment?

MR. KUDRICK: Sure.

DR. EBERSOLE: In order that we don't do things piecemeal, I think we ought not to eliminate the vacuum breakers without consideration of some of the pressure transients brought about by hydrogen combustion. It's not a hydrodynamic load. It's just another mechanical load and I would be unhappy to see that we had solved the hydrodynamic load problem and still left ourselves vulnerable to whatever it may be, cyclic loads, and perhaps shock loads due to periodic hydrogen combustion.

MR. KUDRICK: If you are referring to the aerials -- on the Mark I's and II's, as you are aware, we have taken the steps to have those plants inerted such that we will now be on an oxygen control rather than a hydrogen control.

With respect to Mark III's, I can appreciate your comment, yes.

I would now like to quickly summarize relative to the Mark III program what has happened since our last meeting in January with the Subcommittee meeting. As promised, our draft acceptance criteria were issued in March of '82 where all the remaining Mark III utilities have now in hand our acceptance criteria which are the same criteria that we discussed with the Subcommittee.

We have indicated, out of order here, that we have -- that we also completed our review of Grand Gulf, which simply meant that we published our evaluation on the pool dynamic loads.

What is anticipated to occur now for final closure is that we will be issuing a draft evaluation report next month which will document our bases upon acceptance of each of the individual acceptance criteria and based on peer review and comments, we will publish a final new reg in December of this year. And that will yield final closure on pool dynamics for Mark III's.

With that diversion, I would like to now get back on the issue at hand and that is the Humphrey concerns. I would like to very quickly summarize the major milestones that have occurred since the introduction of the concerns to both the Staff and MP&L. We have indicated that our first initial contact was May 13 when we had a telecon between the Staff and Mr. Humphrey; I should indicate that on that same day we actually got a call from MP&L prior to our contact with Humphrye. MP&L Had received a letter from Mr. Humphrey and felt it prudent to notify the Staff of the contents of that particular letter and based on that telephone call from MP&L, we then contacted Mr. Humphrey.

At that time, there were -- that we were aware of, there were about 10 concerns identified. And it was our understanding that on May 17 MP&L would actually hold detailed discussions with Mr. Humphrey to identify all the concerns that could possibly be related to the Grand Gulf station. And that did occur. The Staff was not involved in that particular meeting. But 10 days later, on May 27, we had a meeting with MP&L and Mr. Humphrey. And during that meeting, the -- all of the concerns were identified and a preliminary response was presented by MP&L to the Staff. And that response was documented the following day.

For the next several weeks, we concentrated strictly on Grand Gulf and its evaluation, and then we kind of broadened our scope and looked at the possible consequences for the other BWR suppression containments. And we thought it prudent to notify the boards on the I's and II's because of the possibly applicability of these concerns to those other plants. And we did that in June, June 21.

The next significant step was July 7. We requested from MP&L some additional information based on a fairly estensive evaluation of their responses that were given back on May 28. We also formally sent out requests to both the Mark I's and II's to respond to those areas that we felt were applicable to their particular plant and two weeks ago MP&L presented to the Staff a complete closure program that identified all the key elements that they felt were necessary to get final closure on all of the final concerns.

And as Mr. Humphrey indicated, there was a meeting last week, last Thursday, with representatives of all the BWR utilities. They were Mark III primarily, but there was representation from the Mark I's and II's and their AE's. And at that time, I'd like to characterize that meeting as simply a meeting where the concerns were identified, so that everybody understood what those concerns were. There was no attempt to resolve those concerns.

I would now like to briefly review what our review philosophy has been prior to the Humphrey concerns and will continue to be beyond this point. And that is that we do not intend, as an agency, to review to the depth that a designer would have to understand the -- all systems. We believe that there is -- we do have a competent industry out there, we rely on the industry for the minute details. And that we, as a Staff, review what we believe are major issues and we will kind of divide our time, depending on the importance of the individual issues. And we have, as you know, gone to significant depths of review in pool dynamic loads. We felt that that was necessary on many of the issues as will be presented later on in the next two days. We questioned whether that level of detail is necessary on all areas of interest in containment design.

We are following through on those issues because they have been specifically raised on the Mark III plan.

I'd like to -- you probably see so many different categorizations of the concerns. I'd like to just add one more cataloguing of those concerns because there are a lot of them and you try to look at them in different ways to try and filter them down into the main issues. And this one attempt filters down the 68 individual comments into 6 major categories as we see them.

The bulk of the comments are related to pool dynamic loads and that's why we believe that it's appropriate to be discussing these concerns with the Subcommittee. There are other areas, however, that have been raised as a result of the issues. One of them is that a question as to whether or not all of the phenomena that actually exists during a transient, have all of those phenomena been incorporated into the DBA calculations, or have we left out some effects that should have been considered and were not.

DR. CATTON: Are you referring to pool stratification?

MR. KUDRICK: That's one possible area where you could include it in detail in a DBA analysis or you could consider it within the margin of consideration.

DR. CATTON: At some point, could we hear why one should be concerned about pool stratification? I have my own view of this. I'd like to hear somebody tell me why. Maybe I'm right or wrong.

MR. KUDRICK: I can give you my interpretation of pool stratification. It affects the pool temperature response and we do have design limits imposed upon the containment design and on equipment within that containment; so that all of your equipment qualification programs are based on those design values for the equipment as well as the major structures. If it happened that a stratification effect would cause the actual temperature response to exceed that design value, then the qualification of all components related to that temperature are in question. That's basically the concern.

Now, whether it's a significant extension of the temperature is the real issue. We understand that there will be stratification. Now, is it a big concern or are we talking about small perturbations about the norm. And I think the latter is the case for that one particular issue.

DR. ZUDANS: Jack, I'd like to ask another question. You mentioned the margins. Now, if you look at all these 68 issues that were raised and you look at the way you've defined the pool loads before and the margins that you set and the margins -- the reasons for those margins, did you identify any of the issues that were in fact violating your margin assumptions?

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MR. KUDRICK: No.

DR. ZUDANS: In other words, you would have put bigger margins if you knew about ---

MR. KUDRICK: No. To answer your question simply, no.

DR. EBERSOLE: Mr. Kudrick, some time ago, we were talking about the implications of downcomer failure on the Mark II's and the Mark I's, the rather striking terminal results you've got if you had such a failure. At that time, it was said that containment sprays might be a rather effective mitigator for the -- some degree of failure of the downcomers in a prolonged blowdown. However, at that time we didn't discuss in effect the matter of stratification which would be coincident with that problem. I just want to point out that in going back to Mark I's and II's, stratification and the effects of it in this context ought to be looked at against the calculations we did for downcomer failure.

MR. KUDRICK: Keep in mind I'd just like to -- I can appreciate the concerns.

DR. CATTON: On the stratification question, I believe it came up quite some time ago with respect to Mark II. There were measurements to be made and comparisons of those measurements to be made against calculations. And I have seen none of these. As a matter of fact, I don't think -- well, I haven't seen anything yet.

MR. KUDRICK: Let me put it in perspective. Now, what

I see as the difference between the concern on Mark III and the I's and II's, Mark I's and II's, they are short-term limited. In other words, your maximum pressures are generated early into the transient, the seconds into the transient.

The Mark III, your peak is not -- does not occur until hours into the transient. The fact that you are talking about long-term pool response magnifies the importance of the stratification. For those plants that have short-term peaks, I believe that the stratification takes a much lesser role.

Now, from the standpoint of the Mark II's, we have already addressed stratification in our safety evaluation report. And at that time, we were looking at test data that supported some degree of stratification which we felt was within bounds of the margins that were set. The issues now take issue with that level of importance and we're going through in a little more detail and looking at it.

CHAIRMAN PLESSET: Why don't you go on, Jack.

MR. KUDRICK: The third category is just what we've been talking about, the validity of using bulk conditions for DBA calculations. Should we be continuing to use bulk temperature responses as opposed to thermo gradients within the pool. The answer to that question, we believe that we should still continue based on the information that we have in hand today.

DR. CATTON: You were going to tell us why you concluded that.

MR. KUDRICK: Yes. I believe that the method of presentation is we're going to try to characterize where the Staff stands on each of the various issues and not necessarily get into the detailed technical justification. We're going to let that justification up to MP&L and GE and so forth, so we're not going to really get involved in the technical justification. Hopefully that will be coming up.

Another -- what we think is a fairly important issue that has -- is placed on the agenda and so will be discussed rather thoroughly, and that is the question of interfacing between the NSSS and the architect/engineer, especially in these complex areas of pool dynamics and how the design evolved and making sure that the design evolution considered all the consequences of the -- of those design changes.

The fifth one is the incorporation of the DBA analysis and the emergency procedures. Simply stated, all that means is that you are establishing emergency procedures which we think are fairly important, make sure that those emergency procedures are consistent with the assumptions that have been made in the DBA analyses. And that's normally a part of our review anyway, but that's several of the issues directed in that area.

And finally, it's the verification that the tech specs agree with the analysis. Again, that's normally part of our review and hopefully we'll discuss all of those.

That kind of concludes my little summary of where we are. Mr. Fields now will present an overview of the Staff's views initially on all of the concerns and then get into a little more depth on each of the individual ones.

MR. PLESSET: Thank you, Jack.

Tape 3

MR. FIELDS: Good morning. The initial schedule of time for this presentation was one hour. I don't believe it will take quite that long.

MR. PLESSET: You've got all the time you need.

MR. FIELDS: One point I would like to add to the description of the breakdown of concerns for -- Mr. Humphrey's concerns. We had listed 22 areas and 68 sub-areas for Mr. Humphrey's concerns as catalogued by MP&L. There was a couple of concerns added by Mr. Humphrey in a letter dated Juny 17, which accounts for, I think, maybe a slight difference between our numbers and MP&L's numbers. And we have received a couple of days ago, from Mr. Humphrey, a marked up version of MP&L's questions that MP&L developed after talking with Humphrey and I have a copy, a few copies of that with me and would like to leave these here.

What I'd like to discuss now is the applicability and resolution approach the Staff is going to take for resolving the Humphrey issues.

(Slide presentation.)

A number of Mr. Humphrey's concerns can possibly apply to the other BWR's because they all are using the pressure suppression concept. And a number of the issues can be carried over, although the magnitude may be different. Some of the issues are not applicable to the other two designs simply because they do not incorporate that particular design feature. For example, Mark I's do not have upper pools, so the questions related to upper pool dump are, of course, not a problem for the Mark I's and II's.

The issue importance will vary for the I's, II's and III's because of the different design features. And I plan to get into the specific applicability to each of the containment types when I present the overview of the Humphrey issues.

The Staff is right now developing a program -- well, for resolving these questions on the Mark I's, II's and III's. We have had discussions with the Mark I's. We've sent questions to the Mark I's last month and their preliminary response, verbally, is that they are going to be coming in with a generic approach to the problem.

NRC will issue an evaluation report on review of this generic response.

The Mark II's, we have been discussing this issue with the Mark II owners group and the individual utilities and their preliminary response is that they are going to be making plant-specific responses with the exception of the RHR issue, for which they had planned to make a generic response. And the responses will be coming in on the individual plant dockets.

Grand Gulf the other Mark III's have had to be divided simply because of the scheduler problems that we face and because this originally came up on Grand Gulf and they've had somewhat of a head start. Grand Gulf has some plant-unique considerations that make them different from Stride in several respects. For instance, they do not have containment vacuum breakers, so the question that Mr. Humphrey had on containment vacuum breakers does not apply. So therefore they have their own plant-unique considerations.

They have developed an action plan which was presented to us on the 14th of this month and in a lot of cases they are taking an independent approach to resolve these issues.

There is a possibility -- well, further analysis is being conducted right now by MP&L to confirm the results that they basically presented to the Staff over the last couple of months. There is a possibility that if sufficient margin does not exist in a couple of the crucial areas -- that's the relief line actuation into the suppression pool and the encroachment issue -- that is there's a possibility that some further testing may be required. Let me correct that. I do not mean to say relief line actuation; I meant to say RHR pool mixing. Those are the two areas that we're possibly considering for the testing.

Grand Gulf is, of course, participating with the other Mark III's to make sure that there is a consistent approach and that long-term resolution is needed and that they will be up-to-date on that.

As far as the Stride package and the other Mark III's, they will of course be following the Grand Gulf resolution and participating in a peer review group. We see this peer review group as an independent body that will review the issues and come up with their conclusion on the magnitude of the problem. This will be presented to the Staff as an additional piece of information to make our conclusions.

As far as the long-term analysis and the testing for other Mark III's, it would be very similar to anything that would be required for Grand Gulf.

The resolution schedule is still somewhat up in the air right now because of the -- we just haven't had too much time to have real detailed discussions. We sent a letter to the Mark I owners group on the 15th asking them to provide us with a full schedule for resolution. The response is due tomorrow. So we do not have at the present a schedule for the Mark I resolution except for some phone conferences, phone calls that were made to a couple of the Mark I's.

The Mark II's, we have sent letters in early July and the basic response is they are going to be tying their evaluation to their plant licensing schedule.

The next slide gives some idea of when those responses will be coming in.

Grand Gulf, we did a sufficient review and concluded that for the low power license, these issues were not a concern. The action plan which was provided on 7/15 provided Grand Gulf's schedule for resolving the rest of these issues. Basically, in mid-August, they wish to provide the justification for a full power license and with long-term refined analysis coming in in October and November.

For the other Mark III's, the schedule for resolution is still under development. We will of course be tying this in with the individual schedule of requirements for the Mark III's to make sure that there is no problems in that respect.

Our preliminary indication is that a generic evaluation report covering those issues which either did not apply to Grand Gulf or which were in the long-term resolution category will follow the Grand Gulf program.

This slide is to give an indication when the various utilities got involved in the process. Mark I's and II's were present at the May 27, 1982 meeting and they have been keeping abreast of all of the developments since then. They havent' done a preliminary evaluation and have indicated to us that they have not uncovered any new safety concerns.

Mark III's, of course, began with the May 17 meeting between Humphrey and MP&L and evaluations performed to date for

Grand Gulf and also by GE, they have not uncovered any major safety concerns for Mark III containments as well.

We want to give an indication of the licensing stage for the various BWR's since they are in every conceivable stage. The Mark I's, most of them are operating except for Fermi-2 which is in for their OL review and Hope Creek-1 and 2, which is a post-CP plant.

The Mark III's, the La Salle just received their 5 percent power license. Nine Mile Point-2 is a post-CP. The rest of the Mark II's are pursuing their operating licenses.

Mark III's, again Grand Gulf is -- has their 5 percent power license. Clinton, Perry, River Bend are the next three plants up for an operating license. Allens Creek, Skagit/Hanford is in the CP stage. And the rest of the Mark III's are post-CP.

The Staff made a number of phone calls to the utilities to get some idea of the schedule responses to the Staff's requests. And this slide here gives all the information that we have at this point. The Mark II's are basically coming in in October with their evaluation of the situation. There's a couple of Mark I's here, the Fermi-2 and Hope Creek, which will be coming in consistent with their licensing schedule.

The Mark III's, Grand Gulf is as previously mentioned. GESSAR, which is the GE standard balance of plant, hopes to have this evaluation complete by November of '82. The other

Mark III's we do not have specific information on the schedules at this point.

That completes my discussion of the applicability and resolution approach.

Did you wish to take a break before I get into the overview of the concerns?

MR. PLESSET: Well, I was going to ask you, how you-- are feeling vigorous enough to continue right on?

MR. FIELDS: Certainly, no problem.

MR. PLESSET: I notice that the Perry and Clinton don't have any dates yet. Maybe they will tell us more about this tomorrow.

MR. KUDRICK: I think we could add that they will be -- as a minimum -- consistent with their licensing schedule.

MR. PLESSET: Yes, that's the minimum, yes.

Well, if you are willing, we'll continue right on.

MR. FIELDS: All right.

(Slide presentation.)

MR. PLESSET: This will get into the specific concerns, I gather?

MR. FIELDS: Yes.

MR. PLESSET: And Mr. Fields will go through that. This may stimulate some discussion by the people up here at the table. They've been pretty good so far.

MR. FIELDS: The next item in the presentation is the

NRC's overview of Mr. Humphrey's concerns.

I'd like to start off by describing the presentation approach. And for ease of presenting the material, I have grouped Humphrey's concerns into common technical areas. This is again another grouping of the concerns. I hope they will not confuse anybody.

The 68 concerns identified by Mr. Humphrey are -- get into quite minute detail of some points. It's not my intention to present all of the minute details, but just to hit the high spots of all the concerns. There is certainly any question, getting into more depth, I could get into the depth as required.

After identification of each major technical area, I will discuss the applicability of the area to the different containment designs. The discussion of how the NRC reviewed the -- this technical area before Mr. Humphrey's concerns were identified to us, and provide the current NRC assessment of the safety significance of Mr. Humphrey's concerns at this point.

We're going to be putting an emphasis on Grand Gulf because of the licensing schedule and where Grand Gulf differs from the Mark III's, we will be identifying that for each of the areas.

I'd like to start off with providing the members of the ACRS the Staff's idea of what needs to be provided on the

Grand Gulf docket so that the staff can accept them for a full power license. As I indicated earlier, they have some refined analyses that are coming in in October, November of this year. We're looking for them to provide us with the assumptions that's going to be used in each final analysis and a rationale for why the assumptions are the correct ones.

Also, if they have any preliminary results of these refined analyses, we would be looking for that in August as well. We're talking about the mid-August submittal that they are coming in with to justify the full power license.

They made mention in the May 28 submittal by MP&L of certain values as to why these concerns were secondary. For example, they would say the increase in pool thermal stratification was 6 to 10 degrees. We would like to have the basis, a little more details of the basis for those numbers.

We are putting emphasis for Grand Gulf on the encroachment issue and we would like to have some additional justification before the full power license in order to be able to resolve this issue. I will get into a little bit later of why we feel that Grand Gulf is in better shape than the other Mark III's at this point for the encroachment issue.

Also we're looking for MP&L to develop a comprehensive analytical program to accurately define this phenomenon. There is a possibility of a test program as well but that will depend in part on how much margin is demonstrated by the analysis.

If the Staff judges that sufficient margin is not demonstrated by analysis, we may be requiring testing in the following areas:

One is the pool thermal mixing capability of the RHR system. I think this could be best done in conjunction with the SRV test program that MP&L is getting ready to start.

The second one is perhaps some sub-scale testing of the effect of encroachment on the various aspects of hydrodynamic loads. Pool shape, velocity ---

DR. CATTON: Before you leave the stratification, you mentioned 6 to 10 degrees and it sounded as if it were only 6 to 10 degrees, you would be perfectly happy to -- with the state of affairs as it is. How much pool stratification must occur before you get concerned? That sort of gives one a feeling for whether or not your particular analysis would be any good.

MR. PLESSET: You have to speak into the microphone.

DR. CATTON: I will repeat the question.

How much pool stratification must occur before you are concerned, and under what circumstances?

MR. FIELDS: There is currently in the load definition a value for pool thermal stratification. I don't exactly recall what that number is. So the concern is how much more -- how much effect does the various aspects brought up by Mr. Humphrey, how much effect does that have on the current definition of pool thermal stratification.

DR. CATTON: It's really two parts. I'm interested in that. When you say six degrees of stratification, and if you were to tell me that you thought that was important, you've got a damn tough problem on your hands in trying to calculate that. If you told me that 50 degrees was where it became very important, that's an easier problem and I'm trying to get a measure of where the difficulties are in putting your hand around the stratification question.

MR. KUDRICK: Dr. Catton, maybe I can respond.

DR. CATTON: We can come back to it.

MR. KUDRICK: No, I think it's important enough so that we should address it now. Right now, under a very conservative analysis, the FSAR's are showing at a minimum of 10 degree margin between the design value of 185 and what they believe the calculation will yield. And we can get into a lot of the conservatisms that we're talking about.

But one of the major conservatisms that is in hand is the -- what the actual differential temperature would be between the pool and the atmosphere. Right now, they are assumed to be intimately tied together. I think that's a very conservative assumption. So, when we talk about stratification between 6 and 10 degrees, what we're saying is that even including all of the conservatisms that are associated with the analysis, we're still within the bounds of the design. So certainly that's no problem.

As we start creeping up, if you want engineering judgment, I would guess that you're talking about somewhere in the neighborhood of 20 degree differential between pool and atmosphere just because of the cooling effects that that large containment would have. That's a judgment call and certainly would have to be substantiated with analyses. And that, I think, kind of characterizes where we are with a lot of these concerns, is that in many areas, as engineers, you can use your backgrounds and kind of estimate what the effects are.

But from a regulatory standpoint, we're looking for the actual analyses. And that's what we're waiting for, is that actual analysis.

I don't know if I've answered your question on that one.

DR. CATTON: I'm not sure you have either.

MR. KUDRICK: Very simply stated, I think it's at a minimum of 10 degrees. We're definitely bounded. I would say that in 20 degrees, you're talking about more -- additional analytical support, okay. You would really start questioning the feasibility of the design if you were like approaching 40 and 50 degrees.

DR. CATTON: The coupling is probably pretty weak until you get to saturation, saturation of the surface, with respect to pressure. Then the coupling would be strong.

MR. KUDRICK: You are assuming now that the atmosphere is at a bulk temperature, uniform temperature. What in reality is going to happen is you are going to have gradients throughout that containment.

DR. CATTON: Sure. But I'll start steaming from the pool when the surface of the pool gets to saturation relative to the pressure. Until that point, I really wouldn't be too concerned.

MR. KUDRICK: Basically that's how the design was arrived at. I mean it was assuming that the atmosphere was in saturation conditions with the pool and that's how you arrive at the 115 PSI, 185 degree design limits. So they are fairly well bounded right now. But, you know, when you start pushing the limits, you start requiring more and more sophisticated analyses for justification. And I think that's the point I'm trying to make.

DR. ZUDANS: In this same context, could I ask a question? If the stratification becomes an issue, it would only be because the assumption would have to be that the air -- atmosphere is heated to the surface temperature of the water. And then you'd have some physical limitation because the containment is designed for 50 PSI. And if that temperature goes substantially above 185 degrees, you begin to violate that pressure design, design pressure.

At what temperature would that happen?

MR. KUDRICK: 185 is the design temperature of that containment.

DR. ZUDANS: Which shows 50 PSI.

MR. KUDRICK: Approximately 50 PSI.

DR. ZUDANS: Without any gradient to the volume of the containment.

MR. KUDRICK: That's right.

DR. ZUDANS: So that is a big conservatism and that's really unknown and that could be 50 degrees instead of 20 at the surface.

MR. KUDRICK: Well, as a matter of fact, your preliminary responses from MP&L indicate that they believe that it's somewhere between 40 and 60 degree differential.

DR. ZUDANS: Right.

MR. KUDRICK: Between pool and atmosphere. Just to give you an understanding of the type of conservatisms that we're talking about.

DR. ZUDANS: And isn't this too that they also stated some place that the total heat absorption capacity of the structure in that area is equivalent to about total water capacity of the pool heat absorption?

MR. KUDRICK: I don't know -- I don't have that good of a memory.

DR. ZUDANS: It's a very tremendous ---

MR. KUDRICK: It's a large capacitance, especially when you're talking about hours into the transient.

DR. PLESSET: Go ahead now.

MR. FIELDS: The second area of possible testing is the -- on the effect of encroachments. Basically this is a very complex phenomenon and we haven't been able to conclude at this point that the margins that are inherent in the design are more than adequate to completely cover any effects of the encroachment. We're still examining that right now.

DR. PLESSET: I see you have some of your distinguished consultants here. Have they participated in that?

MR. FIELDS: Yes, they have, in looking at this problem. And we can discuss under the specific areas our preliminary conclusions.

DR. PLESSET: You will discuss it?

MR. FIELDS: Yes.

DR. PLESSET: Okay, fine.

MR. FIELDS: Not that we have too much in the way of conclusions at this point.

DR. PLESSET: They may have though.

MR. FIELDS: For ease of presentation and providing the NRC's assessments on the various containment types, I did break down Humphrey's concerns into technical areas. This is an index between the technical areas in Mr. Humphrey's concerns for your convenience.

1.8, Humphrey concerns 1.8 and 2.4, I don't believe you have had a chance to see before because this was in the June 17 submittal by Mr. Humphrey and basically those dealt with the effect of -- 1.8 was the effect of encroachments on pool thermal stratification. 2.4 was the effect of SRV-VL sleeve loads on pool thermal stratification.

I would now like to get into the individual technical areas. The first one is the local effect of encroachments on hydrodynamic loads. Mr. Humphrey's concerns included these effects on the pool swell velocity, the breakthrough heighth, the submerged structure loads, and the pool thermal stratification all within the area around the local encroachment.

This concern is only -- only applies to Mark III's and our previous NRC review approach was basically that the encroachments would mitigate pool swell loads above the encroachment and that the amount of encroachment was such that it would have little or no effect on the global pool swell response, which I believe everybody is in agreement with.

I would like to break down the current NRC assessment into two areas, one is Grand Gulf and the other is the other Mark III's. We feel that the current Grand Gulf design is probably adequate because they designed their containment for more conservative loads than the other Mark III's. At our request, they used a velocity of 60 feet per second. They used the absolute bubble pressure to design their submerged structures and their ACU floor is several feet higher than the standard plant design.

However, we haven't been able to completely resolve this issue and we are looking for some more justification, some more analysis to show that the percent increases and velocity breakthrough height, whatever, are bounded by the current numbers used by an MP&L designed plant.

Now, we haven't been able to quantify, at this point, the amount of increase in velocity breakthrough height, whatever, due to these encroachments. We have had some preliminary discussions with MP&L and Mr. Humphrey. They seem to be using the same data base and arriving at different conclusions.

We have not yet been given that data base or that analysis so we haven't been able to provide an independent review. They are, at -- MP&L and GE are right now developing a comprehensive story for our review, but basically while we do not feel that there are going to be any major problems, we haven't come up with any hard and fast numbers.

MR. PLESSET: Is it possible that the loads might be reduced?

MR. FIELDS: Well, yes. Certainly above the encroachments, you would have much less impact loads. And the question is by pushing the pool horizontal some distance and then having it come up in a restricted area with basically the same driving force as the rest of the pool in the non-encroachment area the effect -- this effect and what it does to the breakthrough and velocity is not deemed to be a large effect. The quantification of that is what we're looking for.

MR. KUDRICK: I think, to put this in perspective, the initial concern relative to velocity and impact characteristics, Mr. Humphrey indicated that he felt that as an upper band we're talking about 20 percent increase in potential velocity increases if velocities were to increase.

Well, the current criteria calls for 50 feet per second. MP&L evaluated Grand Gulf for 60 because we had not yet arrived at our final criteria. So they already are covered for the 20 percent on velocity. So what we're doing from Grand Gulf perspective is focusing in on what really will impact their design relative to this concern, and I think we've concluded that it primarily is in delayed breakthrough. This is one of the issues that have been raised that because of encroachments, you can possibly delay your breakthrough point and therefore elevate your froth impact loads on the containment.

We don't think that we're going to get actual liquid impacts, but, you know, based on the fundamental thrust of the issue is that there is a possibility of delayed breakthrough. So we're not saying that it is, but that's the treatise that we're looking at.

DR. PLESSET: This will be quite different for different plants because of the distance between the encroachment ACU floor, for example, and what heighth difference is there.

MR. KUDRICK: Dr. Plesset, I think a lot has to depend upon the response. If the response comes in in a bounding analysis, it may not necessarily be a plant-unique consideration, that there would be a sufficient margin established by the MP&L response to cover all plants. But you are right, if it's a close call, that it could possibly become a plant-unique.

DR. PLESSET: We were familiar with the 60 feet per second that you and Mississippi Power & Light people accepted, agreed upon, rather. What's the status with Perry and Clinton? Has that been established?

MR. KUDRICK: Basically because of the timing situation, they're not within constraints; they are evaluating their plant on the 50 feet per second. This is not to say that they are any weaker than at Grand Gulf, but their evaluations are going to be based on 50 rather than 60.

DR. PLESSET: Thank you.

DR. CATTON: I thought 50 was still a little high.

DR. PLESSET: Well, some members of this group felt that the 50 was adequate. But we're not going to go into that at this time. Maybe it's a distraction.

MR. KUDRICK: We understand your views.

MR. FIELDS: Another point I think should be made is the encroachments vary from plant to plant. And each plant has different, slightly different design, and so that would have to be looked at as well. That's why our assessment of the other Mark III's and Stride is still underway and we haven't gotten into those assessments in as much detail as for Grand Gulf because we are concentrating on Grand Gulf.

DR. CATTON: Why is pool stratification under hydrodynamic load? Area one, your previous slide.

MR. KUDRICK: While he is looking ---

DR. CATTON: I don't think it belongs there. It was mentioned in passing by Humphrey when he was referring to encroachment on loads.

MR. KUDRICK: Well, condensation loads, as you know, are one of the parameters.

DR. CATTON: Is that what you're referring to?

MR. FIELDS: I basically just included it under encroachments. It probably could have gone better under another.

DR. CATTON: It's not a very serious question.

DR. BUSH: Could I ask a question before we get much further? We're using the term "DBA" and "DBA" is a generic term that covers a multitude of sins and what may be applicable to one DBA is totally inapplicable to another. So I think we may have to clarify as we go along which one you are using in a bounding sense.

MR. FIELDS: All right.

The second area dealt with the non-uniform venting at the HCU floor. Mr. Humphrey's concern's that there are possible lateral loads on the HCU floor gradings and a possible increase in local wetwell pressure. This is a concern that applies only to the Mark III's and our previous review approach was that we made a judgment that a little lateral movement of froth would occur. However, we did not perform detailed analysis. Since then we have done some analysis on this issue and our consultants at B & L looked at the problem in some detail and they have concluded that 90 percent, or even close to 100 percent of the froth droplets would be stopped at the HCU floor and would not move laterally.

So our preliminary evaluation is that this concern should not at all become a design issue and it is indeed a secondary effect.

DR. BUSH: Then how do you account for the statement you need a detailed analysis?

MR. FIELDS: What we're looking for here is the -- the statement was made earlier by MP&L that little movement would occur. We're looking for their analysis to show that this is true and in combination with the analysis that we're doing, it will provide a complete background, complete story for this issue.

Sometimes when a detailed analysis is required, we're just looking for the details, not so much a very rigorous ---

MR. KUDRICK: Dr. Bush, just to give you an idea of how rapidly these items change, quite frankly we heard of the analyses last night relative to our consultants. So we are moving on a day to day basis on these issues and we're trying to keep you abreast of where we stand. We've went over that analyses with our consultants. It seems reasonable. It seems like a reasonable approach to take. We would be still looking for the applicant to confirm that.

DR. PLESSET: Detailed is an adjective that has a lot of meaning, Spence.

DR. BUSH: I recognize that.

MR. FIELDS: The third area concerns pressure drops through floors that are located above the HCU floor and this again applies only to the Mark III's. Mr. Humphrey's concern was that no specification was provided in the Stride package for the minimum flow area and if these areas were very crowded, it could effect vent clearing. As it turns out, the HCU floor is the most restrictive to flow because the steam tunnel basically. And our previous review approach did identify the HCU floor as the most restrictive and we did not include any specifications floor for floors above that simply because we did not believe that the possible changes in design would create such a large difference.

Our current assessment of the safety significance is that the concern is not a safety issue for Grand Gulf or Mark III's and Grand Gulf has indeed provided an analysis that shows our -- or provided a statement that they have looked at the floors above the HCU floor and they do have greater open areas. We do not see this as a major concern, a major issue.

DR. PLESSET: Have the structural people and NRC decided that the HCU floor will withstand a 60 foot per second impact? They were still going through that structural analysis. Could you tell me?

MR. KUDRICK: It's my understanding that they have concluded satisfactory on that.

DR. PLESSET: Okay.

Tape 4

MR. FIELDS: The next area is the safety relief valve discharge line sleeve loads. And this applies to Mark III's and previous NRC review did not consider that -- did not identify that this loading of this area existed. Mr. Humphrey's concern was that you could have Co and chugging loads to the sleeve and may affect the support design and submerged structure design inside the pool.

DR. CATTON: What is the percentage of a single vent that this cross-sectional area represents?

MR. FIELDS: I'd say -- well, I have the number.

It's 2-1/2 percent of the total area of the top vents. The total sleeve areas -- there's 20 SRV's at Grand Gulf, so you are talking about 2-1/2 percent of that -- the sleeve area is 2-1/2 percent of the total top vent area.

MR. KUDRICH: I think it's somewhere around the total equivalent of one vent.

DR. CATTON: I was thinking more in terms of one.

DR. PLESSET: Compared with one SRV.

MR. FIELDS: All right. Divide 40 by 20 so you are talking about one percent.

DR. CATTON: So it's one percent. That's pretty small.

MR. FIELDS: It is pretty small.

DR. CATTON: What elevation is it located at? Is it above the vent, below them, or ---

MR. FIELDS: The same. It's the same elevation as the top vent.

DR. CATTON: Same elevation as the vent. One percent of one vent's area; is that correct?

DR. PLESSET: Per square foot.

DR. CATTON: That's trivial.

DR. PLESSET: It's about a square inch filtered area, if I figured correctly.

MR. KUDRICK: Maybe MP&L can help us on the details of that gap. I think it's an intercell gap around the SRV pipe between the sleeve and the pipe.

DR. PLESSET: I guess about one square inch area.

MR. KUDRICK: I think it's a little bigger than that.

DR. PLESSET: A little bigger? Maybe two square inches? Maybe can Mississippi Power & Light help us on it? They shouldn't hesitate to give us a number. What's the area equivalent of a sleeve.

MR. TOWNSEND: I think the total area in the system for all of the SRV sleeves combined is about two to three percent of the top row vent area in the containment.

DR. PLESSET: Would you identify yourself?

MR. TOWNSEND: Hal Townsend, General Electric.

DR. PLESSET: Well, what we were asking is something a little bit different. What is the area equivalent of one sleeve compared with one vent?

MR. TOWNSEND: As I remember the number, it's about 30 square inches and that ---

DR. PLESSET: That's about a square foot, isn't it?

MR. TOWNSEND: A vent is about four square feet.

DR. PLESSET: One vent?

MR. TOWNSEND: One vent is four square feet.

MR. KUDRICK: 27-inch diameter approximately.

MR. TOWNSEND: Normally 600 square inches.

DR. PLESSET: Okay.

MR. TOWNSEND: So it's about -- a sleeve per vent area. It's about five percent and there's about half as many sleeves as there are vents. So overall, it's about two and a half percent.

DR. PLESSET: Well, that's a different question then.

MR. KUDRICK: Let me, out of ignorance, suggest that I think it's about four square feet divided by 20 lines. So it's about a fifth of a square foot per line that we're talking about, vent area. If the numbers that I hear coming across are about right, that's it.

MR. SCHROCK: Five percent.

MR. FIELDS: The number quoted by Grand Gulf is the total sleeve area, 2-1/2 percent of the total top vent area. Since there is 40 top vents and 20 SRV's, you're talking about 1.25 percent sleeve area per vent, per top vent.

DR. PLESSET: A little over one percent.

MR. FIELDS: A little over one percent.

MR. KUDRICK: We agreed on a global basis that this is an extremely second order effect when you're talking about the pool swell phenomenon and condensation phenomenon. I think the concern is focusing in on what impact does that condensation have on the pipe itself, the SRV piping. Is there any danger of aggravating the scenario by additional loads on that pipe that have not been considered.

DR. PLESSET: We're not worried about any fluid mechanical effect. It's the effect on the SRV line itself.

MR. KUDRICK: I think we kind of focus in on that, yes.

MR. FIELDS: The concern was expressed in that indeed you are correct in saying that his concern was not only with the sleeve support itself but the other submerged structures also, and basically his main thrust was that you might have structural resonance because of the frequencies of the sleeve could be mugh higher than the frequencies that the CO and chugging loads from the top vents are.

And his point was that this has not been evaluated at all and you just didn't know what it is.

DR. PLESSET: It sounds unlikely to me. I guess it does to you too.

MR. KUDRICK: Yeah, I think that we are talking about a somewhat secondary issue and I think Mr. Fields will go through and give you the Grand Gulf approach on it. It becomes even lesser.

MR. FIELDS: Grand Gulf has made a final decision. They just informed us a week or two ago that they're considering sealing these SRV sleeves. So therefore there would be no flow through these sleeves and this issue would not apply to Grand Gulf at all.

DR. BUSH: Are you sure you don't exchange one set of problems for another if you do that because you now set up concentration cells and under those circumstances you should be able to get very severe pitting, even in a schedule 80 pipe. So you may change King Log for King Stork.

MR. McGAUGHEY: Excuse me. We're -- Jim McGaughey, Mississippi Power & Light Company. We're looking at a method of sealing them, of a seal on there, you know, if it becomes an issue that's the only way to resolve it, I personally would like to avoid doing that.

MR. FIELDS: That's correct. I didn't mention you were doing it. I said you were considering it.

As far as the Stride package or the other Mark III's, this particular design feature is essentially the same for all the containments, so therefore conclusions reached on one, the Staff believes that are applicable to all Mark III's, would either follow Grand Gulf's approach or provide us with some additional information to show that the possible structural resonance that you could have from these loads are not limiting as far as design goes, are basically that we are just looking for a little more detail on this issue. Because of the small floor area, we do not think it is a major issue.

The fifth area deals with the ECCS relief line discharge loads. The concerns had to do with hydrodynamic loads, loads on relief lines, effect of pool level on ECCS relief line discharge and the coupling of these loads with the pool dynamic load resulting from a LOCA.

This area is potentially applicable to all the BWR's. The previous NRC review approach was that most ECCS relief lines have very low flow rates and the hydrodynamic loads are insignficant. The RHR relief line loads weren't quantified. Basically the RHR relief line would only be a possibility if you were operating this RHR system in the steam condensing mode and you over-pressurized your RHR heat exchanger. And this is not a safety function of the plant. It's only an option that can be used if the plant operators deem it is necessary.

The effect of pool level on relief line performance was not explicitly addressed for the Mark III's and is currently being looked at to make sure that there is no problems with higher pool levels or lower pool levels on the performance of these valves.

Grand Gulf has committed not to use the RHR system in the steam condensing mode and until this issue is resolved between the NRC and MP&L and the other ECCS relief lines probably produce insignificant hydrodynamic loads not only on structures on the pool but also on the relief lines themselves.

And we're looking for the same approach from the Mark III's as well here.

DR. EBERSOLE: May I comment on an aspect of that problem as it pertains to the Mark I's and II's and the old designs. There is a relief problem associated with those. In clearly the vents or exhausts of those turbines because the possibility of not clearing. There is usually a relief valve or actually it's a disc on the final stage of the turbines. And my recollection is that -- the discharge from that is thrown into the general secondary containment on the thesis that you can stop the discharge flow by closing the entry valves, which you could also do in the condensing mode with these condensers.

I think that should be reviewed in the context that you are looking at this, whether or not the discharge from these relief valves should, in fact, not have gone to the suppression chamber in the event that the ordinary exhaust is plugged. Do you follow me?

MR. FIELDS: You are saying that there are some relief lines in the Nark I's that relieve to the secondary containment.

DR. EBERSOLE: Right, these are on the last stages of the turbine. They are to protect against the cork not going out fast enough in the exhaust of these turbines, and they discharge direct to the secondary containment. They do not go back to the torus, or the other containment. I think that should be looked at in the course of your investigation.

MR. KUDRICK: Let me make sure I understand.

DR. EBERSOLE: Look at the turbine exhausts.

MR. KUDRICK: Normally now the turbine exhaust would exit into the pool, right?

DR. EBERSOLE: Because of the possibility that it would be plugged or that it will not clear in time.

MR. KUDRICK: There's a tap-off.

DR. EBERSOLE: There's a tap-off and that is a disc which dumps right into the auxiliary building. And I always thought that was lousy design. And I suggest that you look at it again.

MR. KUDRICK: All right, we will note that.

DR. ETHERINGTON: A little bit off the present topic. the PWL's have seen some serious problems of putting water into steam and vice versa. Does the Staff feel completely satisfied that the RHR house switching from the steam condensing mode to the water cooling mode doesn't involve any problem of any kind?

MR. KUDRICK: Unfortunately you have asked an area that the Staff really has not gotten into and I feel very uneasy in commenting at all on that particular area.

DR. BUSH: In that context I was going to ask the question, what does the Staff -- what is the Staff requiring with regard to instrumentation because it appears to me that adequate instrumentation in the RHR mode would not only resolve the load -- many of the load questions but probably by inference would also resolve some of the other questions with regard to the DBA.

MR. KUDRICK: Dr. Bush, I'm sure you are aware of the temperature monitoring systems that are in place in all the BWR's that could be used to extrapolate into a -- to identify the discharge point whether it be an SRV line or an RHR relief line. Are you referring to something over and above that?

DR. BUSH: I'm thinking of pressure sensors and I'm thinking of instrumentation of the piping because I believe that by looking at these records you could pretty well infer what the level of loads are. After all, that's a common technique that's used.

MR. KUDRICK: That's correct. And I believe the issue simply stated is that when you're in a steam condensing mode, that if a relief valve were to pop you are in an analogous situation to an SRV pop, and then there are resulting loads. Now, whether those loads are well within design or not, is another question. The issue is that have they been considered in the design. And then, secondly, if tey have been considered, how significant are they. But it's an SRV type question.

DR. PLESSET: Well, I was going to declare a 10-minute break.

MR. FIELDS: Let me finish this one slide here.

DR. PLESSET: Oh, yes.

MR. FIELDS: I had talked about the Mark III's and since this is applicable to the II's, I'd like to say our preliminary assessment for the II's and I's, Mark II's have told us verbally that they have done some examination of this problem and they did not -- have not uncovered any significant safety issues. And they are preparing a more detailed response for our review.

Mark I's, they have not provided us with an assessment yet and we are still looking for some information on the Mark I's. Of course, they have operated -- they do have many, many years of operating experience and we haven't seen any significant problems with these lines as yet.

DR. PLESSET: Okay. Well, let me also make an announcement that after the break, Mr. Fields will continue and then after him this morning will be a presentation by GE, a perspective of theirs on these questions. I think we'll have that this morning before lunch.

So let's take a 10-minute break.

(A 10-minute recess was taken.)

DR. PLESSET: Let's continue with Mr. Fields' presentation now.

MR. FIELDS: The next area deals with the possible isolation of the drywell pool from the suppression pool. This can occur following a LOCA or main steam line break if the operator follows the ECCS flow to the point that the water that spills out of the break into the drywell does not overflow the weir wall and again be connected, in the thermal response way, to the suppression pool water.

This isolation of the water inside the drywell from the suppression pool may result in increased suppression pool temperatures. Now, I mentioned weir wall for Mark III's. The situation is slightly different for Mark I's and II's, in that while you don't have weir walls, you have other obstructions or cavities where water could collect and not communicate with the suppression pool itself.

So it is possible -- possibly could apply to all the Mark III's, Mark I', II's and III's. The magnitude is less on the Mark I's and II's, I believe.

The previous NRC review approach is we did not consider this scenario basically because -- well, we just didn't get into quite that depth of review as far as assuming that the operator would follow the ECCS. And basically we rely on conservatisms in the containment model to account for uncertainties in the pool temperatures. We have many conservatisms in the calculation of the pool thermal response. And the current NRC assessment is that this issue should not be a design issue.

MP&L has now provided some numbers for us and it shows that the change in temperature between isolating the drywell water from the suppression pool and not isolating it, there's a difference of about 6 degrees and while we would like some more information on how that number was arrived at, we do not feel that presents a problem in the containment response.

As I mentioned before, the effect on Mark I's and II's probably is smaller than the Mark III's because of the volume of water trappage, it should be smaller. And for the I's and II's, they were just basically covering the base by just looking at maybe a scoping analysis to see what the effect is.

We do not see this issue as being a major one.

Mr. Humphrey had a number of concerns on the use of bulk pool temperatures and various calculations. His concerns stated that you could have some thermal stratification and that this should be included in your containment response analysis, in your analysis of the RHR heat exchangers, and basically said upper pool dump or containment spray operation may aggravate thermal stratification. This may affect the RHR heat exchanger efficiency and could increase your containment temperature pressure response.

This is a concern that possibly applies to all the BWR's and the previous NRC review approach was we did recognize thermal stratification could exist. We've done some analysis to calculate the magnitude of the stratification. We did not include in the containment response analysis thermal stratification because of the very large conservatisms that are inherent in the containment response model. And the basic one is you do not consider heat sinks, which is established procedure for PWR's, and you are assuming that the containment atmosphere is at the same temperature as the suppression pool, which is another large assumption, large conservatism.

The -- all the possibilities raised by Mr. Humphrey were not explicitly included in our review. Our current NRC assessment is for Mark III's that this problem should not result in a design issue. We've had some information on the Grand Gulf docket that said there is more than enough margin in the RHR heat exchangers. They quote a number of 10 degrees. And the containment response model, you're talking about 50 to 60 degrees of margin. This should be adequate to cover thermal stratification. We are looking for a few more details.

DR. CATTON: With respect to thermal stratification, if you assumed that the only part of the pool that was acting as an effective heat sink, was that between the bottom edge at the top vent and the top of the pool? Would that push you beyond the design limits?

MR. FIELDS: Basically the containment response assumes that the suppression pool is 185 degrees and that the containment atmosphere is also at the same temperature. So ---

DR. CATTON: I'm asking you to ignore about half the pool as a heat sink, and if that leads you to a design question, design problem.

MR. KUDRICK: Dr. Catton, if you continue to consider bounding calculations and if you continue to ignore the heat sinks that are there in the containment and just essentially eliminate it, 50 percent of the pool, yeah, you would show that you're above the design temperature of 185. So I think the simplistic approach just won't work here because it's just too bounded.

DR. CATTON: Well, I understand. But, see, what you're doing is you're sort of telling me that gee, in one end of this, we're sort of conservative so on the other end we don't have to do it right, because a fully mixed pool is not correct. And I'm just trying to get a measure as to how serious it is. And what you're telling me is that if I take what I think is a reasonable cut at getting a conservative estimate on the part of the pool, it's too conservative.

MR. KUDRICK: Well, it can't be any worse.

DR. CATTON: But it's too conservative.

MR. KUDRICK: Well, it can't be any worse if you just take the pool above the top vent, that's only seven feet of water.

DR. CATTON: Well, I would take plus the vent.

MR. KUDRICK: That's another two feet.

DR. CATTON: So it's nine feet of the pool.

MR. KUDRICK: That would give you nine feet of the pool.

DR. CATTON: If you are slowly bubbling steam into that pool, that really is where your effective heat sink is. I gather there's no answer to that question at this time?

MR. KUDRICK: No, I ---

MR. FIELDS: What you are interested in is what is the magnitude of the thermal stratification including all these effects.

DR. CATTON: Thermal stratification keeps coming up and I continue to try to get a feel for how serious it is. So I postulated a certain circumstance that I think would be one limit. If you take that limit, it sounds to me like you exceed your very conservative design limits. That's doesn't leave me with very much.

MR. KUDRICK: As we were discussing during the break, when we first looked at thermal stratification, General Electric did have a test program in their PSTF facility that was geared specifically to look at pool stratification in that pool. And they ran a wide spectrum of tests and actually measured what the stratification would be inside that facility.

It was to a large part the results and evaluation of that information that led us to conclude that when you look at the test data and also recognizing the modes that that plant would be in operation post-LOCA -- for example, RHR circulation -- it was on that basis that we concluded along with that analysis the stratification was within the margins that were available to that particular plant. And -- but you can't look at it too simplistically because it's a very complex interrelated set of relationships. Eventually you are going to get down to a back of the envelope calculation that's going to show that you are in trouble.

DR. CATTON: I guess I'd like to see or hear from GE how they do their calculations and maybe hear a little bit about their experiment, or get the reports so the Subcommittee doesn't have to listen to it all.

MR. FIELDS: If you have Appendix 3(B) to GESSAR, that does include the analysis they did to calculate the thermal stratification.

DR. CATTON: I've heard from GE with respect to their calculations at one of our previous meetings and at that time they indicated they were using a code called Relap 5, or something, which is just totally inappropriate. I don't have the foggiest. Maybe it was Relap 4, I don't know.

MR. FIELDS: Perhaps GE can respond to it later or would you like to do it now?

MR. TOWNSEND: I can do it now or later.

DR. PLESSET: It depends on how long you want. If you want to do it in some detail, we can do it later.

MR. TOWNSEND: Let me have a quick shot at it right now.

DR. PLESSET: All right. Go ahead.

MR. TOWNSEND: First, Jack is right that we do a very limiting calculation assuming thermal equilibrium to estimate the containment design pressure at 15 PSI and at 185 degrees the vapor pressure of the -- from the pool is enough to give you 185 -- 15 PSI design pressure in the containment. And that does ignore any non-equilibrium effects or any stratification effects in the pool. We have experimental data from our test program as far as vertical stratification in the pool when you have steam condensation going on. And one of the interesting results of that is that we do see the -- when we have chugging in the top vent only, the bottom vents are being pumped somewhat and the pool -- in effect, the flow in the bottom vents is oscillating.

But then it has a net flow into the vents back up to the weir and out of the top vent. And from our experimental data, we can show that that will turn the pool over in somewhere between 5 and 10 minutes. So the bottom half of the pool is being used as part of our heat sink.

The stratification we see in those tests is something on the order of 5 to 10 degrees above the bulk pool temperature and we try to account for that in the design.

SRV discharges is another major way you can put energy into the pool. I think probably the best measure of that stratification is from the Kuosheng start-up test where a single valve was discharged into the pool first with no RHR cooling and then with a single RHR loop and then with two. And then the single discharge case, I think the limiting stratification was approximately 19 degrees without any circulation.

When you have either one or two recirc loops -- or circulation loops operating, the stratification is on the order of nine degrees. So we see rather modest stratification there, from the SRV discharges as well. There's been questions raised about the suction of the RHR system not being exactly at the bulk mean temperature in the pool. The RHR suction is near the mid-plane of the pool and within a very few degrees, it is taking suction from the mid-plane.

Another thing we have looked at is what is the significance of increasing the pool temperature, particularly when we take credit for the non-equilibrium between the containment air space and the suppression pool surface temperature. We see that the containment air space temperature lags the suppression pool temperature by quite a substantial margin on the order of 25 to 35 degrees, and as a result the pressure in the containment airspace stays very low in our best estimate calculations of what's going on in the containment.

The -- we've also looked at the -- at this 185 degree limit and what is its significance. I think that's something Dr. Catton asked earlier. And really other than from this very superficial steady state calculation, we don't see any great significance. We've tried to identify when we would have a problem as we increase the temperature and the first thing that we can find that gives us much of a problem is getting up in the 230-260 degree range where we begin to have some problems with pump seals in the RHR loops. And then I think that's even very questionable about how fast those seals will degrade.

So we have a very substantial margin before anything really starts to happen to the containment. And I'll show you later that the kind of margins we think we have before we'd really get into containment failure. And we just don't feel the stratification is a big issue.

DR. CATTON: May I ask you a question? You mentioned a couple of modes whereby you might have stratification up to maybe 20 degrees. But you didn't mention the steam condensing spray mode where you are rejecting heat out of the vent.

MR. TOWNSEND: Okay, you take the RHR off of the pool and spray under that condition and you would say you're going to stratify the pool, or not mix the pool as well, although you are still taking suction.

DR. CATTON: You've also put an input -- a heat input right on top of the pool.

MR. TOWNSEND: Yes.

DR. CATTON: What degree of temperature spread do you get there?

MR. TOWNSEND: Well, then recognize that when we are spraying the suction is being taken out of the pool and run through the RHR heat exchangers so you are spraying cold water into the air space and you are holding the containment temperature -- pressure down and temperature by the spray, and so if the pool stratifies under that condition, I don't think it's any serious issue.

To answer your question, we haven't looked at the degree of stratification explicitly there because we can't see that it causes a problem.

DR. CATTON: There's another aspect though as you approach saturation, and I assume that when you are talking about 230 pounds, the containment pressure has gone up as well.

MR. TOWNSEND: 230 degrees.

DR. CATTON: The containment pressure has gone up as well.

MR. TOWNSEND: Yes.

DR. CATTON: As you approach saturation, you start to leak the steam right through.

MR. TOWNSEND: Through the pool surface into the air space.

DR. CATTON: That's right.

MR. TOWNSEND: Yes.

DR. CATTON: The upper layer of the pool doesn't have to get to saturation to bleed steam through. It's a little bit below that when steam will start going right through.

MR. TOWNSEND: Agreed. And then you're into a dynamic analysis, if you will, of how much of that steam is being condensed out on the containment structure and how much are you taking out with sprays.

DR. CATTON: Certainly, but it comes in different kinds of ballgames.

MR. TOWNSEND: Yes, it's a very difficult thing to calculate, I might add.

DR. CATTON: I'm eager to see the experimental data that you're basing this on.

MR. TOWNSEND: Okay. I don't have that with me today unfortunately.

DR. PLESSET: Have you looked at the intermediate break analysis here in connection with this pool heat-up?

MR. TOWNSEND: We've looked at the whole spectrum.

DR. PLESSET: You have?

MR. TOWNSEND: Yes.

DR. PLESSET: What -- dod you find any problems with the intermediate size breaks?

MR. TOWNSEND: No, they're very comparable.

DR. PLESSET: They can go on for quite a while.

MR. TOWNSEND: Yes. I will show you a slide later that has a little comment on it that we have looked at our containment capability on a best estimate basis without containment cooling at all and we -- our best estimate today is that we have something like 40 hours without containment cooling before we reach the rupture pressure of the containment. So we feel we have a lot of margin.

DR. PLESSET: Fine.

DR. CATTON: That's with a fully mixed pool.

MR. TOWNSEND: I'm not sure about that, Dr. Catton, what the exact assumption is on that.

DR. PLESSET: Okay, now go ahead.

Tape 5

MR. SCHROCK: I just wanted to ask Dr. Townsend what type of transient it was that produced the 30-degree lag that you mentioned?

MR. TOWNSEND: That particular case was a DBA that we were looking at and ---

MR. SCHROCK: So it's pretty fast?

MR. TOWNSEND: Yeah, it's DBA and it's a long-term lag. This is several hours when you continue to add the decay heat. So I think any of the transients that you deal with, you dump the stored energy in a matter of seconds to minutes into the pool and you bring the pool temperature up to something like 140-150 degrees and then it's kind of a race after that point of adding decay heat and taking energy out with the RHR system to reach the peak. And in the Mark III containment, the peak is temperature is reached usually in the four to six hour range the way we calculate it.

MR. FIELDS: The next area deals with the operational aspects of the RHR system. Mr. Humphrey's concerns cover the effect of RHR discharge and suction on pool mixing, the amount of RHR usage and cycling of the sprays with the containment spray effect on RHR heat exchanger and the possibility of backflow through the containment spray lines of reactor water at system pressure.

Some of these concerns are applicable to the I's and II's as well.

The previous NRC review approach did not uncover any design deficiencies of the RHR system. However, not all the concerns identified by Mr. Humphrey were specifically reviewed by the Staff.

The usage -- for instance, the example of cycling of the sprays, the operational considerations of having to go from a containment spray mode to a pool cooling mode and back to containment spray mode, the effects of that on the instrumentation and on the equipment is really beyond the normal scope of review that the Staff gets into.

After examining the preliminary information provided by MP&L and GE, we have concluded that the concerns should not become a design issue. However, some more information on the quantification of these -- some of these aspects is needed and we're possibly looking for a test, as we mentioned earlier, on the effect of the RHR operation on the pool mixing capability.

We don't expect the situation to be any worse for Mark I's and II's based on a preliminary look at the design features, but we will be looking for some quantification of these concerns as they relate to their plants.

Area number nine is the drywell to wetwell steam bypass leakage. And Mr. Humphrey's concerns were that the FSAR design case, which was a small break, is not the limiting case. Instead an intermediate break was. A bypass -- steam bypass leakage was not included in the containment response calculation. Bypass leakage could cause locally high temperatures inside the containment near the drywell wall where the leakage could possibly go through.

You could have a possibility of high temperatures in the drywell without two PSI scram if your initial conditions in the containment and drywell were such that you had a pressure differential existing between the drywell and containment, that is if your normal operational procedures you had a couple of PSI difference between drywell containment and then you had a small break, you could possibly not reach the two PSI scram point and still uncover the top vents. This would allow our - you could have the leakage of the steam could prevent the two PSI from occurring which would prevent the reactor from scramming.

And bypass leakage could be aggravated by ECCS throttling and his point there is if you don't stop ECCS, you have ECCS spillage into the drywell which will condense the steam and stop bypass leakage.

DR. ZUDANS: Could you explain this two PSI? How could you leak from drywell into containment and build up a pressure in the containment so that it would depress the water in the containment and nothing creates the pressure in the source, in the drywell.

MR. FIELDS: I made the mistake of condensing two concerns into one. Let me go back and start over again on that one.

DR. ZUDANS: All right.

MR. FIELDS: His concern here is if you have a bypass area between the drywell and containment, you can be leaking steam -- you say you have a small break, very small break. Steam could be going through the bypass area without having to go through the vents.

DR. ZUDANS: Okay.

MR. FIELDS: If the area is large enough, the pressure rise in the drywell will not reach two PSI. However, if you continue to add steam into the drywell, your temperature can continue to go up. So the problem is you will not automatically depressurize your reactor vessel because you do not reach a two PSI scram signal and the high temperatures could have an environmental effect on the equipment inside the drywell.

DR. ZUDANS: But there is no way to uncover the vents for this scenario.

MR. FIELDS: For this scenario, right.

MR. KUDRICK: Basically the concept is that you are adding energy to the containment before you get scram. Leak before scram type of scenario, where you could have it for an extended period of time and then change all your initial conditions when you're actually getting to a LOCA scenario.

DR. ZUDANS: That means it's just a longer duration. Eventually it will reach the two PSI if you need to scram.

MR. KUDRICK: That's right.

DR. ZUDANS: It's a question of how long that time is and what it does in terms of local temperatures.

MR. KUDRICK: That's correct.

DR. CATTON: This is an easy enough thing to check out, isn't it? Just do the calculation with bypass.

MR. KUDRICK: I'm not sure that you want to -- you could do that, but ---

DR. CATTON: That's the logical thing to do.

MR. KUDRICK: I think we're short-circuiting his ---

MR. FIELDS: The next -- what I wanted to describe is basically our philosophy on bypass leakage. We are requiring that Mark III's, as well as Mark I's and II's, consider bypass leakage for evaluating the capability of the struture to withstand possible bypass leakage. However, there are no known bypass leak source between drywell and containment. And the tests that were performed very recently on Grand Gulf showed that the leakages were very small. I mean a factor of maybe five percent of the capability of the structure, maybe even less than that.

And it is not the Staff's intention that bypass leakage be a design requirement that should be included in all aspects of the containment design. Merely an additional feature to show capability of the structure in respect to containment pressure response.

We do have containment sprays that will condense any steam in the containment and we are asking that the licensees do leak test at 10 percent of the bypass capability to provide additional assurance. And while our review did not include all of Mr. Humphrey's concerns, because of the philosophy of not requiring this issue to be a design requirement and because the tests that were done to date show that there's a very little bypass leakage, the Staff does not feel that this concern needs to be a design issue.

We are looking for some further information to quantify some of these aspects and something looks like it is extremely sensitive and will have to be reevaluate -- we will have to reevaluate some of our thinking.

The Mark I's and II's have even less communication between the drywell and wetwell and correspondingly less bypass and the situation is not expected to be any worse.

DR. EBERSOLE: May I jump for a moment to the vacuum breaker problem again. Those are potential bypasses.

MR. FIELDS: Correct.

DR. EBERSOLE: They exist in Mark I and II. They are in this containment too?

MR. FIELDS: Yes.

DR. EBERSOLE: You must specify an allowable rate of leakage that -- on those -- to in essence guarantee the suppression process for a large LOCA.

MR. FIELDS: Well, we do have tests that include the vacuum breakers to see what the leakage is through the vacuum breakers.

DR. EBERSOLE: I'm talking about in failed modes.

MR. FIELDS: Well, you would have vacuum breakers that are in series. Do you want to fail both of them?

DR. EBERSOLE: Oh, I might indeed, by mechanical shock due to a sharp loads from -- we mentioned earlier the hydrogen cyclic loads or for that matter the chugging loads on some of the earlier containments.

MR. FIELDS: Right. But we would have to make ---

DR. EBERSOLE: So one cannot simply throw bypass leakage to the winds and say you don't have a limit on it.

MR. FIELDS: We are approaching the resolution of that subject somewhat differently in that we are requiring these vacuum breakers to be able to withstand any dynamic loads that are possible.

DR. EBERSOLE: Then you are going to involve -- invoke the single failure.

MR. FIELDS: Then we will invoke the single failure criteria.

MR. KUDRICK: I think it's just the philosophy now on how we differentiate between a design basis accident and a study to look at the capability of that containment to respond to a degraded situation. We believe that when we look at this particular bypass issue we have already evaluated the degraded situation separately from the DBA and it's not necessary then to tack on to the design basis accident this additional failure because it's a capability already.

DR. EBERSOLE: Did I hear you say that the vacuum breakers are in series? You have a series design?

MR. FIELDS: The Mark III's, yes.

DR. EBERSOLE: What I was going to say, even if you do ---

MR. FIELDS: No.

DR. EBERSOLE: I never heard of such a design.

MR. KUDRICK: Mark II's do have series vacuum valves.

MR. FIELDS: Just a minute. We'll just find out what Grand Gulf has.

MR. KUDRICK: Mark I's and III's, I don't believe do.

MR. RICHARDSON: John Richardson from Mississippi Power & Light.

In case of Grand Gulf, I'm not sure about the other Mark III's, but in the case of Grand Gulf, there are not two check valves or vacuum breakers in series. There is a butterfly valve in series with the check valves. And the butterflies normally close and locked out initially on the LOCA signal and only after the -- 30 seconds after the LOCA, would the butterfly valve open and then of course the vacuum breakers would operate as vacuum breakers.

If the pressure again rose above the set point of those butterfly valves, they go closed, which would eliminate any concern about the bypass with the failed open check valve once the pressure gets high again in the drywell.

DR. EBERSOLE: Thank you.

MR. RICHARDSON: I'd like to add one other thing, that in a DBA case it's not really -- you know, the large break, it's not really concerned with bypass leakage anyway.

MR. FIELDS: The next area deals with concerns related to the hydrogen control system. Mr. Humphrey's concerns were that drywell leakage of hydrogen that did not bubble through the suppression pool could possibly bypass recombiners. There is a recommended interlock that ties recombiner operation to containment spray operation. Recombiner operation may create local high temperatures and that the GE hydrogen analyzer is not operable at volumetric steam concentrations greater than 60 percent.

Some of these concerns are applicable to all of the BWR's and the previous NRC review approach was we examined the location of recombiners, or hydrogen suction points for the I's and II's, to ensure effective recombination. For the Mark III's, for example, the recombiners are located at a platform that is above the entire drywell structure, at an elevation above it, not directly over, but at an elevation above the drywell structure.

And if you had hydrogen leakage through the drywell walls or more likely through a line, it would still be at points below the hydrogen recombiner.

The interlock, the NRC assessment for the Mark II's divided into assessments for Grand Gulf and another assessment for Mark III's. The Grand Gulf design does not include the interlock or the GE analyzer and preliminary information provided on the other concerns indicates they should not be a design issue.

We're still waiting for a little more information on some of their calculations that they provided.

For the Mark III, I was told that they are in the process of removing this interlock as well and we'll be examining their hydrogen analyzer for its effectiveness in all possible situations.

As far as these concerns relate to the Mark I's, most of them rely on hydrogen purge so they do not have recombiners and we did not see these concerns being more of a problem on the I's than they are on the III's. Therefore, they should not be a design issue.

And the same applies for the Mark II's, as well, here.

The next area deals with concerns related to upper pool dump. They include that the low pressure bypass test of approximately 3 PSI does not include the upper pool dump in that once you have upper pool dump, your submergence is greater and that the potential pressure difference between the drywell and wetwall can be greater than 3 PSI, 4, 5 or possible 6 PSI.

The hydrogen purge compressor operation did not explicitly consider upper pool dump. Again, you may have a higher drywell to wetwall water head and you have to pump instead of having a 3 PSI pressure to uncover the top vents, you'd have to have maybe 6 PSI.

The upper pool dump -- the upper pool may not dump if activating signal disappears. Basically, you have an interlock. I think 10 minutes, or is it half an hour, I'm not sure. That once you receive the signal, the pool not immediately dumps, it will wait a certain period of time so you avoid having to consider a pool, upper pool dump, when you have initial pool swell loads.

And the concern there was with solid state circuitry, once you have the signal to dump your upper pool, that signal goes away for some reason. The pool will not be dumped and you still may want it dumped.

DR. CATTON: How far below the top of the weir wall is the water level?

MR. FIELDS: After dump or before dump?

DR. CATTON: Before dump.

MR. FIELDS: Before dump? I believe it's around 10 feet. The normal water level is seven feet.

DR. CATTON: And after dump?

MR. FIELDS: After an inter-burden dump, it is for Grand Gulf just below the weir wall and for the other Mark III's, analysis hasn;t been done and maybe just below or a fraction above weir wall.

DR. CATTON: So the maximum delta-P change would be seven foot of water.

MR. FIELDS: Correct.

And the last concern is once you have a DBA and you dump your pool, the chugging that could possibly occur in the long-term LOCA conditions could be affected by the greater heighth of pool over the top vent.

DR. ZUDANS: I'd like to understand something. What kind of differential pressure are you talking about? If you dump the upper pool, pressure will be the same in drywell anyway.

MR. FIELDS: The upper pool dumps into the suppression pool. What you do is you have to uncover the top vents in order to condense the steam effectively. And so if you have upper pool dump, the amount of water that you have to displace doubles approximately. So therefore the pressure to uncover the top vent doubles.

DR. ZUDANS: But now you're talking about dumping the pool first and then trying to pump the steam through?

MR. FIELDS: Correct.

DR. ZUDANS: I just heard that it will never happen before.

MR. FIELDS: No, it will not happen early in the transient. It will not happen within the first few minutes. You will not have upper pool dump. You are designed to have upper pool dump 10 -- 30 minutes after the accident.

DR. ZUDANS: I see. And a subsequent steam leakage would then have to overcome the five additional feet of waterhead, and that's what creates the additional pressure.

MR. FIELDS: Correct.

DR. ZUDANS: That makes sense.

MR. FIELDS: Okay. Upper pool dump only applies to the Mark III's. And the previous NRC review approach, basically we were worried about not having enough water level over the top vent due to trappage of water inside the drywell. And if you have ECCS throttling by the operator, then you could possibly not even have a drywell pool at all under extreme circumstances, except for what is condensed out during the break.

So we have not explicitly looked at the concern as it relates to not forming a drywell pool.

The current NRC assessment of the safety significance for Grand Gulf is that the licensee has provided sufficient information to indicate that these concerns should not be a design issue. For example, the hydrogen purge compressor for Grand Gulf has operating head of 10 PSI, which is more than enough to account for this. And they have verified that their activating signal will not disappear upon loss of the signal so that it will still dump the upper pool.

And we have looked at the test results for chugging load definitions and the effect of water level of the top vent is a secondary one.

For the other Mark III's, we do not expect to see anything different but we're just looking for some more information on both Grand Gulf and the other Mark III's to tie up this issue.

Area 12 deals with the emergency procedure guidelines. Mr. Humphrey had three basic concerns. The first two are fairly specific to Grand Gulf -- to Mark III's. GE then recommended that the hydrogen control system be activated on low reactor water level, and he said this was not included in the EPG's that he's seen, and that the EPG's would require ADS actuation whereas in some cases one SRV actuation is adequate and you certainly wouldn't like to avoid actuating all of the SRV's or a portion of the SRV's actually if you don't have to.

And the third one was more general in that the EPG's may conflict with DBA conditions. And basically these concerns apply to the Mark III's except the Mark I's and II's could possibly be affected by the last concern since it is a general concern.

The previous NRC review approach was we did look at the EPG's as far -- or we are looking at the EPG's since they are still under development for conflict between DBA situations to make sure that we do not pose guidelines for the operators that would actually create a worse situation than is necessary.

And the first two concerns are really details that are beyond the normal scope of the review. Based on information provided by Grand Gulf, we do not think this is a significant safety issue. They do activate their hydrogen control system if their water level reaches, I believe, one foot above the active fuel level. And EPG's, they -- their procedures for the operator does not include actuating the ADS on the specific case that Mr. Humphrey was concerned about.

We are looking for some more assurances from Grand Gulf that in general the EPG's will not contain conflicting or perhaps causing problems in other areas.

For the other Mark III's, we do not expect the concerns to be design issues but we are looking for some further words on the subject.

And for the Mark I's and II's, our review of the EPG's has not resulted in any design issues being created and of course we will be in -- we have been in the past been examining the affects of EPG's on the entire spectrum of accidents. We do not believe this is a major concern at all.

The area of containment atmosphere response includes concerns dealing with Mr. Humphrey's contention that the environment profile that was developed by GE considered heat transfer from pool to atmosphere. The possibility of heat-up of the wetwell due to adiabatic compression affects, and drysell carryover affecting the long-term pressure response because it may not return to the drywell.

These concerns could possibly apply to all three BWR containment designs. Our previous review approach, we did not consider the use of heat transfer in our confirmatory profile so we do not feel that the first concern is a valid one.

We do not consider the adiabatic compression for mark III's, a scoping analysis done by Mark -- by GE and MP&L show that it's effect is about a half a PSI. So it is negligible.

For the Mark I's and II's, this effect could be larger because you have a smaller volume in the wetwell. We will be examining this effect.

The effect of non-return of air to the drywell, basically, if you do not have any ECCS spillage in the drywell, if you do not have drywell sprays, as in the case of Mark II's, you will not be condensing out the steam in the drywell and you will continue to have a pressure higher in the drywell than in containment. And initially following a DBA, you purge all of the air out of the drywell into the wetwell. And the long-term analysis that we've been doing has assumed that once your initial blow-down was over, the air would return to the drywell based on having ECCS spillage or drywell sprays.

And we do not consider the effect of non-return of the drywell air on Mark III's. This is not a concern on the Mark II's because the peak pressure differential in Mark I's and II's is a short-term where you do consider drywell air carryover in your calculations.

The affect on the Mark III's is a couple of PSI and you just did a straight addition on top of their already conservative design, you still -- design value, you would still be below the design of 15 PSI.

So while we do -- we are requesting some more information to give us a little better handle on some of these numbers, we did not feel this is a major area for any of the BWR's.

DR. CATTON: When you go through this cycle, you purge all of the air out and you are going to leave the steam behind. There could be hydrogen with the steam and then you are going to bleed air in; is that a problem or is that just trivial?

MR. FIELDS: Well, the case -- you know, Mark I's and II's, of course, are going to be inerted so hopefully you would not have a problem of having a hydrogen concentration and then being exposed to a high enough oxygen concentration to give you highly combustible mixture.

For the Mark III's, we are looking at this problem of having a high hydrogen concentration in a pure steam atmosphere and then adding air to it.

DR. CATTON: You condense out the steam and you replace the condensed steam with air through the vacuum breakers, so now you've got your mixture of hydrogen and air.

MR. FIELDS: This is a concern that is being examined on the Mark III's specifically. I'm not sure if we've come to ---

DR. CATTON: I just wante d to know that you are looking at it.

MR. KUDRICK: We are looking at it. We are looking at it from the standpoint of degraded core scenario. We are not necessarily excluding the DBA analysis, but that's where we're really spending our effort right now and we're looking at it from the standpoint of the igniter systems that have already been proposed and are being installed in the Grand Gulf facility.

DR. CATTON: Okay. Thank you.

MR. FIELDS: The next area deals with the use of technical specification limits versus the initial conditions that are -- that is used by the licensees, applicants and their DBA calculations.

We had three basic concerns. One, that the DBA analysis assumptions may be non-conservative. If you have extreme limits in your tech specs, you could actually lead to top vent uncovering before 2 PSI in the drywell and if you have a pressure differential between the drywell and wetwell, it is conceivably allowed by the tech specs, you could possibly affect the initial pool swell loads, vent clearing loads.

These concerns apply to the Mark III's and all the second concern doesn't apply to the II's and the third concern does not apply to the I's. The reason the third concern doesn't apply to the I's is we have a requirement for a pressure differential between the -- there is a tech spec value to have a certain pressure differential between the drywell and the wetwell for the Mark I's.

Our philosophy as far as the use of initial assumptions is that they be conservative, but not necessarily the tech spec values. Our review did not address all of Mr. Humphrey's concerns. His first concern was a very specific one in that the assumptions may actually be non-conservative. And we are examining his concern and we're also waiting for some information from the licensee to thoroughly address that particular one.

Our current assessment is that these concerns should not be design issues, but we are, as I said, looking for some detail analysis.

MR. KUDRICK: I'd like to add one thing. The question concerning the relationship between tech specs and design basis accidents is not a new issue. This has been discussed for quite a long time. And the -- I'd like to leave the impression that we try to examine the tech specs as a normal course of our reviews, so this is not a totally new issue for us.

DR. EBERSOLE: Do you really mean -- what do you really mean when you say that these concerns should not become design issues? I'm a little bit bugged by the way you say that because, of course, they should not be, but it's another thing to say shall not be or will not be.

MR. FIELDS: Well, right now we haven't completed our assessment to the final decimal point. Based on what we see and what we feel now, we say this should not cause any differences in the design.

DR. EBERSOLE: It has a double meaning though, see. You say it should not, and I agree with you, but then there's another interpretation that you are going to so require it that it cannot be.

MR. FIELDS: No, we should say it is not expected to be a design issue. How about that.

MR. KUDRICK: I think in the context -- you know we haven't gotten a lot of the documentation on the information that we received verbally from Grand Gulf, General Electric, and so forth. Based on what we received, there is no evidence to indicate that it would be a safety concern. We still haven't gotten it finally documented. So as a regulator, we are hedging until we see the black-and-white.

DR. EBERSOLE: That's the interpretation of should in this context here.

MR. FIELDS: Yeah, not expected.

DR. EBERSOLE: Fine. Thank you.

MR. FIELDS: The next area is the containment negative pressure aspects. And his concerns are that if you have spray initiation at a minimum tech spec pressure volume inside containment, you could possibly further reduce the containment pressure and exceed containment design. There is some scenarios where you could create a low containment air mass and then if you have either deliberate or inadvertent spray actuation, you could condense all the steam out and be left with just a low air mass which could possible be lower than the pressure that was calculated for the several cases analyzed by the applicant.

And if you have both spray trains actuate simultaneous, your pressure drop could be even greater. This last issue is only a concern for those plants that rely on containment vacuum breakers to mitigate the effects of containment sprays.

For Grand Gulf, they did consider both spray trains actuating simultaneous even though it really doesn't make too much difference for plants without vacuum breakers.

These concerns are possible problem for all the BWR's and as with the tech specs versus conservative assumptions, we did not require the absolute worst case situation for design. The Staff does not feel that you should assume the -- like a negative pressure of 2 PSI as the initial condition before you have a small break followed by containment spray or inadvertent spray, containment spray actuations, just a design philosophy.

However, we are looking a little farther into his concerns to see their possible effects and dependent on the magnitude, we may be asking for some possible changes in the way the operator responds to some of these concerns or maybe an interlock or two. But our preliminary information in the case concerns probably not a design issue for both the Mark III's and I's and II's.

At this point, we do not see that this concern is a major one.

Tape 6

The treatment of SRV accidents and SBA's, some confusion resulted from the May 27 meeting as to whether or not these were treated as transients or as design basis accidents with all of the licensing values that go with that type of analysis. And we do require these accidents to be evaluated using the licensing values and indeed that is the case for Grand Gulf and for the other plants. Basically this question just resulted from some confusing remarks and we do not feel that this is an area that needs to be pursued any further.

For plants that have containment vacuum breakers that takes air from the secondary containment to relieve the negative pressure in the -- inside the primary containment, you have the possibility of having a negative pressure inside the annulus which could exceed the negative pressure design of the annulus, the secondary containment.

We have not looked at this problem in detail, it does not apply to Grand Gulf because they do not have containment vacuum breakers. The initial assessment right now on the other Mark III's is they are probably within their design of their shield building for the accident scenarios that are currently in the FSAR. They are doing some more analysis and we are awaiting those -- these analyses before we make a conclusion.

DR. EBERSOLE: I should think that the standby gas treatment system would be the weakest point, not the structural aspects of the shield building.

MR. FIELDS: Yeah, I'm sure that when we do the assessment, we will look at not only the major structure but anything that could be impacted by the negative pressure as well.

DR. EBERSOLE: Thank you.

MR. FIELDS: That's a good point.

This next area, suppression pool temperature central location resulted from a concern that Mr. Humphrey expressed resulting that the operator may be confused if he was looking at temperature sensors that were in the pool for normal water levels but were actually above the pool level once you have some draw-down of the suppression pool. And if he was reading either atmospheric temperature or whatever, he would be getting conflicting responses from his instrumentation.

This type of review is somewhat beyond the normal scope of review that the NRC does. Having looked at the problem and listened to MP&L, we believe that the operator has sufficient information to make correct judgments. This should not be current. This should be correct. And one of the major instruments that he can rely on is the water level monitors that are in suppression pool. If he correlates that with the temperature sensors, he can easily see which ones are in and which ones are not in the pool.

DR. CATTON: What about the converse? Can you dump the seven foot of water on top of the pool, and how this temperature transducer that you thought was located near the surface and would give you a good indication of strong stratification or whatever, no longer will do that because it is buried deep in the water.

MR. FIELDS: Yeah. Well, the operator would know it's buried. He would not know the temperature of the top of the pool is what you are saying.

DR. EBERSOLE: So he's lost his indicator for stratification.

MR. FIELDS: Yes. Of course, he does have other instrumentation. For instance, containment temperature probes, I mean containment atmosphere temperature probes, so he knows the temperature of the containment atmosphere, which is your critical paramater as far as ---

DR. EBERSOLE: Well, that's certainly true.

MR. FIELDS: So he would be able to make ---

DR. EBERSOLE: He loses his feeling for the margin that he's got left.

MR. FIELDS: That's only if you do not create a drywell pool now.

MR. KUDRICK: Dr. Catton, I don't know if I fully buy that he has lost anything. Because he has level instrumentation and so he knows where the instrument is and he knows how much water is above that instrument. So he will have a fairly good idea of what is happening on his pool. Certainly he won't know right at the top surface what is happening. The concern that we have is if the therma-couple is exposed to the air, now and starts reading air temperature as opposed to water temperature, and the operator now can be misled into thinking that the water temperature is -- that the air temperature is really water temperature. That's really the thrust.

And I think it's a valid consideration. It's a fairly detailed consideration but valid. As a matter of fact, some of the responses that we've gotten back is that it may well be worthwhile to highlight that as a cautionary note to the operators. So I think it's valid comment from Mr. Humphrey in this particular respect.

But I don't think that because of upper pool dump that you lose the ability to note stratification.

DR. CATTON: When I first read Humphrey's comments about those therma-couples, gee, I thought that was kind of neat. They really do have the temperature measurement that will tell them whether or not they are approaching some kind of a limit on the pool. If it's within a few inches of the top and he looks at it now and then, he's going to know whether he has a stratification problem or not.

MR. KUDRICK: Right. But then you look at it the other way and say ---

DR. CATTON: Now, he pours all that water on the top, he's lost that. He probably wasn't using it anyway.

MR. FIELDS: The critical one there is containment atmosphere temperature and he does have probes for that.

MR. SCHROCK: Where are the probes located, the probes for containment atmosphere?

MR. FIELDS: At various points. I'm not sure of all of the locations. They are redundant.

MR. SCHROCK: Do some of them become submerged when the upper pool is ---

MR. FIELDS: I would say no. I'm sure they are all above -- they are probably all located above where pool dynamic loads could occur, so that probably at least they are probably 20 or 30 feet above the pool.

Mr. Humphrey had some concerns about the effect of insulation debris, both on blocking grating that exists above the weir wall for the Stride design and possible carryover of insulation into the suppression pool and blocking of the ECCS suction drainers.

The first concern does not apply to the I's and II's because they don't have gratings. As a matter of fact, the first concern does not apply to Grand Gulf as well because they do not have gratings over the weir wall.

The previous NRC review approach did consider the potential for insulation debris blocking the ECCS suction design and we did look at it quite extensively. As a matter of fact, it's unresolved safety issue, tab 843, deals specifically with this concern.

DR. EBERSOLE: I'd like to comment on that. Every time I hear it I guess I feel obligated. The suction strainers are the most gross and obvious points of impediment to flow that you can find. So everybody homes in on them. Beyond that point, there are spray orifices, spray heads. There are designs of seals and journals which depend on pure water being supplied to them rather than water that contains a slurry of fine fines, which can easily go past the suction strainers. And so when you say you look at debris, do you look at it in the depth that includes the fines, not just the crudes that you're talking about now?

MR. FIELDS: Okay. In answer to that, in two ways, as far as insulation debris, the kind of insulation we are using here or in use is mirroe insulation.

DR. EBERSOLE: I understand that.

MR. FIELDS: It really doesn't break up that fine. The second part of your question of other types of debris like paint or crust or whatever, I'm really not -- I don't have an answer for you today.

DR. EBERSOLE: I think it's important. We shouldn't forget that in homing in on the big strainers. It may not be the problem.

MR. FIELDS: It's a concern that we have to look at. It's not one that was raised by Mr. Humphrey but I certainly understand where there can be ---

DR. CATTON: With respect to insulation, if you have a major pipe break, you are going to rip everything loose that can be ripped loose and it's going to wind up in your suppression pool.

MR. FIELDS: Well, the effect of that -- well, first of all, you'd have ---

DR. CATTON: What is mirror insulation?

MR. FIELDS: First of all, you'd have three or four feet between the weir wall and the drywell. And it certainly isn't obvious to me that all that insulation is going to -- happens to be landing there and then goes through the horizontal vents.

DR. CATTON: It's going to go with the flow. And let me describe an incident for you that I observed. It's been six years now. An incident at the HDR facility in Germany where they were going to run this exotic experiment to test the steam isolation valves in containment. They set up their experiment. They put all sort of exotic instrumentation into the building, everything was done very nicely. It was well-planned. It turns out that that steam flow, which is probably not as violent as the flow you are going to get if you have a large break within the drywell. It ripped everything loose. It covered everything up. And they got very little information out of it. It tore pipes loose, all kinds of nonsense and all of that wound up going with the flow and plastering itself out on everything.

MR. KUDRICK: Dr. Catton, I can appreciate your concern and one of the reasons why Task Action Plan A-43 was developed was principally from that standpoint and that was that there wasn't a systematic study that had been performed in the past relative to the potential amount od debris that's formed. And I can appreciate Mr. Ebersole's comment relative to other types of debris because, as you know, TMI has a lot of sludge down on the bottom. So I can appreciate that type of concern.

A-43 is not that ambitious to assume that they're going to be able to evaluate all forms of debris. They are primarily focusing in right now on the insulation type debris, but it's including all type of insulation within a containment. And they are doing surveys now on various types of reactor systems to identify the sources of the insulation and then to try to come up with some semi-mechanistic evaluation of how or whether the debris can actually get into your sumps. That is not completed, but it's an attempt to address the debris question. I think this is a similar type of concern that is being -- that has been developed on the Mark III's.

We should add that preliminary indications on A-43 is that the Mark III containments have the least amount of potential for debris when you're looking at all the various types of designs.

DR. CATTON: It's worthwhile for whoever is working all this to talk to some of the people at that facility.

MR. KUDRICK: Well, as part of that study, they are doing in-plant surveys on insulation on A-43, but we are having a representative hopefully over at the HDR facility and we certainly will pursue that.

DR. CATTON: That's good.

MR. FIELDS: For instance, in the Mark III design, you know, the suction strainers are located several feel off the bottom of the suppression pool. The flow rates that are around the suction strainers are on the order of, say, three feet per second and for debris such as insulation, you would not expect that to be carried off the floor of the suppression pool and into the debris screens. And you are also designed for 50 percent clogging of the debris screens.

So there is quite a bit of margin and inherent safeness in the Mark III design.

Area 20 is the drywell reflood loads and Mr. Humphrey's specific concern was that horizontal loads on structures in the drywell, due to reflood phenomena, was not specified for Mark III's. This concern is only applicable to Mark III's because this is the only one where you would have the reverse pressure causing water flow from the containment suppression pool.

As part of their -- of our examination of the hydrodynamic loads for Mark III's, we have done a detailed review of this particular item and we've -- we do have acceptance criteria and have concluded that the horizontal movement of the water inside the drywell is minimal and less in the vertical loads.

We do not consider that to be a problem. We do not feel any further study is necessary on the drywell reflood loads.

Area 21 is the containment make-up error for back-up hydrogen purge. This is probably only applicable to the Stride design. It has to be examined for the Mark I's and II's to see if they are using a similar design. But basically for this design, as it is currently expressed in the Stride package, is that if your recombiners fail or is not able to maintain the hydrogen concentration below four percent, you would have a purge line that comes from the drywell and goes into the annulus and then is processed by the standby gas treatment system and exhausts into the environment.

And you have drywell compressors which take air from the containment and pressurize the drywell to take the hydrogen that could exist in the containment, put it in the drywell for purging to the environment.

The concern here is that you have a -- the make-up air to the containment comes from the annulus. So you have a concern here about -- two concerns. One, if your in-leakage to the shield building is not high enough to account for this air flow into the containment, you may produce a negative pressure in the annulus and eventually the flow would stop.

The second concern is if you do not have sufficient in-leakage into the shield building, you would not have a -- the mixing of outside air with the annulus air necessary to keep your hydrogen levels below 4 percent.

This concern is not applicable to Grand Gulf because they have a different design. Their make-up air comes from outside the annulus and their back-up purge exhausts into the annulus. I know that GE right now is evaluating this design and is considering putting in a line into the annulus to take care of this problem.

And we're just waiting for some more information from Mark III's, from GE on this issue to resolve it. And as far as the Mark I's and II's, we just have to see what the relationship -- what this concern is to their present design.

That covers all of the Humphrey concerns identified to date and we have sent to the ACRS a detailed listing of Mr. Humphrey's concerns. As I indicated earlier, he has recently sent us a copy, a marked-up copy that he feels more expressly details his concerns. We have a draft of that. We're going to leave this with you today, the draft, and we'll send you a formal copy probably next week or so.

DR. ETHERINGTON: In those cases where you conceive -- can conceive the possibility of having to make a structural change or changes, are there any where prior operation would lead to significant exposure of personnel making the changes?

MR. FIELDS: I guess you are referring to the operating plants?

DR. ETHERINGTON: Yes. No, to a plant that has not yet operated. If it were to operate before the changes were made, would this lead to serious exposure?

MR. FIELDS: I don't know if we've gotten that kind of level, but ---

MR. KUDRICK: Dr. Etherington, I don't think we got to a point where we're anticipating any design modifications on any plants. So we don't believe that there are any issues right now that may -- I mean, possibly they could require a design modification, but we haven't found that issue yet.

DR. ETHERINGTON: I thought you had a few where you had some feeling that there might be.

MR. KUDRICK: You know, I think ---

DR. ETHERINGTON: These might not be structural changes.

MR. FIELDS: The operator might change his plans.

MR. KUDRICK: There are operator instructions that may change. The boot arrangement that was implied for Grand Gulf around the annular space of the SRV lines, but I think they would be done just for additional protection, additional margin.

DR. PLESSET: Any other question of Mr. Fields before we let him go?

DR. BUSH: One.

DR. PLESSET: Yes, go ahead.

DR. BUSH: In getting back to the term that you use in the preliminary sense that -- of the "should", I believe that in all except two of the issues you in essence expressly stated, it was neither a design or safety issue or both. In other words, it wasn't a safety issue or it wasn't a safety issue and no design changes. These exceptions were your issues 17 and 21, which you had caveats on and I'm just trying to get clarification as to whether you consider these significant.

It appeared to be more a matter of lack of documentation than anything else.

MR. FIELDS: I would say lack of documentation. The two areas that we feel are substantial needs quite a bit of looking at. We identified earlier, the matter of encroachments and the matter of the large ECCS relief lines exhausting in the pool. Those are the two ones we feel are the most substantial.

DR. ZUDANS: One more question along this same line. Except for a few cases, I guess the conclusions you reached are based on the engineering judgment rather than specific quantification of the effects that are claimed to exist. Is that a correct statement?

MR. FIELDS: There is a little bit of both. There is some specific quantification on some cases. Some of the other areas are engineering judgment.

MR. KUDRICK: I think there are many areas where our initial response from Grand Gulf and MP&L has indicated a magnitude of the effect and what we're looking for now is documentation of the bases upon which those numbers were arrived at.

DR. ZUDANS: And this is exactly what I wanted to know. When you say that some analysis is in process of being required, that means you are looking for additional quantification rather than qualitative engineering type of discussion. In some cases, specifically test, that would mean quantification.

MR. FIELDS: The possibility of tests, right.

MR. KUDRICK: And the test issue will be dependent upon the analytical response that we get.

DR. ZUDANS: Whether or not you need it.

MR. KUDRICK: Yes.

DR. PLESSET: Are there any other questions before we break? I guess not.

We'll recess for lunch for one hour.

(Whereupon at 12:13 p.m., the conference was recessed for luncheon, to reconvene at 1:15 p.m. in the same place.)

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AFTERNOON SESSION

1:20 p.m.

DR. PLESSET: Let's reconvene.

I'll call on Mr. Townsend to give the G.E. perspective on what we've been hearing.

MR. DAVIS: Exucse me. Just prior to Hal giving his presentation -- this is Mac Davis from General Electric -- As you'll see later this afternoon and in the morning there is quite a bit of discussion on the details of the action plans to address each one of these issues primarily aimed and quantifying the effects in detail of each one of these issues. We wanted to give this perspective right now as far as General Electric's perspective of the issues relative to conservatisms and significance of the relative issues.

That's the reason for the presentation at this time and with that, I'll let Hal go.

(Pause)

MR. TOWNSEND: This is some General Electric perspectives that I'll just mention to you and I don't intend to go through the issues one-by-one today. I was trying to give us more of an overview of how we feel about these issues.

So, I'd like to start by telling you how we've treated the Humphrey Issues since they were originally raised and these were primarily raised last Fall in the August-

September time frame and as part of a routine cleanup of issues that were concerning the various engineers -- this is something that we do periodically as we progress through the design. We'll ask all the engineers to give us their ideas of problems that may be bothering them so that we can address them in some formal manner.

In a routine clean up of that nature, trying to close out some items that were already on our list and open, we requested this kind of thing and Mr. Humphrey came up with some 23 issues that he felt should be addressed and a few days after that he added another half dozen or so for, say, 28 to 30 total issues.

With these issues in hand, we initiated a series of peer reviews to address the issues. Try to have everyone understand them and see if we really collectively felt they were problems or something we could just dispense with from obvious conservatisms that were in the design.

We went through these in some detail in a series of meetings and we judged generally that they were second order effects and were easily covered by the margins we had in the design. There were a few issues that we couldn't dispense with that way and we sent these through our formal design action process on the Stride GESSAR projects. That precipitates an additional management review and a broader review inside of General Electric.

As a result of those reviews, we did find that there were some nine issues that we should persue on Stride as normal design issues. We did not find that any of them were 10CFR part 21 issues and to this day, we still haven't found that any of these warrant some kind of reportable condition.

So, we have been handling some of these on a routine design basis and that work is still in progress.

After Mr. Humphrey left, we immediately responded by trying to formalize our position on each issue. This was given to Grand Gulf a couple of weeks after John had left GE. Grand Gulf used that information plus information they developed with Bechtel and their own staff to respond on these issues to the NRC and I believe it was May the 27th.

So, we've given NRC one round of responses of what we've felt the issues were and what their significance was to the design.

Since that time, we've been trying to put together programs and respond in a more quantitative manner on each specific issue and you'll hear a rather lengthy presentation this afternoon on the Grand Gulf plan for each of those items.

You've seen a categorization of the issues this morning from Mel Fields. I've wrote them down in a much courser manner here for my overview kind of discussion.

(Slide)

First are pressure temperature issues and of the

66 items that we had on the list of questions and sub questions that have been raised, we find 36 of these are variations of pressure temperature response questions. That includes the stratification issues. The drywall leakage questions. Back and breaker responses and various initial conditions and variations on the blowdown transients that have been brought up in the various issues.

We felt 19 of these had to do with dynamic loads. We've lumped the pool encroachment issues in there. The pool swell question and the SRV discharge line and the pressure relief valve issues.

And then there are some 14 issues that we've called other issues here that really don't fall in the other two categories very well and they primarily are logic questions and a question of debris and that kind of stuff. I'll give you some samples of those. I won't try to go through them exhaustively.

Let me start with the pressure temperature issues and try to give you some perspective of where we are.

When we do our FSAR analysis -- We've talked quite a bit this morning about the FSAR being done with an equilibrium system. No credit for heat syncs or nonequilibrium conditions between the containment and the suppression pool. There's a number of other conservatisms that are used in that analysis.

We typically calculate about 11½ psi peak containment pressure. This is a long term peak in the containment occuring several hours into the accident for a Grand Gulf-type plant. Design bases for the containment is 15 psiG which is comparable to a service level A in code-type calculations.

I've tried to indicate here the higher containment conditions before you really see difficulty with the containment design. I've indicated a 42 psi service level "C" condition. This would be for a steel containment. It's not exactly true for a concrete containment like Grand Gulf, but generally you're up in that category before you reach the ultimate capability and for steel containment, the ultimate capability of the containment shell is up around 60 psi.

So we have a lot of margin on ultimate capability from the standard kind of analysis we do. When we go back and try to do best estimate calculations, taking credit for such things as the actual surface water temperatures, the conservatisms we use in the RHR heat exchange or coefficients, realist estimates of decay heat -- instead of using 102° power, we use 100° power. Take credit for the heat sinks and the nonequilibrium effects. We do those analysis and we find that the peak containment pressure is not 11 psi, but more on the order of 3 to 4 psi. That the temperature of the containment stays very low and the suppression pool is somewhat lower in temperature also.

(Slide)

So, I've shown here what we call a realistic best estimate at about 4 psi. When we try to assess the kind of concerns that Mr. Humphrey has raised, we evaluate those on the order of about 3 psi -- adders on to the nominal 4 or even if you add them to the FSAR kind of number, they're still slightly below the design pressure.

DR. ZUDANS: Could I ask you a question?

MR. TOWNSEND: Yes.

DR. ZUDANS: When you talk about 3 psiG Humphreys add on, is it computed with the best estimate in mind just like you did when you reached your 4 psi, because that means doubling of your pressure. That's not an insignficant relative change.

MR. TOWNSEND: Yes. These haven't been extensive calculations. These are judgments on our part.

DR. ZUDANS: The 3 psiG is not in the same category as your 4 psiG computed?

MR. TOWNSEND: I don't think so. I would say it's more comparable.

DR. ZUDANS: That's important, because you're doubling it and that means that you're -- It's a tremendous difference if it's in the same --

MR. TOWNSEND: I wouldn't say that it would double the pressure. I think if anything it would be added to the

11 psi. So it brings you about to the service level "A" design condition.

I might add in these best estimate calculations, we've talked alot about stratifications this morning and again this is without specifically trying to calculate stratifications, but we do calculate the bulk mean temperature of the pool as around 160 as opposed to 185 that we've designed to. So we have a substantial margin on the --

DR. CATTON: In your best estimate you calculate 160?

MR. TOWNSEND: Yes.

DR. CATTON: And that's a mean temperature?

MR. TOWNSEND: Yes.

DR. CATTON:You don't need much stratification to push that to 185.

MR. TOWNSEND: Yes, but I think the point of this kind of a figure is that you can go to 185 and even if you pick up the additional vapor pressure, you still may be approaching the design condition which you have very large margins yet to the ultimate capability of the container.

DR. EBERSOLE: In that connection, the ultimate capability containment is just the containment as a steel shell. Could you comment on what the margins are about the penetrations and the fine structure of containment?

MR. TOWNSEND: I haven't looked at that directly.

My understanding is generally the penetrations are stronger than the shell and that this limit is the knuckle at the upper head of the shell -- the transition from the eliptical head into the cylinder.

DR. EBERSOLE: The penetrations are stronger than the shell.

MR. TOWNSEND: I think in general, that's true.

DR. EBERSOLE: This includes the electrical penetration?

MR. TOWNSEND: You're asking me a very specific. I don't think I have the answer on it. That was my understanding.

DR. ETHERINGTON: Stronger is one thing, but the tendency for uneven strain to cause splitting of seams, I think, is something that needs to be considered further.

MR. TOWNSEND: Yes.

Okay, I guess the other comment I would make here -- two other comments is these analysis are generally done without any credit for the containment spray systems which are redundant safety-grade spray systems. There are two of them in the containment and they tend to limit containment pressure and temperature below the 15 psi level.

The final point is when we try to take credit for the containment structural heat sinks which are on the same order of magnitude as the thermal capacity of the suppression pool itself. They're really very large. We find that we have on the order of 40 hours before we reach the ultimate capability of the containment even without any cooling at all. So, the operators have a lot of time to establish containment cooling, if they should have gross failure of the RHR system or something of that nature.

Not to belabor that, we've tried here to give a -- again a very rough estimate of what we felt the uncertainties were in each of these 33 issues. A lot of these are judgment calls, as I said before, but generally they indicate temperatures and pressures -- temperatures 10° or less effects. Pressures of a few psi and I would say that these are not necessarily additive in any sense. In fact, some of them are probably contradictory and I've tried to indicate on the far right-hand that we are estimating some 11 psi margin relative to the 15 psi design pressure and some 25° relative to the design.

(Slide)

So our conclusions from this is really that we have quite a substantial amount of margin relative to the extreme capabilities of the system. That most of these issues appear to be second order which I think you've heard a very similar set of comments from Mr. Fields this morning. We think that these really don't warrant an awful lot of work in terms of detailed evaluation at this point based on what we've seen from this and this is consistent with the original conclusions we had reached inside of G.E. before John left and this became somewhat of a public issue.

(Slide)

I'd like to talk a little bit about dynamic loads area and basically the same approach here of where our margins are and I see the margins in nominally four areas.

In the load definitions themselves, we have based these on bounding experiments both in the selection of the test facility geometries and the extreme conditions or range of parameters that we've tested.

When we've taken experimental data, we've then used the highest observed loads that we've tested. We've used extreme wide-range frequency content where we've idealized loads such as some of the time histories we've put into computer codes. We tend to broaden impulses and that sort of thing to maximize the energy content and generally we don't take credit for phasing or desynchronization of loads like chugging or condensation oscillations.

I've tried to list here on the bottom some of the conservatisms in relevant loads. I've listed pool swell velocity and pool height. These are the kind of numbers that we've talked about before of some 30° margin relative to the 50 feet per second velocities that we have on our normal design basis relative to what we've seen experimentally and the 45° is the margin that we've seen between the 19 feet design break through elevantion and what we've seen experimentally there also.

The -- In particular the issue of loads on encroachments. We have done some more detail investigation of that. It's still ongoing, but we've found that when we look at the timing of events associated with the pool swell encroachments we see that the encroachment itself tends to impede the acceleration of the flow around the encroachment and we look at the velocities, then, resulting in that area relative to the clean portions of the pool and we find that the velocities lag in time to the point that we get breakthrough in the bulk proportion of the pool and we will divert the steam flow that is driving this acceleration away from the encroached area and vent it into the air space.

We see that the velocities never do reach the nominal velocities that we've talked about in the past. Based on that, we think that the encroachment issue is really a non issue. There are no increases in loads. You'll see in somewhat more detail in that when Mr. Hobbs talks later today.

DR. PLESSET: Are these the results of calculations?

MR. TOWNSEND: Yeah, what we've done in that area is we tried to get a bounding driving pressure for this system by looking at a pool that has the vents below the encroachment blocked off so you maximize the drywell pressure before vent clearing and the driving force into the adjacent areas of the pool. Get a base case for that. Then we do a two dimensional analysis underneath the encroachment with the same driving conditions and compare the velocities that are generated in the two regions. And we find that the velocity around the encroachment actually lags and it's lagging enough that -- well, I don't remember the numbers off hand, but they're substantially below the velocities in the rest of the pool at the time of breakthrough and the elevation is not nearly as high.

DR. PLESSET: I'm not expressing any reservation about it. Just curious. And you say that we will hear more about this.

MR. TOWNSEND: Yeah, you'll hear several slide presentations on the subject with some pictures.

DR. PLESSET: All right, we can wait.

MR. TOWNSEND: Like I say, that's still an ongoing study. It's not complete yet, but the results to date indicate that it really isn't a concern.

DR. ZUDANS: When you first stated that characteristic, you said you got it from test results and now in response to Dr. Plesset's question you said analysis. Which one was it?

MR. TOWNSEND: Okay, the analysis of the encroachment is an analysis.

DR. ZUDAN: Not the test.

MR. TOWNSEND: The clean pool pool swell velocities elevations are based on experiments and there is conservatism in those.

DR. ZUDAN: When you explained the lag velocity and the pool velocity and developing the encroachment, that was analytical, that was not experimental.

MR. TOWNSEND: Yes.

(Slide)

The other areas associated with dynamic loads where we have substantial margins are first in the load combinations and we tend to use or we always use the bounding loads in each of the loads that go into a load combination. This is a very unlikely or low probability type load combination and we really don't know how to quantify that in terms of how much margin is associated with that kind of thing. But we feel that it is substantial and like I said, I don't know how to put a number on it, but there is something there that we should take credit for if we can figure out how to do it.

The other area is dynamic analysis. We do linear dynamic analysis when we use very low damping values and we use spectral broadening. Our structures people when they go through this conclude that they have a conservatism of something like a factor of 2 to 3 associated with that.

And when we look at the code stresses and allowables and the fact that we calculate static stresses from the dynamic analysis that we previously used for displacements and take credit for or we don't take credit for stress duration or the minimum material properties, we find we have another factor of 2 or 4 in that area.

So, over all we have a very substantial margin in those areas and when we add them all together we feel that our overall margin in dynamic load is something on the order of a factor of 6 to 24.

(Slide)

DR. CATTON: Is that additive as contrasted with multiplicative? Is he adding or multiplying?

MR. TOWNSEND: I'm multiplying them together there.

DR. CATTON: That's a little gross isn't it?

MR. TOWNSEND: No, I don't think so.

Even additive it is still a very large margin.

DR. CATTON: I understand, but --

DR. ZUDANS: This is obviously an exaggeration. You loaded that structure dynamically and it would fail certainly long before 24 times succeeding its load. But the fact is you do have some conservatism.

MR. TOWNSEND: Yes.

DR. ZUDANS: And you can't exactly multiply, because if you compute stresses dynamically, you did the multiplication --

MR. TOWNSEND: Yes.

DR. ZUDANS: --and then you still compared to the allowables. There is no further multiplication allowed at that point.

MR. TOWNSEND: That's right.

DR. ZUDANS: So this picture is misleading.

MR. TOWNSEND: But -- Even at that, you're comparing to allowables and that's not a failure.

DR. ZUDANS: I do not disagree with, but not 6 to 24.

MR. TOWNSEND: Okay. I won't argue with you about the number. I think the point that we wanted to make is that they are large factors.

(Slide)

We had a similar kind of comparison here to show you which issues are in this category. The 19 we associated with dynamic loads. The pool swell encroachments as I said we've concluded are no effect on the dynamic loads. The SRV discharge line questions as we talked about earlier, they're very small sources in the pool and we feel those are in the two to three percent category.

The RHR relief lines we're still looking at and I haven't indicated a number here. The others are still relatively small effects in comparison to the margins that we have.

(Slide)

Again, the dynamic loads are quite conservative. The containment capability for dynamic loads we feel is very high and again the same conclusion from the previous areas that we don't think these warrant an awful lot of work of this kind.

DR. ZUDANS: I'd like to ask one question.

MR. TOWNSEND: Surely.

DR. ZUDANS: In this configuration considering all the possible combinations of events, what is the highest negative pressure that the steel shell can see?

MR. TOWNSEND: I think the highest negative pressure that we see is during the inadvertent spray actuation of both containment sprays and that generates a negative pressure of about 2/10 psi.

DR. ZUDANS: That's the maximum pressure that you can get?

MR. TOWNSEND: Yes.

DR. ZUDANS: And that's even without the vacuum breakers towards this shield -- the outside secondary containment?

MR. TOWNSEND: That's with the vacuum breakers.

DR. ZUDANS: What about without?

MR. TOWNSEND: Without the vacuum breakers on a

Grand Gulf-type plant, I think it's --

DR. ZUDANS: It's a concrete building. I'm not concerned about that.

MR. TOWNSEND: You're talking about the steel shell.

DR. ZUDANS: That's right.

MR. TOWNSEND: What we see if a differential pressure between the anulus and the containment of about 2/10 psi. Without vacuum breakers we see the anulus as pulled down somewhere between two and three psi. If we put a vacuum breaker in than that obviously is less.

DR. ZUDANS: I guess you mean anulus between containment and --

MR. TOWNSEND: And the shield building.

DR. ZUDANS: -- the secondary containment.

MR. TOWNSEND: Yes.

DR. ZUDANS: I'm looking at it the other way where the anulus pressure is higher than the inside containment pressure. I'm looking for external pressure on steel containment.

MR. TOWNSEND: Yes and that's about 2/10 psi.

DR. ZUDANS: That's all you can get.

MR. TOWNSEND: Yes.

DR. ETHERINGTON: When you say conservative by a factor of 2 to 4, does that mean with reference to code allowable or expected failure?

MR. TOWNSEND: Which one are you looking at?

DR. ETHERINGTON: I'm looking at code stress and allowables, but that's for example only.

MR. TOWNSEND: I would say that that's with respect to failure.

DR. ETHERINGTON: Then you're picking up some rather nebulous things when you talk about minimum material properties and it's true. On balance you're a little above minimum. On the other hand, if you fail the tensile specimen, you're allowed to run a retest. You can't do that for a containment.

MR. TOWNSEND: Yes.

(Slide)

Let me talk about the other category and I'll just give you some examples. I haven't tried to cover the whole list of 14 items that we have here, but first the RHR/mixer permissive.

This is an ongoing design issue at G.E. and on the GESSAR system it's -- there was originally specified an interlock between the hydrogen mixers and the containment spray system so that the hydrogen mixers could not be turned on without the spray being activiated.

We've subsequently looked at that and we're in the process of removing that on the interlock as being an unnecessary feature. So, I think that one is being handled as a routine design item and it's essentially being taken care of.

DR. EBERSOLE: Could you say why it was originally put there?

MR. TOWNSEND: To tell you the truth, I don't know why it was originally put there. I think probably someone being very cautious and being concerned about the heating from the recombiners, but the heat loads aren't really all that big.

As an example, Grand Gulf recombiners are like 75 kilowatts each and there's two of them in the containment. It's not an overwhelming number. So, we have looked at that and again there are high elevations in the containment where there is no critical equipment around and we're removing that interlock.

Drywell flooding: This was a question about inadvertent flooding of the drywall following an upper pool dump and this is a low probability event, for sure. We feel it's an availability question, not a safety issue, on the basis that we have looked at flooding in the drywell and the emering of the recirc loops or the bottom legs of the recirc loops and the recirc pumps and it's thermal shock problem on the equipment. The equipment is good for something like 100 of these events during the life of the plant. So we really think that that one is essentially a nonissue.

The insulation debris, we talked about earlier today. I think Dr. Ebersole made some good points there about some of the other types of debris. Specifically the mirror-type insulation. We have done a study that we feel is quite conservative in that it doesn't take credit for any hangup of the insulation on equipment inside the drywell which is really quite likely and we find that we would block less than ten percent of the suction strainers.

DR. EBERSOLE: May I ask? Do you still use polishing filters for the seals and journals supply of cooling water like hydroclones?

MR. TOWNSEND: I really don't know that detail. I can't answer that for you.

DR. EBERSOLE: Does anyone know?

This is to really clarify the water for the seals and journals.

You have no supplementary filters in NPL?

MR. RICHARDSON: I have to take a look, but if I'm not mistaken, there's like some orificing in there for the seal lines which are pretty small, but the orifice size is larger than the size of the strainers on the suction. So that you obviously would have no problem.

DR. EBERSOLE: Thank you.

DR. CATTON: What is mirror insulation.

MR. TOWNSEND: Mirror insulation is insulation that is used on this high-pressure piping. It's two layers of stainless steel with very thin layers of stainless steel spot welded at points inbetween. So it's a multi-layered radiating type reflective insulation.

DR. CATTON: How thin is the thin sheets? How thin are the thin sheets?

MR. TOWNSEND: I don't know if I know that. I think it's 2½ mils.

DR. CATTON: That is pretty thin.

MR. TOWNSEND: Yeah. And the outer layer, I think is on the order of ten to four mils.

DR. CATTON: Have you done any tests with it to see what happens when it's subjected to flow and things like that?

MR. TOWNSEND: Not to my knowledge.

DR. CATTON: Than how do you come to that conclusion?

MR. TOWNSEND: That kind of a conclusion is based on trying to assess what areas can be blown off the piping due to different pipe breaks.

DR. CATTON: If you don't know what will blow it off, how can you assess that?

MR. TOWNSEND: Well, we have some idea of the jet loads that it's subjected to. And I believe it was done with estimates of the sizes that these can fragment into and falls into the pool. Can those pieces be picked up and sucked into the strainers is a kind of analysis.

DR. CATTON: You get thin sheets like that and they get cross-wise to any small flow.

MR. TOWNSEND: Yes.

DR. CATTON: It will get sucked right in.

So, really what it is is that it's a judgment rather than any kind of a test or --

MR. TOWNSEND: Let me say it's an analysis with a lot of judgment in it. Okay?

DR. CATTON: I don't know how you can analyze something like that.

(Slide)

MR. TOWNSEND: The suppression pool temperature sensor location, again, we talked about that this morning in Mel Fields' presentation.

Generally we do have redundant sensors in the pool and we have the alarms on the level of the suppression pool to alert the operator if the pool level is down and we feel the operator does have enough information in the control room to allow him to take intelligent actions to turn the equipment on and also we don't see a major problem with having the pool surface temperature go to something about the expected values anyway.

So, we simply don't feel that one is a problem.

Suppression pool makeup system logic was a problem that we had in -- on the GESSAR project. For small breaks there was not a seal in of the automatic signal to dump the pool following a small break accident and we are reviewing that and are in the process of making the change to seal that signal in so that it does always dump the upper pool on a small break.

In addition, for small breaks, the operator does have a substantial amount of time to take manual action, if necessary.

So, again, those are typical of the kind of things that we're handling as routine design items as we progress through the GESSAR design.

DR. ZUDAN: Could I ask you a question on this 10 percent blockage in GESSAR calculation?

MR. TOWNSEND: Yes.

DR. ZUDANS: How did you arrive at percent? What are the basic assumptions there? How many suctions are there in ECCS and which portions of this insulation get to be deposited where?

MR. TOWNSEND: I'm afraid I don't have the details of that, but it's something along the lines of looking at some length of insulation that can be blown off the pipe that's failed and if there is a -- well, there will be a jet discharged and any piping that's in that jet stream will have its insulation blown away. So you get a handle on the overall amount of insulation that comes off.

Some kind of estimate of how the insulation fragments, you dump it all in the pool and then pick it up off the floor of the pool and suck it into the strainers as some kind of --

DR. ZUDANS: If something like that happened, as you described now, then all of the insulation that is free to flow would flow towards the nearest suction.

MR. TOWNSEND: Yes.

DR. ZUDANS: And if anything got in the direction, I would say would cover more than ten percent anyway. In other words, it's not quite conclusive how you got to that picture.

MR. TOWNSEND: All I can say is that we have the analysis that we've done and we can open those up to scrutiny and --

DR. ZUDANS: Well, I guess you'd better do it.

MR. TOWNSEND: Yes.

DR. ZUDANS: -- you're convinced it's okay.

DR. EBERSOLE: I wonder if I might ask you to sort of do something for us. Maybe before sometime tomorrow, would you call back and find out what the water purity requirements are for the pumps and seals on your low pressure water flooding and HRH system?

MR. TOWNSEND: Sure.

DR. EBERSOLE: This is right out of the specification.

MR. TOWNSEND: All right.

DR. EBERSOLE: It maybe all right. I'm not sure.

MR. TOWNSEND: Okay, because I simply don't know that.

(Slide)

Again, this group of other issues are the things that we sorted through. We found some of them to be what we felt to be insignificant and others that we are pursuing to make changes in the design of the equipment as necessary to insure that it works.

As a final conclusion --

(Slide)

-- from our reviews, we have concluded that there is not a lot of additional work needed on these things other than the nine issues that we previously had under active pursuit and we think we do have some very substantial margins in our ultimate containment capability compared to what we do in standard analysis and again, we don't think that these issues warrant an awful lot of work other than these few that we are working on and have selected to continue.

DR. CATTON: Would it be possible for you to give me the report number that describes your containment analysis so that I could get a copy of it?

MR. TOWNSEND: The standard containment analysis?

DR. CATTON: The one that's associated with what you're describing here. So that I can see how you couple things together. How you handle your suppression pool. How you put the whole package together to come to the conclusions that you have.

I'd also like to see your best estimate analysis. What kind of assumptions you made or engineering judgments you made in order to get at a best estimate calculation.

MR. TOWNSEND: Okay. That's something we owe the NRC shortly and we can provide that.

DR. CATTON: Thank you.

MR. TOWNSEND: I don't know if someone knows the report numbers here or not. Maybe I'd better get you a number --

DR. CATTON: Well, you're going to deliver it to NRC.

MR. TOWNSEND: Yes.

DR. CATTON: I'm sure that Jack will deliver it to Paul.

MR. TOWNSEND: Okay.

DR. PLESSET: Could you remind us what those nine issues what you're pursuing in GESSAR?

MR. TOWNSEND: I think I have a list of them here. Yes.

DR. PLESSET: Could you give that to us as a hand-out?

MR. TOWNSEND: Yeah, do you want me to read them to you or would you like --

DR. PLESSET: Where are they? Are they in this last handout?

MR. TOWNSEND: No. They're not flagged specifically there. I can tell you what they are.

There's the RHR/heat exchange or effectiveness in the spray mode, is one.

There is one we're handling which is a clarification in out containment loads report that deals with --

MR. BOEHNERT: Do you have numbers on those there?

MR. TOWNSEND: Not to the numbers that we have in these Humphrey Issues. I've got them from an internal design list.

DR. PLESSET: Could you let us have that maybe tomorrow? You don't need to go through that --

MR. TOWNSEND: Sure.

DR. PLESSET: That would be easier. Just so we have it in one place.

MR. TOWNSEND: Yes.

DR. PLESSET: Fine, thank you.

Yes, Mr. KUDRICK: I'd just like to get a clarification based on that presentation. Are the issues based on satisfactory conclusions on the MP&L docket on all the other remaining issues?

MR. TOWNSEND: I'm not sure I understand your question, Jerry.

MR. KUDRICK: Nine issues that you say that you are independently pursuing.

MR. TOWNSEND: Yes.

MR. KUDRICK: Is this in addition to areas that are being pursued on the Grand Gulf docket?

MR. TOWNSEND: These nine are nine issues that we are pursuing on GESSAR for the GESSAR design before these issues came up.

DR. PLESSET: What's the relationship of those issues to the Mississippi Power and Light?

MR. TOWNSEND: They're generally, I think, items that are being addressed in the Mississippi Power and Light program also. There's a couple of them that are unique to GESSAR that aren't applicable to Mississippi --

DR. PLESSET: They do not enter into the Mississippi Power and Light --

MR. TOWNSEND: A couple of them dealing with vacuum breakers in the containment, as an example.

DR. PLESSET: Okay, is that what you wanted?

DR. CATTON: When you supply that list of nine issues for us, would you sort of key them to the Humphrey Issues if you could?

MR. TOWNSEND: Yeah, I can do that.

DR. PLESSET: Mr. Davis, is there anything else you're going to present at this time?

MR. DAVIS: No, that's it.

DR. PLESSET: Thank you. I believe that we can go to the last topic on today's agenda unless you have a question, Jack?

MR. KUDRICK: No, no.

DR. PLESSET: Let's go to the presentation by Mississippi Power and Light, which I think is scheduled next.

MR. MCGAUGHY: My name is Jim McGaughy, Mississippi Power and Light Company.

On May 12th of this year, we received out of the blue in the mail a letter announcing the formation of Humphrey Engineering specializing with expertise in BWR containment analysis and offering their services to us to perform these kinds of analysis.

Also in the letter it noted that Humphrey Engineering was aware of some safety concerns with the Mark III containment and suggested that we should retain Humphrey Engineering to help solve these concerns. When the letter stated safety concerns, it was a flag to us and we immediately got on the phone with Humphrey Engineering and spent several hours trying to categorize and -- to determine what the different concerns were.

After our phone discussion, we talked to the NRC

Staff and tried to characterize the concerns with them as best we could.

After further discussion with Humphrey Engineering, it was determined that they would come down for a business development-type visit at which time we talked contract terms and rates and so forth and then qualifications of Humphrey Engineering and then in some detail we discussed all of the issues that we discussed here today.

Humphrey Engineering also stated that they felt that we should retain them to help them solve these problems and that they had some plans of attack and solutions to most of the problems that had been identified. So, based on what we had heard that day, we had somewhat of a gut feeling that probably everything would be all right.

We met with the NRC on May 27th with Humphrey Engineering to discuss the various issues and what our initial impressions of their merits were and since that time we've embarked on a considerable program to address each one of those issues.

To date nothing has changed our opinion that none of the concerns have safety signficance as they relate to our plant and we're prepared now to discuss in detail how we intend to address each one of these issues.

I'd like to introdue Sam Hobbs.

I'm sorry.

DR. PLESSET: Do I understand correctly that you did not enter into an agreement with Humphrey Engineering?

MR. MCGAUGHY: We have not, no.

DR. PLESSET: I just want to clarify it. Thank you.

DR. CATTON: Do you anticipate any delay in the licensing process for you as a result of the Humphrey Issues?

MR. MCGAUGHY: We do not. I think you'd have to ask Sam that, but from our -- We see no reason to delay our license because of that.

DR. PLESSET: Would you identify yourself? I'm sorry I was distracted here for a moment. I didn't get your name.

MR. RICHARDSON: I'm John Richardson with Mississippi Power and Light.

DR. PLESSET: Thank you.

MR. RICHARDSON: Before I get started, basically I just want to cover an overview of our plan of attack and something on generic efforts underway, before we get into the detailed program.

Before I get started, there was some question this morning about the cross-sectional area of the annulus, the sleave around the discharge line -- SRV discharge line. I don't have the exact dimensions, but some numbers that are pretty close and basically the SRV discharge line itself is about 12 3/4 inches outside diameter and the sleeve is approximately 13½ inches inside diameter. When you run those numbers out, you end up with about 15½ square inches. If you take one horizontal vent which is a 28 inch inside diameter and you run that out, you get about 615 square inches. The ratio between that cross-sectional area one sleeve and SRV live to one horizontal vent is about 2½ percent. So when you take into account the 20 SRV lines and the fact that there are 45 rows of vents or just 45 top vents, and you take that ratio of 20 to 45, obviously the area to the 20 lines to the 45 top row of vents is probably like one percent. Pretty small.

DR. CATTON: Two and a half percent is the number I wanted. And that's small, very small.

DR. PLESSET: Let's stick with the 2½ percent anyway. I see where you got your number.

MR. RICHARDSON: Anyone that's the basis for the number and hopefully that clarifies that.

DR. PLESSET: Well, thanks for getting our arithmetic straight.

(Slide Presentation)

MR. RICHARDSON: In my part of the presentation, the first slide is basically just a synopsis of events or background. I think that's been adequately covered so far today. I really don't intend to go through that. It was just intended to show that we really have responded to these things expeditiously and there's quite a bit of work that has been undertaken already.

What I really wanted to cover was just an overview of our proposed plan. What we've done and what we intend to do before we get into the details.

(Slide)

Initially after Mr. Humphrey's letter, most of our attention was immediately focused to identify what the safety concerns were that he referenced in his letter. That took sometime. They were not written down and we had to spend sometime with Mr. Humphrey to actually identify the issues and we've gone through several iterations and I think we're probably at the point now that we know what the issues are and I think you've described them pretty adequately so far today.

Our next real effort was devoted to evaluating these issues for any safety significance in our initial evaluation which was conducted prior to our low power licensing to determine thatthe concerns really do not impact plant safety. It was concluded that the technical questions were adequately addressed by the Grand Gulf design and that the issues basically did not consider the overall level of conservatism and margin inherent in the containment design and that any effects that might come out of the issues would well be within the design margins.

We still believe that that's the case. That none of the issues are safety concerns, but in order to prevent any licensing delays, we have committed to a program to quantify the effects and submit the detailed analysis to justify those contentions. That program which we'll be discussing in detail with you this afternoon consists of:

Planned specific analysis.

Procedure and technical specification reviews.

Potentially some cost effective plan modifications.

Right now we may or may not and then to date we havent' identified any need for testing, but we have not precluded that option. It's still a possibility to resolve some of the issues if the analysis does not adequately resolve it with the staff.

The schedule for completing our program is basically we submitted the action plan on the 15th of July and our initial report will be submitted August 19th and that will contain a detailed description of the analysis, assumptions and expected results if that analysis is not completed or expected to be completed prior to full power licensing.

It will also, for those items, contain a justification for proceeding at full power and then detail description of analysis and results for anything that's completed at that time.

DR. PLESSET: So, you have approval for five percent power operation?

MR. RICHARDSON: That's correct.

DR. PLESSET: How long would you like to have this low power testing continue? It's not up to you, but if you had a choice.

MR. RICHARDSON: Are you saying, when do we feel we need a -- be ready to beyond five percent power?

DR. PLESSET: Yes. Well, what I really meant was how much low power testing and operation do you feel is desirable?

MR. RICHARDSON: We feel it's desirable to get that over with and to get up to full power as quickly as possible.

DR. PLESSET: I know.

You'll learn something from the low power operation. Maybe it's only going to be a week, but how much do you think you need?

You have people who have never been near an operating Mark III BWR 6 .

MR. RICHARDSON: We have people who have been near and operated earlier BWR designs.

DR. PLESSET: Not a BWR Mark III plant.

MR. RICHARDSON: Well, since we're the lead domestic plant --

DR. PLESSET: You're it.

MR. RICHARDSON: That's right.

DR. PLESSET: Yes.

How long do you think you'd like to have by way of getting experience? It's a serious question. You must have thought about it. Would you like a week, a month, six months?

MR. RICHARDSON: I think that right now we're looking at a full-power license sometime in the beginning of October -- Late September or the beginning of October.

If you look at three or four months, we feel that's more than adequate time for people to gain the experience they need.

DR. PLESSET: Okay, you answered it. You say three or four months --

MR. RICHARDSON: Yeah.

DR. PLESSET: -- will be enough.

MR. RICHARDSON: Certainly.

DR. PLESSET: That's what I wondered what your feeling was. It's worth knowing what your ideas are.

That doesn't necessarily mean that the Staff or the Licensing Board will go along with it, but it's an input. Right?

MR. RICHARDSON: We hope that there will not be anything to delay a full-power licensing.

DR. PLESSET: I understand that. That's reasonable.

Have any of your people been to Taiwan to see the Kuosheng plant?

MR. RICHARDSON: We've had some people go there in particular during their inplant test program -- SRV inplant test program.

DR. PLESSET: They haven't stayed there though?

MR. RICHARDSON: No.

DR. PLESSET: They were there while the SRV testing was going on?

MR. RICHARDSON: That's correct.

DR. EBERSOLE: Are you getting any input from that plant as to what's happening on a routine basis?

MR. RICHARDSON: Well, generally, yes. That simply is yes. That G.E. start up people are at that plant and they have, I think, it's almost daily start up reports that they issue and feeds back to our start up organizations. So their experience not only against our start up organization but the problems that the operators faced at Kuosheng were also disseminated to our operations people.

DR. PLESSET: Isn't the ambient temperature higher there than even it is for you?

MR. RICHARDSON: I'm not that familiar with Taiwan.

DR. CATTON: The humidity is about the same.

MR. RICHARDSON: To get back to where I was at.

The other two reports will be submitted October 1st

November 1st.

You'll see some specific items that will have a scheduled day when we go through it in detail, but basically the way it stacks up is that we have approximately 37 major action plans to resolve these issues and it contains like 84 specific actions. If you add all that up based on when we intend to submit them, you'll find that the one is complete and one is in progress with the TMI BWR owners group and that's the emergency procedure guidelines. The question regarding the development of those guidelines in conflict with design basis accidents.

29 are anticipated to be submitted by the -- or completed and submitted by the August 19th submittal. 40 or 49 percent by October 1st and then the other 13 by November 1st.

In addition, right now, we have instituted a generic effort. We've formed an owners group of the Mark III owners and that group consist of those of us who have an operating license or will have one in the near term.

Mississippi Power and Light.

Cleveland Electric.

Illinois Power

and Gulf State Utilities

And in addition, General Electric is part of that owners group.

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And the effort right now is centered around the review of our action plan -- Grand Gulf's plan to develop a generic action plan for all the owners to identify areas requiring plant unique analysis and agree on a plan for resolution and finally the -- establish a review panel to independently review the action plans and the results of the analysis.

Based on several discussions with the Staff, it was felt that inorder to close each of the issues, it may be beneficial to have a panel of experts who are semi independent of the people resolving the issues to review the plans and resolution and to in fact agree that they have been dealt with adequately and we've agreed to try and establish such a group and basically the panel will be composed of GE/AE utility experts not actively involved in resolution of the issues and charged with assuring that the issues have been properly identified. Review the generic and plant unique action plans and the completed work and that the issue -- verifying that the issues are closed and right now we see that taking place sometime in early 1983. We haven't really set a final date for it.

DR. ZUDANS: You made reference to major issues. I thought in the beginning you said that they were all minor?

MR. RICHARDSON: The major categories. We've broken them up into major categories. We feel that they are not safety concerns. There are some 60 issues and what I mean is that we've broken them down into 22 major categories.

DR. ZUDANS: But they're not major in the physical sense. They're major in just --

MR. RICHARDSON: Major in category.

DR. ZUDANS: Figuratively speaking.

MR. RICHARDSON: That's correct.

DR. ZUDANS: Now, in this process of yours -- three sets of reports that you plan to issue. What role will Mr. Humphrey play? Is he under contract to you?

MR. RICHARDSON: From our standpoint, the role he'll play is if we need any information regarding what the issue is and I don't anticipate any of that at this time, we might contact him to find out what the issue is, but no active role --

DR. ZUDANS: He's not working for you?

MR. RICHARDSON: That's correct. No active role in working with us to resolve the issues.

DR. EBERSOLE: May I ask a question and it's a little bit philosophical.

Mr. Humphrey has identified what you might call a field of issues -- 60, for heaven sake. Which we find out happily doesn't get too far into your pre-established margins. You find you can accomodate these.

What activity do you have like Mr. Humphrey's that originally satisfied those margins that established them that makes it come out this way? How do you know Mr. Humphrey has only identified -- perhaps he's identified 60 our of 300 issues that you might be looking at.

Where is an activity comparable to Humphrey's where in you look at the variety of fine structured details that might happen to your plant and establish reasonable margins? It seems to me that this comes out very fortuitous here. We have got 60 things that came up. None of them seem to have cut into your margins much.

That either says that you were mighty smart in putting those margins in or just plain lucky.

DR. PLESSET: Well, I'd like to maybe help him, Jesse. You're a very difficult fellow sometimes.

That's a very good question, but there has to be some reliance on designers of a nuclear seam supply system number one and number two, on the architect engineer. If we can't have some reliance on them, we're really sunk.

Do you agree with that?

DR. EBERSOLE: I would, but I would like to know what his basis for margins. Why is a margin one thing --

DR. PLESSET: I've helped him a little bit. Maybe he can carry on now.

DR. RICHARDSON: I think generally the design of a nuclear power plant is extremely conservative. There's a strength in depth concept. There's a margin in conservatism built into each analysis and each design and they are either additive or multiplicative, whichever you choose, I guess, but it adds up and --

DR. EBERSOLE: But you almost suggest, though, having defined a margin. You really don't need to look into the detailed structure of what's in that margin and where you might eat it up or work on it.

DR. PLESSET: Now, you've introduced a very useful point. This is a point not included before.

DR. EBERSOLE: This is what I'm after.

DR. PLESSET: Okay, I think that one bear down on.

DR. EBERSOLE: I want to know -- yes. What do you do to really confirm in the long term that your margins are what they're suppose to be or rather that they cover contingencies?

MR. RICHARDSON: I'm not sure that I understand completely your question, but I'll try and answer it.

DR. EBERSOLE: Humphrey's 60 items did not go into your margins too deeply, so we all might be happy about that. Is there an effort ongoing where in you look at the margins in a similar investigative way and satisfy yourself without Humphrey that you in fact in the long term look at your design or continuing to be happy with these margins.

Maybe you could put it in your own words, Dr.

Plesset?

DR. PLESSET: Well, I think that you have a very valuable point that touches very deeply on management's attitude towards a valuable asset they don't want to endanger. So somebody thinks of a lot of problems and they say, well we have got margins which looks like they do.

So, maybe they turn Mr. Richardson loose on themselves and continue to study, to consider interaction problems in this system.

Will you do that, do you think?

You've got your full power license,let's presume. You're not going to sit back and be happy and just keep jugging out electricity and leave it at that. I don't think you are.

MR. RICHARDSON: Well, certainly not.

DR. PLESSET: This is what Mr. Ebersole wants to know. What will you do, if anything? Is that right?

DR. EBERSOLE: Yes, that's right.

MR. RICHARDSON: I think that there are always ongoing efforts to evaluate the plant's performance and the design of the plant. In particular, I note specific to MP&L now. I'm not talking generically for the industry, but we have as a result of one of the TMI requirements, this independent safety engineering group and of course they have some specific roles as identified by the Staff and we have also identified for them. One of their jobs is to do that type of work. To continually look at interactive effects and some of the operational transients and look at the plant and make sure that it is safe.

We have another group in our organization, a nuclear safety group that looks at some of the ongoing generic and safety concerns that are identified at other plants and by the NRC or other owners and evaluate those relative to Grand Gulf.

I think all that type of effort evaluates the plant, the margin you have and the performance of the plant.

DR. EBERSOLE: Let me give you a case in point. As you notice in this discussion here, we're taking a great long hard look at the HCU platform realizing that it will be impacted by the effects of the LOCA and that the HCUs must still be working that the time that it occurs to execute a SCRAM function.

Yet for all of these years G.E. not having to look at HCUs since they were out in the building someplace, has permitted the control rod drive supply and exhaust tubes to stand in the direct potential blast of LOCA effect with no consideration as to what might happen if these were cramped or broken or otherwise distorted. An effect far more violent than you get on impact on HCU control unit.

Now, your design when we went down and examined it in the field we noted this and I believe you're putting blast shields as is Perry in this area.

MR. RICHARDSON: At one time it appeared that we may have to have a shield for jet impingement loads, but now it has shown that it does not need them.

DR. EBERSOLE: I'd like to see the defensive arguments that you don't have to do that.

MR. RICHARDSON: We have submitted that to the Staff.

DR. EBERSOLE: Has the Staff approved this? And if so, I'd like a copy of their defense of this.

DR. PLESSET: Have you seen that yet, Jack?

MR. KUDRICK: We would not normally get involved in that particular type of --

DR. EBERSOLE: Well, it's just as important as the HCU platform goes, if not a hell of a lot more so.

MR. KUDRICK: I agree with you. It's a different branch. We will find out and get the copy and have it sent to you.

DR. PLESSET: I think you see what Mr. Ebersole is trying to get at. You mentioned a safety engineering group. There are lots of things like this. You'll have some smart fellows in it that are going to be hard working and troublesome?

MR. RICHARDSON: Sure, of course.

MR. MCGAUGHY: Can I expand on this?

They are hard working and they are also troublesome. You met them at our meeting last fall.

DR. ETHERINGTON: Did Mississippi invite G.E. comment on the containment design?

MR. RICHARDSON: I'm sorry. What was the question?

DR. ETHERINGTON: Did Mississippi invite G.E.'s comment on the AE's containment design?

MR. RICHARDSON: There's a detailed review process that goes on. As a matter of fact -- I'm not sure that I understand your question exactly, but there's a very closely coupled interface working relationship between G.E. and Bechtel in the case of Grand Gulf and it goes back all the way to the beginning of the project where there was -- because this was the lead plant there was a task force specifically set up to kind of work out the relationship between the G.E. design -- the G.E. portion and the Bechtel portion and that interface relationship has worked completely through.

There has been a control process for Bechtel review of G.E. work and G.E. review of Bechtel work. I'm not sure if that specifically addresses your question.

DR. ETHERINGTON: No. I understand, of course, that Bechtel knows what is expected, but the question really was did G.E. have a chance to check the design and see that it did satisfy their requirements?

MR. RICHARDSON: We're going to discuss that in detail tomorrow. I just as soon wait until then if that's all right with you.

DR. PLESSET: Is that all right with you?

DR. ETHERINGTON: Yes.

DR. PLESSET: Fine, tomorrow.

MR. MCGAUGHY: In response to Jesse's question, though, we have -- Our independent safety engineering group with a little bit different concept than what I think the Staff has, although they have agreed with ours. I have characterized the staff's as the group that goes around and kicks the tires and sees that everything looks all right. We have fellows that do that, but this group is called an operational analysis group within the nuclear plant engineering group and they also have analytical capability and are involved in building computer models of the plant so that a system interactions from a reliability and safety standpoint can be measured and evaluated based on the experience of going around and kicking the tires and then going back and feeding that into analytical tools to be able to quantify what these things mean.

DR. BUSH: Could I comment?

I think that what you have is not necessarily in that function, but if your review panel is not too circumscribed and, in other words, is able to look at the issues and not simply provide an audit function, I think you have something that could be of major value to the entire industry if it's handled correctly.

I participated in some and the interactive effects of people with diverse backgrounds and not directly implicated in the project, so to speak, often uncover things that would never be uncovered otherwise and I think that if it's handled right, there could be a major benefit.

You may be surprised of some of the things that will come out when you get a group of people together like that.

MR.MCGAUGHY: You're talking about the review panel that John just talked about.

DR. BUSH: I think it has the potential of being of great value if it's handled correctly. If it is just going to audit the values, it isn't going to be very valuable, but if it's permitted to serve in an interactive and integrated sense, I think that it could be very,very valuable.

MR. MCGAUGHY: What I was addressing though was a permanent part of our operating organization.

DR. BUSH: But such groups are generally circumscribed by men that are faced with that too and their interests -- They usually have what I call short vision more so than looking at it in the longer sense for very obvious reasons.

DR. EBERSOLE: Along that same line and I realize that we're getting a little bit off, Mr. Chairman, but I'd better mention it.

One of the fascinating aspects of the Perry Project was they had hydraulic delay devises on their main feed water check valves. Have you got those?

MR. RICHARDSON: I'm not sure on what hydraulic delay devises you're talking about.

DR. EBERSOLE: These are dampeners to apparently delay the crashing closure of these valves should they have to do what they're suppose to do, but are rarely designed and analyzed to do and that is to intercept a full feed water flow reversal on the basis of pipe break.

By and large check valve experiences have never included that violent sort of physical condition and those are not put in there for nothing.

So, as just an adjunct and a peripheral matter, here, on the general topic of whether you're looking at these things, I'd be interested in how you defend your valves if you don't have those.

MR. MCGAUGHY: We do not have those.

DR. EBERSOLE: You do not have them.

Already we have an interesting littl diversion.

MR. RICHARDSON: We discussed that with you in our subcommittee back in -- those specific valves and how our valves are designed.

DR. EBERSOLE: And maybe yours have other competence. I don't know.

Has the Staff examined that? This will be about the fifth time I've asked them that, but it doesn't bother me.

MR. KUDRICK: I think you'll get the same answer that we had in the other four. Although, I wasn't part of that answer.

DR. EBERSOLE: I'll keep working on that.

DR. PLESSET: We're kind of disrupting your presentation.

MR. RICHARDSON: That's all right.

Before we get into the details of our action plan, there have been a lot of ways to group these issues and the way we've grouped them for today's presentation is that there are 15 major categories that we intend to discuss.

Originally there was some 22 major categories of the 60 some odd issues; they were broken down basically into 22 basic issues. Six issues were agreed -- Six of the original 22 it was agreed that they were basically resolved for Grand Gulf and one issue associated with the emergency procedure guideline development, we feel should be handled by the people who developed those guidelines and we have taken action to notify them and that's in progress.

So that's where you end up with the 15 issues we'll be discussing and we intend to present a summary of each branch or category and the potential effect of that issue.

Review the most significant MP&L actions to address the issue and

Describe the technical details of the analysis in most cases.

Without anything further, I'll introduce Sam Hobbs who will go through the detail and resolution that we contend.

MR. HOBBS: My name is Sam Hobb and I'm with Mississippi Power and Light.

(Slide Presentation)

The first line is a listing of the 15 major categories of issues that I'll be discussing. I don't plan to read those since I'll be going through them item by item as we proceed. I would like to make one remark about the general format of what I'll be doing and I'll adjust this somewhat in response to questions.

First I will discuss the issue and the major effects and to some extent you have seen at least a summary presentation of that by Mr. Humphrey this morning. In addition you saw a slightly different viewpoint from the Nuclear Regulatory Commission this morning. I will put that slide up. I will not spend a lot of time on it for each of those issues, because I think that will probably be a more expeditious way to proceed unless there are questions.

The second thing that I will discuss for each issue will be the action plan which we have instituted for handling that issue.

Last, for most of the issues, we will then discuss in somewhat more technical detail what it will be done in the action plan, the basis and the assumptions. We vary on local encroachments from, I believe, four or five slides for that down to no slides for a few issues that are really covered by similar approaches on other issues and where we put them in for the sake of completeness at this time.

(Slide)

The first major concern is local encroachments. Basically, this concern is that structures located at or above the suppression pool surface will cause the pool swell to be locally different from the phenomena described in GESSAR and generally used for design in Mark III containments. The potential effects are higher pool swell velocity and breakthrough height.

Higher impact and drag loads. HCU floor or steam tunnel liquid impact.

HCU floor failure and result in failure to scram. The possibility that the flow might move laterally and apply unaccounted for loads.

There would be higher submerged structure loads if the velocities were higher and the pressure loads on the containment load would be different.

(Slide)

Basically, our action plan for resolving local encroachments are that number one, we will furnish details of the one-dimensional analysis which predicted a 20 percent increase in pool swell velocity.

DR. CATTON: This is for what reduction in cross-sectional area of the encroachment?

MR. HOBBS: Approximately 50 percent.

DR. PLESSET: On what kind of basis is that calculation made?

MR. HOBBS: It was --

DR. PLESSET: Ideal fluid?

MR. TOWNSEND: It's primarily a continuity argument just looking at --

DR. PLESSET: That applies to everything.

MR. TOWNSEND: It was primarily a continuity argument just looking at the change in area for the unobstructed surface down to the block surface.

DR. PLESSET: He said it was all squeezed into the reduced area.

MR. TOWNSEND: Yes.

DR. PLESSET: And no recovery beyond the encroachment.

MR. TOWNSEND: That's true, yes. Very crude analysis.

DR. PLESSET: That's hardly worth sending in, is it?

MR. TOWNSEND: No. No, it's not.

MR. HOBSS: Initially, we discussed this internally and we're not planning to. However, since this was a portion of the basis for the concern which was identified by John Humphrey, the Nuclear Regulatory Commission felt that they wanted to see that analysis and so we are going to submit it.

I think that I would rather trust their judgment on that than not.

DR. PLESSET: I don't want to question their judgment, that's for sure. I'd like to see that calculation.

MR. HOBBS: The second task is that we will use a two-dimensional code to make better predictions of pool swell velocity. The code that is being used is a version of the SOLA code and we will be adding a bubble model to the SOLA code and we will be making use of that code based on our best judgment at this time. We expect that we will show the pool velocity. In fact, decreases near encroachments. I will be discussing that in somewhat more detail on the next two or three slides.

Breakthrough which is a phenomena which is not modeled by SOLA and which we do not anticipate being able to model with SOLA will be based on the application of some empirical data to the results and the interpretation of the results.

DR. ZUDANS: When you say two dimensional, which two dimensions do you plan to use in this model?

MR. HOBBS: Basically, it will be a vertical slice.

DR. ZUDANS: Asymmetric, is that what you're assuming?

MR. HOBBS: Yes.

DR. ZUDANS: That means you assume a continuous encroachment all around the circumference.

MR. HOBBS: Yes, however, by making use of a technique of -- I'll be discussing the techniques that will be used in that analysis in a little more detail, but by doing more than one slice and by taking into account potential 3D effects between them for both encroached regions and non encroached regions, I believe that we're going to be able to even with the 2-D analysis make some very solid predictions that will be very credible.

DR. ZUDANS: I can't quite see how with that asymmetric model you can consider three dimensional effect.

MR. HOBBS: Basically by doing several different calculations and relating the results to each other. We will do calculations on an unencroached pool, a clean pool and on an encroached pool and will -- As I said, I will discuss that in a moment or two where I can digress from this slide and come back to it.

DR. ZUDANS: Go ahead.

MR. HOBBS: Once the calculations are complete there, we will evaluate new submerged stucture loads based on the new pool velocity profiles if that is required and we will compare pool velocities near encroachments with a clean pool and show that the loads are within the current design basis.

Finally, we will evaluate bounding loads on the HCU support steel provided by lateral movment of pool swell froth.

DR. SCHROCK: Have you used SOLA previously for this type of confrontation?

MR. HOBBS: Yes, sir. The early calculations which were done and which John Humphrey had based his comments on when he raised the issues with us were based, number one, on a 1-D calculation and second, on a 2-D calculation which had made use of SOLA.

DR. SHROCK: If you have to add a bubble model now, it isn't at all clear to me what kind of calculation for this problem you have utilized SOLA.

MR. MCINTYRE: Terry McIntyre from General Electric. We actually use a version of a SOLA VOF code that was developed by Los Alamos a few years ago. SOLA has the capability for a free surface and another surface below the surface of the water.

In the current version of the code, it's necessary to input pressures at free surface and in the bubble.We were

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driving SOLA with an estimate of the pressure.

The change that will be made through the SOLA code is to build in the relationship between the bubble pressure and the drywell pressure and account for the bubble pressure as the bubble expands and the flowdown vent into it.

Does that answer your question?

DR. SCHROCK: Yes, thank you.

DR. CATTON: SOLA codes like any other computer code -- it's been -- You most likely get it with the test case, right? And you can run the test case and make sure that the deck you've got is in good shape. It turns out if you take that test case and you run the normal kinds of numerical tests on it, you'll find that as you decrease the mesh size, the answers will change from the test case.

Further, there's some simple problems you can test with the SOLA. Like if you take two surfaces and just squeeze them and pull them a part, that's a really simple fluid mechanics problem. SOLA won't really solve that problem.

If you're going to use SOLA or any other computer code for that matter, you've got a hold bunch of testing of the code you've got to do before it has credibility. Unless one of the artisans from Los Alamos runs it for you.

MR. MCINTYRE: First of all, you're right. SOLA is basically a multi-dimensional fluid dynamics code.

DR. CATTON: It's two dimensional, I believe.

MR. MCINTYRE: It's two dimensional. There are three-dimensional versions of it also.

DR. CATTON: That have not been tested either.

MR. MCINTYRE: And you can get different answers by different nodalization. We're doing too things about that.

First of all, when we build the two-dimensional models with the bubble in it -- the bubble pressure model, we are bench-marking that against existing clean pool data and then we'll perturb that clean pool model to look for the effect of the encroachments.

Secondly, we have in fact, hired not Los Alamos, but Flow Sciences, which is Tony Hurt --

DR. CATTON: Who wrote SOLA.

MR. MCINTYRE: -- who wrote SOLA and they are consultant with us on it.

DR. CATTON: Good.

DR. PLESSET: I'm still a little skeptical about what you're going to get out of it, but maybe that is being pessimistic on my part.

I'm worried about how much you're going to rely on those results to prove your case. You're sure within a too narrow space between your capability and the answers you get. You might have trouble -- resistance from the staff, for example, based on this kind of analysis.

I don't know if I made myself clear.

MR. HOBBS: Should I take that as an observation or a question?

DR. PLESSET: If you want to reassure me right now, fine.

MR. HOBBS: I've been advised to reassure you.

We do intend to depend primarily on the results of this code. I think that we intend to do that precisely as we have said by making use of advisors, of people who are very knowledgeable in using the code, and by comparing it to existing clean pool data and we believe that when we have our full story put together that it will be very credible and very convincing. We've got a great deal of confidence in that.

MR. RICHARDSON: I'd like to add one thing. As the Staff presented this morning, we do have, we feel, considerable margin in a lot of cases because of the conservative load definition that Grand Gulf has adopted. The higher height of the HCU floor, the 60 feet per second instead of the 50 feet per second. There have been a lot of things that we have adopted and designed to the absolute bubble pressure for the submerged structure loads.

Many of the things we have adopted which give us some additional margin, possibly.

DR. CATTON: Just a word of caution. There are a

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few examples of the nuclear industry where the SOLA code is being used in the way that it is just flat not applicable. And I would -- And this is a situation where it really should have been a three-dimensional calculation, but it's a two dimensional calculation and so it's just wrong.

So, be careful. You have a three-dimensional problem that you're trying to represent with a two-dimensional so one of your steps is going to have to be to justify that that indeed is more conservative, which I think it is.

DR. PLESSET: You've got to be sure that your inputs and the variation that you cover in your condition is enough to reassure those who are skeptical. That's one of the things that I wanted to say.

DR. CATTON: Some of us make our living with codes and we just don't believe them.

DR. SCHROCK: I have just one final comment that I want to make.

The reason that I questioned it in the beginning is that I think that it is not an especially good choice on your part. I think that you're facing some code developmental problems and there exist some codes -- EPRIS has sponsored a number of code developments in this area. I think that you should have a look at some of the computations that J-Corp has done for problems of this same kind. I think that you'll find that there are, indeed, available codes that are

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already proven.

You won't have to rely on using a code where there is a developmental aspect to prove something where you have such a short term need.

MR. HOBBS: We had considered making use of a three-dimensional version of SOLA and had rejected it because we felt that the developmental process would in fact be difficult and probably not appropriate to something where we wanted an expeditious resolution. I'll certainly direct a few questions to the people who have advised us to use SOLA, but I think that the selection probably was made as judiciously as we could and I think I'll go ahead rather than attempt to justify it.

DR. SHROCK: I think you have a good deal of developmental problem in putting your bubble model into the SOLA code. That's the main point.

DR. PLESSET: That model is really crucial, because that bubble pressure is driving this thing. If they're off on that, everything is off. Right?

Anyway, we may not have helped you, but you can see that there is some concern about elaborate calculations.

MR. HOBBS: Yes, sir.

Before proceeding on some of the details on how we are planning to do our analysis, I want to try and place the encroachment on Grand Gulf into some perspective.

(Slide)

The only major encroachment at Grand Gulf is the tip platform and I sketched this up last night without the benefit of compasses, so it is not exactly to scale.

The suppression pool is somewhat larger compared to the tip platform than it is shown here. The total encroachment of the tip platform into the suppression pool is slightly over three percent. I thought that that was a rather dramatic --

DR. CATTON: Before you take that off -- This is a little unfair.

DR. PLESSET: Are you going to make a comment?

DR. CATTON: There is something between that tip platform and the outer wall right there.

DR. PLESSET: That would make a big difference.

MR.HOBBS: I'm sorry. I didn't hear you.

DR. PLESSET: This is not fair, it seems to me to -- the presentation of the problem of having an encroachment in this wetwell. I could be worried about something between the tip platform and the outer wall of the containment.

MR. HOBBS: Yes, sir. In fact, we will talk about where the HCU floor is in just a moment.

DR. CATTON: Or just slightly to the right or to the left of that platform.

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MR. HOBBS: Yes.

DR. PLESSET: It's not fair to use this as a very important parameter.

DR. CATTON: And with respect to your modeling, again. When you model this, inertia may play a lot stronger role than the -- just locking off of part of the area and under those circumstances you're going to get geysering, which is quite a bit different than the kind of calculation it sounds like your attempting to make.

MR. HOBBS: All right, the actual layout of the tip platform with respect to the nearest area where the HCU floor is that the tip platform as can be seen --

(Slide)

-- has the HCU floor extending diagonally to one side of the tip platform. The closest approach of the tip platform to the HCU floor of horizontally in the plan view is around three feet and out the outer edge of the tip platform about 14 feet.

In addition, there is a catwalk beneath the HCU floor and just about the pool level which extends to the tip platform and which we would expect to actually break up the pool swell in that vicinity and to mitigate the effects.

DR. CATTON: On your HCU floor, it looks to me from this picture like you're going to get quite a slap on the edge of it as a result of the encroachment.

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MR. HOBBS: I would think that that would depend on how far out the effects of the encroachment extend.

DR. CATTON: That certainly is true, but it looks to me like you have to do a multi-dimensional calculation if you're going to do a calculation at all.

DR. PLESSET: Where are the nearest vents located in this -- where would they be in this picture?

MR.HOBBS: The vents are located completely around the suppression pool with the center to center distance of about five feet, so without having sketched this to see the exact number of vents, there would be three, four, five vents --

DR. CATTON: Underneath the --

MR.HOBBS: -- underneath the tip platform.

I don't have the drawings that I can check that with.

DR. PLESSET: That's okay. That's all right.

(Slide)

MR. HOBBS: That shows the vents -- there are four vents directly under the tip platform.

DR. CATTON: What is that grating? Does that grating extend between the tip platform underneath the HCU floor?

MR. FIELDS: What are you referring to?

MR. HOBBS: The grating in here?

MR. FIELDS: That's the HCU floor elevation. There's also a --

DR. CATTON: A catwalk.

MR. FIELDS: -- a catwalk that is a couple feet above the pool that extends all the way around the containment.

DR. CATTON: Is that catwalk solid?

MR. FIELDS: It's grated.

DR. CATTON: That's going to have some strange effect on this process too.

DR. ZUDANS: And that deflector under tip platform extends into the water.

MR. FIELDS: Yeah, straight down.

DR. ZUDANS: So, as soon as water begins to move, it already has to move in a constrained state in front of the pit platform.

MR. HOBBS: Yes, this is the elevation in the lower drawing.

DR. ZUDANS: So it would be solid water that would rush past this platform -- past this deflector and past the grating. It is such a complex arrangement that you give up on that analysis in my opinion.

DR. PLESSET: Don't be discouraged.

MR. HOBBS: I'm not discouraged yet.

DR. ZUDANS: I take conservative conditions --

DR. PLESSET: We're going to eagerly look forward to your analysis.

(Slide)

MR. HOBBS: The 2-D analysis which was done before had predicted about a twenty percent effect on peak velocity. In doing that, the bubble model which was in SOLA before would not permit breakthrough and in addition, it would not permit really substantial ligament fitting horizontally.

As a result of that, we feel like the previous calculation was done in such a way that it very substantially overestimated the increased pool swell velocity in the region of an encroachment.

DR. CATTON: Is this what SOLA predicted?

MR. HOBBS: A rough sketch.

That's a free-hand sketch rather than something that has been drawn carefully to scale.

DR. EBERSOLE: May I ask? I don't see what this means unless I see something relative to what the swell was in the non-region of the encroachment.

MR.HOBBS: Basically, the intent of the slide, Dr. Ebersole, was that we were anticipating that you would get a ligament thinning and a breakthrough horizontally and so we would feel that once a breakthrough occurs, that then you would have a basically pressure reduction on the driving force in that vicinity and that that will reduce the pool swell life and tend to -- though we will certainly still get pool rising at that point, it will no longer be driven upward and be accelerated upward.

DR.CATTON: So, when you do this analysis, you essentially are -- this the two-dimensional slice that we're looking at and you have down below the encroachment somewhere you have your vent?

MR.HOBBS: Yes.

DR. CATTON: I don't really think you can do that. I think you have to -- I think there are inertial effects. There's transverse velocity effects that just make that particular cross section look funny.

MR. HOBBS: We appreciate that those effects are there. We think that probably most of those effects will tend to mitigate the increased velocity rather than work the other way.

(Slide)

The summary of what we believe will happen when we do the calculation is on this slide.

The top curve will be a calculation which will show pool swell in the non-encroached region and that pool swell will be generated with a calculation where the vents below the tip platform will be assumed to be plugged so that you will have the increased impedence effects and inertial effects which will cause you to have a slightly higher pool swell velocity in the unencroached regions.

And that will be the top curve.

We will then do a calculation in the encroached region. Based on the calculations that have been done at this time, we expect that effect to lag. Because of the fact that the bubble is continuous or essentially continuous beneath the surface of the pool and it is connected horizontally, when breakthrough occurs, you will have horizontal venting of the bubble and you will relieve the driving pressure.

At that point, rather than continuing upwards, which will be what the encroached regional in the full pool would predict, we would then expect the pool to slack off and no longer be accelerated.

DR. ZUDANS: If that should happen, what you show here, it could -- the only reason it could happen for you is because it represents greater resistance for water to escape upward. If that is the case, bubble pressure should increase and also drywall pressure should increase.

MR. HOBBS: Yes, we basically -- I think that I was attempting to address that in the comments that I made about how I would do the unencroached calculation. That we would in fact assume that the worst thing that could happen in terms of increasing drywell pressure and bubble pressure would be if you could completely stop flow from occurring through the vents below the encroached region.

So we will assume in doing our calculations of a non-encroached curve that those vents are plugged and are not available to relieve pressure.

DR. ZUDANS: I understand that, but you see these two calculations that you demonstrate on this graph -- they are for complete asymmetric model. So, if you show the encroached curve, that means that it is all around encroached and no vents see it equally and you get a delayed swelling because there is more resistance for water to escape upward. That would have to go with a higher bubble pressure and also high driver pressure.

You looked at those numbers in the calculation.

MR. TOWNSEND: To answer that is that we run a separate analysis --

DR. ZUDANS: I understand that.

MR. TOWNSEND: -- to get the driving pressure condition and both of these regions are fed by a common plenum.

DR. ZUDANS: Driven by the same pressure history?

MR. TOWNSEND: Yes. And we drive both analysis by the same pressure condition --

DR. ZUDANS: Then you can't compare, because it's incorrect.

MR. TOWNSEND: It just says that the bubbles in that region is a slightly smaller volume.

DR. ZUDANS: If you would drive with a source of energy with a break, it would create higher driving pressures for encroached --

MR. TOWNSEND: We have bounded it already by assuming the maximum resistance by blocking the four or five vents that are under --

DR. ZUDANS: What you're saying is that this driving force is taken from your worse condition and applied to both?

MR. TOWNSEND: Yes. So the curve that we show is a non-encroached curve there is actually slightly higher in velocity than we would expect in a free pool.

DR. ZUDANS: Because you're --

MR. TOWNSEND: Because we're driving it with a bounding pressure condition.

DR. ZUDANS: That is okay.

MR. TOWNSEND: And then what happens on the slice that we're looking at is an extreme condition. In the center of the tip platform is that -- You're right, we're assuming a rotationally symmetric geometry and we're ignoring the lateral flows which may exist which will damp out the differences between the two curves.

DR. BUSH: Then your continuous bubble is an outgrowth of this model, because I would think that --

MR. TOWNSEND: This is continuous bubble argument really comes from our observations of pool swell in the test facility and we see that very quickly the bubble as it starts to form grows out laterally to the walls in our single facility and --

DR. BUSH: That's the single cell, but with phasing effects, I wouldn't think that --

MR. TOWNSEND: Well, they're going to be synchronized very close and the cross-sectional area of the bubble for lateral flow is quite large. It's going to be something on the order of 30 to 40 square feet. Much larger than the flow path through the vents. So there is a path for direct venting of the steam and air around the tip platform into the other regions of the pool.

DR. CATTON: Could you go back a slide where you show a cross section of this system? The one that shows the pool encroach deflector and tip platform.

(Slide)

What is the pool swell deflector? Is that really where the encroachment is?

MR. HOBBS: Yes, --

DR. CATTON: Or is the encroachment at the tip platform.

MR. HOBBS: There is a steel box extending down from tip platform into the pool.

DR. CATTON: Is it solid?

MR. HOBBS: It has vent holes at the top and bottom, but they're --

DR. CATTON: Basically, it's solid.

MR. HOBBS: Basically, it's solid.

The reason that we have that there is so that the -- it will be able to fill up and we will not encroach the pool and tend to cause overflow during the upper pool dump.

DR. CATTON: Where is the deflector?

MR. HOBBS: The deflector is there to keep you from getting the pool swell coming up and hitting here and then compressing in that very violent event.

DR. CATTON: That makes the thing quite different than I thought, because before you were talking about the tip platform as an encroachment. Really your encroachment is your deflector.

MR. HOBBS: Well, that's correct. The deflector is there basically -- It is not a part of the tip platform, but it is there. It's associated with the tip platform.

DR. CATTON: Then I would be willing to bet that you could hardly see any difference in the pool there than you would elsewhere. Not a whole lot.

MR.HOBBS: We agree.

MR. TOWNSEND: We agree.

DR. CATTON: But I still want to see the analysis. Just to confirm.

(Slide)

MR. HOBBS: The current velocity and breakthrough specifications are very conservative. The data interpretation from the test that have been done are interpreted conservatively. The driving conditions are conversative and there is an NRC imposed margin.

In addition, the impact and drag load definitions used are conservative. We use a conservative velocity and a conservative drag coefficient and make the assumption that we have a flat pool.

Finally, the structural design criteria and the methods used in designing the areas that are subjected to the impact and drag loads are conservative.

(Slide)

Our section issue o- perturbations in load definitions caused by annular vents. We discussed that a little bit previously and I think that I'll just go ahead with the next slide unless there are questions.

(Slide)

Our action plan is that we are at this time evaluating the hardware modification to seal this vent. We have not made a determination yet that we will in fact seal the vent, but we have completed a preliminary evaluation which would indicate that we can in fact design something that will meet the environmental and radiation conditions and be able to do that should we deem that to be a desirable fix.

DR. PLESSET: You shouldn't do it just because you can.

MR. HOBBS: I certainly understand that we don't want to do it just because we can. We in fact have not committed to it and have not made a decision that we will do it. We were proceeding on a parallel path to attempt to define the data with which we could do calculations and evaluate this effect. It appears that such data and its interpretation are very difficult to come by. Our judgment was that we anticpated that this would be an extremely small effect and we decided that we would evaluate whether or not there were hardware fixes that could preclude having to do that evaluation and evaluate whether or not that was desirable.

DR. CATTON: Have you done just simple calculations of pressure -- just fix delta P across your vent with the steam flow. Fix delta P across your SRV sleeve?

If it's 50 square inches, I would bet that it's a heck of a lot less effective because of the increased pressure drop for a given flow, then would be your vent.

MR. HOBBS: I haven't done the calculations. I haven't seen whether or not they've been done. In fact, we haven't discussed it. The issue as described by Mr. Humphrey had to do with accoustic coupling and whether or not we could in fact cause, perhaps, the condensation oscillation and/or chugging to occur at frequencies in the main vents because of being accoustically coupled with these and having things that would be near the resonnant frequencies with the structures and that is the area where data is very difficult to come by.

We don't believe that that will happen.

DR. CATTON: Those sound like questions that have been raised over and over again for multiple events: accoustic coupling and vent to vent and so forth.

MR. HOBBS: But for an annular event of this particular nature, we don't have the data.

Hal, is that correct?

MR. TOWNSEND: Yeah, there is no data for annualar events as you know and I agree with you Dr. Catton, these are similar to very -- there have been many questions that have been raised before and you have to postulate some very severe resonnance kind of phenomena to make this into a problem and our approach here is primarily to look at the data we have on circular vents with different vent links and show that the accoustic resonnance really isn't a strong driving mechanism, but it's more a bubble shedding problem at he end of the vent.

DR. ZUDANS: Do you how the sleeve is supported?

MR. HOBBS: Yes, the sleeve would consist of a clamp around the sleeve and a clamp around the SRV discharge pipe and would then be on an elastic --

DR. ZUDANS: No. How is it supported now if you don't do any changes?

MR. HOBBS: I'm sorry.

DR. ZUDANS: How is it done now, not what you plan to do?

MR. HOBBS: The sleeve is anchored into the drywell wall. I'm sorry. I misunderstood your question.

DR. ZUDANS: And it freely extends over the pipe and no further support against the SRV or anything? It goes all the way down to the knee and then it just cut open and stays free completely the whole length. That's true?

MR. HOBBS: The SRV line itself is supported, but that sleeve is anchored into the drywell wall.

DR. ZUDANS: The SRV line is only supported where the quencher is against the wall or is it also supported otherwise?

MR. HOBBS: It's supported otherwise.

You want to talk about that. I'm not as familiar with that.

DR. ZUDANS: On the sketch that you showed this morning, SRV pipe goes down and then bends down and goes into quencher and there's a lateral support against the wall from the quencher.

MR. HOBBS: There are two other supports above that at a 45° angle.

DR. ZUDANS: Before the sleeve begins. Is that correct? The sleeve is not supported with anything the whole length.

MR. HOBBS: No. I can pass you a sketch or I can describe it. There are -- the sleeve is not supported accept in the wall.

DR. ZUDAN: Draw on this slide.

MR. HOBBS: No, I don't have a transparent pencil.

There are supports here and there are other supports below and this is somewhat out of scale, I'm afraid.

DR. ZUDANS: I'm not really interested where you're going. I'm only interested in the top. The way you show this is a very short sleeve. Actually, it's a very long sleeve.

MR. HOBBS: What is the length of the sleeve?

The unsupported length of the sleeve is six feet.

DR. ZUDANS: Six feet only.

MR. HOBBS: Schedulated pipe.

DR. ZUDANS: And that's a 13 inch ID and it's six feet long, so it is really very stiff cantilevered --

MR. HOBBS: Yes.

DR. ZUDANS: I thought it was like 20 feet long. That's why I asked the question.

DR. PLESSET: Let's go on and try to get a little more progress through your list.

(Slide)

MR. HOBBS: The next issue is unaccounted for relief valve effects.

This one has been identified both this morning by members of the Committee and by the Nuclear Regulatory Commission as being of particular interest also.

Basically the RHR heat exhanger relief valves may produce unaccounted for hydrodynamic loads. The STRIDE design provided only nine inches submergence fo the valves and there was concern that the vacuum breakers might not be adequately sized. The relief valves must function even following an upper pool dump and discharge from the relief valves to the upper level of the pool could aggravate temperature stratification.

And then the final concern was that the same problems mgiht be associated with all of the relief valves in the pool.

The potential effects are that we would change the loading conditions. Create possible pool bypass. Produce impact loads on the relief valves. Produce water jet loads in the pool. Create higher back pressure on the RHRH relief valves and there was some question as to whether or not the existing licensing analysis needed to be altered.

(Slide)

The action plan for resolving this is that we will, number one, calculate vent clearing loads for the RHR heat exchanger relief valves and second, we will provide detailed information on the operation, routing, design capacity and performance of all of the relief valves which discharge to the suppression pool. In particular for the RHR heat exchange or relief, the operation routing and design of that piping as particularly important to the evaluation of this problem.

We will provide data on discharge submergence verses the condensation effectiveness --

DR. CATTON: On this particular item you're going to have to include the temperature of the pool and if you're only nine inches below the surface, I would hope that you don't use the bulk temperature.

MR. HOBBS: We will demonstrate that the discharge piping will remain pressurized during the steam condensing mode of operation and that that will eliminate the water leg on the discharge piping.

We will calculate first pop actuation loads for the RHR heat exchanger relief valves for steam and liquid conditions and evaluate thermal discharge plume into the suppression pool.

DR. EBERSOLE: May I ask. If that occurs, that's really a malfunction, isn't it and you wouldnot be in that mode for any length of time anyway?

MR. HOBBS: That's correct.

On my next slide after this coming one, I will be talking just a very small amount about the operation and basically when you are in the steam condensing mode, there is a pressure control valve and the only way that — the primary way in which you can end up with a safety relief valve actuation is if that pressure control valve malfunctions and overpressurizes the piping.

DR. EBERSOLE: Well, then you want an interim relief which you're going to come at very quickly.

MR. HOBBS: That's correct.

DR. EBERSOLE: By chopping the steam flow.

MR. HOBBS: That's correct.

DR. EBERSOLE: So this is just a very short term condensation process that you'll be in.

MR. HOBBS: That is exactly correct. There were some concerns expressed by Jim Humphrey that perhaps the pressure control valve failing wide open would not be the controlling failure and you might have a controlling failure which would cause you to have an oscillating opening and closing and you needed to observe for that.

We would agree that you will open the valve and that you will -- and as soon as you realize that you were in that situation, that you will close it and terminate the events.

DR. EBERSOLE: Up ahead of that, the supply into this condensing system, you have oscillation valves.

MR. HOBBS: Yes.

DR. EBERSOLE: Are they doubled? Can I have a stuck open condition in which I do have to deal with a prolonged mode like this?

MR. HOBBS: You have a pressure control valve and a head of a pressure control valve, a motor-operated valve. I don't know if there is another motor-operated valve in serious with that one or not.

Way up stream there is another one so that if you have a failure then of the motor-operated block valve, you can still close the valves.

DR. EBERSOLE: And that's the way you guarantee termination of this particular kind of operating condition, isn't it?

MR. MCGAUGY: Excuse me. This is something that is not every used -- it wouldn't be used in conjunction with the LOCA operation at all.

(Slide)

MR. HOBBS: In evaluating, we will be making use of the following computer codes and the following analysis and we'll be using a computer code entitled VRV to calculate water lag time history for the first pop with steam --

DR. CATTON: What is VRV?

MR. HOBBS: It is a Bechtel code which is used for doing this kind of calculations. That code has been verified and the methodology has been discussed with the Nuclear Regulatory Commission.

DR. CATTON: Go ahead.

MR. HOBBS: Make use of the dynamics of Slug motion of the reflooding water. The affects of condensation and noncondensibles are included in this calculation.

We will use relap 5 to calculate dynamic forcing functions for flashing liquid conditions for the shutdown colling mode.

There is a second method by which you can end up with the safety relief valve actuation and that is with a shutdown cooling mode --

DR. CATTON: Is there any reason you picked relap 5 for this?

MR. HOBBS: Paul --

DR. CATTON: Relap 5 has other purposes when it was put together and you're using it for something maybe not quite what it was designed for and in some respects -- with all due respect to relap 5, it's a good code for it's purpose -- it has less versatility that even SOLA. You've got to be careful.

MR. HOBBS: Okay, I appreciate that.

We will use -- I believe that the remaining codes are all also Bechtel codes that are of the same nature as VRV.

We're making use of RVCL to calculate the dynamic forcing functions induced on the various pipe segments and SBUD will calculate the bubble dynamics in an infinite or finite pool from the mass/energy charging rates into the air bubble and SRVLOP will cacluate the loads on submerged structures using the method of images. The method of images is in fact described to Attachment L to the GESSAR II.

(Slide)

Now, we will return to this slide very briefly.

During the steam condensing mode, once you are in it and operating you will have this motor-operated valve open and the pressure control valve will be controlling pressure in this area here and then you will then be delivering steam into the RHR heat exchange.

In the process entering this mode and the takes between 20 and 30 seconds, the pressure control valve will open. The vent line here -- the two inch vent line -- discharges into the safety relief valve discharge line and we are currently evaluating, but we believe that there will be sufficient steam flow through that vent line and that we will not have a water lag in the discharge line to the suppression pump and we would anticipate that this will make even first pop loads a very low and essentially low and keep the water

lag out of that pipe during an event such as the one postulated
so that we would not get the second pop --

DR. CATTON: Is this the line that only has nine
inches submergence?

MR. HOBBS: What is the submergence, Paul?

DR. CATTON: Five feet?

MR. HOBBS: Normal submergence is five feet.
Following drawdown is --

DR. CATTON: Which line was it that there was some
concern about, because it only had a submergence of nine inches?

MR. HOBBS: The STRIDE design, the G.E. standard
design specifies a minimum submergence for that pipe of nine
inches.

DR. CATTON: But yours is five feet?

MR.HOBBS: But our design is nominally five feet.

DR. CATTON: Got you. Thank you.

DR. EBERSOLE: What is the nominal pressure that
you control it to?

MR. RICHARDSON: 225 pounds.

DR. PLESSET: Maybe we might take a short break
if that's agreeable. Let's take a ten minute break.

(Off the record.)

DR. PLESSET: Let's reconvene and continue with
our discussion.

It's Mr. Hobbs, isn't it and you're on the other relief valve discharge into the suppression pool. Right?

MR. HOBBS: Yes.

DR. PLESSET: Go ahead.

MR. HOBBS: Another area of concern is the other relief valves that may discharge the suppression pool. The RHR heat exchanger relief valve discharge bounds all of the other discharges and the size of that valve is 6" by 8" and the peak mass flux is 310,000 IBM/HR and the normal set point is 500 psig.

The only other steam discharge to the suppression pool is the RCIC turbine exhaust and it is a lower pressure, about 135 psiG, substantially lower max flux and that is equipped with a discharge sparger and of course that is not a rarely used system. It is not used frequently, but it is a system that is used much more frequently than a steam condensing mode of RHR.

DR. EBERSOLE: Could you tell me, where did you exhaust the relief disc discharge for the RCIC? There is a relief disc, a frangable disc in the discharge? To what point did you send it's --

MR. RICHARDSON: Right out into the room.

DR. EBERSOLE: It's right out into the room. Okay.

MR. HOBBS: The next largest relief valve is the shutdown and cooling system over pressure protection valve and the size of that valve is four by six inches and it can only discharge subcooled liquid.

The balance of the relief valves are small capacity thermal expansion protection valves. There are fewer than ten. I think the total number of valves, I think is about ten. I'm tempted to say there are seven, but there are certainly fewer than ten. They can only discharge small quantities of subcooled liquid.

Two examples is a one by one valve on the RHR suction from the reactor recirc system and a one and a half by two valve on the connection from the RHR system flushing source.

Those are pretty typical of the remaining valves. We do not anticipate any problems with any of those.

(Slide)

Major issue number four is suppression pool temperature stratification.

I will run through the issues very quickly.

The suppression pool temperature response analysis was thought perhaps by Mr. Humphrey not to be correct, but inventory of air displaced -- pardon me -- That the water inventory displaced from the suppression pool into the drywell through breakthrough might not be in thermal equilibrium with bulk suppression pool temperature and that the suppression pool will not be at a uniform bulk temperature and that there are a number of factors that may aggravate pool temperature stratification. Interactions could occur between opposing RHR trained discharges and operation of the RHR system and the containment spray mode would decrease the heat removed from the pools.

Potential effects of those issues would be that the suppression pool heat sink capacity would be decreased. Higher pool surface temperatures might alter the containment response and adverse interactions of the RHR discharges might decrease the total heat removed from the pool.

Finally, the containment response might be changed by spray operation.

(Slide)

Our action plan for resolving this is that we intend to submit an analysis demonstrating that the suppression pool maximum temperature increase is six degrees if the drywell pool is formed and if you do not have any kind of thermal contact between those two pools. We will prepare a study that will document that major conservatisms and the suppression pool temperature analysis.

We will show that the overall conservatism is large and we'll provide quantification on the individual areas of conservatism. Calculate effects of failure to recover the drywell air mass and we'll complete an analysis to quantify the effect on the containment response of the higher suppression pool surface temperature.

Predict the maximum temperature difference between the suppression pool bulk temperature and the RHR heat exchanger inlet temperature.

And we will either complete the analysis or propose a test plan to evaluate suppression pool temperature stratification produced by switching to containment spray and by the upper pool dump.

Any test would also evaluate interaction of RHR suction and discharge. We will develop bacteria for switching the containment spray to the suppression pool cooling mode and vice versa and we will document that the containment spray can withstand cyclic operation.

Finally, we'll document that chugging enhances thermal mixes and reduces stratification and we discussed that or General Electric discussed that very briefly this morning.

(Slide)

The conservatisms in the existing suppression pool temperature accident analysis are on the short term we make use of a decay heat energy from ANS standard 5.1 1971 and with a 20 percent margin.

In the long term, we make use of the same ANS standard with a ten percent margin.

Our service water temperature is assumed to be at the site peak forecast temperature.

The RHR heat exchangers are considered to be in a worts case fouled condition following 20 years of service.

Our initial power levels at a licensed maximum of 105 percent rated power.

Initial suppression pool level is at a low water level and the suppression pool temperature is at a tech spec maximum temperature.

The upper containment pools are arbitrarily assumed to be at a 125° and the RHR suppression pool cooling is assumed not to be activated until 30 minutes into an accident where it could be activated as early as ten minutes into an accident.

The HPCS injection is assumedto take suction from the suppression pool rather than its preferred source of the condensate storage tank.

DR. PLESSET: Is this a new Appendix K, a K' or something?

MR. KUDRICK: I don't know.

MR. HOBBS: I'm sorry. Have I missed something?

DR. PLESSET: It was not very funny. A joke. That was directed to the Staff anyway.

MR. HOBBS: In that case, I'll laugh.

I won't laugh when the direct it to me.

(Slide)

In quantifying the effects of failure to recover drywell air mass the assumption will be that the initiating accident is a small break. We will be making use of the General Electric safe code to calculate vessel blowdown and the associated emergency core cooling system performance.

We will be making use of VACBRO4 to calculate drywell and containment pressure response assuming that the drywell remains pressurized and we will include the effects of the drywell and containment heat sinks in doing that calculation.

(Slide)

Another concern was the circumstances and the criteria that might be used for switching from containment spray to pool cooling mode.

Basically we will be evaluating and making use of the following kinds of criteria in doing that. We will take a look at the containment pressure which RHR can be switched back to pool cooling and establish an acceptable rate of rise in the containment pressure following termination of containment spray.

We will incorporate new criteria on the emergency procedures for switching RHR modes and we will do analysis to quantify containment response assuming full bypass leakage capability.

These calculations will assume heat transfer between the suppression pool and the containment atmosphere and again we will take credit for the drywell and containment heat sinks.

(Slide)

Major issue number five is drywell to containment bypass leakage effects.

And the issue basically is the intermediate break accident would actually be the controlling break for bypass leakage. The containment sprays might have to be cicled on and off for controlling bypass leakage effects. Periodic drywell integrity tests should consider upper pool dump. Bypass leakage might dissipate hydrogen outside the region where the recombiners take suction.

Bypass leakage might expose some equipment to excessive environmental conditions and it might allow the drywell temperature to exceed 330° before a scram caused by high drywell pressure.

Potential effects are that the bypass leakage capability might be lower than has been previously thought.

That the containment spray system may not be designed to withstand cyclical operation.

The leakage test may not measure the maximum leakage and that hydrogen may pocket the concentration above four percent.

Potentially environmental qualification envelop might be exceeded and existing accident analysis might not be bounding.

(Slide)

If I am going to fast through the statement of the issues, stop me.

DR. ZUDANS: On this previous slide,what was this first bulleted item? I don't understand it.

MR. HOBBS: That the leakage test may not measure maximum leakage?

DR. ZUDANS: No, no. The first bulleted item. The bypass leakage capability might be lower. What does that mean?

MR. HOBBS: Basically right now we assume a bypass leakage and we test and make sure that we have no more than ten percent of that during periodic tests. Basically the concern is that if in fact you have an intermediate break accident as the controlling case that you will have a different set of results and based on all of the kinds of considerations that went into Mr. Humphrey's Issue, that your total bypass leakage capability for the containment might be lower.

In fact, I think that perhaps the most relevant comment there is that the containment sprays exist on the Mark III containments only because of being able to handle bypass leakage and that initially that was an NRC requirement that bypass leakage be done and that with the normal size Mark III containments that you do need containment spray to handle that.

DR. ZUDANS: What you are saying is that this leakage might be less than postulated in the argument.

MR. HOBBS: No, that the capability to handle the leakage might be lower than has been analyzed.

DR. ZUDANS: So then you're missing the word handle. Capability to handle the leakage would be -- you know.

MR. HOBBS: The wording may not be poor. May not be correct.

DR. PLESSET: Let it go. Don't worry.

MR. HOBBS: Our action plan for resolving this issue is that we will complete a spectrum of bypass leakage capability analysis to confirm the adequacy of our reported capability and we will assess the the potential for pocketing of hydrogen which leaks through the drywell.

Evaluate the need for reducing the allowable leakage based on a pressure of 6 psi in the drywell. That would be following an upper pool dump and establish the drywell temperature response will not exceed 330° when the drywell pressure is less than two psi.

(Slide)

In calculating the bypass leakage effects, the new bypass analysis will be performed for differing break sizes using existing analytical methods.

Basically the calculations will assume the drywell remains pressurized after the first 13 minutes of the transient.

We will include effects of drywell and containment heat sinks.

And the analysis will be performed at the high suppression pool level reflecting upper pool dump.

The impact of the drywell remaining pressurized should be negligible since the containment sprays are available to control pressure.

(Slide)

Evaluation of hydrogen pocketing:

We're going to spatial studies and we will assume that the leakage occurs through electrical penetrations. The intent of the study is to ascertain whether or not the pocketing under solid floors is possible.

We will do an analysis and study to determine whether or not pocketing in the wetwell could exceed four volume percent.

One of the reasons for hydrogen being an issue in this particular area has to do with purge compressor capacity and I've forgotten the standard plant purge compressor capacity, but for Grand Gulf the purge compressor capacity is somewhat higher and they're 1130 cubic feet per minute each.

DR. CATTON: Do you have sprays in the drywell?

MR. HOBBS: No.

DR. CATTON: Just in the --

MR. HOBBS: Just in the containment.

(Slide)

We will complete an analysis establishing the maximum drywell temperature and the vessel blowdown for the controlling intermediate break will be done using the safe code and we'll calculate containment and drywell pressure and temperature with the VACBRO4 code using full bypass leakage capability of .9 square feet.

DR. CATTON: What is VACBRO4?

MR.HOBBS: VACBRO4 is the mode number of the code and that is the General Electric code.

DR. CATTON: For containment analysis?

MR. HOBBS: Yes. The VACBRO4 is evidently an acronym for vacuum breaker and the code originated as a containment response analysis code to evaluate containment vacuum breaker effects and has been -- it is capable of doing other things as well.

The analysis will include the effects of drywell heat sinks and we will verify that the drywell temperature does not exceed 330° in the time limit imposed prior to operator actions to correct the transient.

DR. EBERSOLE: Are the vacuum breakers in the drywell wall?

MR. HOBBS: Inside the wall?

DR. EBERSOLE: I mean are there vacuum breakers in the drywell shell?

MR. HOBBS: Yes.

DR. EBERSOLE: And what is their design basis for CFM flow rates?

I would suspect it would be virtually instantaneous condensation from an inadvertent spray since you don't have sprays.

MR. HOBBS: There is no spray in the drywell.

DR. EBERSOLE: You can get sprays from mal --

MR.HOBBS: You can get sprays perhaps from malfunctions or from cool flow exiting a break inside the drywell, however, when you do get that condensation, you essentially under the worst case conditions get a drywell negative pressure transient and you generate some reverse pool swell and the vacuum breakers are not sufficient to --

DR. EBERSOLE: Yes, but what I'm really pursuing is what's the maximum delta P- that you can get with respect to low drywell pressure verses high containment pressure.

Can you get enough to worry about buckling?

MR. FIELDS: It's designed for 21 psiG.

DR. EBERSOLE: 21 buckling?

MR. FIELDS: The drywell.

DR. EBERSOLE: Negative? The 21 buckling pressure?

MR. FIELDS: Yes, it is.

DR. EBERSOLE: What's the calculated value of the buckling load under the worst case? And what is the worst case?

MR. FIELDS: The worst case is where you have zero air in the drywell and all steam and you have almost a continuous condensation and then you have pressure in the --

DR. EBERSOLE: Is that a calculated number or is it done by tests or what?

MR. FIELDS: No, it's just calculated. It's a pure bounding calculation.

DR. EBERSOLE: What's the accuracy of that calculation.

MR. KUDRICK: It's a bounding number. Correct me, if I'm wrong.

DR. EBERSOLE: Okay, you're just going to put a full vacuum in it?

MR. KUDRICK: Yes, it's just a partial pressure of the steam at a relatively low temperature and then it's the full differential pressure.

DR. EBERSOLE: Thank you.

(Slide)

MR. HOBBS: Major issue number six is RHR permissive on containment spray.

I'm not going to spend very much time on this. Basically the concern was that the recombiner exhaust might produce hot spots with temperatures that exceed environmental qualification envelopes and that the potential effects are that you could have to change your environmental qualification profiles and there was a concern as to whether or not you had to actuate containment spray prior to turning on the recombiners for temperature control which had originated with an early STRIDE design.

Grand Gulf did not have that design with that interlock.

(Slide)

Our action plan for resolving this issue is that we intend to submit drawings showing equipment located near the recombiners. Submit drawings showing the area arrangement above the recombiners and finally as a matter of information we will summarize the criteria used for actuating the containment sprays.

Basically, we do not have any equipment in the vicinity of the recombiner exhaust which could be adversely effected.

(Slide)

Major issue number seven is basically that higher suppression pool surface temperature may result in stratification and the program used to calculate environmental qualification parameters incorrectly considers heat transfer from the suppression pool to the containment atmosphere.

Potential effects of that are that the containment pressure response may not be bounding and the environmental qualification profiles may not be conservative.

(Slide)

Our action plan for resolving that one are basically that we will complete an analysis to quantify the effect on the containment response of the higher suppression pool surface temperature. We will quantify the conservatisms inherent in assuming thermal equilibrium between the suppression pool and the containment atmosphere and provide a list of assumptions used in calculating the environmental parameters.

DR. CATTON: When you do this on the part number one. If you could kind of do it on the basis of percent mixed, it would be of interest, I think.

MR. HOBBS: I'm familiar with what we're planning there. Let me change slides, because basically what we're planning to do is the stuff on this slide.

(Slide)

We'll take that under advisement. Are you taking notes or somebody? Okay. It will be on the transcript.

The maximum stratification case was discussed in the GESSAR questions and answers. The existing analysis will be rerun with higher suppression pool temperature so that we will bound the maximum effects of stratification.

Our existing code has an option to calculate heat and mass transfer from the pool to the atmosphere and using worst case pool temperatures, the analysis will be rerun making use of that interaction and we will quantify the conservatism in assuming that thermal equilibrium with that particular analysis.

(Slide)

Major issue number eight is containment air mass effects.

The technical specifications permit plant operation at conditions which differ from the initial assumptions used in accident analysis. Tech specs permit operation at -2 psiG and conditions may exist which create low air mass inside the containment.

Potential effects are that it could change the FSAR transient analysis. Produce excessive negative pressure transient and conceivably that the top row of the vents could be covered during normal operation.

(Slide)

Our action plan for resolving that is basically that we will quantify the conservatism within the existing containment pressure and temperature response analysis and we will complete realistic analysis to demonstrate that even with all parameters at the worst credible values, the existing containment design pressure is acceptable. We'll take credit for heat sinks and we'll take credit for air space-to- suppression pool differences.

The Grand Gulf technical specification limiting conditions for containment to auxiliary building differential pressure will be changed and in fact that was changed prior to the granting of our low power license. That item is completed. Instead of two psi, it is -.1.

We will calculate the minimum air mass which can exist inside containment and evaluate the worst case negative pressure transient which could result in this low air mass.

DR. CATTON: When you do these calculations, do you allow evaboration to take place until it comes to equilibrium as well or do you actually calculate the mass transfer?

MR. HOBBS: Did you hear that?

MR. MCINTYRE: I didn't hear the question. If you'll repeat it.

DR. CATTON: I'm just wondering if you account for evaboration from the surface of the pool, because that maybe your dominant --

MR. MCINTRYE: We account for both evaboration and mass transfer.

DR. SCHROCK: I also wanted to ask about that calculation. Are you considering a natural convection effect within the atmosphere in this code?

MR. MCINTYRE: I'm not sure what you mean by natural convection effect. I think the answer is yes.

We use experimentally derived heat and mass transfer coefficients from the pool in natural convection, yes. We use the Tagomy relations for heat transfer for the walls, if that's the other question. I'm not sure if you mean from the pool or to the wall.

MR. KUDRICK: Just a comment.

I don't think they meant to say Tagomy in the containment.

MR. MCINTYRE: Ichida, I'm sorry.

VOICE: You're using Ichida?

MR. MCINTYRE: We're evaluating that, right? The code has the capability. It has both Tagomy and Ichida built into it and also the option to overlay anything you want and what I've been told here is that we're planning and using just natural convect heat transfer coefficients in the containment right now.

(Slide)

MR. HOBBS: The conservatism in the containment response analysis. Part of the containment atmosphere is not in thermal equilibrium with the pool and the containment temperature and pressure will significantly lag the pool response.

We neglected effects of containment heat sinks and drywell heat sinks.

In addition there is a very high relability of drywell cooling system which is designed to remain functional under a variety of adverse circumstances and we take no credit for that.

Basically all of the conservatisms that we previously talked about on the suppression pool temperature response also apply to the containment response calculation.

DR. EBERSOLE: Does that higher reliability imply a redundant design system with multiple water and electrical splice?

MR. HOBBS: We do not take credit for it as a safety related system, but it can be put on to standby service water and the valves and the methods for doing that are operated with class 1A power.

DR. EBERSOLE: Are the fans on 1A?

MR.HOBBS: Yes.

Redundant fans and redundant cooling coils as well.

DR. EBERSOLE: Is that system seismically qualified?

MR. HOBBS: I don't think so.

DR. EBERSOLE: It's not suppose to be operational in an earthquake.

MR. RICHARDSON: It's not designed to function in the middle of an earthquake.

It's seismically supported, obviously at HVC duct work. It's not designed to falldown either.

(Slide)

MR. HOBBS: We're doing containment negative pressure transient calculations and the NRC had said earlier that they did not think that this would be a problem for us and we agree. We do not think that it would be a problem either. We're trying to quantify that.

Basically we have identified this. This has three scenarios. There is in fact -- There are in fact a couple of variations on this and I think five scenarios that I think we're evaluating.

The first two are RWCU breaks. The first is with the containment isolated and then with actuation of both trains of containment spray.

The second case is with the containment unisolated and then actuating both trains of containment spray.

The variation on that is that you start with the containment not isolated and that you choose the worst time to isolate the containment from the point of view of minimizing containment air mass and then actuate both trains of containment spray.

The fourth one is the loss of all containment HVAC and that then cooldown on noncondensibles once you have cooling restored and a final one which we did not put on here but which we are doing, is a little bit nonsensical, but we were looking for scenarios where we could properly evaluate

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this effect and that would be that we would have the purge compressors operating which normally only operate in the post accident mode and that we would have an inadvertent upper pool dump.

Basic analysis assumptions are that we start at 14.7 psi with a relative humidity of 100 percent and a containment spray temperature of 80°.

(Slide)

The next major category of issues are drywell air mass effects. Basically the emergency procedure guidelines require the operator to throttle ECCS operation and that therefore the drywell atmosphere will not be quenced.

Potential effects of that would be to change containment pressurization and to increase drywell bypass leakage.

(Slide)

Our action plan for resolving drywell air mass effects is basically that we will complete a realistic analysis to evaluate maximum pressure increase that we can attribute to drywell air remaining in the containment. We will include containment heat sink effects and containment spray effects in doing that evaluation. Evaluate effects of maximum leakage on the containment response and again the NRC had indicated that this was a matter of some confusing language in one of our earlier meetings.

We have confirmed with them that the SBA and the stuck open relief valve analysis are treated as DBAs.

DR. ZUDAN: I have a question actually that goes back further, but could be good at this point. At sometime you said that you had established a drywell temperature that does not exceed 330° when the drywell pressure is less than 2 psiG. I'd like to see a physical scenario where you could have temperature that high with the pressure that low.

How is it possible on basic principle?

MR. HOBBS: Basically if you have a very small break accident and you are blowing steam into the drywell --

DR. ZUDANS: Wouldn't that steam be saturated steam as soon as it hits the drywell?

MR. HOBBS: I would assume so.

DR. ZUDAN: Well, then if you have a --

MR. HOBBS: Super heated.

DR. ZUDANS: That's clear if that's the case if it's super heated.

(Slide)

MR. HOBBS: Weir wall overflow is an issue that was identified. There might be any number of factors which combine to cause the suppression pool to overflow the weir wall following the inadvertent upper pool dump and the potential effects would be to induce thermal stress in hot equipment.

(Slide)

Our action plan for resolving this issue is basically that we are performing a revised analysis to access potential for weirwall overflow and that the new analysis will consider any significant factors which could aggravate such a thing.

In addition, we are providing to the NRC details of the interface document which controls design of the weirwall with respect to those issues.

(Slide)

Basically the original plants specific design analysis considered only suppression pool and containment upper pool level high levels and the results were satisfactory. A revised plant specific design analysis will consider high levels for both pools and maximum drywell negative pressure and the effect of any encroachment in the suppression pool.

That was the relevance of what we had mentioned earlier that the tip station encroachment is a hollow steel that extends into the pool has vent holes at the bottom and near the top which would enable that to fill.

(Slide)

The next major issue is operational control for drywell to containment differential pressure and the hydrodynamic loads are defined assuming equal levels in the drywell wier annulus and the suppression pool. And the tech specs permit elevation differences between the pools.

The potential effects are that we could change the vent clearing load definition.

(Slide)

Our action plan for resolving this item is that we will define maximum possible differences between the weir annulus and the suppression pool levels and evaluate changes in the hydrodynamic loads which might result from maximum possible differences.

(Slide)

Some additional technical information on that analysis is that we will be using DBA main steamline break which produced controlling hydrodynamic loads in that the existing analysis using M3CPT to be rerun with maximum level differences provided by specifying drywell and containment initial pressures.

The output from the analysis will be basically a new vent clearing velocity, a new velocity field in the pool and a new submerged structure loads using the new velocity profile.

And those new submerged structure load will be compared agains the loads calculated by absolute bubble pressure.

(Slide)

Containment spray backflow is the next issue.

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The concern is that if you have a check valve failure in the LPCI lines that it can lead to vessel leakage to the containment atmosphere through the spray headers during the switch over from LPCI mode to containment spray mode of the of RHR system.

And the potential effects would be to change the containment pressure response.

(Slide)

The action plan for handling this issue will be to quantify the maximum backflow which can occur and assess associated effects on the containment response and evaluate possibility of adding interlock to prevent simultaneious actuation of these valves at the first refueling outage.

The concern basically is that you could be operating running through your RHR pump, your heat exchangers and in through your injection valve that when you get a signal to open the containment spray valve and close the injection valve that this opens simultaneously as this closes that if this check valve were allowing backflow or substantial leakage that you could in fact then have flowout into the spray gutters.

(Slide)

The next major category of issues is the effect of suppression pool level on temperature measurements. The basic issue is that suppression pool temperature sensors may

10

be uncovered by post accident pool drawdown.

Potential effects arethat the operator could be mislead by erroneous information from uncovered sensors.

Basically our action plan on this issue is that we will revise our emergency procedures to require the operator to check pool level prior to reading the bulk pool temperature and we have a very substantial amount of information on pool level which is vital to that purpose.

DR. CATTON: How does the operator get the bulk pool temperature?

MR.HOBBS: By averaging a number of pool temperature readings.

DR. CATTON: So what he would do then is to check the level and ignore this one if --

MR. HOBBS: Yes, that's correct.

DR. CATTON: How many temperature measurements are there that he has to average?

MR. HOBBS: There's a good many. I don't know exactly. 24 and they're distributed circumferentially around the suppression pool.

DR. CATTON: Does he literally add them all up and divide by 24?

MR. HOBBS: During normal operation valves and the plant computer takes care of that.

DR. CATTON: Can he tell the computer to ignore the thermal couple number 24?

MR. HOBBS: I don't think so.

DR. CATTON: He essentially then would have to add 23 and divide by 23.

MR. HOBBS: Well, you --

DR. CATTON: I'm just curious.

MR. HOBBS: When the pool level drops, it will simultaneously uncover more than one. There are several at one level and several more at another level and several more below that.

(Slide)

Major issue number 19 is the effects of chugging from local --

DR. EBERSOLE: Do these level devices and thermal devices survive the mechanical effects of all this dynamic discharge and so forth?

MR. HOBBS: Yes, sir.

DR. EBERSOLE: With what sort of mechanical margins do you put on the strength of those?

MR. HOBBS: We're not prepared to answer that right now. We can get you an answer.

DR. EBERSOLE: I'm just interested in the survivability of all of this instrumentation you say is going to work.

MR.HOBBS: The instruments that are used post accident are designed to withstand this and I can't give you the details today, but we can get them for you.

DR. EBERSOLE: Sounds like it might be in a rather active environment. I think I would have to agree with that.

MR. HOBBS: Major issue number 19 is the effects of chugging from local encroachments and additional submergence.

The basic issue is that structures located at or above the suppression pool surface will cause chugging to be locally different from that described in GESSAR used for design.

The potential effects are possible higher chug loads on the pool boundaries. Basically there would be submerged structures, vents, the basemat, the containment walls.

(Slide)

Our actual plan for resolving this issue --

DR. CATTON: Was that sentence written correctly on the previous slide? Are you talking about structures of both the suppression pool surface?

MR.HOBBS: Yes. Basically, in our case in the -- the question is that as chugging occurs that if you have an encroached region where you have a longer distance to a pre-surface and you have basically increased impedence because of the increased distance that could you then get higher bubble pressures and worse chugging effects.

DR. CATTON: Go ahead.

MR. HOBBS: Is that fairly clear?

DR. CATTON: I think it was above the suppression, but you could out of hand ignore it.

MR. HOBBS: Well, if it's above. All right.

DR. CATTON: And if it were just touching, you could probably out of hand ignore it. Anyway, go ahead.

MR. HOBBS: If it extends into the pool, we would be looking at it. We would like to ignore it.

MR. MCINTRYE: Dr. Catton, I think it should just say at the pool level.

DR. CATTON: That would be better. Above implies that you're --

MR. HOBBS: I have to agree, I think the wording is --

MR. MCINTRYE: We're duplicating the words for the use of the slide. Just at pool level.

MR.HOBBS: Our action plan for resolving this issue is that we will submit information showing that chugging is more dependent on mass flux than on the distance to the presurface and we will quantify to the maximum extent possible the inertial inpedance effects on chugging loads and we'll evaluate the adequacy of available models for predicting the impact of longer acoustic paths on load definition.

(Slide)

We have a little bit of additional information on this one. Basically we intend to show the chug impulse with encroachments is no worse than the unencroached case.

That there is higher clearing inertia, slower vent clearing beneath the encroachment. We don't expect the steam bubble to be any larger and we don't expect the chug impulse to be any larger.

We will show that the acoustic chug pulse transmission is essentially unchanged and we'll be making use of the pool acoustic model and we will attempt to evalute 3-D effects.

(Slide)

The last issue was lateral loads during drywall negative pressure transient. Basically, we would rather not discuss that. We think the Nuclear Regulatory Commission feels that we have a sufficiently conservative appoarch that we don't need to do additional work on that.

That concludes my presentation unless there are any questions.

DR. PLESSET: Are there any more questions?

DR. ZUDANS: Could I ask one?

DR. PLESSET: Well, maybe one, yes.

DR. ZUDANS: When your computer code calculated the blowdown, what does it assume that the steam comes out of the break and then it expands to the one in the containment or to the drywall or what?

How is it done?

MR. MCINTYRE: Our codes basically do not make an assumption of what happens to the steam immediately when it comes out of the break. The codes do a mass energy balance of the air steam mixture in the drywell at any time so that you take the breakflow rate at the vent valve according to the vessel pressure and the quality coming out and add that mass and energy to the drywell contents and then you go into a thermodynamic module which evaluates the pressure and temperature from the end valve and --

DR. ZUDANS: Let's assume that every pound of steam that comes out of the break instantly occupies the entire volume of the drywell.

MR. MCINTYRE: That's correct, yes. It's a thermodynamic equilibrium.

DR. ZUDANS: Under those conditions your calculations should show whether it's physically possible or not, depending on the break size to achieve the situation. I asked the question before: 2PSIG verses 330°.

MR.MCINTRYRE: That's correct. In general in a small break case so long as the reactor -- as long as the breakflow remains saturated steam from the vessel, the steam will super heat and the codes do account for that.

DR. ZUDANS: So it could build up to 330°.

DR. PLESSET: Any other questions?

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Thank you again for your patience and effectiveness.

I think this completes our agenda for today and we'll continue tomorrow with a presentation from General Electric from the NSSS/Architect Engineer interface.

We'll have a summary from Dr. Sherwood.

Mr. Humphrey will make some brief remarks and then we'll have some presentations from Illinois and Cleveland Electric.

So, with that, let's recess until tomorrow.

(Whereupon, at 4:30 p.m., the hearing was recessed until tomorrow.)

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

Nuclear Regulatory Commission

in the matter of: ACRS Subcommittee Meeting on Fluid Dynamics

Date of Proceeding: July 29, 1982

Docket Number:

Place of Proceeding: San Jose, California

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

Deborah Easley

Official Reporter (Typed)

Deborah Easley (Bmm)

Official Reporter (Signature)

HUMPHREY ENGINEERING, INC.
BWR CONTAINMENT DESIGN AND ANALYSIS

OVERVIEW PRESENTATION

OF

POTENTIAL MARK III CONTAINMENT INTERFACE ISSUES

FOR

ACRS FLUID DYNAMIC SUBCOMMITTEE MEETING

JULY 29, 1982

JOHN M. HUMPHREY

A.M. session

JMH 7/29/82

MARK III INTERFACE ISSUES

- BACKGROUND
  - MARK I PROGRAM
  - MARK III DESIGN
- ORGANIZATION
- OVERALL ASSESSMENT

JMH 7/29/82

MARK I PROGRAM EXPERIENCE

- HISTORY HAS SHOWN THE MARK Is ARE RELIABLE PLANTS

- MANY CONTAINMENT INTERFACES WERE MISSED IN THE ORIGINAL DESIGN

  ⟶ MARK I PROGRAM

- MARK I OWNERS SPENT SEVERAL YEARS WORKING WITH THE NRC TO REEVALUATE THE ADDITIONAL CONTAINMENT INTERFACES

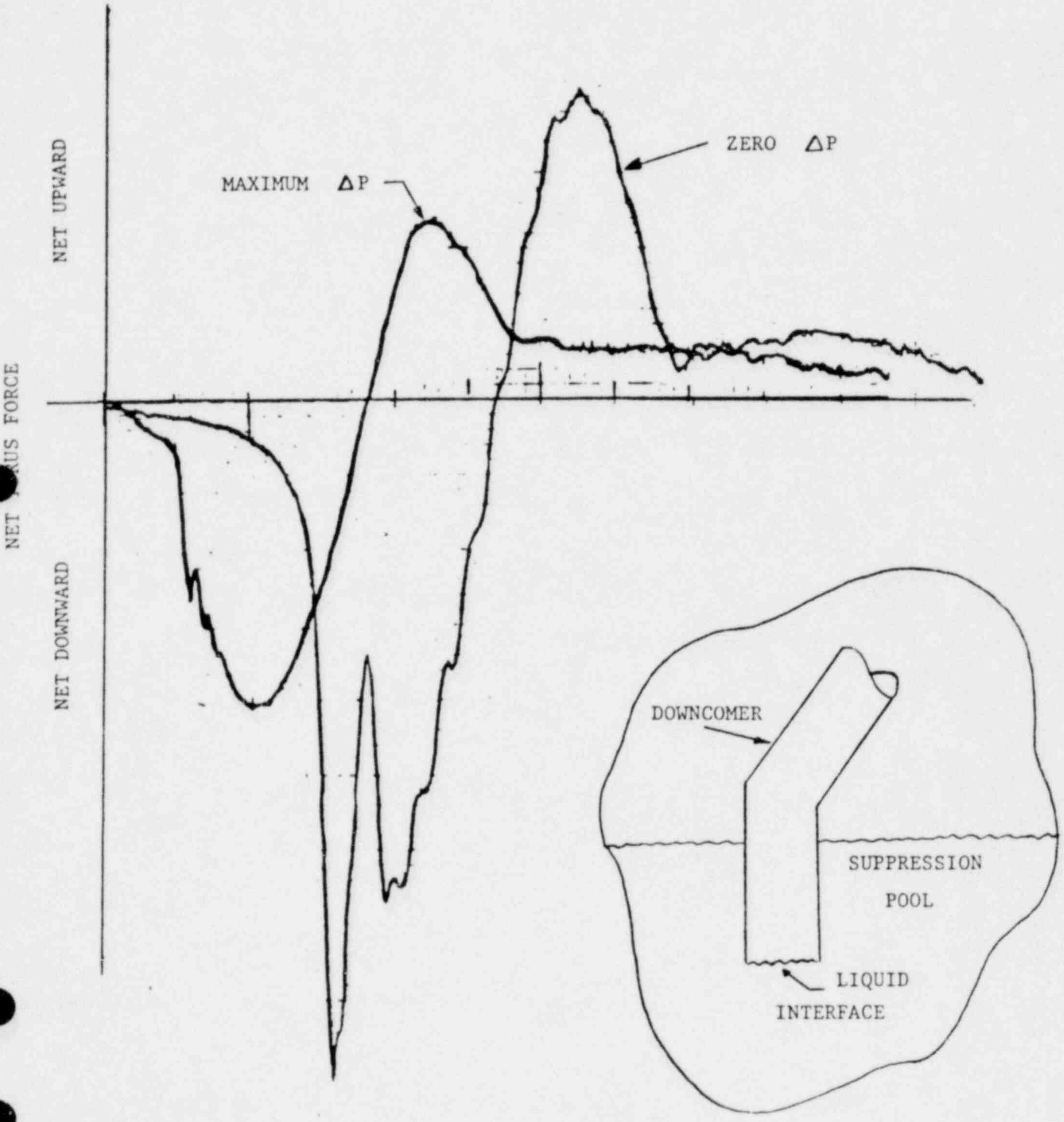
- THE MARK I PROGRAM SUCCESSFULLY RESOLVED ALL OUTSTANDING ISSUES

- HOWEVER OPERATING PLANT STATUS
  - LIMITED DESIGN OPTIONS
  - INCREASED PROGRAM COST

- LESSON LEARNED: DILIGENTLY PURSUE EARLY UNDERSTANDING AND RESOLUTION OF ALL POTENTIAL DESIGN INTERFACE ISSUES

JHM 7/22/82

EFFECT OF DRYWELL TO WETWELL PRESSURE DIFFERENTIAL (ΔP) ON MARK I POOL SWELL LOADS



JMH 7/29/82

CONTAINMENT LSE EXPERIENCE ON MARK III

- MARK III/BWR-6 IS FUNDAMENTALLY AN EXCELLENT PRODUCT SUPPORTED BY EXTENSIVE TESTING AND ANALYSIS

- MARK III IS A SIGNIFICANT EVOLUTION IN BWR CONTAINMENT DESIGN
  - DRYWELL INSIDE PRIMARY CONTAINMENT
  - MAIN VENTS AND SRV LINES ENCASED IN CONCRETE
  - LARGE CONTAINMENT VOLUME

- THE MARK III CONTAINMENT SYSTEM HAS MANY MORE INTERFACES BETWEEN THE GE-NSSS AND THE CUSTOMER/AE THAN MARK I

- GE/INDUSTRY INTERFACE ON MARK III PRIMARILY VIA GESSAR AND TVA-STRIDE DESIGN

JMH 7/29/82

TVA-STRIDE CONTAINMENT ISSUES

- TVA-STRIDE FSAR WORK IDENTIFIED MANY UNRESOLVED CONTAINMENT ISSUES
    - DESIGN FEATURES OR CHANGES WITH UNIDENTIFIED INTERFACES
    - CARRYOVER OF MARK I AND MARK II ANALYSIS ASSUMPTIONS
    - INCOMPLETE FEEDBACK ON TECH SPEC OR OPERATING PROCEDURE INTERFACES
    - DISCONNECTS BETWEEN GE AND CUSTOMER/AE
- AS CONTAINMENT LSE, I HELPED IDENTIFY CONTAINMENT ISSUES AND INITIATE WORK ON STRIDE TO EVALUATE AND RESOLVE THEM
- TVA-STRIDE CANCELLATION TERMINATED MOST OF THE WORK ON MARK III ISSUES

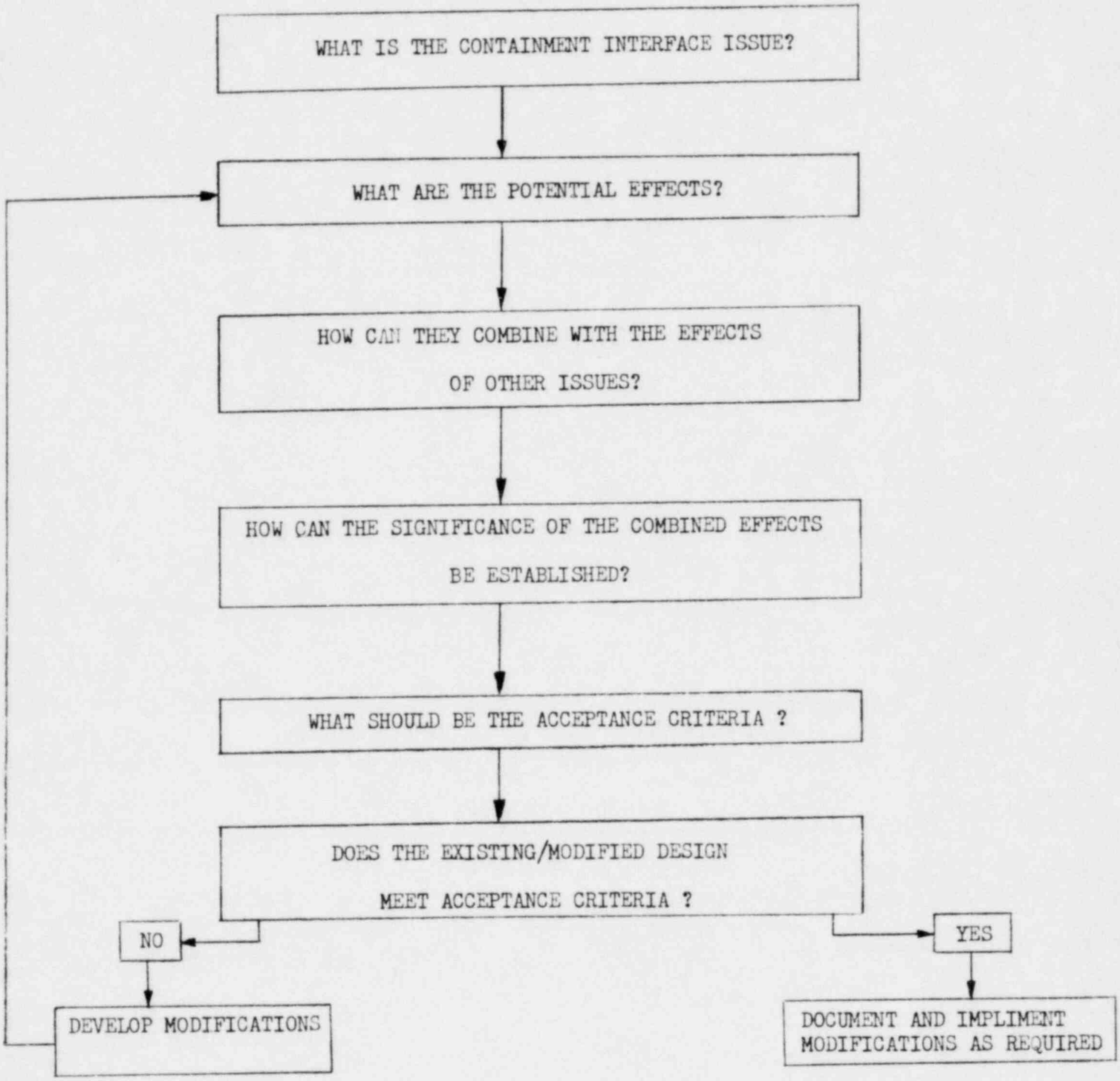
JMH 7/29/82

NEAR TERM OBJECTIVES

- UNDERSTAND AND EVALUATE ALL MARK III CONTAINMENT INTERFACE ISSUES
- AVOID UNEXPECTED PLANT EVENTS
- MINIMIZE IMPACT ON PLANT STARTUP AND OPERATION
- PROVIDE MAXIMUM FLEXIBILITY FOR RESOLUTION OF INTERFACE ISSUES

JMH 7/22/82

CONTAINMENT INTERFACE ISSUE EVALUATION FLOW CHART



REV 0, 7/16/82
PAGE 1 OF 2

HUMPHREY ENGINEERING, INC.
BWR CONTAINMENT DESIGN AND ANALYSIS

PRELIMINARY MATRIX OF MARK III CONTAINMENT INTERFACE ISSUES
AND THEIR POTENTIAL EFFECTS

		POTENTIAL EFFECTS										
REF 1	CONTAINMENT INTERFACE ISSUES	POOL SWELL LOADS	DRYWELL FLOODING	POOL TEMPERATURE RESPONSE	OTHER CONTAINMENT LOADS	CONTAINMENT TEMPERATURE	CONTAINMENT PRESSURE	DRYWELL TEMPERATURE	HYDROGEN CONTROL	CONTAINMENT NEGATIVE PRESSURE	OTHER NUCLEAR ISLAND EFFECTS	DRYWELL LEAKAGE CAPABILITY
1.0	LOCAL POOL ENCROACHMENTS (D)	1.1 -1.5	X	X	19.2				X			
1.0	NON-UNIFORM HCU VENTING (D)				1.6& 1.7		X					
2.0	SRVDL SLEEVE FLOW (D)	X		X	2.1- 2.3							
3.0	ECCS RELIEF LINES (D)			3.6	3.1-3.5 & 3.7							
4.1	DRYWELL POOL MIXING (A)			4.1								
4.2	EPG VESSEL LEVEL CONTROL (P) VS CONTINUOUS BREAK FLOW (A)			X	X	X	9.1 9.2	X				
4.3	UNIFORM POOL TEMPERATURE (A)			4.3		4.4 7.1	4.4 7.1					
4.7,4.10	RHR SUCTION/DISCHARGE (D)			X	X	X	X					
4.6	POOL = SERVICE WATER TEMP (A)										X	
4.8 4.9 13.0 14.0 15.0	CONTAINMENT SPRAY (D) SPRAY CYCLING (P) TWO LOOP OPERATION (D) RPV BACKFLOW (D) PLENUM RESPONSE (D)			4.5 4.9 13		X X X	 X			X X 13	 X X 15	
5.1	DRYWELL LEAKAGE USING SBA (A)											5.1
	NO DRYWELL LEAKAGE (A) VS ALLOWABLE TECH SPEC VALUE (P)			5.3		5.5	5.2 5.6	5.8	5.4		X	
	EARLY CGCS OPERATION (P) VS NO CGCS OPERATION FOR FSAR(A)			X		6.3 6.5	X		6.2	X		
7.2	EVAPORATIVE POOL MODEL (A)					7.2	X					
7.3	SHORT TERM EQUILIBRIUM (A)						X					

REV 0, 7/16/82
PAGE 2 OF 2

HUMPHREY ENGINEERING, INC.
BWR CONTAINMENT DESIGN AND ANALYSIS

PRELIMINARY MATRIX OF MARK III CONTAINMENT INTERFACE ISSUES AND THEIR POTENTIAL EFFECTS (CONTINUED)

REF 1	CONTAINMENT INTERFACE ISSUES	POOL SWELL LOADS	DRYWELL FLOODING	POOL TEMPERATURE RESPONSE	OTHER CONTAINMENT LOADS	CONTAINMENT TEMPERATURE	CONTAINMENT PRESSURE	DRYWELL TEMPERATURE	HYDROGEN CONTROL	CONTAINMENT NEGATIVE PRESSURE	OTHER NUCLEAR ISLAND EFFECTS
8.0	CONTAINMENT AIR MASS (P)	X		X			8.1	8.3	X	8.2 8.4	
9.3	IBA, SBA AND TRANSIENTS (A)			X		X	X			X	
12.0	UPPER POOL DUMP (D & P)		10.1 10.2	4.5	17 19.1	X	X		5.7	X	
	LOCA SEAL IN (D)			12		12	12				
	NO MAX UPPER POOL VOLUME(P)		X						X		
	VESSEL LEVEL CYCLING (D)		X								
11.0	VACUUM BREAKER CONTROL OF ΔP(D)	11.0	10.1		X						
16.0	SPTMS SENSOR UNCOVERY (D)			X	X	X	X				
18.0	INSULATION DEBRIS EFFECTS (D)			18.2	18.1						
20.0	DESIGN DRYWELL REFLOOD(D)				X				X		
21.0	BACKUP PURGE MAKEUP AIR(D)								X	X	

REFERENCE 1: ATTACHMENT TWO, LETTER J.P. MC GAUGHY, MP&L TO HAROLD R. DENTON, USNRC JUNE 8, 1982.

(D) = DESIGN FEATURE
(A) = ANALYSIS ASSUMPTION
(P) = TECH SPEC OR OPERATING PROCEDURE

JMH 7/29/82

CONTAINMENT ISSUE/EFFECT CATEGORIZATION

- BY SOURCE
  - DESIGN FEATURE
  - ANALYSIS ASSUMPTION
  - TECH SPEC OR OPERATING PROCEDURE
- BY MAJOR CATEGORY
  - POOL ENCROACHMENTS
  - ADDITIONAL STEAM DISCHARGE PATHS
  - SUPPRESSION POOL TEMPERATURE RESPONSE
  - DRYWELL LEAKAGE
  - CONTAINMENT PRESSURE RESPONSE
  - UPPER POOL DUMP

JMH 7/29/82

OVERALL ASSESSMENT

- DISCONCERTING THAT SO MANY MARK III OPEN ISSUES EXIST THIS LATE IN IN THE PRODUCT CYCLE
- NONE APPEAR TO THREATEN THE FUNDAMENTAL BASIS OF THE MARK III DESIGN
- ALL SHOULD BE RESOLVABLE VIA OPERATING PROCEDURE OR MINOR DESIGN MODIFICATIONS
- THESE ISSUES ARE DIRECTED AT MARK III WITH LITTLE EXPECTED IMPACT ON MARK I.

ACRS FLUID
DYNAMIC SUBCOMMITTEE
MEETING

HUMPHREY CONCERNS
ON
BWR CONTAINMENTS

JULY 29 - 30, 1982

MEETING OBJECTIVES

- STATUS OF REVIEWS
- COVERS: MARK Is, IIs, AND IIIs
- EMPHASIS ON GRAND GULF
- SAFETY SIGNIFICANCE OF CONCERNS

AGENDA

JULY 29, 1982

I. SUBCOMMITTEE INTRODUCTION - M. PLESSET, CHAIRMAN 8:30 AM

II. COMMENTS BY J. HUMPHREY 8:45 AM

III. NRC PRESENTATIONS 9:30 AM

A. INTRODUCTION

1. BACKGROUND

2. PROBLEM DEFINITION

**** BREAK **** 10:15 AM

B. DESCRIPTION AND RESOLUTION APPROACH 10:30 AM

1. APPLICATION TO CONTAINMENT TYPE (MARK I - III)

2. APPROACH FOR RESOLUTION

3. SCHEDULE

**** LUNCH **** 11:30 - 12:30 PM

C. NRC OVERVIEW OF SPECIFIC CONCERNS 12:30 PM

**** BREAK **** 2:30 PM

IV. MISSISSIPPI POWER AND LIGHT PRESENTATION (GRAND GULF) 2:45 PM

A. INTRODUCTION

B. DETAILED ACTION PLAN

**** RECESS **** 5:00 PM

JULY 30, 1982

V. RECONVENE 8:30 AM

VI. GENERAL ELECTRIC PRESENTATION 8:35 AM

- GESSAR II/STRIDE CONTAINMENT DESIGN

**** BREAK **** 10:30 AM

VII. NSSS/AE INTERFACE 10:45 AM

A. GRAND GULF PLANT - MP&L/BECHTEL/GE

B. STRIDE - GE

VIII. ILLINOIS POWER COMPANY PRESENTATION (CLINTON) 11:45 AM

**** LUNCH **** 12:15 - 1:15 PM

IX. CLEVELAND ELECTRIC ILLUMINATING COMPANY PRESENTATION (PERRY) 1:15 PM

X. J. HUMPHREY REMARKS 1:45 PM

XI. DISCUSSION AND ADJOURN 2:45 PM

ACRS MEETING CHRONOLOGY

DATE	SUBJECT
SEPTEMBER 25 - 26, 1981	MARK III HYDRODYNAMIC LOADS EVALUATION
OCTOBER 15, 1981	GRAND GULF FULL COMMITTEE
JANUARY 22, 1982	MARK I, II, AND III CURRENT STATUS

MILESTONES FOR MARK III HYDRODYNAMIC LOAD DEFINITION

- 3/82 DRAFT ACCEPTANCE CRITERIA COMPLETED
- 8/82 ISSUE DRAFT EVALUATION REPORT
- 12/82 ISSUE NUREG REPORT
- 3/82 REVIEW COMPLETED FOR GRAND GULF

HUMPHREY RELATED MILESTONES

MAY 13	TELECON: INITIAL CONTACT BETWEEN NRC - HUMPHREY
MAY 17	MP&L - HUMPHREY: MEETING IDENTIFYING CONCERNS
MAY 27	NRC - MP&L - HUMPHREY MEETING
MAY 28	MP&L SUBMITTAL ADDRESSING HUMPHREY CONCERNS
JUNE 21	BOARD NOTIFICATION ON MARK I. & II
JULY 7	NRC REQUESTS ADDITIONAL INFORMATION FROM MP&L
JULY 5-15	LETTERS TO MARK II UTILITIES
JULY 15	LETTER TO MARK I OWNERS GROUP
JULY 15	MP&L SUBMITS ACTION PLAN
JULY 22	MEETING BETWEEN HUMPHREY AND MARK I, II & III OWNERS

NRC REVIEW PHILOSOPHY

- IDENTIFY IMPORTANT PHENOMONA
- ASSESS IMPORTANT IN RELATION TO DESIGN
- DEPTH OF REVIEW DEPENDENT ON PERCEIVED IMPORTANCE

EX: SUPPRESSION POOL TEMPERATURE STRATIFICATION EFFECT ON CONTAINMENT PRESSURE

  - ORIGINAL ANALYSIS IGNORED HEAT SINKS AND ASSUMED THERMAL EQUILIBRIUM
  - STAFF CONCLUDED THESE CONSERVATISMS BOUNDED THE STRATIFICATION EFFECT

SUMMARY OF MR. HUMPHREY'S CONCERNS

- 22 CONCERNS
- 68 INDIVIDUAL COMMENTS
- 6 MAJOR CATEGORIES
  - POOL DYNAMIC LOADS
  - USE OF ALL PHENOMENA IN DBA CALCULATIONS
  - VALIDITY OF USING BULK CONDITONS IN DBA CALCULATIONS
  - INTERFACE ISSUES
  - INCORPORATION OF DBA ANALYSIS IN EMERGENCY PROCEDURES
  - TECHNICAL SPECIFICATION VALUES VS. ANALYTICAL ASSUMPTIONS

SCHEDULED RESPONSES TO THE STAFF'S REQUEST FOR ADDITIONAL INFORMATION

REGARDING THE HUMPHREY CONCERNS

PLANT	DOCKET NO.	CONTAINMENT TYPE	PROGRAM SUBMITTAL	EVALUATION COMPLETED
Shoreham	50-322	MARK II	07/28/82	10/82
Fermi - 2	50-341	MARK I	07/30/82	09/30/82
Limerick	50-352/353	MARK II	07/30/82	10/82
Hope Creek	50-354/355	MARK I	[1]	[1]
Zimmer	50-358	MARK II	07/21/82	10/82
La Salle	50-373/374	MARK II	07/09/82	09/01/82
Susquehanna	50-387/388	MARK II	11/82	Not known
WNP-2	50-397	MARK II	07/23/82	09/23/82
Nine Mile Pt. 2	50-410	MARK II	[1]	[1]
Grand Gulf	50-416/417	MARK III	07/16/82	08/19/82 [2]
rry	50-440/441	MARK III	Not known	Not known
GESSAR II FDA	STN 50-447	MARK III	08/13/82	11/82
River Bend	50-458/459	MARK III	Not known	Not known
Clinton	50-461/462	MARK III	Not known	Not known
Skagit/Hanford	50-522/523	MARK III	[1]	[1]

[2] More important aspects of Humphrey concerns to be addressed first with balance to be addressed by 11/82.

[1] Information not specifically requested by NRC; will be addressed during either CP or OL review.

ACRS FLUID
DYNAMICS SUBCOMMITTEE
MEETING

HUMPHREY ISSUES:
APPLICABILITY AND RESOLUTION APPROACH

JULY 29, 1982

APPLICABILITY OF HUMPHREY CONCERNS TO MARK Is, IIs, AND IIIs

- SIMILARITY OF BWRs - PRESSURE - SUPPRESSION CONCEPT
- SOME ISSUES NOT APPLICABLE TO ALL CONTAINMENT TYPES

  (E. G., UPPER POOL DUMP)
- ISSUE IMPORTANCE WILL VARY FOR Is, IIs, AND IIIs
- SPECIFIC APPLICABILITY OF ISSUES DETAILED IN LATER PRESENTATION

APPROACH TO RESOLUTION

MARK Is

- DISCUSS ISSUE GENERICALLY WITH MARK I OWNERS GROUP
- PRELIMINARY RESPONSE: GENERIC APPROACH
- ISSUE EVALUATION REPORT

MARK IIs

- DISCUSS WITH MARK II OWNERS GROUP AND INDIVIDUAL UTILITIES
- PRELIMINARY RESPONSE: PLANT SPECIFIC EXCEPT RHR ISSUE
- RESPOND ON INDIVIDUAL PLANT DOCKETS

MARK IIIs

A) GRAND GULF

- PLANT UNIQUE CONSIDERATIONS
- ACTION PLAN - INDEPENDENT APPROACH
- FURTHER ANALYSIS/TESTING TO CONFIRM RESULTS, IF NECESSARY
- PARTICIPATION IN PEER REVIEW GROUP

B) STRIDE/OTHER MARK IIIs

- INCORPORATE RESULTS OF GRAND GULF REVIEW
- PARTICIPATION IN PEER REVIEW GROUP
- LONG TERM ANALYSIS/TESTING, IF NECESSARY

RESOLUTION SCHEDULE

MARK Is

- 7/15/82 - LETTER TO MARK I OWNERS GROUP
- 7/30/82 RECEIVE PROPOSED SCHEDULE FOR RESOLUTION

MARK IIs

- 7/5 - 15/82 - LETTER TO MARK II UTILITIES
- EVALUATION TIED TO PLANT LICENSING SCHEDULE

GRAND GULF

- SUFFICIENT JUSTIFICATION EXISTS FOR LOW POWER LICENSE
- 7/15/82 - ACTION PLAN
- 8/19/82 - MP&L SUBMITTAL PROVIDING JUSTIFICATION FOR FULL POWER LICENSE
- 10/1/82 - REFINED ANALYSIS ON SELECTED ISSUES
- 11/1/82 - REFINED ANALYSIS ON REMAINING ISSUES

STRIDE/OTHER MARK IIIs

- SCHEDULE FOR RESOLUTION UNDER DEVELOPMENT
- PRELIMINARY INDICATION: GENERIC EVALUATION REPORT WILL FOLLOW GRAND GULF PROGRAM

PRELIMINARY EVALUATION

MARK Is AND IIs

- EVALUATION PROCESS STARTED WITH MAY 27, 1982 MEETING
- PRELIMINARY EVALUATION HAS NOT RESULTED IN ANY NEW SAFETY CONCERNS

MARK IIIs

- EVALUATION PROCESS BEGAN WITH MAY 17 MEETING BETWEEN HUMPHREY AND MP&L
- EVALUATIONS PERFORMED TO DATE FOR GRAND GULF HAVE NOT UNCOVERED ANY MAJOR SAFETY CONCERNS FOR MARK IIIs

LICENSING STAGE OF BWRs

MARK Is - HOPE CREEK 1 AND 2 - POST-CP
FERMI 2 - OL
REST OF MARK Is - OPERATING

MARK IIs - LASALLE - 5% POWER LICENCE
NINE MILE POINT 2 - POST-CP
REST OF MARK IIs - OL

MARK IIIs - GRAND GULF - 5% POWER LICENSE
CLINTON, PERRY, RIVER BEND - OL
ALLENS CREEK, SKAGIT/HANFORD - CP
REST OF MARK IIIs - POST-CP

ACRS FLUID

DYNAMICS SUBCOMMITTEE MEETING

OVERVIEW OF MR. HUMPHREY'S CONCERNS

JULY 29, 1982

pm Session

PRESENTATION APPROACH

GROUP HUMPHREY CONCERNS INTO COMMON TECHNICAL AREAS

APPLICABILITY OF AREA TO THE DIFFERENT CONTAINMENT DESIGNS

DISCUSS PREVIOUS NRC REVIEW APPROACH.

PROVIDE CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

EMPHASIS ON GRAND GULF.

REMAINING INFORMATION NEEDED TO APPROVE GRAND GULF FULL POWER LICENSE

- PROVIDE AND JUSTIFY IMPORTANT ASSUMPTIONS TO BE USED IN LONG-TERM DETAILED ANALYSIS

- ANY PRELIMINARY RESULTS OF LONG-TERM STUDY

- COMPLETE DISCUSSION OF HOW RESULTS IN MP&L's MAY 28 SUBMITTAL WERE ARRIVED AT

- EMPHASIS ON ENCROACHMENT ISSUE
  1) PROVIDE AS MUCH JUSTIFICATION AS POSSIBLE
  2) DEVELOP COMPREHENSIVE ANALYTICAL/TEST PROGRAM TO ACCURATELY DEFINE THIS PHENOMENON

- COMMITMENT TO FOLLOWING TEST PROGRAMS IF STAFF JUDGES THAT SUFFICIENT MARGIN NOT DEMONSTRATED BY ANALYSIS:

  1) POOL THERMAL MIXING CAPABILITY OF RHR SYSTEM IN CONJUNCTION WITH SRV TESTS

  2) SUBSCALE TESTING OF EFFECT OF ENCROACHMENTS ON POOL SHAPE, VELOCITY, LIGAMENT THICKNESS AND BREAKTHROUGH HEIGHT.

INDEX BETWEEN TECHNICAL AREAS AND MR. HUMPHREY'S CONCERNS

#	TECHNICAL AREA DESCRIPTION	COVERS HUMPHREY CONCERN(S)
1	LOCAL ENCROACHMENTS - HYDRODYNAMIC LOADS	1.1-1.5, 1.8, 19.2
2	NON-UNIFORM VENTING AT HCU FLOOR	1.6
3	PRESSURE DROPS ABOVE HCU FLOOR	1.7
4	SRV DISCHARGE LINE SLEEVE LOADS	2.1-2.4
5	ECCS RELIEF LINE DISCHARGE LOADS	3.1-3.7
6	ISOLATION OF WATER IN DRYWELL	4.1-4.2
7	BULK POOL TEMPERATURE IN DBA ANALYSIS	4.3-4.5, 7.1
8	ASPECTS OF THE RHR SYSTEM	4.5 (PART), 4.6-4.10, 5.3, 14
9	STEAM BYPASS	5.1-5.2, 5.5, 5.8, 9.2
10	HYDROGEN CONTROL SYSTEM	5.4, 6.2-6.5
11	UPPER POOL DUMP	5.6-5.7, 10.1-10.2, 12, 19.1
12	EMERGENCY PROCEDURE GUIDELINES	6.1, 17, 22
13	CONTAINMENT ATMOSPHERE RESPONSE	7.2-7.3, 9.1
14	TECH. SPECS. VS DBA ASSUMPTIONS	8.1, 8.3, 11
15	CONTAINMENT NEGATIVE PRESSURE	8.2, 8.4, 13
16	TREATMENT OF SRV ACCIDENTS AND SBAs	9.3
17	SECONDARY CONTAINMENT NEGATIVE PRESSURE	15
18	POOL TEMPERATURE SENSER LOCATIONS	1.6
19	INSULATION DEBRIS	18.1-18.2
20	DRYWELL REFLOOD LOADS	20
21	BACKUP H_2 PURGE	21

AREA #1 EFFECT OF LOCAL ENCROACHMENTS ON HYDRODYNAMIC LOADS

(1.1-1.5, 1.8, 19.2)

- VELOCITY
- BREAKTHROUGH HEIGHT
- SUBMERGED STRUCTURE LOADS
- POOL THERMAL STRATIFICATION

APPLICABILITY

MARK IIIs ONLY

PROVIOUS NRC REVIEW APPROACH

- ASSUMED ENCROACHMENTS WOULD MITIGATE POOL SWELL LOADS
- DETAILED REVIEW NOT PERFORMED

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

GRAND GULF

- CURRENT DESIGN PROBABLY ADEQUATE BECAUSE
  1) 60 FT/SEC
  2) ABSOLUTE BUBBLE PRESSURE
  3) HCU FLOOR HEIGHT
- HOWEVER, MORE JUSTIFICATION NEEDED

STRIDE/OTHER MARK IIIs

- MORE STUDY NEEDED BEFORE ASSESSMENT CAN BE MADE

AREA #2 NON-UNIFORM VENTING AT THE HCU FLOOR (1.6)

- LATERAL LOADS ON HCU FLOOR GRATINGS
- INCREASE IN LOCAL WETWELL PRESSURE

APPLICABILITY

MARK IIIs

PREVIOUS NRC REVIEW APPROACH

- JUDGED THAT LITTLE LATERAL MOVEMENT OF FROTH WOULD OCCUR
- DETAILED ANALYSIS NOT PERFORMED

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

- PRELIMINARY ANALYSIS INDICATED CONCERN SHOULD NOT BECOME A DESIGN ISSUE
- DETAILED ANALYSIS REQUIRED

AREA #3 PRESSURE DROPS THROUGH FLOORS ABOVE HCU FLOOR (1.7)

- NO SPECIFICATIONS PROVIDED IN STRIDE
- COULD AFFECT VENT CLEARING

APPLICABILITY

MARK IIIs ONLY

PREVIOUS NRC REVIEW APPROACH

- IDENTIFIED HCU FLOOR AS MOST RESTRICTIVE TO FLOW
- DID NOT REVIEW VENT AREAS OF OTHER FLOORS

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

- GRAND GULF
  - ALL FLOORS ABOVE HCU FLOOR HAVE GREATER OPEN AREA THAN HCU FLOOR
  - CONCERN IS NOT A SAFETY ISSUE

STRIDE/OTHER MARK IIIs

- EXPECT SAME ARRANGEMENT AS GRAND GULF
- CONCERN SHOULD NOT BECOME A DESIGN ISSUE

AREA #4 SAFETY RELIEF VALVE DISCHARGE LINE (SRVDL) SLEEVE LOADS (2.1-2.4)

- CO AND CHUGGING LOADS THROUGH SLEEVE
- MAY AFFECT SRVDL SUPPORTS AND SUBMERGED STRUCTURE DESIGN

APPLICABILITY

MARK IIIs ONLY

PREVIOUS NRC REVIEW APPROACH DID NOT CONSIDER THIS PHENOMENON

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

GRAND GULF

- PROPOSED SEALING OF SRVDL SLEEVES
- NO LONGER A SAFETY ISSUE

STRIDE/OTHER MARK IIIs

- COULD FOLLOW GRAND GULF'S APPROACH
- PRELIMINARY ANALYSIS DOES NOT PREDICT SIGNIFICANT LOADS
- FURTHER ANALYSIS IS REQUIRED

AREA #5 ECCS RELIEF LINES DISCHARGE LOADS (3.1-3.7)

- HYDRODYNAMIC LOADS
- LOADS ON RELIEF LINES
- EFFECT OF POOL LEVEL ON ECCS RELIEF LINE DISCHARGE
- COUPLED WITH DBA

APPLICABILITY

MARK Is, IIs AND IIIs

PREVIOUS NRC REVIEW APPROACH

- LOW FLOW RATES OF MOST ECCS RELIEF LINES MADE HYDRODYNAMIC LOADS INSIGNIFICANT
- RHR RELIEF LINE LOADS NOT QUANTIFIED
- RHR RELIEF LINE ACTUATION NOT PART OF ANY SAFETY ACTION
- EFFECT OF POOL LEVEL ON RELIEF LINE PERFORMANCE NOT EXPLICITLY ADDRESSED FOR MARK IIIs

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

GRAND GULF

- WILL NOT USE RHR SYSTEM IN STEAM CONDENSING MODE UNTIL LOADS ACCEPTED BY NRC
- OTHER ECCS RELIEF LINES PROBABLY PRODUCE INSIGNIFICANT HYDRODYNAMIC LOADS

STRIDE/OTHER MARK IIIs

- CAN FOLLOW SAME APPROACH AS GRAND GULF
- DETAILED ANALYSIS REQUIRED

AREA #5 (CONTINUED)

MARK IIs

- PRELIMINARY RESPONSE IS THAT THIS AREA IS NOT A SIGNIFICANT SAFETY PROBLEM
- DETAILED ANALYSIS REQUIRED

MARK I

- HAVE NOT DEVELOPED ASSESSMENT
- DETAILED ANALYSIS REQUIRED

AREA #6 ISOLATION OF DRYWELL POOL FROM SUPPRESSION POOL (4.1-4.2)

- OPERATOR MAY THROTTLE ECCS BEFORE DRYWELL POOL FLOWS OVER WEIR WALL
- RESULTS IN INCREASED SUPPRESSION POOL TEMPERATURE

APPLICABILITY

MARK Is, IIs AND IIIs

PREVIOUS NRC REVIEW APPROACH

- DID NOT CONSIDER THIS SCENARIO
- RELIED ON CONSERVATISMS IN CONTAINMENT MODEL TO ACCOUNT FOR UNCERTAINTIES IN POOL TEMPERATURES.

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

- PRELIMINARY ANALYSIS SHOWS Δ TEMP = 6°F
- SHOULD NOT BE A DESIGN ISSUE
- DETAILED ANALYSIS REQUIRED

MARK Is AND IIs

- VOLUME OF TRAPPED DRYWELL WATER NOT TOO LARGE
- EFFECT IS PROBABLY SMALL
- DETAILED ANALYSIS REQUIRED

AREA #7 USE OF BULK POOL TEMPERATURE IN DBA CALCULATIONS (4.3-4.5, 7.1)

- UPPER POOL DUMP OR CONTAINMENT SPRAY OPERATION MAY AGGRAVATE THERMAL STRATIFICATION
- RHR HEAT EXCHANGER EFFICIENCY MAY BE REDUCED
- CONTAINMENT TEMPERATURE/PRESSURE MAY BE AFFECTED

APPLICABILITY

MARK I, IIs AND IIIs

PREVIOUS NRC REVIEW APPROACH

- RECOGNIZED THERMAL STRATIFICATION COULD EXIST AND CALCULATED MAGNITUDE
- DID NOT INCLUDE IN CONTAINMENT RESPONSE ANALYSIS BECAUSE OF LARGE CONSERVATISMS IN MODEL
- DID NOT EXAMINE ALL POSSIBILITIES RAISED BY MR. HUMPHREY

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

- MARK IIIs
- MARGIN IN RHR HEAT EXCHANGERS AND CONTAINMENT RESPONSE MODEL SHOULD BE ADEQUATE TO COVER THERMAL STRATIFICATION
- SHOULD NOT RESULT IN A DESIGN ISSUE
- DETAILED ANALYSIS REQUIRED

MARK Is AND IIs

- MAGNITUDE OF CONCERN NOT EXPECTED TO EXCEED MARK III SITUATION
- DETAILED ANALYSIS REQUIRED

AREA #8 OPERATIONAL ASPECTS OF THE RHR SYSTEM (4.5 (PARTIAL), 4.6-4.10, 5.3, 14)

- EFFECT OF RHR DISCHARGE AND SUCTION ON POOL MIXING
- AMOUNT OF RHR USAGE AND CYCLING OF SPRAYS
- CONTAINMENT SPRAY EFFECT ON RHR HEAT EXCHANGER
- POSSIBILITY OF BACKFLOW THROUGH CONTAINMENT SPRAYS LINES

APPLICABILITY

MARK Is, IIs AND IIIs

PREVIOUS NRC REVIEW APPROACH

- REVIEW DID NOT UNCOVER ANY DESIGN DEFICIENCIES
- NOT ALL CONCERNS REVIEWED BY STAFF

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

MARK IIIs

PRELIMINARY INFORMATION INDICATES CONCERN SHOULD NOT BECOME A DESIGN ISSUE

- DETAILED ANALYSIS/TESTS REQUIRED

MARK Is AND IIs

SITUATION NOT EXPECTED TO BE WORSE THAN MARK IIIs

- DETAILED ANALYSIS REQUIRED

AREA #9 DRYWELL TO WETWELL STEAM BYPASS LEAKAGE (5.1-5.2, 5.5, 5.8, 9.2)

- FSAR DESIGN CASE (DBA) NOT LIMITING CASE
- BYPASS LEAKAGE NOT INCLUDED IN CONTAINMENT RESPONSE CALCULATION
- BYPASS LEAKAGE COULD CAUSE LOCALLY HIGH TEMPERATURES IN THE CONTAINMENT
- BYPASS LEAKAGE COULD RESULT IN HIGH TEMPERATURES IN DRYWELL WITHOUT 2 PSIG SCRAM
- BYPASS LEAKAGE COULD BE AGGRAVATED BY ECCS THROTTLING

APPLICABILITY

MARK Is, IIs AND IIIs

PREVIOUS NRC REVIEW APPROACH

- RELIED ON ESF CONTAINMENT SPRAYS TO ELIMINATE BYPASS STEAM
- CONSERVATISMS IN CALCULATION OF BYPASS LEAKAGE
- REVIEW DID NOT INCLUDE ALL OF MR. HUMPHREY'S CONCERNS

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

MARK IIIs

- PRELIMINARY INFORMATION INDICATES CONCERN SHOULD NOT BECOME A DESIGN ISSUE
- DETAILED ANALYSIS REQUIRED

MARK Is AND IIs

- SITUATION IS NOT EXPECTED TO BE WORSE THAN MARK IIIs

AREA #10 HYDROGEN CONTROL SYSTEM (5.4, 6.2-6.5)

- DRYWELL LEAKAGE OF HYDROGEN COULD BYPASS RECOMBINERS
- RECOMMENDED INTERLOCK TIES RECOMBINER OPERATION TO CONTAINMENT SPRAY OPERATION
- RECOMBINER OPERATION MAY CREATE LOCAL HIGH TEMPERATURES
- GE HYDROGEN ANALYZER INOPERABLE AT VOLUMETRIC STEAM CONCENTRATIONS $>$ 60%

APPLICABILITY

MARK Is, IIs AND IIIs

PREVIOUS NRC REVIEW APPROACH

- EXAMINED LOCATION OF RECOMBINERS OR H_2 SUCTION POINTS FOR EFFECTIVE RECOMBINATION
- OTHER CONCERNS NOT EXPLICITLY EXAMINED BY THE STAFF

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

GRAND GULF

- DESIGN DOES NOT INCLUDE INTERLOCK OR GE ANALYZER
- INFORMATION PROVIDED ON OTHER CONCERNS INDICATES THEY SHOULD NOT BE A DESIGN ISSUE
- DETAILED JUSTIFICATION REQUIRED

STRIDE/OTHER MARK IIIs

- WILL NEED INFORMATION ON INTERLOCK AND GE ANALYZER
- DETAILED JUSTIFICATION REQUIRED

AREA #10 (CONTINUED)

MARK Is

- MOST DO NOT HAVE RECOMBINERS
- PROBABLY NOT A DESIGN ISSUE

MARK IIs

- SITUATION SHOULD NOT BE ANY WORSE THAN MARK IIIs
- SHOULD NOT BECOME A DESIGN ISSUE

AREA #11 UPPER POOL DUMP (5.6-5.7, 10.1-10.2, 12, 19.1)

- LOW PRESSURE BYPASS TEST DOES NOT CONSIDER UPPER POOL DUMP
- HYDROGEN PURGE COMPREESSER OPERATION MUST CONSIDER UPPER POOL DUMP
- DRYWELL FLOOD COULD OCCUR FOLLOWING UPPER POOL DUMP
- UPPER POOL MAY NOT DUMP IF ACTIVATING SIGNAL DISAPPEARS
- UPPER POOL DUMP MAY AFFECT CHUGGING LOAD DEFINITION

APPLICABILITY

MARK IIIs

PREVIOUS NRC REVIEW APPROACH

- STAFF ASSUMED WATER TRAPPAGE INSIDE DRYWELL WOULD PREVENT POOL LEVEL FROM EXCEEDING PRE-ACCIDENT LEVELS
- OTHER CONCERNS NOT EXPLICITLY EXAMINED

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

GRAND GULF

- LICENSEE HAS PROVIDED SUFFICIENT INFORMATION TO INDICATE THAT THESE CONCERNS SHOULD NOT BE DESIGN ISSUES
- DETAILED JUSTIFICATION NECESSARY

STRIDE/OTHER MARK IIIs

- SIMILAR DESIGN TO GRAND GULF IN THIS ASPECT
- CONCERNS SHOULD NOT BE DESIGN ISSUES
- DETAILED JUSTIFICATION NECESSARY

AREA #12 EMERGENCY PROCEDURE GUIDELINES (EPG) (6.1, 17, 22)

- GE RECOMMENDATION TO INCLUDE H_2 CONTROL SYSTEM ACTIVATION ON LOW REACTOR WATER LEVEL NOT INCLUDED IN EPGs
- EPGs WOULD REQUIRE ADS ACTUATION WHEN IN SOME CASES ONE SRV IS ADEQUATE
- EPGs MAY CONFLICT WITH DBA CONDITIONS

APPLICABILITY

- MARK IIIs - ALL CONCERNS
- MARK Is AND IIs - PROBABLY ONLY THE LAST CONCERN

PREVIOUS NRC REVIEW APPROACH

- FIRST TWO CONCERNS BEYOND SCOPE OF NORMAL REVIEW
- EPGs ARE EXAMINED BY THE STAFF FOR POSSIBLE CONFLICTS

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

GRAND GULF

- SHOULD NOT BE A SIGNIFICANT SAFETY ISSUE BASED ON PRELIMINARY RESPONSE
- DETAILED JUSTIFICATION NEEDED ON LAST CONCERN

STRIDE/OTHER MARK IIIs

- BASED ON GRAND GULF RESPONSE, DO NOT EXPECT CONCERNS TO BE DESIGN ISSUES
- DETAILED JUSTIFICATION NEEDED ON LAST CONCERN

MARK Is AND IIs

- NORMAL REVIEW OF EPGs HAS NOT RESULTED IN ANY DESIGN ISSUES BEING CREATED
- DETAILED JUSTIFICATION NEEDED ON LAST CONCERN

AREA #13 CONTAINMENT ATMOSPHERE RESPONSE (7.2-7.3, 9.1)

- ENVIRONMENTAL PROFILE CONSIDERED HEAT TRANSFER FROM POOL TO ATMOSPHERE
- ADIABATIC COMPRESSION EFFECTS
- DRYWELL AIR CARRYOVER MAY NOT RETURN TO DRYWELL

APPLICABILITY

MARK Is, IIs, AND IIIs

PREVIOUS NRC REVIEW APPROACH

- DID NOT USE HEAT TRANSFER IN CONFIRMATORY ENVIRONMENTAL PROFILE ANALYSIS
- DID NOT CONSIDER ADIABATIC COMPRESSION OR NON-RETURN OF AIR TO DRYWELL

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

- PRELIMINARY INFORMATION INDICATES CONCERNS NOT A DESIGN ISSUE
- DETAILED ANALYSIS ON LAST CONCERN REQUIRED

MARK Is AND IIs

- ADIABATIC EFFECTS AND NON-RETURN OF DRYWELL AIR NEEDS TO BE EXAMINED BEFORE ASSESSMENT CAN BE MET

AREA #14 TECHNICAL SPECIFICATION (T.S.) LIMITS VS. DBA INITIAL CONDITIONS (3.1, 8-3, 11)

- DBA ANALYSIS ASSUMPTION MAY BE NON-CONSERVATIVE
- MAY LEAD TO TOP VENT UNCOVERING BEFORE 2 PSIG IN DRYWELL
- DRYWELL/WETWELL ΔP MAY AFFECT HYDRODYNAMIC LOADS

APPLICABILITY

MARK IIIs - ALL CONCERNS
MARK IIs - FIRST AND THIRD CONCERNS
MARK Is - FIRST AND SECOND CONCERNS

PREVIOUS NRC REVIEW APPROACH

- REQUIRED DBA ASSUMPTIONS TO BE CONSERVATIVE, NOT NECESSARILY T.S. VALUES
- REVIEW DID NOT ADDRESS ALL OF MR. HUMPHREY'S CONCERNS

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

- MARK IIIs
- PRELIMINARY INFORMATION ON CONSERVATISMS IN ANALYSIS AND REVIEW PHILOSOPHY INDICATES THAT THESE CONCERNS SHOULD NOT BECOME DESIGN ISSUES
- DETAILED ANALYSIS REQUIRED

- MARK Is AND IIs
- MAGNITUDE IS NOT EXPECTED TO EXCEED MARK III SITUATION
- DETAILED ANALYSIS REQUIRED

AREA #15 CONTAINMENT NEGATIVE PRESSURE (8.2, 8.4, 13)

- SPRAY INITIATION AT MINIMUM T.S. PRESSURE
- SPRAY INITIATION DURING LOW CONTAINMENT AIR MASS CONDITIONS
- BOTH SPRAY TRAINS ACTUATING SIMULTANEOUSLY

APPLICABILITY

MARK Is, IIs AND IIIs

PREVIOUS NRC REVIEW APPROACH

- DID NOT REQUIRE ABSOLUTE WORST CASE SITUATION FOR DESIGN

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

MARK IIIs

PRELIMINARY INFORMATION INDICATES CONCERNS PROBABLY NOT A DESIGN ISSUE

- DETAILED ANALYSIS REQUIRED

MARK Is AND IIs

- NOT EXPECTED TO EXCEED MARK III SITUATION
- PROBABLY NOT A DESIGN ISSUE
- DETAILED ANALYSIS REQUIRED

AREA #16 TREATMENT OF SRV ACCIDENTS AND SBAs (9.3)

- TREATED AS TRANSIENTS OR DBAs

APPLICABILITY

MARK IIIs

PREVIOUS NRC REVIEW APPROACH

- REQUIRED SRV ACCIDENTS AND SBAs TO BE EVALUATED USING LICENSING VALUES

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

- NOT A SIGNIFICANT SAFETY ISSUE
- QUESTION RESULTED FROM CONFUSING REMARKS MADE AT MAY 27 MEETING

AREA #17 SECONDARY CONTAINMENT NEGATIVE PRESSURE (15)

- CONTAINMENT VACUUM BREAKERS MAY CAUSE NEGATIVE PRESSURE IN SECONDARY CONTAINMENT

APPLICABILITY

BWRs UTILIZING CONTAINMENT VACUUM BREAKERS

PREVIOUS NRC REVIEW APPROACH

- ISSUE NOT EXAMINED

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

GRAND GULF

- NO CONTAINMENT VACUUM BREAKERS

BWR PLANTS WITH CONTAINMENT VACUUM BREAKERS

- NO ASSESSMENT AS OF YET
- CONDITIONS REQUIRED TO CREATE SEVERE NEGATIVE PRESSURE INSIDE CONTAINMENT UNLIKELY
- DETAILED ANALYSIS REQUIRED

AREA #18 SUPPRESSION POOL TEMPERATURE SENSOR LOCATIONS (16)

- SENSORS ABOVE A DRAWN-DOWN POOL MAY CONFUSE OPERATORS

APPLICABILITY

MARK Is, IIs AND IIIs

PREVIOUS NRC REVIEW APPROACH

- BEYOND NORMAL SCOPE OF REVIEW

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

- OPERATOR SHOULD HAVE SUFFICIENT INFORMATION TO MAKE CURRENT JUDGMENTS
- CONCERN SHOULD NOT RESULT IN A DESIGN ISSUE
- DETAILED JUSTIFICATION NEEDED

AREA #19 EFFECTS OF INSULATION DEBRIS (18.1, 18.2)

- INSULATION DEBRIS MAY BLOCK GRATING ABOVE WEIR WALL
- INSULATION DEBRIS MAY BLOCK ECCS SUCTION STRAINERS

APPLICABILITY

- MARK IIIs - BOTH CONCERNS
- MARK Is AND IIs - SECOND CONCERN

PREVIOUS NRC REVIEW APPROACH

- POTENTIAL FOR INSULATION DEBRIS BLOCKING ECCS SUCTION STRAINERS LOOKED AT EXTENSIVELY
- OTHER CONCERN NOT EXAMINED

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

GRAND GULF

- NO GRATING EXISTS OVER WEIR WALL
- STAFF HAS ACCEPTED MARK III ECCS SUCTION STRAINER DESIGNS WITH RESPECT TO DEBRIS CLOGGING THE INLETS

STRIDE/OTHER MARK IIIs

- WILL EXAMINE GRATINGS ABOVE WEIR WALL
- DO NOT EXPECT CONCERN TO BECOME DESIGN ISSUE

MARK Is AND IIs

- ECCS SUCTION STRAINERS ARE DESIGNED FOR LARGE AMOUNTS OF CLOGGING
- DO NOT EXPECT CONCERN TO BECOME A DESIGN ISSUE

AREA #20 DRYWELL REFLOOD LOADS (20)

- LOADS ON STRUCTURES IN DRYWELL DUE TO REFLOOD PHENOMENA

APPLICABILITY

MARK IIIs

PREVIOUS NRC REVIEW APPROACH

- DETAILED REVIEW PERFORMED AND ACCEPTANCE CRITERIA DEVELOPED

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

- NRC ACCEPTANCE CRITERIA FOR REFLOOD LOADS IS CONSERVATIVE
- NO FURTHER STUDY IS NECESSARY

AREA #21 CONTAINMENT MAKEUP AIR FOR BACKUP H_2 PURGE (21)

- OUTSIDE AIR NOT ADDED TO CONTAINMENT
- EVENTUALLY LESS REDUCTION IN CONTAINMENT HYDROGEN CONCENTRATION OCCURS

APPLICABILITY

MARK IIs, MARK IIIs

MARK Is THAT RELY ON RECOMBINERS

PREVIOUS NRC REVIEW APPROACH

- BACKUP H_2 PURGE NOT SAFETY RELATED
- SPECIFIC CONCERN NOT PREVIOUSLY REVIEWED

CURRENT NRC ASSESSMENT OF SAFETY SIGNIFICANCE

GRAND GULF

- DIFFERENT H_2 BACKUP SYSTEM DESIGN
- CONCERN DOES NOT APPLY

STRIDE/OTHER MARK IIIs

- CONCEPT HAS NOT YET BEEN EVALUATED
- DETAILED JUSTIFICATION REQUIRED

MARK Is AND IIs

- RELATION OF THIS MARK III DESIGN CONCEPT TO MARK I/II DESIGN NOT YET BEEN DETERMINED
- MOST MARK Is RELY ON DIFFERENT SYSTEM

PERSPECTIVE

ON

HUMPHREY ISSUES

TREATMENT OF HUMPHREY ISSUES

- WHEN FIRST RAISED (FALL 1981)
  - -Peer and Management Reviews
  - -Most were judged second order effects and covered by existing margins
  - -Remaining items were ongoing Design Actions on STRIDE/GESSAR

- AFTER HUMPHREY RESIGNATION
  - -Responses on each issue formalized
  - -Grand Gulf meeting with NRC to respond on each issue
  - -Each issue now being addressed quantitatively on Grand Gulf

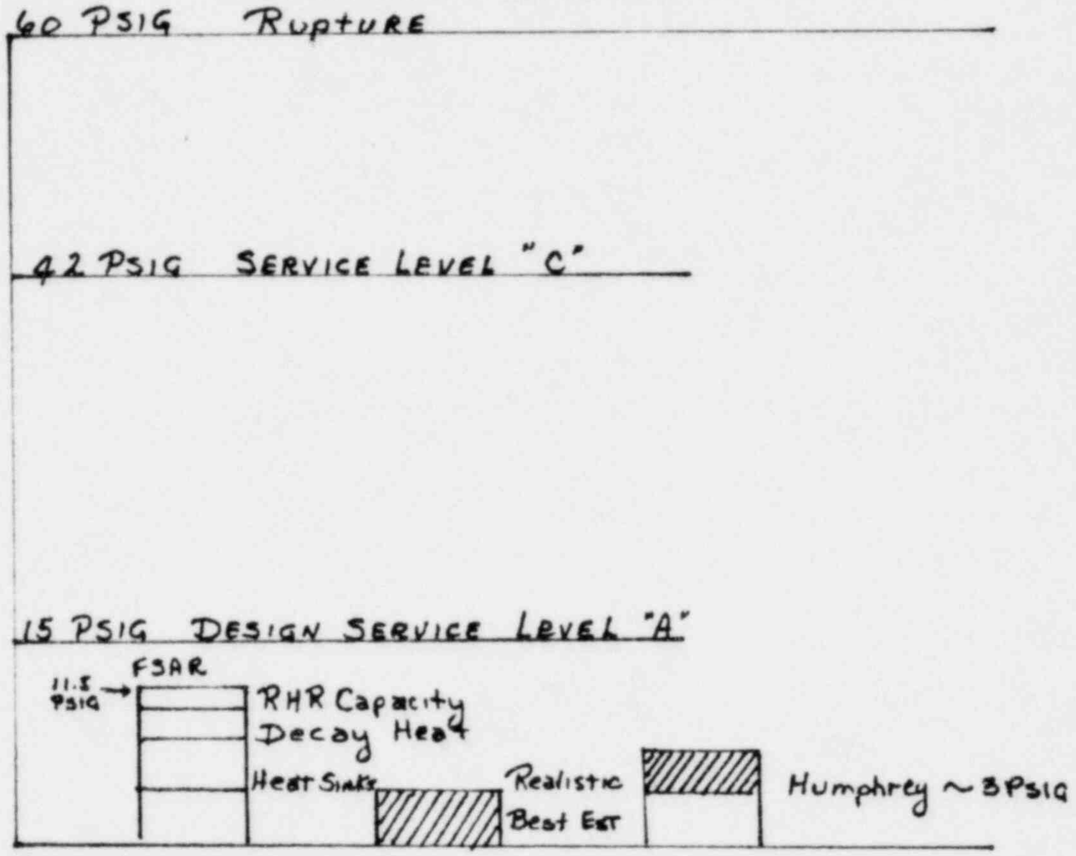
CATEGORIZATION OF HUMPHREY ISSUES

- CONTAINMENT PRESSURE - TEMPERATURE RESPONSE
  (33 SPECIFIC ITEMS)
  -Suppression pool temperature response
    - Stratification and mixing
    - Pressurization effects
  -Drywell bypass leakage capability
  -Containment vacuum breaker response
  -Initial conditions
  -Alternate accident scenarios

- DYNAMIC LOADS
  (19 SPECIFIC ITEMS)
  -Pool encroachments
    - Pool swell
    - Condensation loads
  -SRV discharge line sleeve
  -RHR pressure relief line

- OTHER ISSUES
  (14) SPECIFIC ITEMS)
  -RHR/Mixer permissive
  -Drywell flooding
  -Insulation on debris
  -Suppression pool temperature sensor location
  -Suppression pool makeup system logic

FIGURE OF PRESSURE MARGINS



OTHER EFFECTS

- BEST ESTIMATE OF SUPPRESSION POOL TEMPERATURE ~160°F
- SAFETY GRADE CONTAINMENT SPRAYS LIMIT CONTAINMENT PRESSURE AND TEMPERATURE EVEN WITH DRYWELL LEAKAGE
- WITHOUT ACTIVE CONTAINMENT COOLING BUT CREDIT FOR STRUCTURAL HEAT SINKS, OPERATOR HAS APPROXIMATELY 40 HOURS TO ACT BEFORE RUPTURE PRESSURE IS REACHED

HUMPHREY ISSUE		ESTIMATED EFFECT	MARGIN
1.7	MINIMIM FLOW AREA ABOVE POOL	0	
3.6	POOL TEMP. DUE TO RHR SRV	3°F	
4.1		10°F	
4.2		3 PSI	
4.3		3°F	11 PSI
4.4		7°F	BEST EST.
4.5	SUPPRESSION POOL TEMPERATURE	2°F	TO DESIGN
4.6	STRATIFICATION	0	
4.7		3°F	25°F
4.8		7°F	BEST EST.
4.9		0	TO DESIGN
4.10		3°F	
5.1		0 PSI	
5.2		0 PSI	
5.3		0 PSI	
5.4	DRYWELL TO CONTAINMENT	0 PSI	
5.5	BYPASS LEAKAGE	5°F	
5.6		0 PSI	
5.7		0 PSI	
5.8		0°F	
7.1	CONTAINMENT PRESSURE	7°F	
7.2	RESPONSE	0°F	
7.3		0.5 PSI	
8.1	CONTAINMENT AIR MASS	3°F/1 PSI	
8.2	EFFECTS	0	
8.3		0	
8.4		0	
9.1	FINAL DRYWELL AIR MASS	3 PSI	
9.2		0	
9.3		0	
13.0	90 SECOND SPRAY DELAY	0	
14.0	RHR BACK FLOW THROUGH SPRAY	3 PSI	
15.0	SECONDARY VACUUM BREAKER PLENUM RESPONSE	-3 PSI	

WMD:LM/8P-1
7/28/82

SUMMARY

PRESSURE - TEMPERATURE ISSUES

- ISSUES ALL SEEM TO BE SMALL SECOND ORDER EFFECTS RELATIVE TO OVERALL MARGINS

- MARGINS BETWEEN EXPECTED RESPONSE AND ULTIMATE CAPABILITY ARE EXTREMELY LARGE

- GE FEELS THESE ISSUES DO NOT WARRANT CONTINUED DETAILED QUANTITATIVE EVALUATION

DYNAMIC LOAD CONSERVATISMS

LOAD DEFINITIONS

- BASED ON BOUNDING TESTS
  - -Geometry
  - -Pool temperature
  - -Air content
  - -Single cell

- TEST DATA ENVELOPED
  - -Highest observed loads bounded
  - -Wide frequency content
  - -Idealized time histories maximize energy content
  - -No credit for phasing

- ESTIMATES OF CONSERVATISM

DYNAMIC LOAD	CONSERVATISM
Pool Swell Velocity	30%
Pool Swell Height	45%
Bulk Pool Swell Impact Loads	~100%
HCU Floor 20 ΔP	100%
Chugging	50 - 100%

DYNAMIC LOAD CONSERVATISMS

- LOAD COMBINATIONS

  -Bounding combinations of maximum loads

  -Highly unlikely combinations

- DYNAMIC ANALYSES

  -Linear analysis

  -Low damping valves

  -Spectral broadening

CONSERVATIVE BY FACTOR OF 2 - 3

- CODE STRESS AND ALLOWABLES

  -Static analysis

  -No credit for stress duration

  -Safety factor on ultimate strength

  -Does not recognize strength and ductility

  -Minimum material properties

CONSERVATIVE BY FACTOR OF 2 - 4

DYNAMIC LOAD CONSERVATISMS

- OVERALL CONSERVATISM

-Load Definitions	1.5 - 2
-Load Combinations	?
-Dynamic Analyses	2 - 3
-Code Stress & Allowables	2 - 4

OVERALL CONSERVATISMS 6 - 24

HUMPHREY ISSUE		ESTIMATED EFFECT	MARGIN
1.1	POOL ENCROACHMENTS FOR POOL SWELL	0	MULTIPLIERS OF 6 TO 24
1.2		0	
1.3		0	
1.4		0	
1.5		0	
1.6		< 1 PSI	
2.1	SRV DISCHARGE LINE SLEEVES	2-3%	
2.2		2-3%	
2.3		2-3%	
3.1	RHR RELIEF VALVE DISCHARGE	*	
3.2		*	
3.3		*	
3.4		*	
3.5		*	
3.7		*	
11.0	OPERATIONAL CONTROL OF DRYWELL TO CONTAIN. ΔP	15%	
19.1	SUBMERGENCE EFFECTS ON CHUGGING LOADS	< 25%	
19.2		< 25%	
20.0	LOADS ON DRYWELL STRUCTURES DURING REFLOOD	< 10%	

* UNDER EVALUATION

WMD:LM/8P-2
7/28/82

DYNAMIC LOAD SUMMARY

- DYNAMIC LOADS ARE CONSERVATIVE

- CONTAINMENT CAPABILITY FOR DYNAMIC LOADS IS VERY HIGH

- GE DOES NOT CONSIDER THE LOAD VARIATIONS SUGGESTED BY THE HUMPHREY ISSUES TO BE SIGNIFICANT ENOUGH TO WARRANT FURTHER WORK

"OTHER ISSUES"

- RHR/MIXER PERMISSIVE
  - -An ongoing design issue
  - -GESSAR system had an interlock requiring containment spray operation before hydrogen mixers could be activated
  - -A design change is in progress to remove this unnecessary interlock

- DRYWELL FLOODING
  - -Low probability event
  - -Availability issue not safety issue
  - -Not a significant concern for pipes and pumps in lower drywell

- INSULATION DEBRIS
  - -Bounding analyses shows ECCS suction blockage is <10% with mirror insulation used in GESSAR
  - -ECCS design basis is 50% blockage

"OTHER ISSUES"

- SUPPRESSION POOL TEMPERATURE SENSOR LOCATION
  - -Concern is delayed operator action if he relies only on surface temperature measurements when sensors can be uncovered
  - -System has redundant sensors and level alarms to help operator avoid problem
  - -Nothing dramatic happens with high surface temperature in pool

- SUPPRESSION POOL MAKEUP SYSTEM LOGIC
  - -Ongoing design issue on GESSAR
  - -Logic is being changed to insure SPMs are sealed in for small break accidents
  - -Operator has time to pump upper pool manually for SBAs even without logic change

OTHER ISSUES SUMMARY

- THESE ISSUES ARE EITHER OF LITTLE SIGNIFICANCE, OR ARE BEING CONSIDERED AS NORMAL DESIGN CHANGES

SUMMARY

- FROM OUR REVIEWS, WE CONCLUDED NO ADDITIONAL WORK IS NEEDED ON MOST OF THESE ITEMS OTHER THAN 9 ISSUES GE WAS PURSUING ON GESSAR.
- OVERALL MARGINS FOR CONTAINMENT PERFORMANCE ARE VERY LARGE, AND EASILY COVER HUMPHREY ISSUES
- IT IS GE's JUDGEMENT THAT HUMPHREY ISSUES ARE SECOND ORDER, AND DO NOT NEED TO BE ADDRESSED IN ANY MORE DETAIL THAN ORIGINALLY PLANNED

SYNOPSIS OF EVENTS

1. JOHN HUMPHREY LETTER DATED MAY 8, 1982 RECEIVED BY MP&L ON MAY 12, 1982

2. INITIAL MEETING WITH GE, BECHTEL, MP&L AND JOHN HUMPHREY ON MAY 17, 1982.

3. MEETING WITH NRC, MP&L AND JOHN HUMPHREY TO DISCUSS THESE ISSUES AND MP&L'S RESPONSE ON MAY 27, 1982.

4. MP&L RESPONSES FORMALLY SUBMITTED ON MAY 28, 1982.

5. MP&L PROVIDED JUSTIFICATION BY LETTER JUNE 8, 1982 FOR FUEL LOADING PENDING FINAL RESOLUTION OF THESE ISSUES.

    - COMMITTED TO ACTION PLAN

6. MP&L FORMALLY RECEIVED REQUESTS FOR ADDITIONAL INFORMATION FROM THE NRC TO RESOLVE THE ISSUES ON JULY 8, 1982.

7. MP&L RECEIVED INFORMALLY A COPY OF MR. HUMPHREY'S LETTER TO AL SCHWENCER DATED JUNE 17, 1982 ON JUNE 27, 1982.

8. MP&L MET WITH NRC ON JULY 14, 1982 TO REVIEW ACTIONS AND SCHEDULES FOR PROVIDING FINAL CLOSURE OF ISSUES.

9. ACTION PLANS FOR RESOLVING ISSUES AND RESPONDING TO NRC INFORMATION REQUEST SUBMITTED TO NRC ON JULY 15, 1982.

10. MEETING HELD WITH MARK III OWNERS, GENERAL ELECTRIC, PLANT ARCHITECT ENGINEERS AND JOHN HUMPHREY ON JULY 22, 1982

11. FORMED A MARK III OWNERS' GROUP FOR PERFORMING GENERIC WORK ON JULY 22, 1982.

WMD:PES:LM/108A-13
7/28/82

MP&L APPROACH TO RESOLUTION
OF THESE CONCERNS

1. INITIAL EVALUATION DETERMINED THAT THE CONCERNS DO NOT IMPACT PLANT SAFETY

   - INITIAL REVIEW CONCLUDED THAT ALL TECHNICAL QUESTIONS ADEQUATELY ADDRESSED BY GGNS DESIGN
   - ISSUES RAISED DUE TO SELECTIVE OR UNREALISTIC COMBINATIONS OF ANALYTICAL ASSUMPTIONS, BOUNDARY CONDITIONS, TEST DATA AND SYSTEM PERFORMANCE
   - ISSUES DO NOT CONSIDER THE OVERALL LEVEL OF CONSERVATISM AND MARGIN INHERENT IN THE CONTAINMENT DESIGN
   - ANY EFFECTS WITHIN DESIGN MARGINS

2. TO QUANTIFY THE EFFECTS, A COMPREHENSIVE PROGRAM UNDERTAKEN

   - CONDUCTING PLANT SPECIFIC ANALYSES
   - PROCEDURE AND TECHNICAL SPECIFICATION REVIEWS
   - IMPLEMENTING SOME COST EFFECTIVE PLANT MODIFICATIONS
   - EVALUATING NEED FOR TESTING

3. SCHEDULE FOR COMPLETING PROGRAM TO ADDRESS ISSUES

   - ACTION PLAN SUBMITTED JULY 15, 1982
   - INITIAL REPORT WITH JUSTIFICATION FOR FULL POWER OPERATION PENDING FINAL RESOLUTION ON AUGUST 19, 1982.

     - DETAILED DESCRIPTION OF ANALYSIS, ASSUMPTIONS, EXPECTED RESULTS IF NOT COMPLETED PRIOR TO FULL POWER LICENSE
     - DETAILED DESCRIPTION OF ANALYSIS AND RESULTS IF COMPLETE

   - SUPPLEMENTARY INFORMATION SUBMITTED ON OCTOBER 1, 1982.
   - FINAL PROGRAM REPORT ON NOVEMBER 1, 1982.

4. ACTIVELY INVOLVED IN GENERIC EFFORT

OWNERS' GROUP FOR RESOLVING THESE ISSUES

1. OWNERS GROUP INVOLVES

   - MISSISSIPPI POWER & LIGHT COMPANY
   - CLEVELAND ELECTRIC ILLUMINATING COMPANY
   - ILLINOIS POWER COMPANY
   - GULF STATES UTILITIES
   - GENERAL ELECTRIC COMPANY

2. OWNERS GROUP EFFORTS INCLUDE:

   - REVIEW OF GGNS ACTION PLAN TO DEVELOP GENERIC ACTION PLAN
   - IDENTIFY AREAS REQUIRING PLANT UNIQUE ANALYSIS AND AGREE ON ACCEPTABLE PLAN FOR RESOLUTION
   - ESTABLISH REVIEW PANEL TO INDEPENDENTLY REVIEW ACTION PLANS AND RESULTS OF ANALSYIS

3. REVIEW PANEL COMPOSED OF GE/AE/UTILITY "EXPERTS" NOT ACTIVELY INVOLVED IN RESOLUTION OF THE ISSUES AND CHARGED WITH

   - ASSURING ISSUES HAVE BEEN PROPERLY DEFINED.
   - REVIEWING GENERIC ACTION PLANS.
   - REVIEWING PLANT UNIQUE ACTION PLANS
   - REVIEWING COMPLETED WORK AND VERIFYING ISSUES ARE CLOSED.

4. SCHEDULED COMPLETION IN EARLY 1983

37 MAJOR ACTION PLANS

CONTAINING 84 SPECIFIC ACTIONS

1 COMPLETE

1 IN PROGRESS WITH BWROG (TMI)

29 FOR AUGUST 19 SUBMITTAL (35%)

40 FOR OCTOBER 1 SUBMITTAL (49%)

13 FOR NOVEMBER 1 SUBMITTAL (16%)

WMD:LM/8Q-7
7/28/82

FORMAT OF MP&L PRESENTATION

- ISSUES GROUPED INTO 15 MAJOR CATEGORIES
  - ORIGINALLY DEFINED 22 MAJOR ISSUES
  - 6 ISSUES RESOLVED
  - 1 ISSUE ASSOCIATED WITH EPG DEVELOPMENT AND SHOULD BE ADDRESSED BY BWROG
- PRESENT SUMMARY OF EACH MAJOR CATEGORY AND POTENTIAL EFFECT
- REVIEW MOST SIGNIFICANT MP&L PLANNED ACTIONS TO ADDRESS THE ISSUE
- DESCRIBE THE TECHNICAL DETAILS OF THE ANALYSIS IN MOST CASES

WMD:LM/8Q-1
7/28/82

MAJOR CATEGORIES

I. LOCAL ENCROACHMENTS

II. PERTURBATIONS IN LOAD DEFINITION CAUSED BY ANNULAR VENTS

III. UNACCOUNTED FOR RELIEF VALVE EFFECTS

IV. SUPPRESSION POOL TEMPERATURE STRATIFICATION

V. DRYWELL TO CONTAINMENT BYPASS LEAKAGE EFFECTS

VI. RHR PERMISSIVE ON CONTAINMENT SPRAY

VII. CONTAINMENT PRESSURE RESPONSE

VIII. CONTAINMENT AIRMASS EFFECTS

IX. DRYWELL AIRMASS EFFECTS

X. WEIRWALL OVERFLOW

XI. OPERATIONAL CONTROL OF DRYWELL TO CONTAINMENT DIFFERENTIAL PRESSURE

XIV. CONTAINMENT SPRAY BACKFLOW

XVI. EFFECT OF SUPPRESSION POOL LEVEL ON TEMPERATURE MEASUREMENT

XIX. EFFECTS OF CHUGGING FROM LOCAL ENCROACHMENTS AND ADDITIONAL SUBMERGENCE

XX. LATERAL LOADS DURING D/W NEGATIVE PRESSURE TRANSIENT

WMD:LM/8L-1
7/28/82

I. LOCAL ENCROACHMENTS

ISSUE: STRUCTURES LOCATED AT OR ABOVE THE SUPPRESSION POOL SURFACE WILL CAUSE POOL SWELL TO BE LOCALLY DIFFERENT FROM THE PHENOMENA DESCRIBED IN GESSAR AND USED FOR DESIGN.

POTENTIAL EFFECTS:

- HIGHER POOL SWELL VELOCITY AND BREAKTHROUGH HEIGHT
- HIGHER IMPACT AND DRAG LOADS
- HCU FLOOR OR STEAM TUNNEL LIQUID IMPACT
- HCU FLOOR FAILURE AND FAILURE TO SCRAM
- FLOW MAY MOVE LATERALLY AND APPLY UNACCOUNTED FOR LOADS
- HIGHER SUBMERGED STRUCTURE LOADS
- PRESSURE LOADS ON CONTAINMENT WALL

I. LOCAL ENCROACHMENTS

1. FURNISH DETAILS OF 1-DIMENSIONAL ANALYSIS WHICH PREDICTED 20% INCREASE IN POOL SWELL VELOCITY.

   OCTOBER 1, 1982

2. USE 2-DIMENSIONAL CODE TO MAKE BETTER PREDICTIONS OF POOL SWELL VELOCITY.

   - ADD BUBBLE MODEL TO SOLA
   - SHOW POOL VELOCITY DECREASES NEAR ENCROACHMENTS
   - USE EMPIRICAL DATA TO ESTABLISH BREAKTHROUGH

   OCTOBER 1, 1982

3. EVALUATE NEW SUBMERGED STRUCTURE LOADS BASED UPON NEW POOL VELOCITY PROFILES.

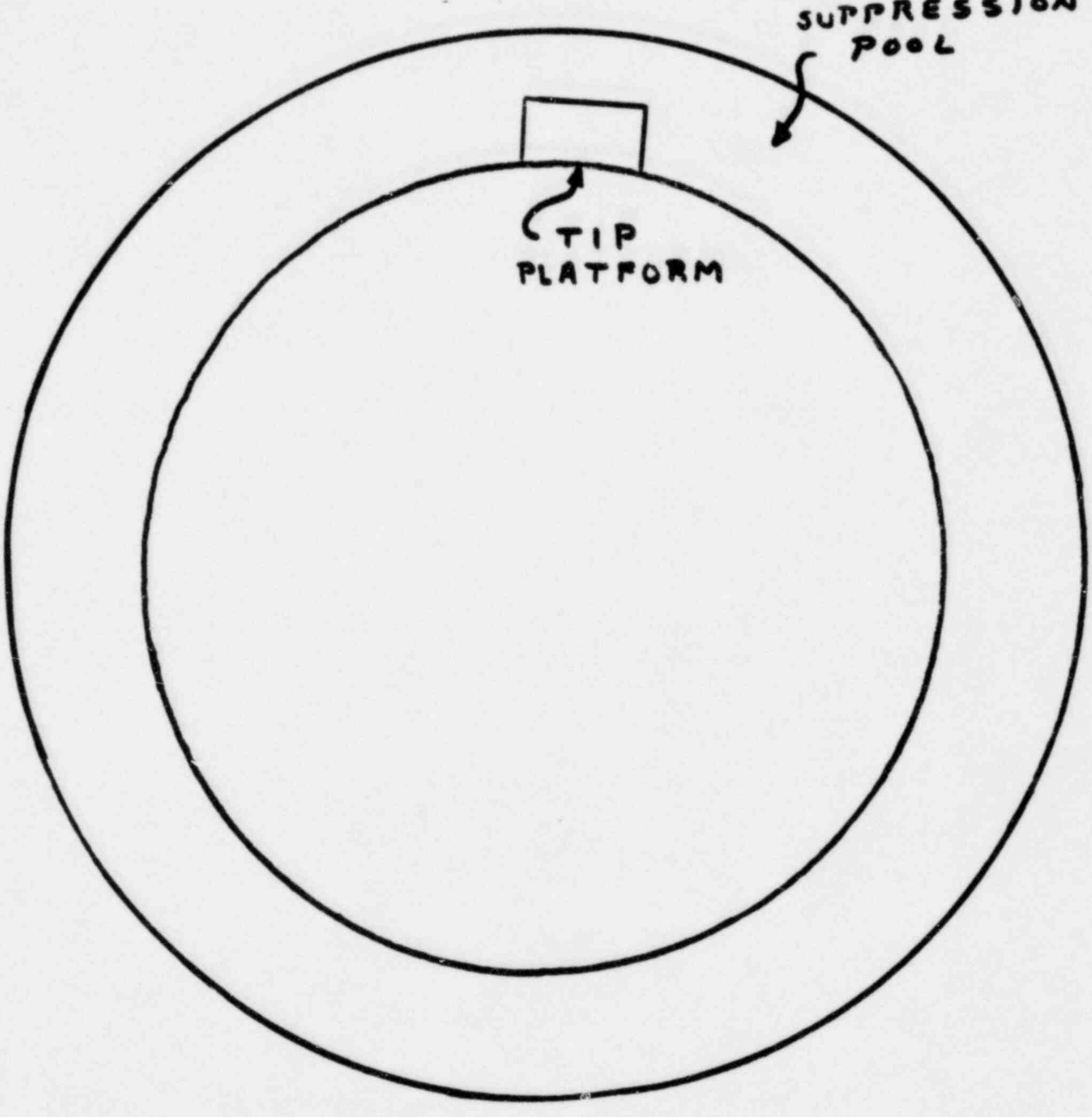
   - COMPARE POOL VELOCITIES NEAR ENCROACHMENTS WITH CLEAN POOL
   - SHOW LOADS WITHIN CURRENT DESIGN BASIS

   NOVEMBER 1, 1982

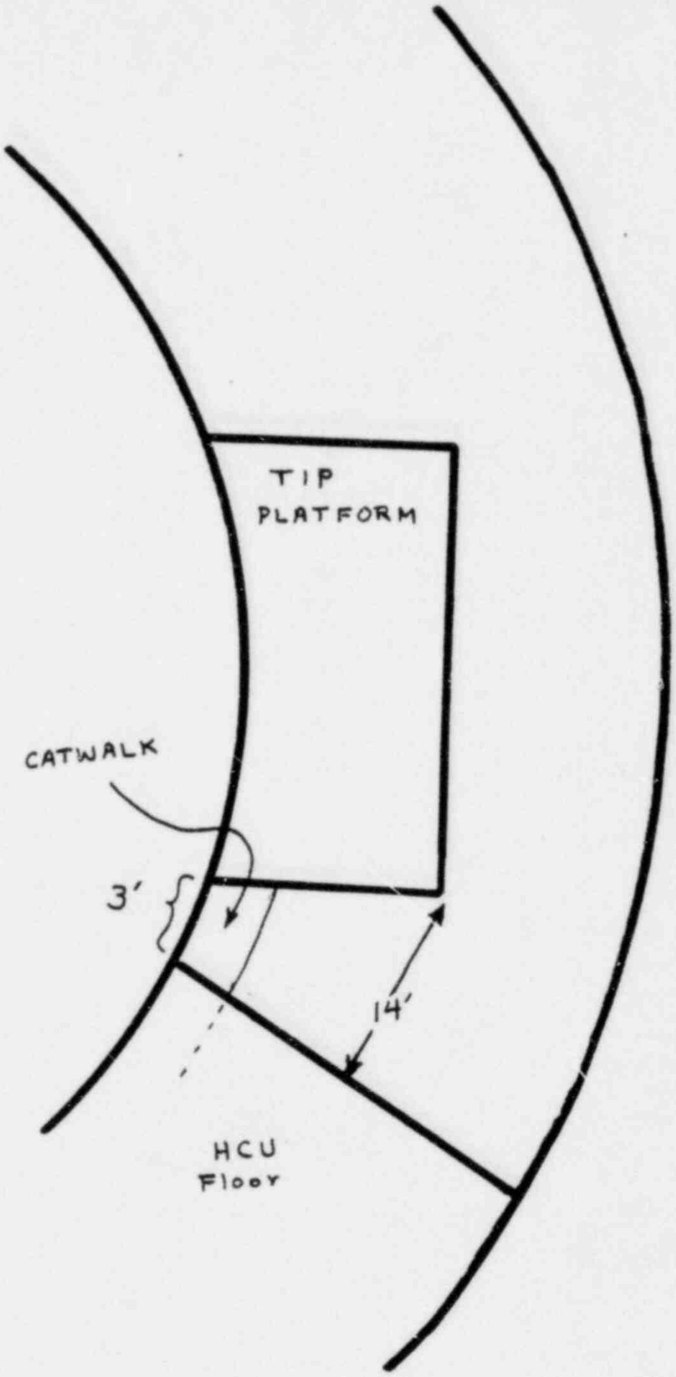
4. EVALUATE BOUNDING LOADS ON HCU SUPPORT STEEL PROVIDED BY LATERAL MOVEMENT OF POOL SWELL FROTH.

   OCTOBER 1, 1982

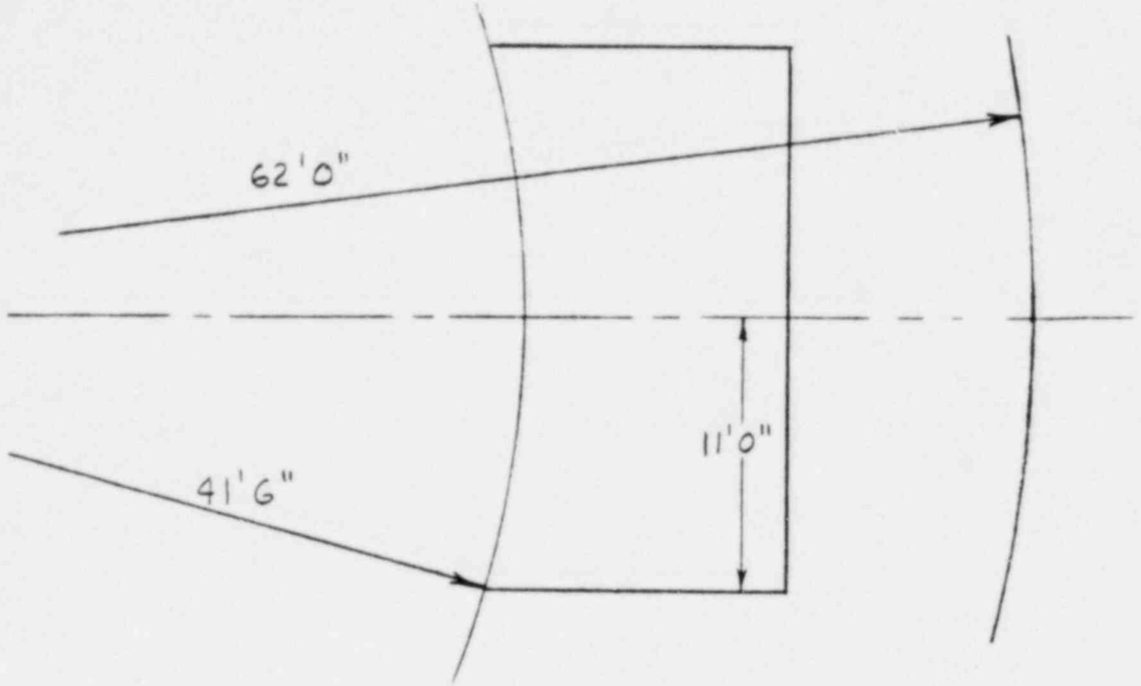
WMD:LM/8L-2
7/28/82

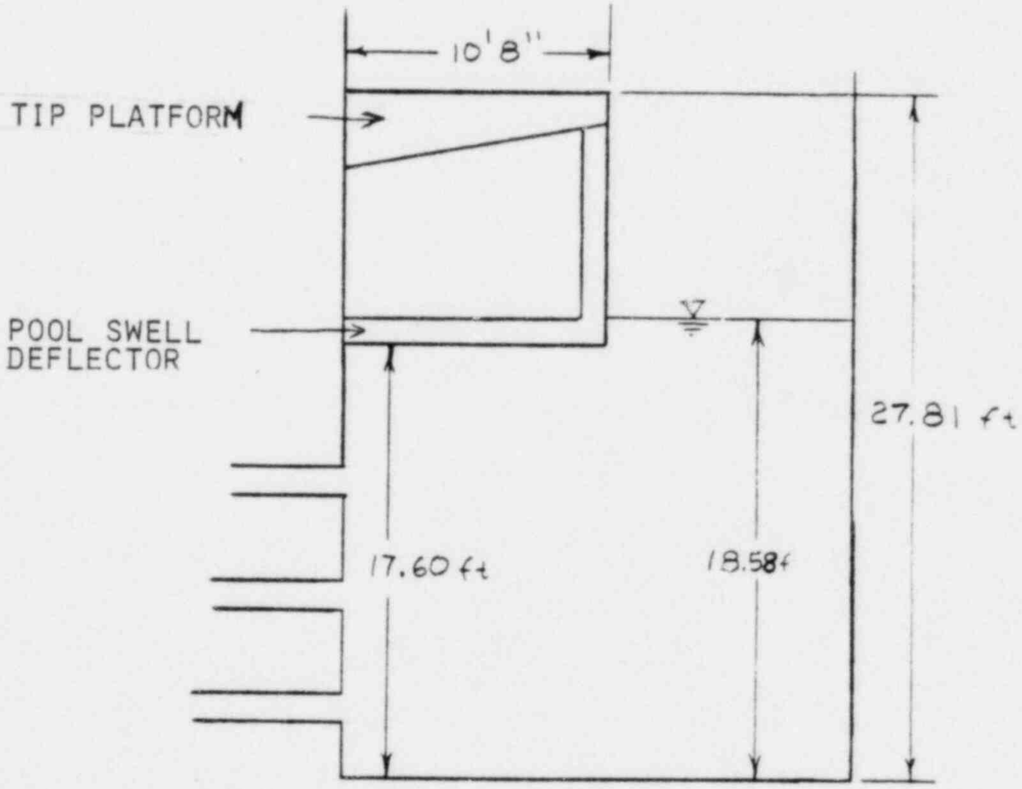


APPROXIMATE REPRESENTATION OF RELATIVE ENCROACHMENT AREA

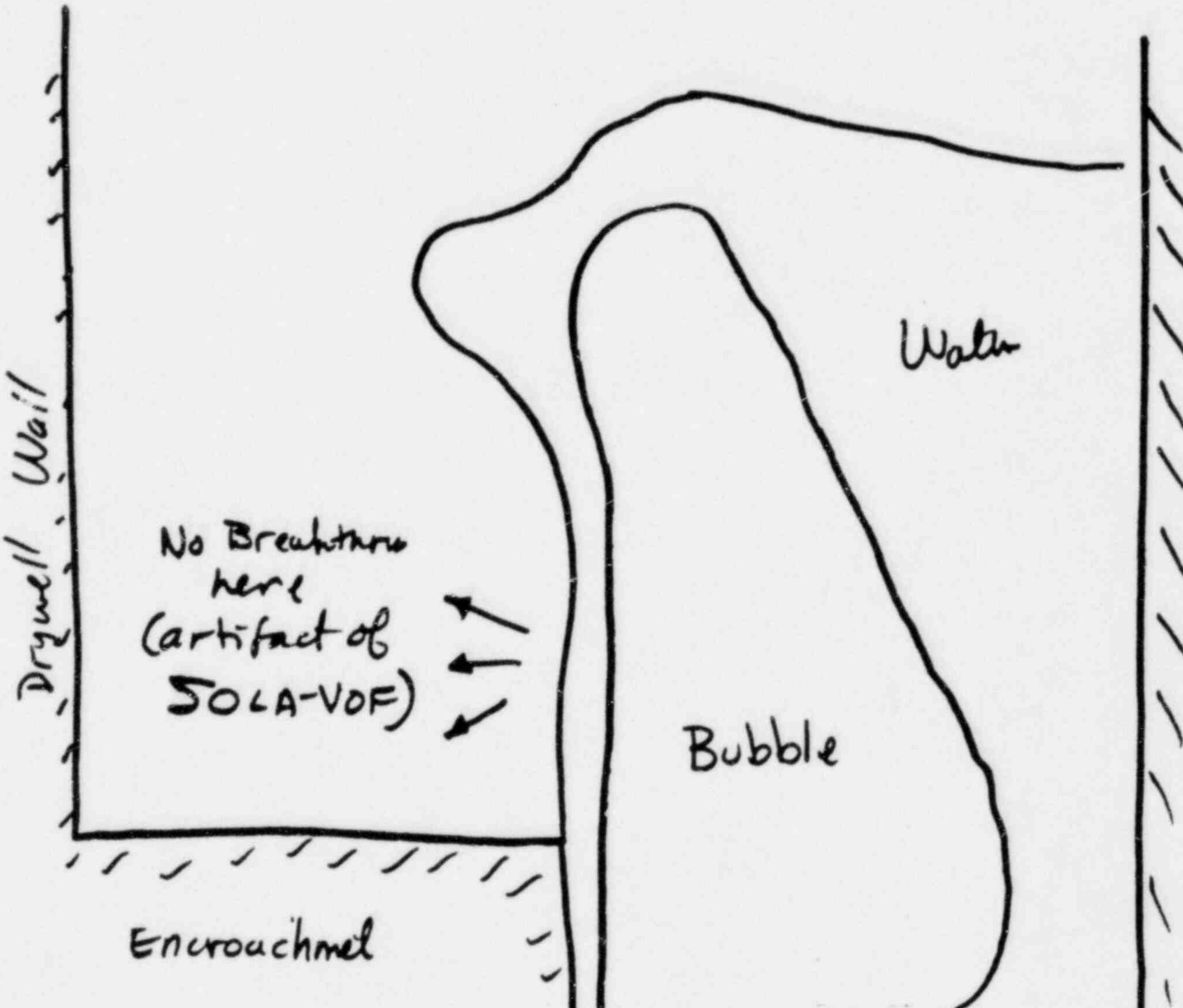


GGNS
Relationship of Encroachment
to HCU Floor

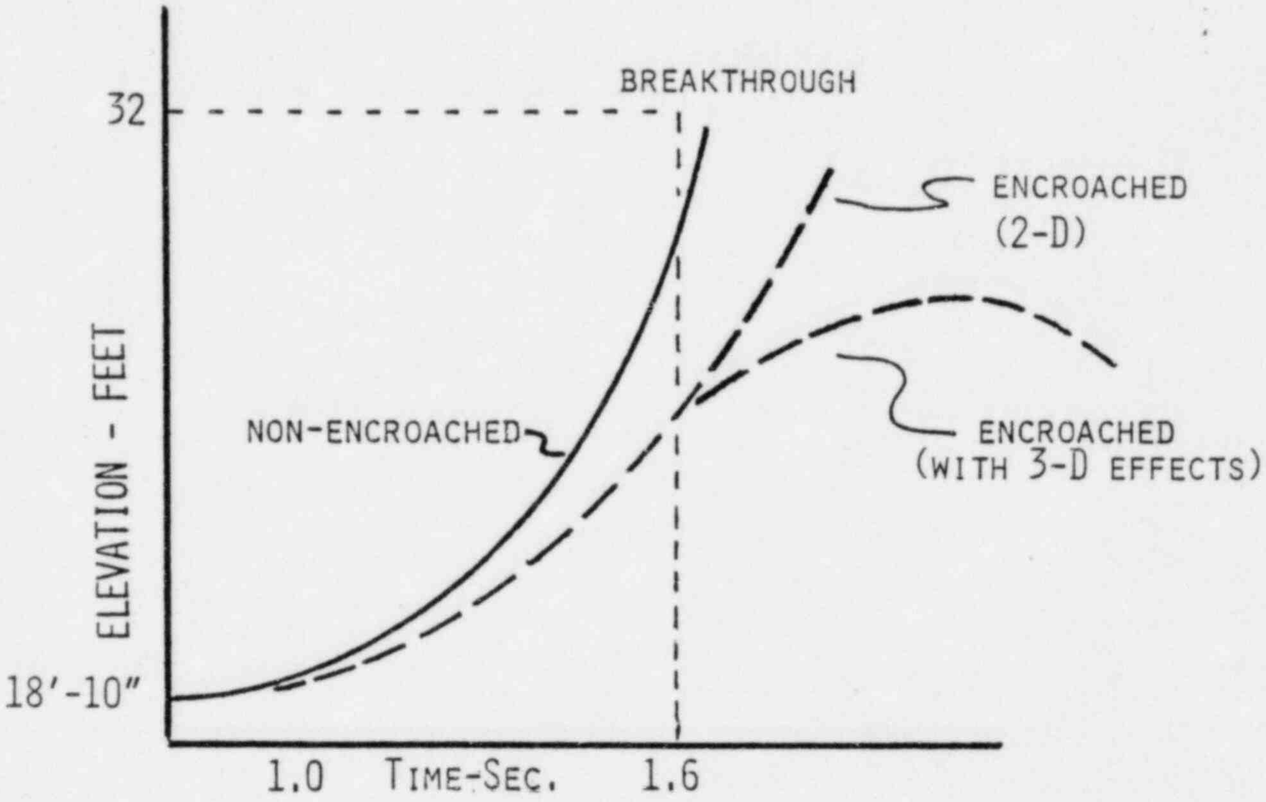

62'0"
41'6"
11'0"


10'8"
TIP PLATFORM
POOL SWELL DEFLECTOR
27.81 ft
17.60 ft
18.58f

- Very conservative analyses predict ~20% effect on velocity



- 3-D EFFECTS WILL LIKELY CAUSE POOL SWELL VELOCITY AND BREAKTHROUGH HEIGHT IN VICINITY OF ENCROACHMENT TO BE LESS <u>THAN BULK</u> POOL VELOCITY AND BREAKTHROUGH HEIGHT



- BREAKTHROUGH IN ADJACENT CELLS RELIEVES DRIVING PRESSURE
  - BUBBLE IS CONTINUOUS
  - VENT FROM UNDER ENCROACHMENT WHEN BUBBLE REACHES TOP OF ENCROACHMENT
  - CIRCUMFERENTIAL RUNNOFF

- CURRENT VELOCITY AND BREAKTHROUGH SPECIFICATIONS ARE VERY CONSERVATIVE
  - DRIVING CONDITIONS
  - DATA INTERPRETATION
  - NRC IMPOSED MARGIN
- IMPACT AND DRAG LOAD DEFINITIONS ARE CONSERVATIVE
  - FLAT POOL
  - CONSERVATIVE VELOCITY
  - DRAG COEFFICIENT
- STRUCTURAL DESIGN CRITERIA AND METHODS ARE CONSERVATIVE

II. PERTURBATIONS IN LOAD DEFINITION CAUSED BY ANNULAR VENTS

ISSUE: THE ANNULAR REGION BETWEEN THE OUTSIDE SURFACE OF THE SAFETY RELIEF VALVE DISCHARGE LINE AND THE INSIDE SURFACE OF THE DRYWELL WALL SLEEVE SURROUNDING THE DISCHARGE LINE PROVIDES AN UNACCOUNTED FOR VENT FROM THE DRYWELL TO THE SUPPRESSION POOL.

POTENTIAL EFFECTS

- CONDENSATION OSCILLATION MAY OCCUR THROUGH OPENING AT FREQUENCIES NEAR STRUCTURAL RESONANCE.
- C.O. AND CHUGGING THROUGH OPENING APPLIES UNACCOUNTED FOR LOADS ON SRVDL AND PENETRATION SLEEVE.

II. PERTURBATIONS IN LOAD DEFINITION CAUSED BY ANNUALR VENTS

1. EVALUATE A HARDWARE MODIFICATION WHICH SEALS THE VENT PRODUCED BY THE ANNULUS BETWEEN THE SAFETY RELIEF VALVE DISCHARGE LINE (SRVDL) AND THE SRVDL SLEEVE.

2. SEAL IS AN EXPANDABLE ELASTOMER.

3. SEAL WILL WITHSTAND MAXIMUM TEMPERATURE PRESSURE, RADIATION AND OTHER ENVIRONMENTAL PARAMETERS.

OCTOBER 1, 1982

SAFETY/RELIEF VALVE DISCHARGE LINE (SRVDL) SLEEVE

- IN ORDER TO PROVIDE TIMELY RESOLUTION, THE ANNULAR REGION WILL BE SEALED.
  - FLEXIBLE BOOTS CONSTRUCTED OF AMORPHOUS SILICONE DIOXIDE WILL BE USED.
  - BOOTS WILL BE DESIGNED TO WITHSTAND NORMAL, TRANSIENT AND ACCIDENT CONDITIONS.
  - BOOTS WILL BE CLAMPED TO THE SLEEVE AND TO THE SRVDL.

III. UNACCOUNTED FOR RELIEF VALVE EFFECTS

ISSUE: THE RHR HEAT EXCHANGER RELIEF VALVES MAY PRODUCE UNACCOUNTED FOR HYDRODYNAMIC LOADS. THE STRIDE DESIGN PROVIDED ONLY NINE INCHES SUBMERGENCE FOR THESE VALVES. VACUUM BREAKERS FOR THESE LINES MAY NOT BE ADEQUATELY SIZED. RELIEF VALVES MUST FUNCTION FOLLOWING UPPER POOL DUMP. DISCHARGE FROM RELIEF VALVES TO UPPER LEVEL OF POOL MAY AGGRAVATE TEMPERATURE STRATIFICATION. SAME PROBLEMS MAY BE ASSOCIATED WITH ALL RELIEF VALVES IN POOL.

POTENTIAL EFFECTS DESIGN BASIS

- CHANGE LOADING CONDITIONS.
- CREATE POSSIBLE POOL BYPASS.
- PRODUCE IMPACT LOADS ON RELIEF VALVES.
- PRODUCE WATER JET LOADS IN POOL.
- CREATE HIGHER BACK PRESSURE ON RHR RELIEF VALVES.
- ALTER EXISTING LICENSING ANALYSIS.

III. RHR HEAT EXCHANGER RELIEF VALVE EFFECTS

1. CALCULATE VENT CLEARING LOADS FOR RHR HEAT EXCHANGER RELIEF VALVES.

   OCTOBER 1, 1982

2. PROVIDE DETAILED INFORMATION ON OPERATION, ROUTING, DESIGN CAPACITY, AND PERFORMANCE OF ALL RELIEF VALVES WHICH DISCHARGE TO THE SUPPRESSION POOL.

   AUGUST 19, 1982

3. PROVIDE DATA ON DISCHARGE SUBMERGENCE VERSUS CONDENSATION EFFECTIVENESS.

   OCTOBER 1, 1982

4. DEMONSTRATE THAT DISCHARGE PIPING WILL REMAIN PRESSURIZED DURING STEAM CONDENSING MODE, ELIMINATING WATER LEG IN DISCHARGE PIPING.

   AUGUST 19,1982

5. CALCULATE FIRST POP ACTUATION LOADS FOR THE RHR HEAT EXCHANGER RELIEF VALVE FOR STEAM AND LIQUID CONDITIONS.

   OCTOBER 1, 1982

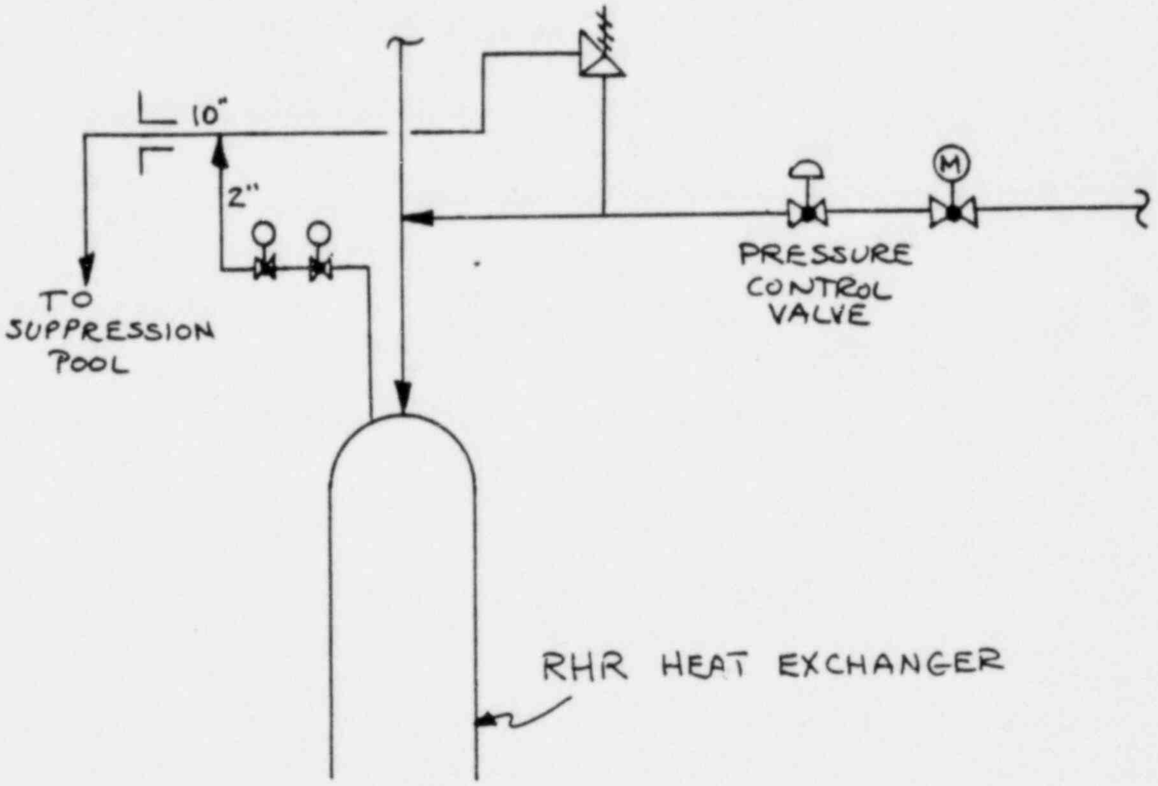
6. EVALUATE THERMAL DISCHARGE PLUME INTO THE SUPPRESSION POOL.

   OCTOBER 1, 1982

RHR HEAT EXCHANGER RELIEF VALVE

o THE FOLLOWING COMPUTER CODES WILL BE USED DURING THE ANALYSIS OF THE SUBJECT LOADS:

- VRV WILL CALCULATE WATER LEG TIME-HISTORY FOR THE FIRST POP WITH STEAM USING THE DYNAMICS OF THE SLUG MOTION OF THE REFLOODING WATER; THE AFFECTS OF CONDENSATION AND NONCONDENSIBLES ARE INCLUDED IN THE CALCULATIONS.
- RELAP 5 WILL CALCULATE THE DYNAMIC FORCING FUNCTIONS FOR FLASHING LIQUID CONDITIONS FOR SHUTDOWN COOLING MODE.
- RVCL WILL CALCULATE THE DYNAMIC FORCING FUNCTIONS INDUCED ON THE VARIOUS PIPE SEGMENTS.
- SBUD WILL CALCULATE THE BUBBLE DYNAMICS IN AN INFINITE OR FINITE POOL FROM THE MASS/ENERGY CHARGING RATES INTO THE AIR BUBBLE AND INITIAL CONDITIONS.
- SRVLOP WILL CALCULATE THE LOADS ON SUBMERGED STRUCTURES USING THE METHOD OF IMAGES; THE METHOD OF IMAGES IS DESCRIBED IN ATTACHMENT L TO GESSAR II, APPENDIX 3B.


10"
2"
TO SUPPRESSION POOL
M
PRESSURE CONTROL VALVE
RHR HEAT EXCHANGER

OTHER RELIEF VALVES
DISCHARGING TO THE SUPPRESSION POOL

- RHR HEAT EXCHANGER RELIEF VALVE DISCHARGES BOUND ALL OTHER DISCHARGES
  - SIZE IS 6" X 8"
  - PEAK MASS FLUX IS 310,000 lBM/HR
  - NORMAL SET POINT IS 500 PSIG
- RCIC TURBINE EXHAUST IS THE ONLY OTHER STEAM DISCHARGE TO THE POOL
  - LOWER PRESSURE, 135 PSIG
  - LOWER MASS FLUX
  - EQUIPPED WITH DISCHARGE SPARGER
- NEXT LARGEST RELIEF VALVE IS SHUTDOWN COOLING SYSTEM OVER PRESSURE PROTECTION VALVE
  - SIZE IS ONLY 4" X 6"
  - CAN ONLY DISCHARGE SUBCOOLED LIQUID
- BALANCE OF RELIEF VALVES ARE SMALL CAPACITY THERMAL EXPANSION PROTECTION VALVES (FEWER THAN 10 VALVES)
  - CAN ONLY DISCHARGE SMALL QUANTITIES OF SUBCOOLED LIQUID
  - E.G. 1" X 1" VALVE ON RHR SUCTION FROM REACTOR RECIRCULATION SYSTEM
  - E.G. 1 1/2" X 2" VALVE ON CONNECTION FROM RHR SYSTEM TO FLUSHING SOURCE

WMD:LM/8L-5
7/28/82

IV. SUPPRESSION POOL TEMPERATURE STRATIFICATION

ISSUE: THE SUPPRESSION POOL TEMPERATURE RESPONSE ANALYSIS MAY NOT BE CORRECT. INVENTORY DISPLACED TO DRYWELL WILL NOT BE IN THERMAL EQUILIBRIUM WITH BULK SUPPRESSION POOL. SUPPRESSION POOL WILL NOT BE AT A UNIFORM BULK TEMPERATURE. A NUMBER OF FACTORS MAY AGGRAVATE POOL TEMPERATURE STRATIFICATION. INTERACTIONS MAY OCCUR BETWEEN OPPOSING RHR TRAIN DISCHARGES. OPERATION OF RHR SYSTEM IN CONTAINMENT SPRAY MODE DECREASES HEAT REMOVED FROM POOL.

POTENTIAL EFFECTS

- SUPPRESSION POOL HEAT SINK CAPACITY DECREASED.
- HIGHER POOL SURFACE TEMPERATURES MAY ALTER CONTAINMENT RESPONSE.
- ADVERSE INTERACTIONS OF RHR DISCHARGES MAY DECREASE TOTAL HEAT REMOVED FROM POOL.
- CONTAINMENT RESPONSE MAY BE CHANGED BY SPRAY OPERATION.

IV. SUPPRESSION POOL TEMPERATURE STRATIFICATION

1. SUBMIT ANALYSIS DEMONSTRATING A SUPPRESSION POOL MAXIMUM INCREASE OF 6°F IF THE DRYWELL POOL IS FORMED.
   AUGUST 19, 1982

2. PREPARE A STUDY DOCUMENTING MAJOR CONSERVATISMS IN THE SUPPRESSION POOL TEMPERATURE ANALYSIS.

   - QUANTIFY INDIVIDUAL CONSERVATISMS
   - SHOW OVERALL CONSERVATISM IS LARGE

   OCTOBER 1, 1982

3. CALCULATE EFFECTS OF FAILURE TO RECOVER THE DRYWELL AIRMASS.
   OCTOBER 1, 1982

4. COMPLETE ANALYSIS TO QUANTIFY THE EFFECT ON CONTAINMENT RESPONSE OF HIGHER SUPPRESSION POOL SURFACE TEMPERATURE.
   OCTOBER 1, 1982

5. PREDICT THE MAXIMUM DIFFERENCE BETWEEN THE SUPPRESSION POOL BULK TEMPERATURE AND THE RHR HEAT EXCHANGER INLET TEMPERATURE.
   OCTOBER 1, 1982

6. COMPLETE ANALYSES OR PROPOSE A TEST PLAN TO EVALUATE SUPPRESSION POOL TEMPERATURE STRATIFICATION PRODUCED BY SWITCHING TO CONTAINMENT SPRAY; AND UPPER POOL DUMP. ANY TESTS WOULD ALSO EVALUATE INTERACTION OF RHR SUCTION AND DISCHARGE.
   AUGUST 19, 1982

7. DEVELOP CRITERIA FOR SWITCHING CONTAINMENT SPRAY TO SUPPRESSION POOL COOLING MODE AND VICE VERSA.
   OCTOBER 1, 1982

8. DOCUMENT THAT CONTAINMENT SPRAY CAN WITHSTAND CYCLIC OPERATION.
   NOVEMBER 1, 1982

9. DOCUMENT THAT CHUGGING ENHANCES THERMAL MIXING AND REDUCES STRATIFICATION.

WMD:LM/8L-6
7/28/82

CONSERVATISMS IN EXISTING SUPPRESSION POOL TEMPERATURE ACCIDENT ANALYSIS

- SHORT TERM DECAY ENERGY DISSIPATED IN POOL ASSUMED ANS 5.1 - 1971 CURVE PLUS A 20% MARGIN
- LONG TERM DECAY ENERGY DISSIPATED IN POOL ASSUMED ANS 5.1 - 1971 CURVE PLUS 10% MARGIN
- SERVICE WATER TEMPERATURE IS AT SITE PEAK FORECAST TEMPERATURE
- RHR HEAT EXCHANGERS ARE IN A WORST CASE FOULED CONDITION BASED ON 20 YEARS OF SERVICE
- INITIAL POWER LEVEL IS AT LICENSE MAXIMUM OF 105% RATED POWER
- INITIAL SUPPRESSION POOL LEVEL IS AT LOW WATER LEVEL
- SUPPRESSION POOL TEMPERATURE IS AT TECHNICAL SPECIFICATION MAXIMUM
- UPPER CONTAINMENT POOLS ARE ARBITRARILY ASSUMED TO BE AT 125°F
- RHR SUPPRESSION POOL COOLING IS ASSUMED NOT TO BE ACTIVATED UNTIL 30 MINUTES INTO ACCIDENT. COULD BE ACTIVATED AS EARLY AS 10 MINUTES INTO TRANSIENT
- HPCS INJECTION ASSUMED TO TAKE SUCTION FROM SUPPRESSION POOL RATHER THAN PREFERRED SOURCE OF CONDENSATE STORAGE TANK

WMD:LM/8L-7
7/28/82

QUANTIFY EFFECTS OF FAILURE TO RECOVER DRYWELL AIR MASS

- INITIATING ACCIDENT IS A SMALL BREAK
- USE SAFE CODE TO CALCULATE VESSEL BLOWDOWN AND ASSOCIATED ECCS PERFORMANCE
- VACBR04 WILL BE USED TO CALCULATE DRYWELL AND CONTAINMENT PRESSURE RESPONSE ASSUMING DRYWELL REMAINS PRESSURIZED
- ANALYSIS WILL INCLUDE THE EFFECTS OF DRYWELL AND CONTAINMENT HEAT SINKS

WMD:LM/8L-8
7/28/82

DEVELOP CRITERIA FOR SWITCHING FROM CONTAINMENT SPRAY TO POOL COOLING MODE

- ESTABLISH CONTAINMENT PRESSURE AT WHICH RHR CAN BE SWITCHED BACK TO POOL COOLING

- ESTABLISH ACCEPTABLE RATE OF RISE IN CONTAINMENT PRESSURE FOLLOWING TERMINATION OF CONTAINMENT SPRAY

- INCORPORATE NEW CRITERIA IN EMERGENCY PROCEDURES FOR SWITCHING RHR MODES

- ANALYSES WILL BE COMPLETED TO QUANTIFY CONTAINMENT RESPONSE ASSUMING FULL BYPASS LEAKAGE CAPABILITY

  - CALCULATIONS WILL ASSUME HEAT TRANSFER BETWEEN SUPPRESSION POOL AND CONTAINMENT ATMOSPHERE

  - CREDIT WILL BE TAKEN FOR DRYWELL AND CONTAINMENT HEAT SINKS

WMD:LM/8L-10
7/28/82

V. DRYWELL TO CONTAINMENT BYPASS LEAKAGE EFFECTS

ISSUE: AN INTERMEDIATE BREAK ACCIDENT WILL ACTUALLY BE THE CONTROLLING BREAK FOR BYPASS LEAKAGE. CONTAINMENT SPRAYS MAY HAVE TO BE CYCLED ON AND OFF TO CONTROL BYPASS LEAKAGE EFFECTS. THE PERIODIC DRYWELL INTEGRITY TESTS SHOULD CONSIDER UPPER POOL DUMP. BYPASS LEAKAGE MAY DISSIPATE HYDROGEN OUTSIDE THE REGION WHERE THE RECOMBINERS TAKE SUCTION. BYPASS LEAKAGE MAY EXPOSE SOME EQUIPMENT TO EXCESSIVE ENVIRONMENTAL CONDITIONS. BYPASS LEAKAGE MAY ALLOW THE DRYWELL TEMPERATURE TO EXCEED 330°F BEFORE A SCRAM CAUSED BY HIGH DRYWELL PRESSURE OCCURS.

POTENTIAL EFFECTS

- THE BYPASS LEAKAGE CAPABILITY MAY BE LOWER.
- CONTAINMENT SPRAY SYSTEM MAY NOT BE DESIGNED TO WITHSTAND CYCLICAL OPERATION.
- LEAKAGE TESTS MAY NOT MEASURE MAXIMUM LEAKAGE.
- HYDROGEN MAY POCKET AT CONCENTRATIONS ABOVE 4%.
- ENVIRONMENTAL QUALIFICATION ENVELOP MAY BE EXCEEDED.
- EXISTING ACCIDENT ANALYSES MAY NOT BE BOUNDING.

V. DRYWELL TO CONTAINMENT BYPASS LEAKAGE EFFECTS

1. COMPLETE A SPECTRUM OF BYPASS LEAKAGE ANALYSES TO CONFIRM ADEQUACY OF GGNS REPORTED CAPABILITY.

   NOVEMBER 1, 1982

2. ASSESS THE POTENTIAL FOR POCKETING OF HYDROGEN WHICH LEAKS THROUGH THE DRYWELL.

   AUGUST 19, 1982

3. EVALUATE THE NEED FOR REDUCING ALLOWABLE LEAKAGE BASED UPON A PRESSURE OF 6 PSIG IN THE DRYWELL.

   NOVEMBER 1, 1982

4. ESTABLISH THAT DRYWELL TEMPERATURE RESPONSE WILL NOT EXCEED 330°F WHEN DRYWELL PRESSURE IS LESS THAN 2 PSIG.

   NOVEMBER 1, 1982

WMD:LM/8L-11
7/28/82

CALCULATING BYPASS LEAKAGE EFFECTS

- o NEW BYPASS LEAKAGE CAPABILITY ANALYSES WILL BE PERFORMED FOR DIFFERING BREAK SIZES USING THE EXISTING ANALYTICAL METHODS
  - CALCULATIONS WILL ASSUME DRYWELL REMAINS PRESSURIZED AFTER THE FIRST 13 MINUTES OF THE TRANSIENT
  - INCLUDE EFFECTS OF DRYWELL AND CONTAINMENT HEAT SINKS
  - ANALYSES WILL BE PERFORMED AT HIGH SUPPRESSION POOL LEVEL RELECTING UPPER POOL DUMP
- o IMPACT OF DRYWELL REMAINING PRESSURIZED SHOULD BE NEGLIGIBLE SINCE CONTAINMENT SPRAYS ARE AVAILABLE TO CONTROL PRESSURE

HYDROGEN POCKETING

- SPATIAL STUDIES ARE BEING PERFORMED ASSUMING THAT THE LEAKAGE OCCURS THROUGH ELECTRICAL PENETRATIONS. THE INTENT OF THE STUDY IS TO ASCERTAIN WHETHER OR NOT POCKETING UNDER SOLID FLOORS IS POSSIBLE.

- PERFORM AN ANALYSIS/STUDY TO DETERMINE WHETHER OR NOT POCKETING IN THE WETWELL WILL EXCEED 4 VOLUME PERCENT.

NOTE: THE GRAND GULF PURGE COMPRESSORS HAVE A CAPACITY OF 1180 SCFM.

WMD:LM/8N-5
7/28/82

COMPLETE ANALYSIS ESTABLISHING
MAXIMUM DRYWELL TEMPERATURE

- CALCULATE VESSEL BLOWDOWN FOR THE CONTROLLING INTERMEDIATE BREAK USING THE SAFE CODE

- CALCULATE CONTAINMENT AND DRYWELL PRESSURE AND TEMPERATURE WITH VACBR04 CODE USING FULL BYPASS LEAKAGE CAPABILITY OF 0.9 FT^2

- ANALYSIS WILL INCLUDE THE EFFECTS OF DRYWELL HEAT SINKS

- VERIFY THAT DRYWELL TEMPERATURE DOES NOT EXCEED 330°F IN THE TIME LIMIT IMPOSED PRIOR TO OPERATOR ACTIONS CORRECTING TRANSIENT (10 MINUTE LIMIT)

WMD:LM/8L-13
7/28/82

VI. RHR PERMISSIVE ON ON CONTAINMENT SPRAY

ISSUE: THE RECOMBINER EXHAUSTS MAY PRODUCE HOT SPOTS WITH TEMPERATURES WHICH EXCEED THE ENVIRONMENTAL QUALIFICATION ENVELOPE.

POTENTIAL EFFECTS

- ENVIRONMENTAL QUALIFICATION PROFILES CHANGED.
- CONTAINMENT SPRAY ACTUATED TO CONTROL TEMPERATURES.

VI. RHR PERMISSIVE ON CONTAINMENT SPRAY

1. SUBMIT DRAWINGS SHOWING EQUIPMENT LOCATED NEAR RECOMBINERS.

   AUGUST 19, 1982

2. SUBMIT DRAWINGS SHOWING AREA ARRANGEMENT ABOVE THE RECOMBINERS.

   AUGUST 19, 1982

3. SUMMARIZE CRITERIA USED FOR ACTUATING THE CONTAINMENT SPRAYS.

   AUGUST 19, 1982

VII. CONTAINMENT PRESSURE RESPONSE

Issue: Higher suppression pool surface temperature may result from stratification. The program used to calculate environmental qualification parameters incorrectly considers heat transfer from the suppression pool to the containment atmosphere.

Potential Effects:

- The containment pressure response may not be bounding.
- The environmental qualification profiles may not be conservative.

VII. CONTAINMENT PRESSURE RESPONSE

1. COMPLETE ANALYSIS TO QUANTIFY THE EFFECT ON CONTAINMENT RESPONSE OF HIGHER SUPPRESSION POOL SURFACE TEMPERATURE.

   OCTOBER 1, 1982

2. QUANTIFY THE CONSERVATISM INHERENT IN ASSUMING THERMAL EQUILIBRIUM BETWEEN THE SUPPRESSION POOL AND THE CONTAINMENT ATMOSPHERE.

   OCTOBER 1, 1982

3. PROVIDE A LIST OF ASSUMPTIONS USED TO CALCULATE THE ENVIRONMENTAL PARAMETERS.

   OCTOBER 1, 1982

EFFECTS OF SUPPRESSION POOL TEMPERATURE STRATIFICATION ON CONTAINMENT RESPONSE

- MAXIMUM STRATIFICATION WAS DISCUSSED ON PAGE 3B032-28 IN THE GESSAR QUESTIONS AND ANSWERS

- EXISTING ANALYSIS WILL BE RERUN WITH HIGHER SUPPRESSION POOL TEMPERATURE TO BOUND MAXIMUM EFFECTS OF STRATIFICATION

- THE EXISTING ANALYTICAL CODE HAS AN OPTION TO CALCULATE HEAT AND MASS TRANSFER FROM THE POOL TO THE ATMOSPHERE

- USING WORST CASE POOL TEMPERATURES, THE ANALYSIS WILL BE RERUN WITH OPTIONAL INTERACTION BETWEEN THE POOL AND THE ATMOSPHERE. THIS QUANTIFIES THE CONSERVATISM IN ASSUMING THERMAL EQUILIBRIUM BETWEEN THE POOL AND THE ATMOSPHERE.

WMD:LM/8L-16
7/28/82

VIII. CONTAINMENT AIR MASS EFFECTS

ISSUE: TECHNICAL SPECIFICATIONS PERMIT PLANT OPERATION AT CONDITIONS WHICH DIFFER FROM THE INITIAL ASSUMPTIONS USED IN ACCIDENT ANALYSES. TECHNICAL SPECIFICATIONS PERMIT OPERATION AT -2 PSIG. CONDITIONS MAY EXIST WHICH CREATE LOW AIR MASS INSIDE CONTAINMENT.

POTENTIAL EFFECTS:

- CHANGE FSAR TRANSIENT ANALYSES.
- PRODUCE EXCESSIVE NEGATIVE PRESSURE TRANSIENT.
- TOP ROW OF VENTS MAY BE UNCOVERED DURING NORMAL OPERATION.

VIII. CONTAINMENT AIRMASS EFFECTS

1. QUANTIFY CONSERVATISMS IN EXISTING CONTAINMENT PRESSURE AND TEMPERATURE RESPONSE ANALYSES.

   NOVEMBER 1, 1982

2. COMPLETE REALISTIC ANALYSIS TO DEMONSTRATE THAT EVEN WITH ALL PARAMETERS AT WORST CREDIBLE VALUES, THE EXISTING CONTAINMENT DESIGN PRESSURE IS ACCEPTABLE.

   - CREDIT FOR HEAT SINKS
   - AIR SPACE-TO-SUPPRESSION POOL TEMPERATURE DIFFERENCES

   NOVEMBER 1, 1982

3. ALTER THE GGNS TECHNICAL SPECIFICATION LIMITING CONDITIONS FOR CONTAINMENT TO AUXILIARY BUILDING DIFFERENTIAL PRESSURE.

   COMPLETED

4. CALCULATE MINIMUM AIR MASS WHICH CAN EXIST INSIDE CONTAINMENT AND EVALUATE THE WORST CASE NEGATIVE PRESSURE TRANSIENT WHICH COULD RESULT FROM THIS LOW AIR MASS.

   OCTOBER 1, 1982

CONSERVATISMS IN CONTAINMENT RESPONSE ANALYSIS

- CONTAINMENT ATMOSPHERE IS NOT IN THERMAL EQUILIBRIUM WITH SUPPRESSION POOL. CONTAINMENT TEMPERATURE AND PRESSURE WILL SIGNIFICANTLY LAG POOL RESPONSE.

- NEGLECTED EFFECTS OF CONTAINMENT HEAT SINKS

- NEGLECTED EFFECTS OF DRYWELL HEAT SINKS

- EXISTENCE OF A HIGH RELIABILITY DRYWELL COOLING SYSTEM WHICH IS DESIGNED TO REMAIN FUNCTIONAL UNDER A VARIETY OF ADVERSE CIRCUMSTANCES IS NEGLECTED

- CONSERVATISMS IN SUPPRESSION POOL TEMPERATURE RESPONSE ANALYSIS APPLY TO CONTAINMENT RESPONSE.

CONTAINMENT NEGATIVE PRESSURE TRANSIENTS

- THREE SCENARIOS HAVE BEEN IDENTIFIED AND THE CONTAINMENT PRESSURE ANALYSIS PERFORMED. WORST CASE PRESSURE OF -3 PSID.
  - RWCU BREAK WITH THE CONTAINMENT ISOLATED AND RHR SPRAYS.
  - RWCU BREAK WITH THE CONTAINMENT UNISOLATED AND RHR SPRAYS.
  - LOSS OF ALL CONTAINMENT HVAC AND COOLDOWN OF NONCONDENSIBLES ONCE COOLING IS RESTORED.

- ONE ADDITIONAL BOUNDING SCENARIO HAS BEEN IDENTIFIED AND THE CONTAINMENT PRESSURE ANALYSIS WILL NOW BE PERFORMED.

- ANALYSIS ASSUMPTIONS:

INITIAL PRESSURE = 14.7 PSIA
INITIAL RH = 100%
CONTAINMENT SPRAY TEMPERATURE = $80^{O}F$

IX. DRYWELL AIR MASS EFFECTS

ISSUE: THE EMERGENCY PROCEDURE GUIDELINES REQUIRE THE OPERATOR TO THROTTLE ECCS OPERATION. THUS, THE DRYWELL ATMOSPHERE WILL NOT BE QUENCHED.

POTENTIAL EFFECTS:

- CHANGE CONTAINMENT PRESSURIZATION.
- INCREASE DRYWELL BYPASS LEAKAGE.

IX. FINAL DRYWELL AIRMASS EFFECTS

1. COMPLETE A REALISTIC ANALYSIS TO EVALUATE MAXIMUM PRESSURE INCREASE ATTRIBUTABLE TO THE DRYWELL AIR REMAINING IN THE CONTAINMENT.

   - CONTAINMENT HEAT SINKS
   - CONTAINMENT SPRAYS

   OCTOBER 1, 1982

2. EVALUATE EFFECTS OF MAXIMUM LEAKAGE ON CONTAINMENT RESPONSE.

   OCTOBER 30, 1982

3. CONFIRM THAT SBA AND SORV ANALYSES ARE TREATED AS DESIGN BASIS ACCIDENTS.

   AUGUST 19, 1982

WMD:LM/8L-20
7/28/82

X. WEIR WALL OVERFLOW

Issue: A NUMBER OF FACTORS MAY COMBINE TO CAUSE THE SUPPRESSION POOL TO OVERFLOW THE WEIR WALL FOLLOWING INADVERTENT UPPER POOL DUMP.

Potential Effects:

- Induce thermal stress in hot equipment.

X. WEIRWALL OVERFLOW

1. PERFORM REVISED ANALYSIS TO ASSESS POTENTIAL FOR WEIRWALL OVERFLOW. THE NEW ANALYSIS WILL CONSIDER SIGNIFICANT FACTORS WHICH AGGRAVATE OVERFLOW.

   AUGUST 19, 1982

2. PROVIDE DETAILS OF INTERFACE DOCUMENT WHICH CONTROLS DESIGN OF THE WEIRWALL.

   AUGUST 19, 1982

WMD:LM/8L-21
7/28/82

WEIR WALL OVERFLOW

- ORIGINAL PLANT SPECIFIC DESIGN ANALYSIS CONSIDERED ONLY THE SUPPRESSION POOL AND UPPER CONTAINMENT POOL HIGH LEVELS. RESULTS WERE SATISFACTORY.

- A REVISED PLANT SPECIFIC DESIGN ANALYSIS WILL CONSIDER HIGH LEVELS FOR BOTH POOLS AND MAXIMUM DRYWELL NEGATIVE PRESSURE AND THE EFFECT OF ENCROACHMENT IN THE SUPPRESSION POOL.

NOTE: THE GRAND GULF TIP STATION ENCROACHMENT IS A HOLLOW STEEL STRUCTURE WITH VENT HOLES AT THE BOTTOM AND NEAR THE TOP.

XI. OPERATIONAL CONTROL FOR DRYWELL TO CONTAINMENT DIFFERENTIAL PRESSURE.

ISSUE: THE HYDRODYNAMIC LOADS ARE DEFINED ASSUMING EQUAL LEVELS IN DRYWELL WEIR ANNULUS AND SUPPRESSION POOL. HOWEVER TECHNICAL SPECIFICATIONS PERMIT ELEVATION DIFFERENCES BETWEEN POOLS.

POTENTIAL EFFECTS:

- CHANGE VENT CLEARING LOAD DEFINITION.

XI. OPERATIONAL CONTROL OF DRYWELL TO CONTAINMENT DIFFERENTIAL PRESSURE

1. DEFINE MAXIMUM POSSIBLE DIFFERENCES BETWEEN THE WEIR ANNULUS AND SUPPRESSION POOL LEVELS.

   AUGUST 19, 1982

2. EVALUATE CHANGES IN THE HYDRODYNAMIC LOADS WHICH MAY RESULT FROM MAXIMUM POSSIBLE DIFFERENCES.

   AUGUST 19, 1982

EFFECTS OF ADDITIONAL SUBMERGENCE ON HYDRODYNAMIC LOADS

- USE DBA MAINSTEAM LINE BREAK WHICH PRODUCES CONTROLLING HYDRODYNAMIC LOADS

- EXISTING ANALYSIS USING M3CPT TO BE RERUM WITH MAXIMUM LEVEL DIFFERENCES PROVIDED BY SPECIFYING DRYWELL AND CONTAINMENT INITIAL PRESSURES

- OUTPUT FROM ANALYSIS
  - NEW VENT CLEARING VELOCITY
  - NEW VELOCITY FIELD IN POOL
  - NEW SUBMERGED STRUCTURE LOADS USING NEW VELOCITY PROFILE

- NEW SUBMERGED STRUCTURE LOADS WILL BE COMPARED AGAINST LOADS CALCULATED BY ABSOLUTE BUBBLE PRESSURE

XIV. CONTAINMENT SPRAY BACKFLOW

ISSUE: A CHECK VALVE FAILURE IN THE LPCI LINES MAY LEAD TO VESSEL LEAKAGE TO THE CONTAINMENT ATMOSPHERE THROUGH THE SPRAY HEADERS DURING SWITCH OVER FROM LPCI TO CONTAINMENT SPRAY.

POTENTIAL EFFECTS:

- CHANGE CONTAINMENT PRESSURE RESPONSE.

XIV. CONTAINMENT SPRAY BACKFLOW

1. QUANTIFY THE MAXIMUM BACKFLOW WHICH CAN OCCUR AND ASSESS ASSOCIATED EFFECTS ON CONTAINMENT RESPONSE.

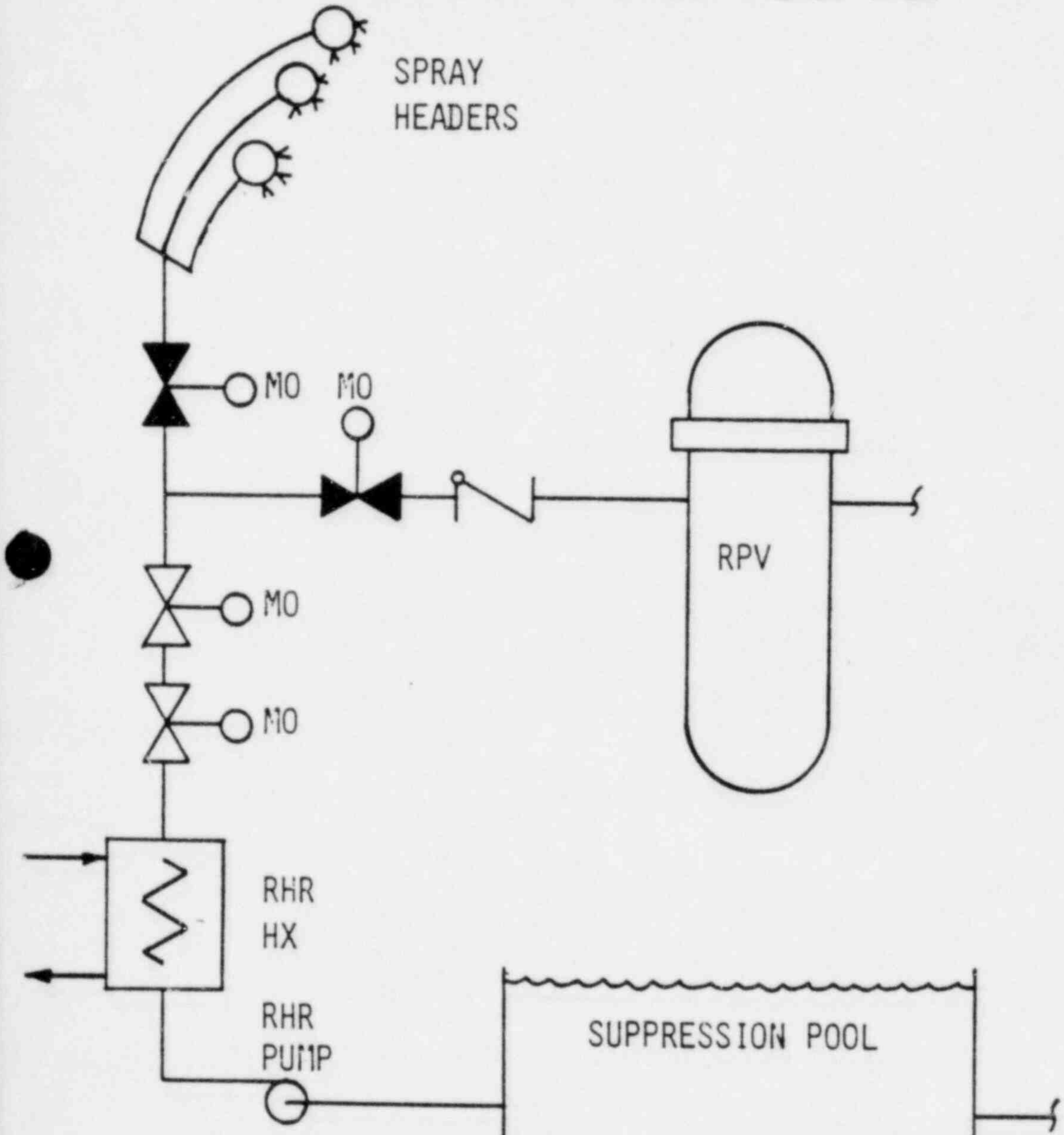
   OCTOBER 1, 1982

2. EVALUATE POSSIBILITY OF ADDING INTERLOCKS TO PREVENT SIMULTANEOUS ACTUATION OF THESE VALUES.

   AUGUST 19, 1982

REACTOR COOLANT BACKFLOW THROUGH CONTAINMENT SPRAY

- POSSIBLE 20-30 SECOND WINDOW WITH BOTH LPCI AND CONTAINMENT SPRAY ISOLATION VALVES OPEN



- ONE CONTAINMENT SPRAY LOOP ACTIVATES (90 SEC. DELAY FOR 2nd LOOP) o RESOLUTION PLAN

- CONSERVATIVE ANALYSIS TO EVALUATE POTENTIAL CONTAINMENT PRESSURIZATION

  - ASSUMPTIONS

    1. RPV AT MAXIMUM LPCI INJECTION VALVE INITIATION PRESSURE.
    2. CONTAINMENT AIRSPACE AT 9 PSIG (MINIMUM CON. SPRAY AUTOMATIC INITIATION).
    3. ALL DRYWELL ATM IN CONTAINMENT AIRSPACE.

  - CALCULATIONAL PROCEDURE

    1. DETERMINE MAXIMUM 'BLOWDOWN' FLOW RATE INTO A COMMON NODE ALSO SERVED BY LPCI FLOW.

       - BASED ON ACTUAL GGNS PIPING GEOMETRY

    2. DETERMINE MINIMUM LPCI PUMP FLOW RATE INTO THIS SAME NODE.
    3. DETERMINE RESULTANT MIXED-FLOW (INTO SPRAY LINE) RESULTANT ENTHALPY.
    4. CALCULATE MASS AND ENERGY ADDITION TO CONTAINMENT AIRSPACE, FOR LONGEST POSSIBLE BOTH-VALVES-OPEN TIME WINDOW.
    5. CALCULATE RESULTING CONTAINMENT AIRSPACE PRESSURIZATION.

       - ASSUME AIRSPACE COMPONENTS (AIR, STEAM, LIQUID) IN THERMODYNAMIC EQUILIBRIUM.

XVI. EFFECT OF SUPPRESSION POOL LEVEL ON TEMPERATURE MEASUREMENTS

ISSUE: SUPPRESSION POOL TEMPERATURE SENSORS MAY BE UNCOVERED BY POST ACCIDENT POOL DRAW DOWN.

POTENTIAL EFFECTS:

- OPERATOR COULD BE MISLED BY ERRONEOUS INFORMATION FROM UNCOVERED SENSORS.

XVI. EFFECT OF SUPPRESSION POOL LEVEL ON TEMPERATURE MEASUREMENT

1. REVISE EMERGENCY PROCEDURES TO REQUIRE OPERATOR TO CHECK POOL LEVEL PRIOR TO READING BULK POOL TEMPERATURE.

AUGUST 19, 1982

XIX EFFECTS OF CHUGGING FROM LOCAL ENCROACHMENTS AND ADDITIONAL SUBMERGENCE

ISSUE: STRUCTURES LOCATED AT OR ABOVE THE SUPPRESSION POOL SURFACE WILL CAUSE CHUGGING TO BE LOCALLY DIFFERENT FROM THAT DESCRIBED IN GESSAR AND USED FOR DESIGN.

POTENTIAL EFFECTS: HIGHER CHUG LOADS ON POOL BOUNDARIES

- CONTAINMENT
- BASEMAT
- VENTS
- SUBMERGED STRUCTURES

XIX. EFFECTS OF CHUGGING FROM LOCAL ENCROACHMENTS AND ADDITIONAL SUBMERGENCE

1. SUBMIT INFORMATION SHOWING THAT CHUGGING IS MORE DEPENDENT ON MASS FLUX.

   OCTOBER 1,1982

2. QUANTIFY TO THE MAXIMUM EXTENT POSSIBLE INERTIAL IMPEDANCE EFFECTS ON CHUGGING LOADS.

   OCTOBER 1, 1982

3. EVALUATE ADEQUACY OF AVAILABLE MODELS FOR PREDICTING IMPACT OF LONGER ACOUSTIC PATHS ON LOAD DEFINITION.

   OCTOBER 1, 1982

ENCROACHMENT EFFECTS ON CHUGGING

- o SHOW THAT CHUG IMPULSE WITH ENCROACHMENTS IS NO MORE THAN UNENCROACHED CASE
  - HIGHER CLEARING INERTIA
  - SLOWER VENT CLEARNING BENEATH ENCROACHMENT
  - NO BIGGER STEAM BUBBLE
  - NO LARGER CHUG IMPULSE
- o SHOW THAT ACOUSTIC CHUG PULSE TRANSMISSION IS ESSENTIALLY UNCHANGED
  - USE POOL ACOUSTIC MODEL
  - EVALUATE 3-DIMENSIONAL EFFECTS

XX LATERAL LOADS DURING D/W NEGATIVE PRESSURE TRANSIENT

ISSUE:	LATERAL COMPONENTS OF DRAG LOADS PRODUCT BY NEGATIVE POOL SWELL HAVE NOT BEEN EVALUATED.
POTENTIAL EFFECTS:	PERTURB NEGATIVE POOL SWELL IMPACT AND DRAG LOAD DEFINITION.

WMD:LM/8N-1
7/28/82

XX LATERAL LOADS DURING D/W NEGATIVE PRESSURE TRANSIENT

1. COMPLETE ANALYSIS TO QUANTIFY MAXIMUM HORIZONTAL LOADS.

   OCTOBER 1, 1982

2. EVALUATE EQUIPMENT SUPPORTS AGAINST DEFINED LOADS.

   OCTOBER 1, 1982

WMD:LM/8N-2
7/28/82