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SUBCOMMITTEE ON GRAND GULF

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UNITED STATES NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE ON GRAND GULF

Room 1406
1717 H Street, N.W.
Washington, D.C.

Wednesday, August 11, 1982

The Subcommittee met, pursuant to notice, at 2:30 p.m.

PRESENT:

DAVID OKRENT, Chairman
MYER BENDER
J. CARSON MARK
CHESTER P. SIESS
JESSE C. EBERSOLE
MR. PLESSET

ALSO PRESENT:

J. RICHARDSON
J. MCGAUGHY
N. STAMPLEY
L. FLOYD
D. HOUSTON
A. SCHWENCER
A. WAGNER

CONSULTANT TO ACRS:

G. SCHOTT

DESIGNATED FEDERAL EMPLOYEE:

MR. H. ALDERMAN

P R O C E E D I N G S

MR. OKRENT: The meeting will now come to order.

This is a meeting of the Advisory Committee on Reactor Safeguards, Subcommittee on Grand Gulf.

I am David Okrent. The other ACRS members who are present at the moment are Mr. Bender, Mr. Mark, Mr. Ebersole, and I expect one or two other ACRS members will be with us, and also Mr. Schott, who is a consultant to the ACRS.

The purpose of the meeting is to discuss the Mississippi Power and Light Company's request for an operating license.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act and the Government in the Sunshine Act. Mr. Alderman is the Designated Federal Employee for the 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 July 28, 1982.

A transcript of the meeting is being kept and it is requested that each speaker first identify himself and speak with sufficient clarity and volume so that he or she can be readily heard.

We have received no requests for oral statements from members of the public. We have received no written statements from members of the public.

We will proceed with the meeting, and as far as I know, we will stay roughly with the agenda laid out by Mr. Alderman. I am hoping that we need not have any more time than is shown on the agenda, and if possible, can complete it in less time, but time will tell.

Why don't we then call upon the NRC to give us a brief rundown on the status of the review.

Mr. Alderman, would you find Mr. Plesset?

MR. ALDERMAN: Okay, sure.

MR. HOUSTON: Does it pick up okay there?

My name is Dean Houston. I am with the Division of Licensing and the assigned project manager on Grand Gulf.

I just wanted to briefly go over the chronology of the review up to the present time.

(Slide.)

MR. HOUSTON: We first issued the Safety Evaluation Report mid-September. The ACRS Subcommittee meeting was held in Jackson September 17 and 18 of '81. The full Committee meeting considered the Grand Gulf operating license mid-October and issued an interim report on October 20.

In the report that was issued, there were three specific issues identified which needed further clarification to consider Grand Gulf for full power. Briefly, these had to do with the management of the organization, its BWR operating experience, and outside members to the Safety Review Board.

The second thing was the impact loads or the LOCA loads on the HCU floor, and the third was hydrogen control.

Following that meeting we issued the first supplement in December. This resolved a few of the outstanding issues that were identified in the SER. Then in June we issued the second supplement concurrent with the low power operating license.

Now, the second supplement supported our low power licensing. It added numerous licensing conditions, and with the exception of equipment qualification, it presented the structural and containment resolution for the LOCA loads on the HCU floor and also presented resolution with a few license conditions of the management concerns.

In July we issued the third supplement which presented resolution for equipment on LOCA loads and a resolution for hydrogen control.

At this time we have approximately 20 issues which have been justified for low power licensing which still need to be cleaned up before we go on to full power. In the first Safety Evaluation Report we identified 19 outstanding issues.

(Slide.)

MR. HOUSTON: The next two slides will show a status report on what has happened with these. I won't say anything about the ones that show up as resolved. They are resolved in the supplement as listed.

I might say a few brief words where we show that they were resolved with some condition.

In the fourth issue, resolved pending confirmation, the confirmation required here is that the thermocouples were to be seismically qualified, and this was supposed to be carried out July 23.

The other confirmation we needed was the increase in the response spectra, a 25 percent increase of the response spectra. The staff felt this was of no great -- would not be of any great problem because there was sufficient margin.

We are comparing an actual load of one to two G, plus the test load of 17 to 20 G.

In item issue 6, the license conditions there are the qualifications on the stated schedules. I think the two things that are of interest are the MSIVs and the RHR heat exchangers were to be qualified by August 31.

Issue No. 9 again is the qualification of containment isolation, dry well and containment isolation valves. The data package is now at NRC and is under review.

(Slide.)

MR. HOUSTON: Following on, we had 19 to begin with and we now have added one, a twentieth one, on containment concerns.

Issue 13 was resolved with license conditions. Those conditions defined the operating shift advisor, the advisor to the corporate management, the training instructors and the detail of the duties of the corporate safety review group.

Issue 14 is resolved for low power. It needs a follow-up site audit and an agreement with the State of Louisiana followed by FEMA review and approval.

Issue 17 is the hydrogen control. The license condition there is based on the comprehensive qualification test program to demonstrate that neither system remains functional in a postaccident environment.

Then 20, the recent containment concerns, is still awaiting further information. We will hear more of that on the schedule today.

MR. OKRENT: With regard to seismic qualification of equipment, are there any questions that the Staff has other than these thermocouples?

MR. HOUSTON: This was back on the LOCA loads.

MR. OKRENT: I don't mean the LOCA loads.

MR. HOUSTON: Those thermocouples?

MR. OKRENT: No, in general, seismic qualification of equipment.

MR. HOUSTON: In the seismic area, I believe the only things remaining to be qualified are the MSIVs and the RHR heat exchangers. The qualification there would be completed by August.

MR. OKRENT: What I am trying to get clear in my mind is a few months ago there was an exchange of correspondence between the Staff and Mississippi Power and Light concerning which equipment had been qualified seismically and which had not.

MR. HOUSTON: Right.

MR. OKRENT: You are saying that those two remaining --

MR. HOUSTON: Right. About the -- I think about the first of April we were informed that there were something like 65 pieces of equipment that were unqualified, and since that time either qualification packages have come in or a jusdification. The only two that I am aware of here are the MSIVs and those RHR heat exchangers.

MR. OKRENT: Okay.

(Slide.)

MR. HOUSTON: I wanted also to go a little bit over the issues that had been introduced since our last meeting on Grand Gulf. The first one is the LPCI modification. In a foreign reactor using the LPCI system as a mode of shutdown cooling, there was some damage experienced to some of the instrument tubes. This was not due to a full flow condition but was due to a resonating lower than full flow condition. A resonant frequency set up in the instrument tubes, and the instrument tubes failed by fatigue in about 12 hours. Since that occurrence in the foreign reactor, Grand Gulf has put on flow deflectors at the inlet lines or inside the shroud where the LPCI system comes in, and the flow deflector should completely eliminate any problem of that order.

They have also gone to a strengthened instrument tube.

The second item here is the probable maximum precipitation flood. The analysis that they originally brought in when they went back and checked it with a reanalysis for some of the obstructions that are present in some of the -- in one drainage basis indicated that with this PMP, a six-hour rainfall of 30 inches, the flood level would go from 133 feet up to 133 feet and five inches and would stay flooded for something like seven hours.

Because of that we have in the license a license condition to sandbag some of the doors in case of a heavy rainstorm.

Today we have recieved their final analysis and an indication of what their permanent fix will be for those doors. We do not anticipate that this will be any problem. The flood level is a rather unusual occurence here.

The third item, containment concerns that Mr. John Humphrey expounded upon, I think I will not say anything more on that since it is an agenda item for later on.

The fourth item is independent design verification. Following the problem that was found at Diablo Canyon, we asked that Grand Gulf have an independent contractor-consultant come in and look at the Grand Gulf plant in two areas. One was a walkdown of the RHR train A line to be sure that it was built as it was designed and to verify that some of the structural members there had been designed and checked properly.

The second area was that they were to look at the Keyway program at Bechtel from a time period of 1978 when General Electric formulated new LOCA loads, to the BWR-6s or MARK IIIs. They were to look at the QA program at Bechtel from '78 to the present and make sure that all of those new loads had been properly factored into the design and into the finally constructed plant.

We have just received their final report. It was issued on the 30th of July. Their conclusions are that everything is in an approved state. They still have one item outstanding, but since they have already checked into that one item in another area of review and found no problem, they feel that in their final report, which the evaluation will be done tomorrow, by Friday I think it is, their final version will show that there are no problems that they have uncovered.

And last but not least, we have the staffing changes. This is both with the plant operating staff and with the corporate safety review group. The staffing changes here that have been of concern to the NRC are those that have happened since the first of

June. I believe this will come out later on in the discussion on management and the plant safety review group, but in general, the first change here was the assistant plant manager leaving early in June representing a large portion of the actual operating experience on BWRs.

Following his leaving, the corporate safety review group lost a member on about July 1 who is the plant manager at River Bend, had been the plant manager at Duane-Arnold for a number of years, had years of actual operating experience. And then in mid-July another replacement, one of the outside consultants from Mississippi State was replaced by a professor from Memphis State. I think all of those will be touched on later in the discussion on management reliability and the plant review group.

That completes what I had intended to give as a review of where we stand in licensing.

MR. OKRENT: Are there any questions of the staff at this point?

(No response.)

MR. OKRENT: Very well. Let's proceed with the next agenda item.

We are to hear from Dr. Plesset summarizing his subcommittee meeting.

MR. PLESSET: Mr. Chairman, we had the two-day subcommittee meeting in which we primarily discussed the Humphrey concerns, and Mr. Ebersole was there, and Mr. Ray was there also. I see Mr. Field from the Staff was there. We went through this in considerable detail.

I might say before I get into some of those details, the concern, when we wrote our letter on Grand Gulf, one of the concerns we expressed in the letter was the hydraulic control unit. There is no problem as far as the hydrodynamic loads are concerned. What was not clear at that time was whether the structure would adequately handle the load. We learned at this meeting from the staff people there that the structural analysis had been completed and they believe that it is all right.

Now, as far as Mr. Humphrey's concerns go, he was employed at GE working on containment problems, I gather, as part of the STRIDE and MARK III program. The STRIDE program was cancelled when TVA dropped their plans to build their MARK III plants. There were two of them under consideration.

Now, these concerns of Mr. Humphrey's appeared for the most part to be very special and rather of second order and not of the kind that would ordinarily come to be considered by us or even by the staff. They represent in a way, if they represent anything, our interface problems between what the nuclear island designer has as his requirement and the architect engineer.

So we did spend some time on how interfaces are treated, and we had some discussions and a presentation by Bechtel, who happened to be the architect engineer on this plant. It was quite interesting. Most of these -- I would say all of these concerns are pretty much generic in nature so that one need not consider it necessarily on Grand Gulf. We are also thinking of Perry and Clinton.

I might say that some of the concerns were kind of interesting to a theoretician. The one that stands out in my mind is the one about the effect of intrusions into the air space above the water level in the pool, when you get a bubble breaking through and giving loads on structures like the HCU floor and so on. The question is -- this was brought up by Humphrey -- does this change the load on the hydraulic control unit in an undesirable way?

Well, it is difficult to say right off hand that it won't or it will for that matter. As a matter of engineering judgment, my judgment is that it won't make any difference. However, the applicant has proceeded with a very interesting calculation of what this intrusion would do. The motion of the bubble up into the space above the undisturbed level of the pool, whether the intrusion -- and the calculation is being done by Dr. Tony Hurt, formerly of Los Angeles, now of his own company. He is a very expert fellow in the behavior of big bubbles like this in liquid, so it will be interesting to see what he gets. My expectation is that it will not be much different from what we already have built into the plant as far as loads go.

The other things were very special, very minor, I would say mostly second order. If one happened not to be on a second order, it would be a matter of judgment whether it was significant or not.

And after the session was all over, I asked the members who were there, and the consultants, did they feel that these concerns had a serious or a significant impact, I should say, on the possibility of Grand Gulf being given a 100 percent power license? And I was quite pleased and surprised, it was unanimous it would not have an effect on the possibility of giving Grand Gulf a 100 percent power license.

I would like to ask Jesse if he would like to make a comment because I have nothing more special to say.

You might like to read the last 15 pages of the transcript of our meeting. I think you might find this of interest.

In our notebooks for tomorrow, you have the minutes as well that Paul already has completed.

Jesse?

MR. EBERSOLE: I want to say I concur with Dr. Plesset in all aspects of what he said. I thought the Humphrey discussion, the some 60-odd issues that he mentioned were pertinent details or fine structure investigations. They represented the kind of thing that maybe MP&L should have had internally within itself to investigate a few things, but they were second order type events that did affect and work into the margins of performance of the MARK III containment. It was well in order that they be considered, although perhaps not in all the limelight that they were considered. They should have simply been worked out between MP&L, the AE in GE, in the course of routinely looking at interface problems of this sort.

To get to the roots of this matter about the projecting area, I think maybe it is a little unfortunate here that we have a disparity, at least in my view. One looks further down the road to say why are we looking at the hydraulic control unit slab and the impact of loads on it. Well, of course we are looking at this because we know within a second or a fraction of a second or a small interval of time we still expect to have these hydraulic control units work coincident with and subsequent to a LOCA where one is losing some of the primary fluid systems. To put the rods in at the same time you are losing the resistance to inserting them, you need the HCU to initially guarantee that you will get insertion. That is the focus of the whole flap that we are trying to be sure the rods go in because the BWR reactor is absolutely going to -- you will be completely out of luck if you don't get the rods in pursuant to a LOCA, unlike a pressurized water reactor which refloods with borated fluid.

Meanwhile, off not too far away, I was dismayed to find that MP&L had apparently with just superficial reasoning decided not to put as anywhere near as intensive an investigation and perhaps do some physical treatment of an analogous problem which is what does a large LOCA do to the supply and exhaust tubes, which is exactly the same problem. It just simply happens to be another physical area. I would like to see why this problem shouldn't be addressed with the same vigor and professional investigation level as the one that we are currently giving to a first stage value, which is some physical damage to the slab on which the HCA unit rests.

MR. BENDER: Jesse, what do you mean by supply and exhaust in this case?

MR. EBERSOLE: Mike, these BWRs have to have a supply pipe and an exhaust pipe to each unit which comes out of the bottom of the reactor. That is the thing that goes back to the hydraulic control unit. It supplies high pressure water to thrust the piston in. It provides an exhaust valve to the dump volume. An upset of even a small fraction of these in a LOCA we believe the reactor would hypothetically at least have some fuel rods -- at least it doesn't take many -- which is totally incompatible with reflooding the reactor with cold clean water because you get a return to fission power for which you are not prepared. You are only prepared to deal with the decay energy aspect of the current heat removal process.

MR. BENDER: Aren't the rods supposed to be in before the swell?

MR. EBERSOLE: No. They are not quite in yet.

MR. PLESSET: That's a delicate point, Mike. They may be within a half a second or three quarters of a second of being completely inserted.

MR. EBERSOLE: It's too much of a race to argue that they are not.

MR. PLESSET: Right. It is all very close. And I think Jesse is very correct. I concur in it, that the hydraulic control unit has to be intact after being hit by this froth.

MR. EBERSOLE: And with it, though, Dr. Plesset, has to go its own exhaust and supply tubes. That is another part of the problem. But it is the same problem.

MR. PLESSET: That's right. It is within three quarters of a second, maybe, of completing scram when that froth and water hits the hydraulic control unit. You just can't have things that way. There is some talk that the scram might be completed, but that's not sure.

MR. BENDER: They are inserted but they haven't gone in far enough to make the plant subcritical? Is that what you are saying?

MR. PLESSET: Exactly.

MR. EBERSOLE: They have pressure in the reactor, they take the very high pressure spherical containment fluid to make [illegible] insertion.

MR. PLESSET: [illegible] that's a good point. It has to be shown to be survivable for the design basis accident. That's a requirement.

MR. BENDER: Perhaps Mr. McGaughy would like to comment, as long as he's here.

MR. MC GAUGHY: I'm Jim McGaughy, Mississippi Power and Light Company.

I may have given you the wrong impression, Dr. Jesse Ebersole. We did very extensive pipe clip and jet impingement calculations on all those, on that piping and all the other piping that was in the drywell, and wherever blast shields and so forth were required as a result of this analysis, we installed it, and where it was not, we did not.

MR. EBERSOLE: I got the impression --

MR. MC GAUGHY: In this case, we did the analysis. It was based on the full thrust, just on one pipe. It survived the analysis, and we did not put the blast shields at that point.

MR. PLESSET: The concern was how complete was this analysis.

MR. RICHARDSON: Very.

MR. MC GAUGHY: It was a very thorough analysis.

MR. EBERSOLE: Did we ever see that? Can we get written evidence of that calculation? Byt the way, this is not just one pipe, this is a great nest of pipes.

MR. MC GAUGHY: To be conservative, we thought one pipe, the most conservative calculation would be the load on one pipe. I may not have the details correct of the analysis, but we will get that for you.

MR. EBERSOLE: Can you talk against it for a cross section of the piping arrangement?

MR. MC GAUGHY: I think we have someone here who can address that.

MR. EBERSOLE: We might have a general discussion of that. It is really the same problem, except to me it is a little bit closer to the problem than the slab on which the HCUs are located.

MR. PLESSET: Except it is a little more horrendous to have that thing fall.

MR. EBERSOLE: You either get the fluid in and out or you don't.

MR. PLESSET: Jesse, would you agree that most of these things are generic?

MR. EBERSOLE: Yes.

MR. OKRENT: A question has been raised concerning the stooping or piping, and I would like to have it addressed sometime today.

Should we do it right now, or does the Applicant want to do it a little later?

Will the Staff make some comment in this area in response to Mr. Ebersole's question?

I just want to know how to schedule this item on the agenda. What is the best time?

MR. EBERSOLE: May I make a comment first? We have to look under LOCA circumstances at anything like seismic interference of tubing or whatever, because we cannot fail in BWRs to get a full set of rods in. Because we reflood it with cold clean water and if we do not get the rods in, in this kind of reactor it is absolutely up the creek. Unfortunately, we do not reflood with borated water.

MR. PLESSET: They are ready to respond.

MR. OKRENT: Why don't we take this right now? The applicant will tell us what studies he has done and then we will see where we go from there. Mr. Mark?

MR. MARK: You used the word "generic." Is the design the same for all plants, or is this done by Bechtel and something else by Lundy?

MR. PLESSET: It is not in any of the plants, but we say the principle will come up in any Mark III.

MR. MARK: You have to make sure about the Mark III's design.

MR. PLESSET: Each applicant, they have to do it, yes. That is right. And they are getting together on doing cooperative work in this area. They do have an owners' group, right?

MR. MCGAUGHY: That is correct.

MR. OKRENT: Why don't we proceed?

(Slide.)

MR. EBERSOLE: Let me comment. This is not generic to Mark III. This is with all boilers.

MR. OKRENT: I want to get it discussed for this Mark III.

(Laughter.)

MR. OKRENT: That is the only one for which I am the Subcommittee Chairman. Please.

MR. RICHARDSON: I am John Richardson with Mississippi Power and Light. The issue that Dr. Ebersole is discussing is that the control rod drive hydraulic unit in certain withdrawal lines come down in certain bundles. They come into the drywell and then they in some cases come along this area of the vessel and the recirc piping and then go underneath the vessel.

So in some cases if you had a pipe break either at the nozzles, which is one place where the break may be postulated, or if you had in the case of a break -- a circumferential break -- here at the recirc header to riser connection, you may get some pipe whip or some jet impingement effects on the CRD bundles.

The question Dr. Ebersole raised was had we looked into that -- would the scram function be impaired? The answer is that yes, we have looked at it in detail. As a matter of fact, before Dr. Ebersole raised it at the site, we had a team which is called an engineering review team that goes around the site looking for spacial system interaction and effects such as jet impingement and pipe whip.

They had seen this potential problem and had begun the analysis. Initially -- well, as I said, the potential damage mechanisms or radial deflection of the riser, if you had a pipe break here, of course you can postulate that you may get radial deflection of that riser arm and, of course, it is difficult to see in this picture because I have not drawn in the CRD withdrawal lines.

But they are not only lines with supports supporting those bundles, okay, and that effect could potentially -- if I remember right, there is a supporter right in this area -- could impact one of the supports for the CRD bundle. That is why we have got these pipe whip restraints and the modification was made as a result of that analysis, where this restraint was tightened to ensure that there be no impact.

In addition, there was -- I think there was one modification made to the support as a result of that pipe whip. In addition, originally the initial analysis by GE said that there may be a longitudinal pipe break right in -- along the header. That was a conservative measure because the stress analysis had not been completed. At a later time the stress analysis, when completed, showed that in fact you would not have a longitudinal break. Okay?

So there may have been some confusion early on in that at one time there was a break postulated there, when the stress analysis was finished and it went away.

The only other area --

MR. OKRENT: Excuse me. I just want to understand the significance of your comment. That means, does it, that this particular break has not been protected against because it is of sufficiently low probability?

MR. RICHARDSON: From a pipe whip standpoint is really is protected against because these restraints were really placed before that, originally, okay. The jet impingement effects were originally looked at until it was found that there was no need for evaluating the impulse loads from the cone because there was no break, okay.

The stress was within allowables. Therefore, in accordance with MTB, the NRC Staff positions on jet impingement and that, there was no need to pursue it any further.

MR. EBERSOLE: So you are invoking the low stress level as an escape route to deny the presence of potential pipe splits that would provide a potential jet to do this?

MR. RICHARDSON: The stresses within allowables.

MR. EBERSOLE: You are riding on the stress level and denying motor failure?

MR. RICHARDSON: We are still postulating breaks in other areas.

MR. EBERSOLE: You are taking this particular place where it would be sensitive effect?

MR. RICHARDSON: In that particular area, yes.

MR. EBERSOLE: You are not doing anything different to the pipe there. It is the same pipe.

MR. RICHARDSON: That is right. We are still postulating breaks here, here --

MR. EBERSOLE: In the general context it is a high stress point.

MR. RICHARDSON: That is right.

MR. EBERSOLE: You are being selective in your break locational routine. Is your argument then you will not have breaks in these critical areas where the break would prevent scram?

MR. RICHARDSON: There are some breaks in areas that could have prevented scram and we will look at that further. That is what I am going through.

That particular break which we have reported on later was analyzed away because of the final stress analysis. That is one particular break.

MR. BENDER: That is a form of break you are saying?

MR. RICHARDSON: That is right.

MR. BENDER: Split. Is that the one you are excluding?

MR. RICHARDSON: The longitudinal split, yes, in that area. There is another one that is postulated down somewhere in this region.

MR. BENDER: But guillotine breaks have been covered at least in a general way. Is that right?

MR. RICHARDSON: The guillotine breaks postulated in this particular stress analysis was at the nozzles here at the interface between the header -- at the nozzles and at the interface between the nozzle and the riser.

MR. BENDER: And you have restraints to take care of those?

MR. RICHARDSON: That is correct.

The other area that was looked into is, for instance, this particular break here establishes a cone this way, like that. Now in one particular case, in one of the risers the bundles came down and, of course, they had supports above and below. And the support was modified.

And originally this was one where I think there was some confusion, Dr. Ebersole, in that that was the support and the break where it appeared we were going to put in some barriers or some blast shields because that appeared it was going to be the easiest way to proceed. That is what we originally reported on to you.

MR. EBERSOLE: Yes.

MR. RICHARDSON: Following that, we decided to proceed with a more rigorous analysis. The initial analysis, in particular, looked only at assumed elastic deformations in the CRD, in certain withdrawal lines. We decided to pursue a more rigorous analysis, which is allowed, and the final analysis was elasto-plastic. It allowed some plastic deformation within the allowable ductility ratios which shows no loss of functionality in the CRD system

The basis for that was some testing that had been performed at the Hanford facility by General Electric. In that testing they showed that -- I may not have the numbers exactly correct, but maybe someone from GE could back me up -- but I think it showed that something like 87 percent of the insert withdrawal lines could actually be impaired and you would still have no functional loss of the scram capability. The timing of the scram was still adequate.

MR. EBERSOLE: Pardon me just a minute. Did you say 87 percent?

MR. RICHARDSON: That is correct.

MR. EBERSOLE: Wait just a minute. How many rods can you have out of this reactor in what locations when you reflood it with fresh, cold, clean water after a loss of coolant accident without returning to criticality? It is a simple question.

MR. RICHARDSON: How many rods can you have out after you reflood without returning to criticality?

MR. EBERSOLE: Right quick. You know, it is not many.

MR. RICHARDSON: One or two, depending on --

MR. EBERSOLE: I have difficulty fitting this with 80 percent of the tube failures.

MR. RICHARDSON: What we are saying is not 80 percent of the tube failures. We are saying with allowing a certain deformation of the tube.

MR. EBERSOLE: A certain amount of deformation.

MR. RICHARDSON: That deformation was shown in the testing done by GE to be pu to 87 percent deformation of a tube, and you still have the flow area to provide the scram function of a rod.

MR. EBERSOLE: Per tube?

MR. RICHARDSON: Per tube, that is correct.

MR. EBERSOLE: We are riding on 87 percent deformation.

MR. RICHARDSON: That is what the test showed. Now in our analysis, we were more conservative. We said that we would only allow 60 percent, if I am not mistaken. Somebody may correct me if I am wrong.

MR. EBERSOLE: Let us stop at this point. I heard that 60 percent deformation is all you are going to allow. What I have difficulty with -- and I ask other members here to consider it -- is the thesis of uniformity of damage rather than selectiveness of damage such that a few tubes, but more than enough, experience virtual full pinch-off or closure. Others get damaged almost none at all.

You are talking about an average effect under a hydraulic load condition. I am looking for the selected view. It does not take many, remember, which in fact did not experience the 60 or 80 percent but really did go full enough closed to preclude their proper function.

MR. RICHARDSON: We showed none in our analysis.

MR. EBERSOLE: None at all?

MR. RICHARDSON: None at all. There is one more piece to that. The testing done at Hanford was a 3/4-inch line, if I am not mistaken. We then did some testing at Mississippi State University to verify that with the amount of load expected that the flow area with a certain bend for the one-inch line, which we had, would still allow the necessary or the required flow for the scram function.

MR. EBERSOLE: You concede there will be perhaps some bending, but not sufficient closures on even a few tubes?

MR. RICHARDSON: That is right.

MR. EBERSOLE: To cause improper rod response.

MR. RICHARDSON: It is a local phenomena and local on certain tubes, and even on those tubes the deformation is not enough to lose the scram function of that rod for those insert-withdraw arms.

MR. BENDER: For the benefit of the few of us who have difficulty understanding the geometrical configuration that you are dealing with, where is this crimping which I guess is the circumstance that is supposed to occur?

MR. RICHARDSON: It is not on any of this piping you see here. The CRD insert and withdraw lines come down and there is an insert and withdraw line for each rod, control rod. They come down in bundles, all right, right along in this area and again go down and go underneath the vessel.

The crimping, if you postulated the break -- the circumferential break -- here with this jet cone coming down, then with a conservative analysis you would be postulating a certain crimping of some of those insert and withdraw lines in one of these bundles.

MR. BENDER: That would be caused a jet pushing on the line and causing them to bear against each other or just to bend in some kind of a sharp curvature?

MR. RICHARDSON: To bend and a certain amount of curvature. I am not sure how much the radii of the bend would be.

MR. BENDER: What is the size of the line?

MR. RICHARDSON: One inch. It is equivalent of a Schedule 80 pipe, if I am not mistaken.

MR. BENDER: And what is being imposed upon them -- a fluid at what pressure?

MR. RICHARDSON: The reactor pressure is 1,000 pounds. I am not sure what the final load on the actual rods would be.

MR. BENDER: So the reactor coolant system pressure would be imposed in some water jet on the piping which would be expected to bend and collapse perhaps due to the sharp rates?

MR. RICHARDSON: Yes.

MR. EBERSOLE: Did you look at the different effects for these pipe turns at the upper and lower areas of actual impact and determine that you did not have any undue strains or deformations reflected off at distant points?

MR. RICHARDSON: The entire support and CRD system was analyzed.

MR. EBERSOLE: In the long run, it is your plant, I get your impression you are working with a very sharp pencil against mammoth consequences if these strange things should occur.

MR. RICHARDSON: This is not an atypical analysis. It is part of the standard analysis done for jet impingement in the standard staff branch position.

It is nothing magic.

MR. EBERSOLE: You are satisfied that you will retain full function?

MR. RICHARDSON: Yes.

MR. EBERSOLE: Without even three failures?

MR. RICHARDSON: Yes. Based on the analyses we have done, we are satisfied.

MR. EBERSOLE: Does Staff have anything to add to this at all? Have they evaluated this?

MR. HOUSTON: In the supplement number 3 they only addressed the functioning of the HCU units with the impact on the floor and with the spray wetting that would hit the electrical.

MR. EBERSOLE: This is a more direct problem.

MR. HOUSTON: I do not believe they looked into the piping in this particular aspect.

MR. RICHARDSON: This particular analysis, a discussion of this event, was submitted to the Staff in several letters which we can give you the letter numbers if you need those.

MR. PLESSET: Do you have any idea what the most damaging jet would be, how far it would have to travel to hit these control rod drive lines?

MR. RICHARDSON: I do not remember the exact distance, Dr. Plesset, from the actual breakdown to the bundle.

MR. PLESSET: The most damaging one. There must be some idea of what distances are involved. Does anybody remember? Ed?

(Pause.)

MR. RICHARDSON: We can give you that information.

MR. EBERSOLE: Are the bundles such that the concentric distance of these pipes are so close that they form a flow impediment and you would get effects you would not see in a one-tube experiment? Do you have tightly grouped bundles that would confine the blast effects and do more serious damage than you saw in a single tube?

MR. RICHARDSON: I do not think that is the case. If anything, the analysis was conservative in that it assumed the full blast was on the actual line, where in reality it is not. It would be dispersed over several lines.

MR. OKRENT: I am sorry. I do not think you mean that. I doubt that you were intending to say that all of the water lost its momentum due to a single tube.

MR. RICHARDSON: I am saying we did not assume that momentum was lost and, therefore, another bundle -- another line was analyzed at a lower load. Okay? That is not what we did.

We took a line. We said here is the loading and what is the deformation. Perhaps I do not understand your question.

MR. EBERSOLE: Do the two bundles confine the mass flow out of a break to a degree such as to impose a higher bundle pressure differential than you would see in the failure of single tubes? My impression is these tubes are very numerous. You have got 185 tubes -- twice that many.

MR. RICHARDSON: 193.

MR. EBERSOLE: It is a really passle of tubes. My basic question is would your testing have looked any different if you directed a steam jet toward a bundle rather than one isolated tube?

MR. RICHARDSON: I do not think it would. I can check into that.

MR. EBERSOLE: I really do not know.

MR. PLESSET: I do not think so. It is just as though it were brought to rest, taking the full impact pressure.

MR. BENDER: A lot depends on what kind of distribution you are looking at. If you apply the force over an area and that area is causing the bundle of tubes to bend, then you might crimp somewhere else. If what you are doing is just looking at the collapsed tube and the force imposed upon it, the worst condition would be putting it all on one tube.

But at the moment I am not sure which one is limiting. In the analysis, which one was limiting?

MR. EBERSOLE: Water and steam. You took it as water and steam -- two-phase.

MR. RICHARDSON: That is right.

MR. OKRENT: Let us see. I have heard, I think, a few questions raised. One of the earlier one related to whether in your looking at the possible damage to these one-inch pipes you did or did not include a full postulated range of pipe whip or full postulated range of jets.

I think the answer was with regard to jets, at least, you took them at certain locations and certain types, and I am not quite sure what you said with regard to pipe whip.

MR. RICHARDSON: The same. The stress analysis identifies the areas of highest stress. You postulate the breaks. You look at your pipe whip and your jet impingements at that break.

MR. OKRENT: Then I have a question that I would like at some point to understand the answer to, but it does not have to be in the next two minutes. It could be on Thursday, if we cannot do it today.

But if one assumes that the stress analysis gives certain results, given that the piping is built as designed and the hangers and stuff function as they are supposed to and so forth, can you get marked differences in stress patterns such that a supposedly low stress region now becomes a high stress region if a hanger fails or a strainer malfunctions?

If not, that is fine. If so, are these scenarios where you could get an adverse effect on this one-inch piping? If so, does that mean you have to take some special measures with regard to being sure that the hangers or snubbers or whatever they are are functioning properly and so forth?

A second kind of question is in any of these regions which are nominally lower stress regions, are there any unusual structures inside the pipe that if they got loose or did something -- I do not know what -- could lead to a rapid development of cracking where you would not ordinarly expect it in BWRs now and then because of whatever it is -- a crevice that should be there, a thermal sleeve that was not doing what it should and so forth?

There are cracks developing very rapidly and there is surprise before it has occurred. It is explained afterwards. I would be interested to know in any of what you would call areas that are sensitive with regard to their effects on tubing if there is any such potential, or did you look and assure yourself there was no potential and so forth?

You may well have looked at this. But that would also be part of the picture if the plant is unusually sensitive to a break in a particular region.

I wonder is it practical to talk at all in terms of a crisp summary of this problem at the full Committee meeting, or is it more sensible to try to come back to this topic later this afternoon, and the Staff will tell us perhaps yes, we reviewed this all in detail. The right man is not here -- whatever.

What are the opinions about that?

MR. BENDER: I have a hard time seeing the specific problem as being something that should be immediately discussed for this plant. We do not know any more about this configuration than any other one, but I do not have any reason to think this one is any worse than any other one.

MR. PLESSET: Mark Is and IIs would be the same.

MR. BENDER: What we should focus on at this point, it seems to me, there might be a lot of important things to worry about and I do not see this one as being anywhere near the level of importance that we warrant putting a lot of tension on it.

MR. EBERSOLE: Let me comment on what Mr. Bender said. Mr. Richardson, do you understand that if I have a loss of coolant accident and things work out I can mitigate? Do you understand what happens if I return to criticality with -- you have got a two-unit plant here. If I return to criticality, I do not care what low power level, if it is five percent fission power. Do you understand what is going to happen to you?

MR. RICHARDSON: Without the scram function?

MR. EBERSOLE: Yes.

MR. RICHARDSON: You have an ATWS, basically.

MR. EBERSOLE: Essentially I would just as soon lose the vessel. It is analogous to a PWR vessel failure.

MR. RICHARDSON: We are not talking about all the rods.

MR. EBERSOLE: It does not matter. You are going to lose containment. You are going to lose both units. You are going to lose the reputation of the business. It is a monumental catastrophe.

MR. BENDER: Jesse, if it happened that way, it would be.

MR. EBERSOLE: I am saying there is no modulation to this consequence. It becomes an absolute sunburst of disaster.

MR. BENDER: Only because you postulated that it would happen. You have not looked at the mechanism that has reason to think it is.

MR. EBERSOLE: I first look at the terminal event. You cannot do a damn thing about this. You cannot put poison in it. It runs all over the floor. There is no stopping the ultimate progress of events.

And when I find a case like that I personally adopt as gross and cheap methods as I can not to really try to, with a great deal of time structure and perhaps a high degree of sophistication, with the attendant lack of confidence, study the method whether I will or will not get into this.

But I am inclined to have very sturdy and unquestionably positive means of prevention in the path of such cascade. Now I do not know whether you have done that or not. Perhaps you have to your satisfaction. I think I will have to leave it at that point.

MR. PLESSET: I think we have gotten a very crude idea of how to analyze against this event, and it is not fair to jump to conclusions.

MR. EBERSOLE: Right. I do not have any feel for confidence.

MR. PLESSET: I was hoping we might get something from this.

MR. OKRENT: This was not discussed, I gather, at the Subcommittee meeting?

MR. EBERSOLE: No.

MR. BENDER: It has not been discussed at any boiling water reactor design meeting that we have run into up till now. I do not see this as being different for this BWR than any other BWR.

MR. PLESSET: Does it not apply to Mark Is and Mark IIs?

MR. BENDER: I think the other 20 to 30 BWRs that are already operating are of more concern than this specific one.

MR. EBERSOLE: Each newcomer into the BWR business should have the benefit of knowing about these things.

MR. BENDER: I think it is a distortion of the problem. I think we have put more emphasis on it than it justifies.

MR. EBERSOLE: Mike, do you deny the potential consequence?

MR. BENDER: If I accept the worst possible consequent that you postulated, it could be very serious.

MR. EBERSOLE: If I fail three tubes, would you agree to that?

MR. BENDER: I do not know that you are likely to fail any.

MR. EBERSOLE: I just gave you three.

MR. BENDER: I do not know and I do not know what the consequences, nor do I know how long it would take for it to fail, nor do I say we need to worry about it.

MR. EBERSOLE: It is a cotter key between human disaster. I would like to see a good one in place.

MR. OKRENT: I guess it would be helpful, I think, if we could learn a little bit more about this question that Mr. Ebersole has raised and I doubt that we will get a full discussion of it today or tomorrow, but if there is more than either the applicant or the Staff could tell us about it tomorrow, I suspect it would be helpful and then the Committee can decide, you know, whether it wants to look at this generically or whether it is in good shape and it needs no further look or whatever.

MR. BENDER: I do not mind hearing about it, but I will repeat what I said before. There are lots of BWRs around. They are all running. The problem is comparable on all of them and why this has suddenly become an issue is a mystery to me. But if it is an issue, then the regulatory staff better look at it for all the plants and we ought to have an answer on the entire group and not just this specific one.

MR. EBERSOLE: May I mention one thing? Consideration of damage to the HCU units is not before. Here it was put on a platform subject to dynamic LOCAs. In my view, that is a far less problem than the one we just got throught talking about.

MR. PLESSET: It is a less problem, Jesse, because --

MR. BENDER: I do not think anybody argues about whether the platform is an issue or not. It was not an issue either, that is all.

MR. PLESSET: Did the applicant make these calculations? Can we spend a little time to get a little more information?

MR. OKRENT: Right now we still have fifteen minutes, according to the agenda, before we leave the subject of thermal hydraulic loads. Okay? So we are not even behind the agenda yet.

MR. PLESSET: Give him five minutes.

MR. OKRENT: I did not know whether it would be better to continue discussion now or try to come back to it later. What does the applicant wish to do?

MR. CESARE: Guy Cesare, Mississippi Power and Light. Perhaps a few words. We might like to collect our thoughts and address some of the general statements that have been said.

But some of your concerns, Dr. Okrent, specifically, we have looked at a full range of jet impingements resulting for pipe breaks exactly consistent with what every BWR has done, consistent with what the Staff's branch technical position on how to construct the break analysis, where you select break locations in terms of circumferential and longitudinal breaks. We have looked at the breaks consistent with the criteria that has been established, for one.

In regard to the hanger performance, in this particular case where the radial -- where the risers are subject to radial deflection we made calculations on our deflections and adjusted those deflections, made some adjustments -- minor adjustments -- in clearance between the riser and the hangers, and those clearances were based on calculations for models that were based on actual testing that General Electric has conducted.

Thirdly, the criteria in the branch technical position does direct you to investigate the amount of stress and usage factor on that piping and we meet that with considerable margins in these particular cases. And in addition to that are you talking about indications of cracks that might be propagate to some type of failure? Is that what you are talking about?

Our in-service inspection program certainly should, as a base line, have picked that up in the installation and pre-service inspections, if we had any problems like that.

MR. OKRENT: Let me, if I can, clarify the point I was trying to make. If -- and this is an if -- if there are certain ruptures that lead to very awkward situations, then you want to make sure that these ruptures are highly improbable. The Staff has laid out a certain branch technical position in which it recognizes it is impossible to restrain all possible configurations at all possible places.

They try to identify some way of saying that these may be the more likely based on stress calculations, so we will postulate these and you need not postulate in others. But if in fact you are counting very heavily on certain kinds of ruptures not occurring elsewhere, you do not want to be surprised in the same way with reactor vessels -- inspection while it is being made and then there is in-service inspection program.

You do not want to be surprised that something you are counting on -- whether it was a hanger performance or something else I do not know, something you are counting on -- in fact did not function in accordance with the analysis. I was just asking whether this extra look was taken in some way. Whether it was an analysis or in-service, I do not know, or whether it was even necessary. I do not know.

Maybe you can tolerate these various other breaks, but if there are some which are relatively intolerable, then one wants to be assured that you just have not assumed everything will be as designed and analyzed over the life of the plant. You may want to do certain other things to assure yourself that it is as designed and analyzed.

That was my part of this set of questions. Is that clear?

MR. CESARE: Yes.

MR. OKRENT: The answer may be that it is all in hand or I do not know. Would the Applicant or the Staff want to add anything to Mr. Ebersole's question at this time?

MR. BENDER: I think we better find out

whether the Applicant understands Mr. Ebersole's question.

MR. EBERSOLE: Does the Applicant understand my question. Mr. Bender wants to know. I will try to rephrase it.

I am really asking --

MR. OKRENT: Let us see.

MR. MC GAUGHY: I think we do, but in response to Dr. Okrent's question, the best answer to that question is we have an ongoing in-service inspection program to see that things stay within tolerances in terms of piping, cracking and so forth over the life of the plant.

MR. OKRENT: Let me say this. I am aware there is an in-service inspection program. There is also a sampling program for bolts. So some of these things were prepared with a certain kind of procedure in mind, a certain kind of failure situation in mind. And they are not always prepared with all of the things in mind that one later thinks of.

So I cannot tell offhand whether the current inspection program, whatever it is, is adequate for this purpose. It may well be. But Ed, I think, was originally preparing the in-service inspection with other kinds of functions. It is possible.

(Pause.)

MR. MC GAUGHY: If I may characterize your concern or question, it is that suppose there is some break that even though it is very unlikely because the stresses are very low and even though it is adequately anchored, suppose it was not -- this particular -- suppose the margins were not there and suppose the anchors were not there. Then what additional have you done to look at that break?

MR. OKRENT: No, no. That is not my question.

If you are counting on the pipe not breaking in certain ways in certain places, and in analyzing it and deciding that this is a very low probability event you are counting on certain hangers functioning, certain snubbers not malfunctioning so that they do not lead to cracking that is not within your calculation, are you putting enough attention to these snubbers and hangers over the life of the plant so that you can be very confident that an undesirable situation does not develop?

That is the sense of my question. You are not just assuming everything is okay or that because we have some kind of an in-service inspection it covers the really critical areas if there are any real critical areas. Is the question clear or not?

MR. TRICKOVIC: My name is Robert Trickovic. I work for Bechtel Power Corporation.

I believe we have led you to believe that we have used an awfully thin pencil, sir. We have not relied entirely on the expectation that our hangers and restraints would perform over a period of 40 years of life. We have assumed postulated breaks to occur in accordance with the rules presented in the branch technical position.

As a matter of fact, we have designed and installed a very significant number of shields to protect sensitive targets. That was step number one.

In a certain number of other targets we have utilized the energy coming out of the postulated break and applied it as an exterior load to some other piping systems and analyzed the ability of those piping systems to withstand that load.

Thirdly, I believe earlier you mentioned the possibility of secondary generated missiles.

MR. OKRENT: No, I did not say secondary generated missiles. Sorry.

MR. PLESSET: They talked about jet impingement.

MR. OKRENT: I did say that we sometimes find cracks, large cracks, in BWR piping due to crevices that trap flow or other things inside pipes, so that even though it was not a high stress location necessarily, or even if it was, you would never expect to find crack growth at the rate it occurs.

What I am saying is you are counting on a region not giving you a major rupture. You just want to have --

MR. PLESSET: They assume that they have ruptures and breaks. Is that correct?

MR. TRICKOVIC: That is correct.

MR. PLESSET: You have it laid out in some sort of recipe formulated by the Staff?

MR. TRICKOVIC: Yes.

MR. PLESSET: You have applied these to these lines?

MR. TRICKOVIC: Including the insert-withdrawal piping bundles.

MR. PLESSET: So they have assumed they have these breaks.

MR. OKRENT: No. Jesse's point, I believe, is that there are some portions of the piping where breaks are not postulated to occur.

MR. EBERSOLE: That is correct.

MR. OKRENT: It is possible for these portions of the piping you might have adverse effects on enough tubing on pipe that you could get to a local situation where it was difficult to shut down the plant. But when you say you have complied with the branch technical position -- which I assume they did or the Staff could complain -- you are making this, I think, kind of analysis.

My point was when you are making this kind of analysis you want to be sure that in addition to analyzing it that over the plant life in fact it does function in a way that we do not get big cracks in these regions. And that is a sort of preventive question and inspection kind of question, to make sure that the look is commensurate with the need.

Jesse's point, I think, is a little different. I think he would prefer not to have the potential there.

MR. EBERSOLE: Right. Or else invoke some mitigating functions. This problem is a little bit analogous to an earlier one that we still have not had -- I do not expect the Mississippi Power and Light or Grand Gulf has got this case in point, but would you run a main steam line even though it is a perfectly straight line and its low stress and high quality and perfectly well inspected -- would you run it right through the control room and declare you had a nice plant?

It is a judgmental problem. You can use the Staff consideration for non-failure and say so what. Do you follow me?

MR. RICHARDSON: Yes.

MR. EBERSOLE: I trust you have not done that.

MR. MC GAUGHY: The answer to the question is no.

MR. RICHARDSON: The answer to your question is no, we have not done that. It would be difficult to do with a BWR.

MR. EBERSOLE: It is almost the same situation. You are allowed a set of dependencies to build themselves on top of your case until you begin to get nervous about how reliable each set of dependencies really is.

MR. OKRENT: Do you understand his point now?

MR. RICHARDSON: I think we understand his point.

MR. OKRENT: That is a good example. I think there was a plant that had a steam line pretty close to the control room, because the branch technical position allowed it.

MR. EBERSOLE: Incidentally, what does the Staff do about steam pipes through control rooms? Do you allow them to do this on the grounds that you can be selective in how your plants fail?

MR. SWENCER: No. No comment.

(Laughter.)

MR. OKRENT: Well --

MR. EBERSOLE: I think we have aired it.

MR. OKRENT: We are now in fact at the point in the agenda where it says break, so I propose we take about eight minutes. We will commence five minutes early and I will feel like I am ahead of the agenda.

(A brief recess was taken.)

MR. OKRENT: The Subcommittee meeting will reconvene.

The next agenda item relates to hydrogen control. According to the way the agenda in front of me is written, we will have a presentation from Mississippi Power & Light, is that correct?

MR. McGAUGHY: That is correct. I'd like to present Mr. Sam Hobbs.

MR. OKRENT: Before you start, if you were not interrupted how long would your presentation take?

(Laughter.)

MR. HOBBS: During our rehearsal yesterday, we got interrupted very frequently. It took around one hour.

MR. OKRENT: Well, let me suggest that you pick out the material that you think is more important to present first, and that you include the material that you could cover in 20 minutes if there were no questions, so that we have ample time for discussion and questions, okay. And then if you have need to call on something else because a detailed question was asked or whatever, you can do it. But get the main parts of your presentation into the first 20 minutes, as it were.

I suspect there will be a lot of interest in the topic and I don't want to use up all of the afternoon on it, okay?

MR. HOBBS: Okay.

(Slide.)

To provide a brief summary of the subject I will discuss today -- and I will attempt to emphasize material which has been submitted to the Nuclear Regulatory Commission and the work that's been done since our last ACRS meeting, where we did discuss hydrogen. I will discuss very briefly system design qualification, our base case selection for containment response evaluation, equipment survivability, structural capability, local detonations, and our testing program.

(Slide.)

If I can go over this one very quickly, basically, we have igniters located in 90 locations in the drywell, wetwell, and the containment, 18 in the drywell, 11 in the wetwell, and 61 in the upper containment. I believe that there are very minimal changes between that and when we last discussed it.

Our separation criteria for igniters in providing locations was 30 feet or up to 60 feet if we only had one train in place. To make up for the use of the GMAC model 7G igniter with the spray shield that includes excess provisions and a transformer for voltage. We use a 120-volt AC power supply, two engineered safety division power division, each division separated into two breaker circuits and these are operated remotely by manual switches in the control room.

The minimum glow plug surface temperature is 1700 degrees.

(Slide.)

Component qualification. Basically, the igniter assemblies are qualified for seismic and hydrodynamic events, with an absolute sum of safe shutdown earthquake LOCA and safety relief valve actuation. They are qualified for the environmental conditions resulting from successive hydrogen burns, as well as for IEEE 323, 1974, environmental conditions, and IEEE 344, 1975, seismic requirements.

We have a testing program under way at this time. The only remaining tests to be conducted are the actual burn environment tests. Those tests are now scheduled for August the 26th. To date we have had no difficulties in passing.

Basically, the operation of our system -- and we will be discussing this in a little bit more detail later -- is that for events that have a potential for excessive hydrogen releases, that is when we get into the situation that requires core cooling without level restoration, when the water level falls to or below the type of the active fuel, then we manually initiate the hydrogen igniter system, the combustible gas control system, purge compressors, and the containment sprays for temperature mitigation.

(Slide.)

The base case selection. We attempted to use realistic initiating events. I'll discuss which events we used. We attempted, given that we were talking about a degraded core situation and not being able in the early stages of an accident to put water into the core, we attempted to construct a realistic scenario.

We made use of our base cases, our two base cases, for sensitivity studies and as a basis for other evaluations in such areas as procedures and how they would be applied in the event of a degraded core systems interaction, whether you could have complicating effects between the hydrogen ignition system and other systems, and for our equipment survivability evaluation.

(Slide.)

Okay. We concluded that we had two base cases -- a stuck-open relief valve and a small break LOCA in the drywell -- that were appropriate for considering. The stuck-open relief valve, basically we considered we had a system transient, loss of feedwater, main steam isolation, closure, that we had either an inadvertent valve opening or a relief valve popping and failing to reclose.

The mitigating events or the mitigating activities is that as core level fell below the top of active fuel conditional safety relief valves would be opened to provide steam cooling across the core. We would initiate the containment spray, energize the hydrogen igniter system, and initiate the combustible gas control system.

(Slide.)

Our basic description of the base case. We made use of MARCH release rates, which were done by Battelle for Sandia, for the NRC for early probabilistic risk assessments, a study that was done. We assumed our combustible gas control system and igniters were initiated 20 minutes into the event. We assumed our upper pool dump was initiated 30 minutes into the event, and we assumed that our ignition criteria, ignition would occur at 8 volume percent and burnup would go to 85 percent completion.

We made the assumption that six foot per second would be the flame speed and that we would have one spray train initiated after the first burn. I would draw your attention that this is an inconsistency from our ~ ~'er slides. What had happened is that after some considerable discussion with the Nuclear Regulatory Commission we had committed to initiate in our containment spray at the same time that we initiated our hydrogen ignition system.

However, at that point we had done an enormous number of analyses and we do not feel that it was necessary, since the containment spray would provide a mitigating effect, to go back and redo those analyses. So we have stayed with the original analyses. So there is a measure of conservatism.

We assumed that we had an appropriate amount of spray carryover from the main containment volume into the wetwell and, because of the fact that at the end of our base case evaluation we had approximately a 7.8 or 7.9 volume percent hydrogen concentration in the upper region, we went ahead and assumed we would have a containment burn.

We did a restart of the code, and when we discuss this in a little more detail in a minute we will discuss both our nominal base case and our base case with forced containment burn at the end.

(Slide.)

MR. BENDER: Excuse me. Just because I like to keep it in order, what is meant by the carryover?

MR. HOBBS: There is considerable blockage fro the upper containment region into the wetwell, which is the region between the HCU floor and the actual surface of the suppression pool. So because of the equipment that's located in the annular region, because there is on the HCU floor in a steam tunnel, because there is some area where the spray would fall into the upper pool, we took what we considered to be an appropiate reduction in containment spray falling into that region.

MR. BENDER: That's all I want to know, thank you.

MR. HOBBS: I can expand on that if you need it.

MR. BENDER: No, that's enough.

(Slide.)

MR. HOBBS: I put my next slide under the stack instead of on top.

Basically, this situation that we have on the left-hand column is our nominal base case. In the right-hand column is with the forced burn. We have no burns in the drywell which, for a stuck-open relief valve -- which is making a delivery of our hydrogen and steam to the suppression pool -- we would not expect. 59 burns in the wetwell and no burns in the containment.

We did have a single forced burn in the containment, which was artificially initiated, although we were very, very close to the appropriate criteria for having a burn occur.

MR. BENDER: That's because the concentration builds up there first?

MR. HOBBS: In the upper containment region?

MR. BENDER: Yes.

MR. HOBBS: No, sir. Basically, the concentration builds up in the wetwell. However, since burns are not complete and since as burns occur there is some expansion and then later on some contraction, and because of the wide mixing that's assumed to occur, you will have a slow buildup of hydrogen in the upper containment region. And unless it basically reaches the same criteria for a burn as the wetwell region has to have, we would assume that there would be no propagation of the burn into that region.

Our peak temperatures in the drywell, wetwell and containment were 137 degrees Fahrenheit, 1,020, 197. With the forced burn in the containment, we then see 681 degree temperature in the containment and a slightly higher temperature in the drywell of 193 degrees, which primarily results from compression.

The peak pressures were 9.6 psig in the drywell, 9 in the wetwell, 8.8 in the containment. With the forced burn we saw peak pressures of 18.6, 23.5, and 23.9, respectively.

(Slide.)

Our other base case was a small break LOCA. For that case we assumed that we had a rupture of a small intermediate sized pipe in the drywell. The mitigating events are precisely the same as they were for the base case, with the suppression pool release with the stuck-open relief valve.

(Slide.)

Now, the differences between the base case description and this case and for the stuck-open relief valve were very, very minor. Basically, the most significant difference, the only difference I believe, is that at 20 minutes into the accident, once additional SRV's began to be opened to provide a steam cooling flow across the core, we assumed a 50-50 split between -- of hydrogen and steam between the drywell and the suppression pool.

Now, that was based on some calculations about the pressure drop through the safety relief valves and the driving force in the vessel.

(Slide.)

Our summary of results for the drywell break case are that we have one burn in the drywell, 32 burns in the wetwell, and one burn in the containment. Lest it seem that only a single burn in the drywell is suspiciously low, since that is where 50 percent of our hydrogen is being released, I would point out that because of the event you have steam inerting very early in the accident, and that then later on you have a hydrogen steam-rich atmosphere with virtually no steam left to support combustion.

The temperatures, peak temperatures, were 707 in the drywell, 2295 in the wetwell, and 860 in the containment. Our peak pressures were 16.3 psig in the drywell, 31.6 in the wetwell, and 32.1 in the containment.

MR. BENDER: But ignition did occur in the drywell?

MR. HOBBS: Basically, we assumed that the combustion gas control system is turned on at the same time the hydrogen ignition system is energized. We began delivering oxygen to the -- or delivering air to the drywell at a rate of 1160 cubic feet per minute. That will eventually build up until you have enough air in the drywell to support combustion.

At that time you get a single large burn in the drywell because of the pressure buildup in the drywell at that time. You then basically burp a portion of the drywell atmosphere out through the containment. There is some unburned hydrogen in this, which ends up with a large burn in the containment as a result immediately following that.

MR. BENDER: Pressures are not -- what turns out to be the limiting pressure?

MR. HOBBS: I'm sorry? You mean as compared to our ultimate capacity?

MR. BENDER: Yes. Well, I was really trying to compare that particular burn with the ones in the wetwell.

MR. HOBBS: The earlier summary with the forced burn in the containment, we saw a 23.5 psig in the wetwell. With forced burn in the containment, that was when that occurred. It was during that forced burn.

MR. BENDER: Thank you.

(Slide.)

MR. HOBBS: The next major topic --

MR. OKRENT: Before you go on to the next topic, let's see if there are questions with regard to the pair of cases you've discussed so far.

(No response.)

MR. OKRENT: Any questions or response from the consultants or the members?

MR. SCHOTT: The set of numbers displayed here on the last or the next to the last slide for the drywell break case appear to be a more recent set than have been exposed to this Subcommittee for that case. Is that -- they don't look dramatically different, but there was a set of comparisons of these two cases included in an item dated, I think, April of this year.

MR. HOBBS: April of this year or April of last year?

MR. SCHOTT: It must have been April of this year. And the stuck-open relief valve case numbers that you have shown here today look much the same. This other slate of numbers looks comparatively scrambled up. The qualitative conclusions that one would draw aren't dramatically different. They're just not the same set of numbers; recognizable within two or three digits.

MR. HOBBS: I might have some confusion about an April of this year submittal. Maybe I will end up being corrected from the floor. We had made some submittals late -- well, early last year. We had then made some follow-up submittals just prior to our ACRS Subcommittee meeting last year, and we had done some six or eight cases.

MR. SCHOTT: There were six or eight cases delineated at that time.

MR. HOBBS: Since then we have changed the base cases. We had identified a preliminary base case. We assumed that we had two trains of containment spray operational for the stuck-open relief valve case, and that turned out not to be a very sensitive assumption at all.

Then for the drywell break case we had assumed that the combustible gas control system would not actuate until it came on automatically, very, very late in the transient. At this time we now assume that those purge compressors are actuated at the same time the hydrogen ignition system is actuated, so that the timing is somewhat different and apparently the detailed pressure analysis is somewhat different.

MR. SCHOTT: This is the drywel' purge, which is a part of the combustible gas control system?

MR. HOBBS: Yes.

MR. SCHOTT: Does the combustible gas control system include any recombiners also, or is that a negligible component of the whole operation?

MR. HOBBS: It doesn't include the recombiners. We do not actuate the recombiners at this time in the accident. The system descriptions that I've seen have the recombiners described, but basically for the early stages of an accident the portions of the combustible gas control system which are important are the purge compressors and the vacuum breakers.

MR. SCHOTT: The vacuum breakers are passive, are they not, or do they have a lockout on them?

MR. HOBBS: They have a lockout. They have block valves.

MR. SCHOTT: Which would be loosened in this automatic -- not automatic. It's manual, but administratively decided upon, administratively undertaken?

MR. HOBBS: Normally, if the operator did nothing, when you achieve the appropriate pressure set points those block valves would open. Then the vacuum breakers would be free to carry out their function. In fact, whether the block valves will open automatically or not, we will actuate them at the system level.

MR. SCHOTT: I think I see the principal difference in the treatment, in the evolution of treatment of former case four, which has now become the current version of drywell break base case.

MR. OKRENT: I wonder if I could ask Mr. Schott and Mr. Mark a couple of questions, or if they would comment on something. In the Staff SER they note that the Sandia National Laboratory had some recommendations. On page 22-2, at the bottom, it says:

"Sandia identifies two areas where it believes the igniter system design may be improved. Sandia recommended that the number of igniters served by circuit breakers. Greater consideration should be given to the nature of the directional flame propagation or that the number of the igniters in the wetwell region would be increased."

Did either of you look at this in detail? Do you agree with the applicant, the Staff, or Sandia, or what? Do you see where I am reading from?

MR. SCHOTT: Yes. I have thought about both of these matters. I am not expert about the electrical matter, but --

MR. OKRENT: Let's take the second part.

MR. SCHOTT: It isn't clear just how the Staff has reacted to it, other than having reiterated Sandia's recommendation, I believe.

MR. OKRENT: Are there any questions you would like to ask in this area, for example?

MR. SCHOTT: I believe the Sandia recommendation with regard to the placement of igniters and the immediate overhead obstruction or lack of it should be taken seriously. I believe I made this point in my response to the proceedings in the Subcommittee meeting in Jackson 11 months ago.

I do believe that Sandia's observation is a worthwhile one.

MR. OKRENT: Is that the identical point that is being addressed here or is it a related one but not identical?

MR. SCHOTT: I believe Sandia has gone farther than I did. I concur with Sandia's judgmental conclusion in this general area. I find nothing with which to quarrel in Sandia's recommendation.

MR. BENDER: There are probably pros and cons to this recommendation. Are the only cons that it means more things to install?

MR. SCHOTT: I don't believe one route to satisfying the recommendation that Sandia suggested. It says: or the number of igniters be increased. Even increasing the number of igniters would do no good if they were less advantageously -- if the initial ones were less advantageously placed than those already being provided.

I believe Sandia's point is that simply having them as near as possible to 30 feet plus or minus a smaller amount, being the spacing, is not the only important consideration or the most important consideration, nor is the most important consideration that they be placed where it costs the least to do so.

But the sense of the observation is that they be placed advantageously with respect to directional flame propagation that each igniter is intended to serve.

MR. BENDER: Have we concluded that they are not placed that way now? That is the question I am trying to find out.

MR. SCHOTT: I cannot tell how well -- I cannot tell if the placement has been modified from what it was a year ago to any significant extent. I don't know how many have been relocated or whether any changes have been made. I see no evidence that any changes have been made.

MR. HOBBS: Let me make a very brief observation about changes. In the wet well region and in the containment region, there have been no changes, with the possible exception of a very minor relocation of a foot or two to more advantageously take advantage of structural supports for mounting or to clear obstacles that might have caused difficulties in having a mixture properly reach an igniter. In the drywell, there were formerly 96 igniters. The 96 lowest igniters in the drywell would have been below the flooding level for a LOCA, and for long-term flooding we did not want to address the issues.

We didn't think that we could appropriately at this time address the issues of qualifying the igniters to be able to withstand long-term flooding. So the six lowest igniters in the drywell were removed. That is the only substantial change that has been made in the number of igniters or in the location.

MR. BENDER: Has Mississippi Power and Light looked at the Sandia recommendation and concluded that they are not worth doing?

MR. HOBBS: Let me make two or three comments. Since Dr. Schott has already mentioned his own recommendations, let me at least address particularly the spray shield above the igniters. To start with, the spray shield above the igniters in the wet well region have been removed. We had sufficient test data that we felt that we could justify not having the spray shields on there, so those igniters will not have any potential candle snuffer effect.

They are also not exposed to as great an extent of containment spray. The igniters in the upper containment and in the drywell region we did not remove the spray shields. However, they are call on to function much less frequently. They are more exposed to turbulence effect from containment spray, and we feel like it is much less of a concern.

As far as the particular Sandia

recommendations, and I don't have a summary of what all of them are with me, but the first one that was mentioned was igniter locations. I would like to point out that Mississippi Power and Light had retained Combustion and Explosive Research, Incorporated to evaluate our HIS system design and give us a determination of its adequacy.

Included in their recommendations were -- although they felt that we had an adequate design, they wanted us to consider adding some additional igniters in certain areas. We are, in fact, considering that. We are primarily looking at adding igniters at a lower level in the wet well, down to approximately seven feet above pool level, to provide an earlier ignition of hydrogen than we would get with the current elevation, substantially above that in the region of 17 to 21 feet.

There were one or two other recommendations, one of which was the additional igniter breakers. We feel like that issue is a little more complex than just providing separate circuit breakers. There are reliability advantages due to increased redundancy. However, you also get increased system complexity, increased complexity of testing, and we have not found any dominant cause for failure that we believe would warrant such a design change with the redundant system that we currently have.

Does that adequately address the concern?

MR. BENDER: I think that is enough for right now. I want to cogitate on it.

MR. MARK: I have the same question as Mr. Bender, whether you had had a chance to assure yourself that you knew what Sandia meant when they wrote these things. In particular, what did they mean by the nature of directional flame propagation? Are they thinking of a jet flame or are they thinking where the hydrogen really goes so you know you have the igniter there?

MR. HOBBS: I would presume they were thinking about where the hydrogen really goes, but we have not addressed that question directly to Sandia. We primarily discussed some other things in our meetings with them.

MR. MARK: You have had meetings with them?

MR. HOBBS: Yes.

MR. MARK: It seems to me they didn't have any more of a chance of having an idea than anybody else about directional flames, because what you really need to be able to find out is what are the patterns of swirling around of the gas as it might come up from that wet well?

MR. HOBBS: That's correct.

MR. MARK: One should know that to be able to say something before your advisers could say where the igniters should be. I am pleased to hear you saying that you are putting some at lower levels than you previously had.

MR. HOBBS: We are evaluating doing that. We have not made a commitment to do so, but we have commissioned a design study and are currently evaluating the results of that design study.

MR. MARK: I believe it is mentioned in the Staff SER that further confirmation of the efficacy and nature of mixing is on the study plan.

MR. HOBBS: Yes, sir. With respect to mixing we will be discussing a possible test program in a few minutes.

MR. MARK: Then this directional flame is not just a flame jet.

MR. HOBBS: I don't believe so.

MR. MARK: Also I had a different question. In the calculations you have made, you have made an arbitrary supposition assumption that the hydrogen didn't ignite until it got to 8 percent and then it did, and that it was uniform throughout the space considered. Now, the latter certainly can't be the case, but it seems to me also that you might perfectly well ignite at

6 percent.

The real point of interest is what is the percent at which you feel you can guarantee ignition?

MR. HOBBS: We felt that the 8 percent was where we could guarantee reliable ignition.

MR. MARK: But you have access to lots of tests. It seems to me that there are many of those in which earlier ignition has been observed.

MR. HOBBS: I think that is exactly correct. Our feeling was also that by going to 8 percent ignition criteria with an 85 percent burnup rather than igniting at, say, 6 percent with a 60 percent burnup, that you would see a larger pressure effect.

MR. MARK: I quite agree. But since you would expect that a large fraction of the time if 6 percent came by an igniter that some flame would start, that you would then have more burns but less pressure problems, which you don't seem to have here anyway, and if you feel you can guarantee at 8, you don't need to go to higher ones, at least you wouldn't regard them as to be expected. You have looked at higher ones, of course, in your sensitivity studies.

MR. HOBBS: Yes.

MR. MARK: That sounds fairly reasonable.

MR. EBERSOLE: Isn't that to some extent a degree of the function of the steam?

MR. MARK: They have to find out about that. The experimental studies have covered a range of that sort, so they are, I presume, taking a good look at all of the observed results and finding out what are the variabilities. Now, at 8 percent you in some circumstances will only get enough for a moving flame. At 6 percent you certainly won't get a down or even sideways flame. So igniters which might pick up stuff at 6 or 8, one would bias, it seems to me, toward the lower levels where they could get their hands on 8 percent stuff and burn it from there on up, because you won't burn it from the ceiling on down.

MR. HOBBS: Before I made an authoritative statement on that, I would want to confer with some of my consultants, but it was my understanding that at 8 percent we felt that there would be downward propagation in a volume.

MR. MARK: This is not the case in the classical writings on the subject, but it may be the case from current experiments, which are much more extensive than what was available in 1941 when some of this work was first reported.

MR. HOBBS: We can get an answer on that for you.

MR. MARK: But things like this should affect the location of igniters, and to that extent I think you and the staff would be consistent with what I understood myself S&L and Sandia might have in mind.

MR. BENDER: I would like to get an interpretation from Dr. [illegible]nott about his views of the location of the igniters as you have heard them described. Do you consider them adequate? Can they be improved? Should they be improved?

MR. SCHOTT: I have not taken time to spot each of the 90-some-odd igniter locations with respect to all but the hardware nearby. I interpret Sandia's reporting to indicate that they have. I would not contend that the locations are inadequate or inappropriate. I take it from what they say they have done to look at them, I take seriously Sandia's recommendation that they can be improved. Whether they need to be -- but I don't believe they have established that they need to be improved.

MR. BENDER: Well, it is the latter point, I think, that we need to dwell on. There are lots of opinions on where to put igniters. The real question is is this good enough. Has the Staff taken that into account and does it have anybody who is authoritative on the location of igniters?

MR. STINGLER: Joel Stingler from Containment Systems Branch. The thrust of the Sandia recommendation is basically that they feel that you obviously benefit by burning leaner mixtures of hydrogen and therefore they would recommend that, where possible, locate the igniters lower at elevations within rooms.

Most of the utilities that have installed igniter systems have struggled with this idea because it is obviously to their advantage to put them in some place where they are not likely to be broken and they don't interfere with operation of the plant, and in this regard, Sandia is merely stating a concept that most people would agree with.

Now, with regard to whether the current number and distribution of igniters is adequate, the Staff hasn't concluded that it is indeed adequate for the interim period. Part of the MP&L program to evaluate combustion above the suppression pool is intended to determine how well they perform in that configuration, and we expect that if as a result of that program it indicates that more or a slightly different location of igniters is warranted to more efficiently burn the hydrogen in that region, then we would expect MP&L and we would expect ourselves to pursue that matter. But for the interim period, the analyses which have been performed to date indicate that additional igniters are not needed presently.

But to go back to the Sandia recommendation, I don't think that there is a precise recommendation to move Igniter X to a certain location. It was merely to emphasize what most people believe, that if the igniters were perhaps lower in elevation, you could derive some benefit from that.

MR. MARK: Having to do with the mixing patterns.

MR. STINGLER: Yes, which we expect to be verified at least in some measure by the test program.

MR. HOBBS: If I could add one comment to Dr. Schott's supposition that Sandia had precisely located all of the igniters. We provided Sandia with a tour of the containment, and they certainly saw some igniter locations. I don't believe they saw all of them. They have reviewed basically drawings for determining the igniter locations.

MR. SCHOTT: That was my understanding, that they had indeed examined pages of drawings.

MR. OKRENT: I had one other question. I would appreciate having this explored briefly if that is appropriate. There was a question raised in the Staff SER as to whether or not oxygen return will be sufficiently rapid into the wetwell. Do any members of the Subcommittee or the consultants have any comments or questions in that regard?

MR. MARK: Well, I certainly saw that same question, and the calculations that you described don't compel one's immediate convictions, either MARCH or CLASSIX. I was interested to see if we can hear that the mixing studies which MPL is committed to ought to give some confirmation of how things go in that respect. That is, you will pump air into a chamber and see whether or not you get back what.

MR. HOBBS After having given a lot of thought and having worked with our consultants in the area of the containment response analysis and the use of the MARCH code, having looked at things we considered should have conservatively represented the possibility for inerting in the wetwell, which would have been the worst case, we found that in fact, we did not observe wetwell inerting, even though our only mechanism for reintroducing oxygen was first expansion and then drawing air back in.

We felt that compared to the very turbulent environment and some other things that are neglected in that calculated, that that was conservative.

In addition, when we asked Dr. Lewis and Karlovitz of Combustion Explosion to evaluate our hydrogen system, they were quite concerned with whether or not there would be inerting, and whether there would be sufficient oxygen to properly support combustion in the wetwell region. They concluded that they believed there would be sufficient air, and that you would, in fact, get oxygen reintroduced back into that area, and that was based on hand calculations that they had done.

MR. OKRENT: Okay, why don't we go on.

MR. HOBBS The next major topic is equipment survivability. Basically, we determined the thermal response of essential equipment exposed to predicted hydrogen burn environments, and we determined the ability of this same essential equipment to withstand pressures resulting from hydrogen burns.

(Slide.)

We can go over this list in a lot of detail, or I can summarize it very briefly.

MR. OKRENT: Before you go over the list of equipment, can I ask the following question. Somewhere in the staff SER they mentioned that they are interested in having an ATWS or some type of an ATWS examined for hydrogen generation to see whether it falls within the things you have already analyzed.

One of the things that could arise, I suppose, is a different criterion on survivability, or there may also be some different conditions on pressure. I don't know what to anticipate or what the staff thinks might be different, or what you think might be different.

If you were to try to analyze some kind of an ATWS situation that led to hydrogen generation, what do you foresee might be different, if anything?

MR. HOBBS Let me address that without going into a lot of detail. Mississippi Power & Light has been very active in the formation of, and currently is the Chairman, for the Hydrogen Control Owners Group for MARK III containments. We commissioned General Electric to do a study on hydrogen generation rates, where they would predict making use of modified codes that they had used for licensing basis calculations.

Early in the course of that work, we had identified ATWS type events as being one thing we felt should be included in that study. However, in our preliminary report which was submitted to the Nuclear Regulatory Commission, the ATWS work was not included because it was incomplete.

At that time, their engineers had, in fact, formed a judgment that the primary effect on hydrogen generation rate would be that there would be an earlier onset of hydrogen but the generation rates would be similar to the generation rates of hydrogen which we have already seen, and that consequently, the effects on containment response and survivability of thermal envelopes and that entire thing would be very, very similar.

Since then, additional work has been done and that analysis is complete in a preliminary form, and we are in the process, in the hydrogen control owners group, of reviewing that and preparing it for submittal to the NRC. It would be somewhat unfair perhaps to throw this kind of thing out without having submitted it to the Nuclear Regulatory Commission, but since the question came up, I thought I would provide that information.

MR. OKRENT: If I understand correctly what you said you expect this report to indicate is that there are no substantive differences in the effect on either pressures or temperatures of equipment and so forth?

MR. HOBBS The primary thing would be a time history of hydrogen generation that we anticipate from that report which would have an effect on us.

The critical effect would be the hydrogen generation rate. The time history at this time, our best estimation is, and the preliminary results have shown, that you have an early onset of hydrogen generation, but the rate is not substantially different.

MR. OKRENT: I think the conclusions I drew follow from what you said, but I don't want to repeat it.

(Laughter.)

MR. HOBBS I draw the same conclusions, Dr. Okrent.

(Laughter.)

In selecting a list of essential equipment, we had three primary criteria. Number one, we wanted to maintain our containment pressure boundary. Number two, we wanted to be able to recover and maintain the core; we wanted to be able to mitigate accident consequences; and finally, we wanted to be able to monitor the course of the event.

Basically, on the first criterion, we determined that we needed containment penetrations, locks, hatches, isolation valves. For the second criterion, that we needed the hydrogen ignition system, safety relief valves, low pressure core spray system and low pressure coolant injection as well as other associated modes of RHR system. We needed our hydrogen recombiners for long-term recovery, we needed the drywell purge pressures and the vacuum breakers, and for monitoring the course of the event, we would need our containment and drywell pressure instruments, high range radiation monitors and our containment and suppression pool temperature instrumentation, as well as our reactor level and pressure instrumentation, and we wanted to have hydrogen analyzers.

The associated instrumentation and controls with all of the equipment was included in that list.

MR. EBERSOLE: May I ask a question about this list? I see the items you have on it. If I could pick one, say, the SRVs, what you are going to count on is the thermal inertia of these pieces of apparatus; something that can take a quick flame in front, but not have any real temperature penetration into the internals. That seems to be the universal figure you are going to use.

When you do that, do you look at such little fine structure as a pigtail of electrical connection makeups, or do you always insure that they are in heavy junction boxes with massive covers and you really do have the massive -- in the thermal inertia context -- the massive systems in the integral component or equipment that you are going to use for that?

For instance, if you have an expose pigtail connection to the SRV solenoid valves, a flash burn will get it. So do you see to it that you don't have literal low-mass electrical apparatus hanging out, as it were, subject to flash burns which they cannot survive?

MR. HOBBS It is my understanding that we are generally not susceptible to that because we do not have that kind of a configuration. In modeling things, we obviously did not do extremely fine detailed modeling, but if there were thermally-sensitive components which were exposed to the burn environment, those were modeled.

MR. EBERSOLE: Would that have included a connector makeup, if such existed, that had very little thermal inertia? Or are you saying they don't exist?

MR. HOBBS I don't believe that those things are directly exposed to the flame environment. Or perhaps if in some few cases they are, that we did model them.

MR. EBERSOLE: One way to avoid this is to say that they were all made up in conduit, that there was no open wiring. Could I say that?

MR. HOBBS I would have to check.

MR. EBERSOLE: Is the thrust of my question clear?

MR. HOBBS Yes.

MR. EBERSOLE: Would you look into that? I just don't want anything to botch up the general approach you are using.

MR. MCGAUGHY: All of these wires are in conduit.

MR. EBERSOLE: That fixes it right there.

MR. HOBBS Very good. I didn't have to confer.

MR. OKRENT: Before you go on, let me ask the subcommittee members with regard to the hydrogen control matter. There are one or two additional areas on the proposed presentation. Now, we can take another hour if that is what we need, but if we can do it in the next 10 minutes and cover the points that you think are important, that would not hurt my feelings.

Are there things more that you want to hear on survivability? Are there things you want to hear on structural capability? Would you like to have local detonations discussed? Do you want all of these discussed, or would you like to ask questions? Could I get a quick expression of opinion from the subcommittee?

Don't do me a favor and defer the questions today to ask them tomorrow.

(Laughter.)

MR. EBERSOLE: Are any of these sudden pressure surges creating any damaging effects on instruments?

MR. HOBBS No.

MR. OKRENT: Are there any topics you particularly want to hear a presentation on?

(No response.)

Are there any topics -- well, should we throw the rest of this open to questions? This is what I am, in a sense, asking -- on the viewgraphs you would have seen if we continued this route?

(No response.)

MR. OKRENT: The response is underwhelming.

(Laughter.)

MR. SCHOTT: You have looked ahead at a notebook full of viewgraphs here.

MR. OKRENT: Don't you have one of these? I am sorry. I assumed you did. Carson, are there any things that you would particularly like to have discussed, while Dr. Schott is looking?

(Pause.)

MR. MARK: I guess probably not. I do have one question I would like to ask, which is somewhat away from the line of presentations. I thought that the staff gave evidence that between what MP&L was doing, what the staff was able to think of and Sandia, that they had covered the survivability area. Had or would come to covering it in a way that looked pretty thoughtful. And the same, I believe, with respect to structural aspects.

I was horrified at the detonation calculation that was done. This is a really hairy construct that was proposed there. There would be concrete, 50 feet long, 20 feet wide, sitting 20 or 30 feet above the surface. Let's assume that exactly that space is full of explodable hydrogen. Now, how it ever gets there, it must take it quite a long while to accumulate there, at the rates anybody is prepared to think of. And it would have an acceleration of about, oh, three-tenths g, and why it is going to sit there, unless you just arrange to put a box around it, I couldn't imagine, but they calculated it anyway.

Well, that doesn't do any harm, and if they learn that even those conditions the detonation doesn't hurt much, then they must really have covered it pretty well.

MR. OKRENT: You reminded me of a question. Are there any situations in which sprays would be off for a while? They hydrogen has been accumulating and then the sprays come on and it leads to a situation that was not combustible, and is now undesirably combustible?

MR. MARK: I think that is kind of a separate question. Obviously, if it happens, they are prepared to withstand 8 percent, even in the full upper containment, without stretching the imagination. And they are prepared to point out that their igniters will work, by them if not before.

But, if you turn off the igniters because of a loss of power -- there is a way of doing that -- then hydrogen can accumulate. It can get to 30 percent throughout the whole space. There is enough of it under the staff's insistence that if you put in 75 percent total, you can get to about 35 percent hydrogen throughout.

And if then the power comes on, you have really got something to see. But that is kind of a question of reliability of the system, rather than what would happen if.

MR. EBERSOLE: Dr. Mark, that is why I asked the steam question. Can you have a steam-rich environment in which you build up a hydrogen concentration? I will just arbitrarily say 11 percent. It doesn't ignite. Then you hit it with a spray, you clarify it, and lo and behold, you have now got 11 percent compl environment.

MR. MARK: But their testing of the igniters is going to allow one to look at real numbers on that. How much hydrogen do you get with this much, or some other amounts, of steam and get ignition?

MR. SIESS: He means condenser steam.

MR. EBERSOLE: Twice condenser steam and have a new highly-enriched body of --

MR. MARK: That 75 percent, you can stand quite a bit of steam and still ignite. But they will be able to tell us that.

MR. SCHOTT: Not if it is more than 50 or 55 percent steam. It is possible to totally inert the system with enough steam, even if there were no hydrogen.

MR. MARK: Well, they are aware of that, and they are saying they don't ignite in the drywell because of that.

MR. SCHOTT: Yes. This MARK III system with the quite substantial isolation of the drywell and even the possibility of limited oxygen availability low in the annulus above the suppression pool -- whether we call that the wetwell or the upper extention throughway -- has a substantial number of distinct situations in which hydrogen can accumulate in the system inspite of the presence of the igniters and accumulate in the drywell after the air has been expelled.

They accumulate, at least by assumption, althoug probably not in reality. It can be thought to accumulate in the upper containment at not fully combustible levels, in the neighborhood of 5 percent hydrogen, which is a substantial amount of hydrogen simply because the volume is great, and all of this is because of the restrictions and general slowness of mixing throughout the whole system. This does give difficulty in predicting with much assurance in doing this modeling with a lot of assurance.

I think that maybe the real benefit of Sandia's attempts to model a large number of cases is the demonstration that a wide variety of modeling results can be obtained simply by changing particulars of assumptions about mixing, assumptions about cooling rates and so on, and the lesson that I think comes from this is that with sprays in particular and other heat sinks that are inherently present, the effects of even quite large accumulations of unburned hydrogen with subsequent cancellation of the inerting effect that made possible those accumulations are such that burning then takes place. These effects are subject to mitigation to a significant extent, and in most cases one can be confident that that mitigation is to below any possible rupture pressure.

MR. OKRENT: Let me ask a question.

MR. SCHOTT: Whether one can say this in 100 percent of the cases, I doubt.

MR. OKRENT: The staff is proposing that what Mississippi Power and Light is doing and is going to do is acceptable on an interim basis. Do any of the Subcommittee members or consultants have any reservations in that regard? I would just like to ascertain that now. Do you have any reservations, Mr. Schott?

MR. SCHOTT: No. I believed a year ago from the form that the system had taken, and I see nothing in the subsequent analyses to change that, that the system is in all likelihood satisfactory. I will be interested to hear more of what really is involved in this testing program, and also to hear some more development, and I haven't spotted that in the notebook here yet, of a concept for controlled burning in the dry well apparently fostered by the early turn-on of the combustible gas or the compressors of something called inverted flame.

That is discussed in a one-page submittal carrying a June 25th transmittal letter date. Attachment 1, pool suppression impact, low pool carryover due to hydrogen combustion, but it really is what seems to be under discussion there, Sam, is some newly recognized merits or mechanisms of controlled burning rather than an all or none situation which was involved in the early modeling of the dry well break case, in which the dry well was at one time feared to be a source of a fairly catastrophic sequence of events begun by a very late reinjection of air into the dry well.

MR. HOBBS: We have -- as I mentioned earlier, we had retained consultants, Dr. Lewis and Carlovitz, to evaluate our system.

MR. SCHOTT: Okay.

MR. HOBBS: We had submitted their report in January or February of this year, which ran around 12 or 13 pages. That is why that one page letter is so brief, is because it was referring back to a phenomena that was discussed in a little more detail there.

MR. SCHOTT: It was discussed in a submittal to you from the consulting firm.

MR. HOBBS: And we submitted that report verbatim to the Nuclear Regulatory Commission.

MR. SCHOTT: It just hasn't crossed my hands yet. Is it available in the building here?

MR. HOBBS: Yes, I believe I have a copy that we can let you have, if Charley doesn't have one handy.

MR. SCHOTT: Okay. Okay.

MR. HOBBS: In any event, what they had said was, when you are introducing air or when you are introducing containment atmosphere which is still oxygen-bearing into the dry well at the dry well purge compressor outlet, that you will in fact get an appropriate range of conditions in that vicinity to have a burn, and you will in fact have a continuous burn in that region. However, you are introducing air into a fuel rather than introducing fuel into air, and apparently the proper name for this is an inverted diffusion flame.

I was somewhat embarrassed after the fact to discover that there was a Scientific American column called The Amateur Scientist, which I had at home, which discussed an inverted flame experiment in a bathtub experiment, and I had not recalled it.

So in any event, with a continuous burn of that nature, you would expect a very, very nominal pressure rise, basically limited by the differences in elevation of the suppression pool, in the annulus, and in the suppression pool proper, and we are in fact -- we have in fact analyzed that case, and we have not yet submitted that to the Nuclear Regulatory Commission. The temperatures in the dry well are somewhat worse in that case than they are in the large burn. So we were in the process of re-evaluating survivability for components that were inside the dry well.

So, we have not made that submittal, but basically we are on the verge of having that ready to be submitted to the Nuclear Regulatory Commission with favorable results, that we do not have problems as a result of that.

MR. SCHOTT: How many cubic feet per minute or in some other equivalent terms of air delivery is involved with these compressors?

MR. HOBBS: Around 1,160 cubic feet per minute per purge compressors. There are two purge compressors. You deliver 1,160 cubic feet per minute.

MR. SCHOTT: 2,300 cubic feet per minute.

MR. HOBBS: Yes.

MR. SCHOTT: That number wasn't available a year ago, and I guess I had forgotten. Thanks.

MR. OKRENT: You expressed an interest in their test program. On parts of it or all of it?

MR. SCHOTT: Comprehension of an outline would be sufficient.

MR. OKRENT: Could we jump to that?

MR. SCHOTT: If there are things on that, if you could find that section.

MR. HOBBS: Just a second. Let me find my slides.

(Slide.)

MR. HOBBS: Our hydrogen testing program we proposed to the Nuclear Regulatory Commission consists of basically three sets of tests. We were intending to evaluate flammability limits on the hydrogen rich, steam rich environment, particularly for the purposes of evaluating flammability limits in the dry well. In addition, we have proposed burn testing above the suppression pool or generally suppression pool burn phenomena testing, and we have proposed testing to resolve the issue of mixing inside the containment. We have actually, I think, proposed either an analytical program or a specific mixing test. The Nuclear Regulatory Commission, I think, has some preference for the test, and there are in fact some elements of the burn test which will contribute to our knowledge of mixing.

(Slide.)

MR. HOBBS: The hydrogen-rich, steam-rich burn phenomena testing, the flammability limit testing, we are intending to have conducted at the AECL White Shell facility. These are basically small scale phenomena tests, to investigate flammability limits which I had already set.

(Slide.)

MR. SCHOTT: The return of air from the dry well purge compressors, is that believed to be sufficient to wash out steam, or is there a steam condensation mechanism that must accompany the operation?

MR. HOBBS: In the vicinity that the air is being returned --

MR. SCHOTT: The hydrogen will diffuse into it quicker than the steam will. Okay.

MR. HOBBS: We have looked at steam condensation for the large burn case, and potential effects there. For our suppression pool burn phenomena testing, we are proposing to build a new large facility to investigate burning above the suppression pool.

MR. SCHOTT: How large?

MR. HOBBS: Full-scale. Not an entire containment, I hasten to add, but a segment of the containment in which we will have grading, concrete walls, a suppression pool and a sparger which will deliver hydrogen into that suppression pool as well as raw events.

MR. SCHOTT: This will be a silo whose diameter is something like the difference in radii between the wet well and the dry well?

MR. HOBBS: Well, tentatively, we had proposed -- this test was basically a recommendation of CORBAK. Let me see if I have the appropriate slide. I believe I do.

We had proposed in response to the recommendation from COMBAX basically a square segment, a 20 foot square, which is the approximate dimensions of the suppression pool region. I believe our suppression pool is 21 feet, 20 feet, 21 feet side to side. Basically this wa the layout of what we have looked at.

(Slide.)

MR. HOBBS: I might add, what we are looking at here is partially whether we will get continuous burn in the region above the suppression pool, which is another thing that COMBAX had suggested we look at as well as heat fluxes at mixing, at air return, be able to look at flow rates of air in and out. So basically this is a very flexible facility for this limited range of phenomena that we are looking at.

MR. SCHOTT: Is this a joint venture with other -- with the owners' group or whatever it is called?

MR. HOBBS: Indeed.

Let me again add a remark or two about our joint venture in that area.

The hydrogen control owners' group which consists of several owners of Clinton, Perry, Gulf State Utilities, and Grand Gulf, as well as an inactive and nonfunding but information exchange membership from TVA, we have retained or made arrangements with Electric Power Research Institute to act as our program manager and to conduct our testing program. That would include the earlier tests that I have mentioned as well. And the only uncertainty in this testing program is that EPRI has recommended that we might want to pursue some smaller scale tests as well, and we are evaluating that. There is a possibility, if we do proceed with such smaller scale tests, that we might discover that there are more appropriate ways to do large scale testing or that large scale testing would not be needed.

However, at this time this is what we are intending to do, and we have made some funding commitments through the Electric Power Research Institute to do so.

MR. SCHOTT: That brings the subject up to date as far as the things that I am aware of. I believe that does bring the subject up to date in relation to the things that I have read about.

(Slide.)

MR. HOBBS: The only remaining item is hydrogen mixing. There we have tentative plans to make use of the HEDL facility at Hanford and to evaluate mixing in a scale test to compare with the available data. As I remarked earlier, if we can find a suitable analytical technique, this test may not be approached. In addition, there will be a certain amount of mixing data available from the full scale tests and/or from the smaller scale burn testing should we pursue that.

That is really all I had on testing.

MR. BENDER: I would just like to get one point clarified, if I could.

Your equipment qualification program I suppose is based on primarily analyzing the heat resistance of equipment under the postulated hydrogen burn conditions?

MR. HOBBS: Yes.

MR. BENDER: You are not really exposing the equipment to burning conditions.

MR. HOBBS: No. We have in fact taken a look at some Fenwall testing of an igniter assembly which was conducted for TVA, and we modeled their igniter assembly, which is not identical to ours, and we made use of the same techniques for modeling their assembly and exposing it to a Fenwall test environment and demonstrated that we were getting conservative results compared to what the test had shown.

MR. BENDER: I really didn't want to know too much about that. The main point I wanted to make was I presume that after this test program is done, it will be important to go back and look at the results and compare the test program with the bases on which the equipment qualification analysis was done just to make sure that the conditions specified matched the results you obtained.

MR. HOBBS: Yes, sir.

MR. MARK: This is a red herring question, really. I have, from reading Sandia reports, the Staff's SER, their interim conclusions on this point, the tremendous work that you guys have in prospect, I am wondering whether in all of that consideration, whether a careful look had been taken at the possible option of just deliberately turning on some burners for methane or propane or benzene or whatever you like at the time the water level gets down to the top of the core, and all you have to do is burn out about 16 percent of the oxygen, because it is inerted by then, and the amount of heat you will introduce is, oh, 70 percent of that which the hydrogen would release if it depleted the oxygen. You could do it at a controlled rate. It would cost you, of course, a tank of propane or methane or whatever was easy to handle, store and deliver. Those techniques are reasonably well known. You just go into the kitchen and see some of them, and you wouldn't have to test your equipment survivability, and you wouldn't have to answer questions about ATWS, and you would really have a fine time in all respects except the cost of this burner.

MR. EBERSOLE: Hear, hear. That's the whole topic that has been grinding around for quite a while.

MR. MARK: You control the rate, you have less heat than the hydrogen. You don't have to impose more cooling rates than you are already prepared to handle, and you could make sure that this spray was working when you turned on the burner.

Has that been carefully gone through by either the NRC Staff or Sandia people or you? That's my question. You can say yes or no.

Then we will move on to the next topic.

MR. HOBBS: No. I think -- I know the NRC research staff has taken a look at one or two things along those lines. I am not sure that those results have been published in the open literature.

When we were first evaluating putting in a hydrogen ignition system, we evaluated a broad range of solutions, water, fog, spray, burners, which I will come back to in a moment, post-accident inerting with and without containment venting for containment release, recombiners which of course require rather horrendous numbers of recombiners. I don't recall all of the things. There were some seven or eight alternatives which we evaluated.

At that time we chose a hydrogen ignition system based on what we believed was sound criteria. As I said, we did evaluate burners. There was some question about the effectiveness of burning as you depleted the oxygen, and about mixing. There is obviously the heat addition rate which, as you point out, is perhaps no more severe than what we are proposing to take as a result of controlled ignition of hydrogen, and a number of other disadvantages. We concluded at that time -- and I don't have that report in front of me, but we concluded at that time that that was a less desirable approach than proceeding with igniters.

Since then, I might point out that I have had some private conversations with Dr. Lewis and Karlovitz of COMBAX, and they suggested that there was in fact another alternative to a hydrogen ignition system that they thought was particularly clean, simple and easy. Then they hesitated and said, well, maybe perhaps not as clean, simple, easy as we think considering the difficulties you have already had with igniters, and that was to install an external gas turbine with some recirculation of air.

But the fact was that in terms of qualifying that equipment, assuring that it will operate, we did not feel that we could approach that quite as expeditiously as we could the igniter system.

MR. MARK: Look, you have answered the question.

The things that are attractive -- and I am not sure how carefully they have been looked at -- you get no products except carbon monoxide and water. You get the carbon dioxide in-house dilutant, so that it adds to the inerting. The water you are always afraid might come out. The carbon dioxide won't. It is as good as water vapor except that it is permanent as a suppressant.

You don't have to answer questions about, well, how do you know the hydrogen might be coming twice as fast or things of this kind in case you have an ATWS. You just skip all that. You make the air inert, and the Staff could go on and do something more important.

MR. EBERSOLE: May I make a comment? I believe you all got on this igniter wagon when TVA first got involved in it.

My understanding is they have been looking at this combuster process, too, involving a gas or oil burning turbine, with various ways of sweetening the combustion process. Of course, the principal way they sweeten it is the compression ratio which enhances the chance of combustion better than they have had in the open atmosphere in the ordinary combustion process. One can improve on the exhaust. It is pretty nice to burn out the 20 percent oxygen and have a net reduction of 20 percent net inventory by putting condensed water back into the containment, which can be handled by a cooler if you wanted to use exhaust cooling.

One of the nicer aspects of this, everyone always needs electrical power. If you had a gas or oil fire, 10 megawatt turbine, there it would be, just a small side stream to use it.

MR. OKRENT: Gentlemen, I'm going to end the discussion of hydrogen control in about one minute unless somebody has a specific question for the Applicant or the Staff.

By the way, as of now, we have not located a copy of the consultant's report referred to by Mississippi Power and Light, so we would appreciate your making a copy available at the close of this item so that the Subcommittee members and our consultants can peruse it, and maybe the staff will check with our staff and see what happened, if indeed we have not received it.

Are there any last minute questions on hydrogen?

(No response.)

MR. CKRENT: Okay, thank you.

I'm going to go on to the next agenda item.

We are nominally at 5:00 o'clock, and I am going to take that item next, management structure and technical capability.

MR. STAMPLEY: My name is Morris Stampley, Senior Vice President, Nuclear Mississippi Power and Light, the operator of the Grand Gulf. My complete time and effort is dedicated to the Grand Gulf project. I would like to make a few general comments. Then we have one more presentation, depending upon the specific areas of your interest.

We announced in 1972 the intention to build and operate the Grand Gulf plant. From that very outset, the safety of the plant has been a dominant theme. We have never compromised that. We believe that our record shows our commitment to safety. We made some early decisions which we still think were correct. We did select a BWR plant. Our evaluation of the nuclear steam supply system we considered the operation of the various plants. We also chose soon after the initial selection to purchase the improved BWR-6 MARK III because we felt that it did have added safety features and some added benefits.

We realized even at that time, by making the first purchase, that there would be additional license and construction activities involved in the purchase of this improved design. We still believe that was a correct decision, and we are pleased with it.

Also in our evaluation of architect engineer constructor, we considered in that evaluation the experience level of a number of architect engineers constructors, and as you well know, we wound up choosing Bechtel Power Corporation toi design and construct the plant. They do have a large amount of experience in that area.

From the very beginning of this project we have had a comprehensive and aggressive quality assurance program, quality assurance manager. We have provided the manager with the necessary independence from cost and schedule pressures. The manager of quality assurance reports directly to me. We have an operational quality assurance manual that governs all aspects of the operation of the plant, and we think it is a good manual.

We have always tried in our operations to obtain the best qualified employees for whatever jobs we have. We think this has been especially true in the manning of the nuclear project for the plant staff and support activities.

There have been turnovers in our organization. Although there have been, we have been successful in recruiting and maintaining a good staff. They have many impressive credentials in both the Navy nuclear program and the commercial power program. We recognized from the outset, and more particularly during the startup phase, the importance of maintaining the morale of our people. We think we have addressed that in the number and quality of our people, in the various levels of organization which has been an area of discussion with this committee previously and with the NRC staff.

As Mr. Houston mentioned, we would be prepared to discuss it if you so desire.

Our policy at MP&L is that all activities pertaining to the safe operation of the plant should be governed by a comprehensive and well thought out procedure. Our president, Mr. Ludkin, and I both have taken a personal interest in this in insisting that we have good procedures and that they be followed. I think one indication of that is a recent memo that he and I jointly signed, and I would like to read you just a couple of statements from that memo to all of the people involved in the Grand Gulf project.

I quote, "The single most important contributor towards safe operation is for us to take the time and to think through every significant action prior to making that action. This must be done even though it means delay or loss of generation. We state further that experience is the most effective way to show the thinking that takes place. Please see that people are provided with good procedures and those procedures are adhered to."

We do realize that we must place continuing emphasis on this matter to proceed.

The nuclear organization in our company has the full support of the top management, and we take a personal interest in seeing that these objectives are accomplished.

I now take a great deal of pleasure in presenting to you Mr. Floyd Lewis. Mr. Lewis is a recognized leader in the utility and is one who is a moving force in the positive actions taken by our industry after Three Mile Island. Many of you are familiar with his activities in the formation and implementation of INPO, his work in ERPI and AIF and all the things that are associated with our industry.

Mr. Lewis is going to give us a presentation, sort of overview of the activities within the Miiddle South Utility System to review the operation of the five nuclear units within the system to ensure that we coordinate our activities and share our resources and experiences to enhance overall safety of these five units.

After Mr. Lewis' presentation, we do have available our own staff to discuss further those specific items if you would care to discuss any of these matters further.

Mr. Lewis.

MR. LEWIS: Thank you very much, Norris.

I am pleased to have this opportunity to be here and to talk with you about a few things involving the organization of the Middle South Utilities System and particularly with respect to those entities in the system that have nuclear commitments.

Also, I will want to talk a little bit about the efforts currently under way to enhance peer review and sharing of resources to achieve the most safe and effective operation of Middle South System nuclear units, and a bit about the recognition of our needs described for operational excellence for safety and financial reasons and measures to improve the flow of information within the Middle South System.

I have not been checked out as an operator here.

(Slide.)

This little chart shows the units in the Middle South System. Along this line are the operating utility companies. We are in the process of combining Louisiana Power and Light Company and New Orleans Public Service, applications having been filed with both the Securities and Exchange Commission and the State Public Service Commission. We hope to consummate that in the very near future.

Looking at these entities, Arkansas Power and

Light Company has a nuclear plant with two operating units, Arkansas Unit 1 and 2. The first of those went into operation back in 1974. Mississippi Power and Light Company and Middle South Energy have the Grand Gulf Unit 1 now in startup about which we are talking today. And Unit 2, which has the limited construction work going forward to protect the investment in that unit. I would like to emphasize that it is our intent, speaking of management, to complete the construction of that unit.

The Louisiana Power and Light Company has the Waterford 3 unit under construction, which is a matter of some months later in schedule than Grand Gulf 1. Middle South Services provides technical and other services to the operating companies. It has about 766 employees, of whom 48 are supporting the nuclear unit in various technical capacities.

System Fuels is a fuel procurement subsidiary of the operating companies, and it is involved with nuclear fuel procurement.

We retained a nationally recognized consultant to give us their recommendation on the optimum organization of our system nuclear resources for achieving our goal of safe and efficient operation of our nuclear units.

(Slide.)

Out of that study we came forth with this organization, which we are in the process of implementing at the present time. I occupy this role (indicating). Reporting to me is a new entity called the System Nuclear Oversight Committee, composed of the highest-level officer in each of the companies indicated here with professional nuclear background. That is the vice-presidential level of the service company of each of the operating companies with the nuclear unit.

And then, while we have not yet identified these people, we plan to have three people from outside the system who will have a very high level of nuclear qualification to participate in this program. We will talk a little bit later about the nuclear assurance staff.

(Slide.)

The functions of this oversight committee include an overview and guidance on a systemwide basis of our nuclear operations. The oversight and appraisal of nuclear activities of the whole system to develop standards for performance.

We do not intend that these just be minimal but standards that we would be satisfied with to provide a focal point for assuring maximum systemwide response to emergency conditions should such occur either within our system or adjacent areas to ensure support services provided for the system and improve effectiveness with continuity of experience and lower cost.

And this is now being pursued on the basis of developing a specific charter for the Middle South Services nuclear services group. The goals we have in mind here are: to achieve a high-level of operational excellence; to promote peer group review and interchange of experience, information, ideas, and resources.

We have approached nuclear with each of the companies that applied for a construction permit and an operating license being staffed up to run their own show.

What we are looking to do now is to provide a vehicle through which the operating experience at Arkansas with the many years now of operating experience and so forth will be brought into play and there will be an interchange on a regular basis among the companies.

Another goal is to ensure compliance with our requirements for safe operation, to promote development of in-house support services on a continous basis, and to promote development of improved career opportunities for nuclear power professionals within the total system.

At this point in time there has been very little movement between the units in the system, and we would hope that we could stimluate cross-fertilization, if you will, and avenues for promotion for people when we are looking to fill spots in the whole system.

Now, you remember that I said we would refer later to this nuclear assurance organization.

(Slide.)

This organization will be administratively located at the service company but will have line reporting relationsip to the nuclear oversight committee. The functions of this small but highly competent group will include providing staff reports for the Nuclear Oversight Committee, carrying out whatever assignments they might receive from that committee, doing studies, contracting fo studies, whatever.

They will have from this group representative on each company safety review committee within the system. They will perform continuing safety oversight of operations of our nuclear facilities. They will perform assessments of risk, control activities to direct appropriate attention to the most important areas, and they will be a focal point for our system contact with the Institute of Nuclear Power Operations in Atlanta.

(Slide.)

The nuclear services organization at the service company, you might remember I said we had about 48 people who almost all of them are in this part of the services company. It peforms systemwide support and specialized technical services, improve effectiveness, continuity of experience, or lower scales of cost can be achieved.

A sample of present activities which are being provided to one or more of the companies include nuclear fuel cycle support, fuel and reactor engineering and analysis support, quality assurance performance, specialized technical services, and regulatory response on a generic or a systemwide issue basis.

In other words, when there is something to be commented on of a generic nature, this group attempts to handle that and gets input from the various people in the various units of the system.

A list of all of the nuclear services now provided for one or more of the operating companies would number about 14 or 15, as I recall.

(Slide.)

Trying to chart out here the relationship of Grand Gulf to the units within the system that can provide assistance to it, I hope you can see across here. I occupy this position and this position. Don Ludkin occupies this position and is also a member of the board of each of these units.

I am chairman of Middle South Services. You have a lot of cross-fertilization, if you will, or you have -- maybe it is sterilization -- but it is the same people who occupy a lot of these spots here and who share responsibility for the performance of the system.

We believe that with the effort that is going forward at the present time, we will have brought to bear the best resources in terms basically of people and experience that we have available in the system.

I hope you see from this some idea of how our system structure is related to Grand Gulf, how we will make available system capabilities to support MP&L and Grand Gulf. I hope that you recognize that we have ongoing efforts to improve peer review and appraisal as a means of maximiizing operational peformance and that we do have a managment commitment to safe, effective operation.

In all candor, I would say to you that it concerns me greatly when our nuclear units are shut down for whatever reason. In September of 1980 we lost $18 million in that one month because our two nuclear units in Arkansas were shut down in a mode where we were not able to pass through the cost consequences of that to customers. But I would --

MR. EBERSOLE: May I ask a question on that? Was that the heating, ventilating, and air conditioning disabling of the solid-state equipment you are referring to?

MR. LEWIS: My recollection -- and do not hold me to this; I am not technically competent, I will confess to you -- the Asian clam problem in the cooling system of the plant, the service water cooling system, I believe, was the major cause of that outage.

What I wanted to emphasize is it is the absolute conviction of the management of the Middle South System that the worst thing we could do for the stockholders whose interests we are charged with protecting would be to permit the operation of a nuclear unit in an unsafe manner.

While the financial consequences are a cause for concern, the risk involved in operating in an unsafe way is far more detrimental to the interest of the stockholders, and it is our commitment not to let that happen on our system.

I would be glad to try to answer any questions. That is all I have.

Yes, sir.

MR. BENDER: Mr. Lewis, being able to see all four systems up there at one time leads me to ask you about the view which Gulf States has of its dependence on the architect-engineering firms and the nuclear steam supply organizations that have supplied the engineering and hardware.

Do you have any thoughts about how they relate to this organizational structure you have set up here?

MR. LEWIS: Well, it is my impression that at this point in time the statement I have heard people say, that you never get finished building a nuclear power plant, has probably been proven true in the experience thus far. And you are apt almost always to find some people on site who are doing retrofitting or maintenance or whatever.

It is certainly our intent, by marshaling the forces of all of our system, to try to be as self-sufficient as we can. But I have no idea at this point in time if that would ever be to the total exclusion of the world of competence that exists outside of the Middle South System.

I do not at this point foresee us ever being at the point where we would be able to be like Duke Power and doing everything from design, construction, right on through. It seems to me we will always be dependent on the architect-engineering community for a major part of our design work and probably with a good bit of our construction management, although we are working to put together a good construction management group within the service company for future projects.

MR. BENDER: How about the nuclear steam supply organization?. You have got Combustion Engineering, GE.

MR. LEWIS: B&W.

MR. BENDER: B&W. No Westinghouse plants?

MR. LEWIS: No, sir. We have two GEs at Grand Gulf, two Combustion, and the one B&W Unit 1.

MR. BENDER: Your understanding is they will continue to provide supporting service to you?

MR. LEWIS: It is my impression that they find that rather lucrative.

(Laughter.)

MR. LEWIS: So our discussions with various ones lead me to believe that they will stay in that business for a long, long time and that they are not looking to give up that source of revenue. Of course, the one area of most concern to me was what I am assured was a misinterpretation on my and many other people's parts of Mr. Welsh's statement for GE whenever it was, sometime back months ago, in which many of us interpreted it as saying, in effect, we are throwing in the sponge and which they have assured us it was a misinterpretation on our part.

They were trying to be realistic in terms of what could be expected in terms of time before some other units would be ordered.

Yes, sir.

MR. EBERSOLE: You have got four stores from which you can buy nuclear steam supplies. What criteria do you use to pick a store?

MR. LEWIS: There are other people here who could surely answer that better than I. But it is my impression that each time we have placed an order, we have, in effect, invited everybody in the business to come forward and make a proposal and that we have given it the most objective appraisal that we could in terms of deciding which is the best at that point in time to meet the needs that we saw and which we were trying to satisfy with the order of a unit.

And that it was that kind of a procedure that led us to choose first B&W, then Combustion Engineering for the second unit at Arkansas and the unit at Waterford and then the two GEs up at Grand Gulf. I am sure Norris or Jim McGaughy or someone could probably speak better to that.

MR. EBERSOLE: Is it fair to say that it is straight economics?

MR. LEWIS: It is my belief that that is what we did. NOw, whether there were some prejudices that were involved at some point, or some preferences, let me put it that way, at some point in the appraisal procedure, I do not think you could ever rule that out totally. But it was best efforts on our part to do a straightforward economic analysis in comparing the offerings.

MR. EBERSOLE: Thank you.

MR. ORKENT: I think we had better go on to some of the specific questions on staffing.

MR. STAMPLEY: We will proceed here with the plant safety committee.

MR. ORKENT: Let us do that next and get it out of the way.

MR. STAMPLEY: Mr. Ken McCoy, our plant manager of Grand Gulf nuclear safety, will address the plant safety review committee.

(Slide.)

MR. McCOY: The Plant Safety Review Committee at Grand Gulf has been functioning for several years now. We did have a change in the Plant Safety Review Committee when the technical specifications were issued, and I will discuss that in just a moment. But the membership and the basic issues reviewed by the safety review committee have not changed.

The function of this committee is twofold. It's composed of seven members, chaired by the assistant plant manager, with the vice chairman as the nuclear support manager. I might add that both of those positions meet equal qualifications in our organization.

The other members are the operations superintendent, the technical support superintendent, the quality superintendent, and the chemistry and radiation protection superintendent, and the maintenance superintendent.

The meeting frequency called for in our specifications is monthly. However, through this period of starting up the unit it has been several times a week.

(Slide.)

The responsibilities of this group include the review in detail of station administrative procedures and changes thereto, safety evaluations, proposed changes which may involve an unreviewed safety question, tests which may involve an unreviewed safety question, proposed changes to tech specs or operating licenses, reports of violations of codes or procedures having nuclear safety significance, reports of deficient systems containing radioactive materials, reports of operating abnormalities or deviations, events requiring 24-hour Commission notification, unanticipated design or operational deficiencies of safety-related structures, systems or components, plant security -- that's a plant security plan and changes thereto -- the emergency plan and changes thereto, potential nuclear safety hazards, investigations or analyses requested by the chairman -- that's the SRC in the corporate office -- and unexpected offsite releases, changes to the process control program, the dose manual and the rad waste systems.

(Slide.)

In addition, the change that was made at the time that we received a low power operating license was that certain functions were designated for independent technical review in accordance with the latest issue of the ANSI Standard 18.7.

These functions -- some of these functions were done during the startup by the PSRC that now are done by independent review. These activities include procedures which affect nuclear safety and shall be prepared, reviewed and approved by an independent review procedure, and that the administrative procedures require a written approval by the plant manager.

In addition, proposed changes to nuclear plant safety-related systems, structures and components will receive a review as designated by the plant manager. Again, that's an independent review. And those changes all must be approved by the plant manager.

EVENING SESSION

(6:00 p.m.)

MR. McCOY: In addition, I might add that, since we're talking about the PSRC, each of those changes receives a safety evaluation, and that, as you saw previously, is reviewed by the PSRC.

Proposed tests and experiments which affect the plant nuclear safety shall receive an independent review. Reportable occurrences and tech spec violations will be investigated, and the recommendation provided to the plant manager. The individuals who are performing this review shall meet the qualification requirements of the ANSI Standard 18.1.

Review shall determine whether or not an unresolved safety issue is involved, and records shall be maintained of these activities.

In general, I think our PSRC has been very effective during the plant startup and I think the changes that were made at the time of the issuance of the operating license will allow that body to become even more effective.

So with that, I will be open for any questions.

MR. OKRENT: Maybe we should also talk about another committee. What's it called, the --

MR. STAMPLEY: The safety review committee.

MR. OKRENT: Yes.

MR. STAMPLEY: We're prepared to do that and we'd like to ask Mr. Larry Dale, our manager of nuclear services, to pursue that, and then we'll go from there.

MR. DALE: Let me begin by just giving you a brief overview of the corporate safety review committee. We organized the committee and had our first meeting back in June of 1981. So this committee has been in effect a little over a year.

Our meeting frequency has been approximately monthly since the beginning. We have expanded from 7 to 11 members since initially organizing the committee. I point out that the 11 does not include the secretary of the committee, so really we have 12 people in the meeting.

The committee does report to the senior vice president - nuclear. Our operations mechanics of the way the committee operates as far as performing the reviews, et cetera, is governed by our nuclear production department procedure 9.2.

We have had formal training sessions for all of the primary members and their alternates on their duties and responsibilities as members of the committee. Our charter duties are in the area of review and have been in accordance with the technical specifications section 652, the areas that you have to review.

We are planning to expand the charter and the areas of review of this corporate safety review committe in conjunction with the nuclear oversight committee that Mr. Lewis discussed. We will expand our charter, our area of review, to back off and take a more comprehensive look at plant operations, and then what is typically done if you just comply with the technical specification.

(Slide.)

Let me briefly tell you about the membership on the corporate committee. The SRC is chaired by the assistant vice president, nuclear production. I serve as the alternate chairman. Mr. John Richardson, our manager of safety and licensing, serves as the secretary. We have the manager of quality assurance, manager of nuclear engineering, the nuclear plant manager.

So we have all the major managers within the production department. We also have our corporate health physicist and our principal engineer, who supervises the operations analysis group. We have representation from Middle South Services, Mr. Jack

Fouchard, manager of systems operation at Middle South Services.

We also have three consultants. Dr. J.M. Hendrie I'm sure needs no introduction to you. We have Dr. D.W. Jones, who is director of the Center for Nuclear Studies at Memphis State University; and we have Mr. J.F. Groves, who is the advisor to the vice president, nuclear production. Mr. Groves was -- is previously the assistant plant manager at Browns Ferry and was assistant plant manager during the startup of all three units of Browns Ferry.

A couple of notes about the committee. Only 2 of the 12 are line management from plant operations. So we feel like we have a high degree of independence from the operating pressures.

25 percent of these people are consultants. 33 percent are not MP&L employees. Individually and collectively, we meet the experience and expertise requirements of the technical specification, and we have on the average 19 years of professional experience, of which 17 years of that is nuclear experience.

So that's all I had intended to say about the corporate review committee.

MR. OKRENT: Any questions on it?

MR. BENDER: Yes. Where do these people

meet?

MR. DALE: We either meet in Jackson in the corporate office or at the plant site, depending on people's travel schedule and that sort of thing.

MR. BENDER: Thank you.

MR. OKRENT: Can I ask a related question? In the letter the Committee wrote, October 20, 1981, the Committee noted or recommended or stated that Mississippi Power & Light also needs to fill certain senior technical personnel positions in its management organization. Have those been filled now?

MR. McGAUGHY: Yes, sir, they have.

MR. OKRENT: Okay.

One other related question. If I understand correctly, the man who I guess was assistant plant manager, who was the person with considerable BWR or LWR experience, who you did have in your organization when we met with you last, has left. Could you tell us something about how he has been replaced and what your operating experience is in your operating organization?

MR. McGAUGHY: Yes. I would like to ask our plant manager to explain that.

MR. McCOY: I think in order to best answer that question you will need to be somewhat familiar with our organization. And I will point out to you the position that was replaced and then discuss the players who are in those positions at the present time.

The position that was vacated, let me say a little bit about that. The man who was in this position went back to his original utility in a very attractive job. There was a promotion to him, and so we certainly don't blame him for that. But it was unfortunate in the timing of our startup that that should happen.

However, that is not to be -- I would not say that's unexpected in a utility which is going into a nuclear operation for the first time and bringing in people from various areas.

That job is presently filled by the man who had held this nuclear support manager job for the previous two years, Mr. Dick Ambersino. He came to us with considerable BWR experience, eight years of BWR experience working for the General Electric Company. It included the experience as a startup engineer on the two Peach Bottom units, as a site operations manager for GE at the Duane Arnold energy center, and had been on loan to Philadelphia Electric as a maintenance superintendent for approximately one year at Peach Bottom.

He has assumed this role in early June, and we feel we had a smooth transition, considering the timing of that.

We also, since our previous discussion with you, have hired a manager with even more BWR experience than either of these two gentlemen. He had been a licensed SRO since 1973 on a BWR. And that was Mr. Don Tomelson, who we hired as an outage manager in this position, with the idea that he would develop and move into the outage management area.

What we did at the time was, since we are not in an immediate outage situation, we moved him to the nuclear support manager's job, and that is on an acting basis.

We also have one other manager with considerable experience, who was the startup manager for the preoperational test phase, who has been an engineer with Mississippi Power & Light Company for approximately ten years, and he is presently at the BWR-6 simulator, obtaining his SRO certification. We intend to move him back at the end of this organization and fill one of these three manager slots.

So that is how we have handled this particular transition. Does that address your question, Dr. Okrent?

MR. McGAUGHY: There's one other thing that we have done. Mr. Groves, who's on the safety review committee, who was former assistant plant manager of operations at Browns Ferry, has spent about 90 percent of his time down at the plant site while we're going through the startup period, as advisor to Mr. McCoy. And also, he comes back and tells us in the general office how he's doing.

MR. OKRENT: Did you say 8 or 80?

MR. McCOY: 80 percent.

MR. McGAUGHY: 80 percent.

MR. McCOY: He's there about three days a week and sometimes on weekends if we have something interesting going on.

MR. OKRENT: How does the staff decide what constitutes sufficient experience?

MR. HOUSTON: We have Bob Benedict from the Human Factors Engineering Branch.

MR. BENEDICT: I'm Bob Benedict with the Licensing Qualifications Branch, the Division of Human Factors Safety.

We have heard this question from Dr. Okrent and others.

MR. OKRENT: I don't have an answer, by the way. This is not a situation where I'm lieing in wait.

MR. BENEDICT: We look for as much experience as we can get in the line organizations for these plants. While we are constrained legally, shall we say, by the ANSI standards that apply today, those that have been recognized by our regulatory guides, we do ask that people provide as much experience as possible.

That is not answering your question. We don't have firm guidelines. When we see that -- depending upon the position of the man in the organization, when we see that a fellow has been involved in reactor operations for a considerable period of time, say several years, we think that is very valuable experience to bring to such an organization as MP&L.

When we see a large percentage of the people in an operating organization as having been concerned primarily with perhaps constructing the plant in the early stages, that that is where much of their nuclear experience is, we like to have that augmented by actual hands-on operation of a hot reactor.

MR. BENDER: I'd like to follow up on Dr. Okrent's question for a moment. We have heard about the organizational structure of a number of utilities over the last year or two. How does this one compare with the last two or three we've reviewed?

MR. BENEDICT: The organizational structure, as shown by organization charts, is very similar.

MR. BENDER: I'm talking in terms of amount of experience in operations, in technical capability and that sort of thing, rather than what the charts show.

MR. BENEDICT: MP&L early on did not give us our warm feeling that we had talked to you about before. We got to the point, I think earlier this year, where we were not red-hot happy, but we were at least warm or perhaps tepid. With the loss of certain of the individuals that had made up so much of the actual operating experience, both on the plant and on the corporate safety review committee, we have kind of gotten a little cooler now.

We would like to see more of that operating experience on the SRC. And we had written off on the changes that Mr. McCoy mentioned concerning the assistant plant manager, and within those constraints, within that organization, as long as the people who are there now stay or anyone who leaves is replaced by somebody better, we are constrained to accept the plant organization.

MR. BENDER: As I understand it, the plant is about to go critical in a week or so. I presume at this time they are adequately staffed up; is that a fair assumption at this stage? Does the Regulatory Staff think they have on hand the right complement of people trained in the right way to do the job?

MR. BENEDICT: Our review is as much a paper review in NRR as anything else. I think that our regional representatives might have some thoughts on perhaps the quality of the operations there. Aside from the theoretical, is there enough experience represented.

MR. LEWIS: I'm Dick Lewis. I'm directing the project and the program in Region II.

Let me say -- and we have a resident inspector, Al Wagner, here also -- that on the MP&L facility we have conducted a very comprehensive inspection program, recognizing early that this was their first nuclear power plant that they were bringing in.

So during the preoperational testing program and the preparation for initial licensing, we put a in a concentrated inspection effort. In addition to the resident program of the regional special staff, we put about twice our budgeted inspector power on that site to identify any potential soft spots that might exist before they received a license and to see, if this problem did exist, that we could get resolution of it to prevent any potential operational problems.

We found early in the program that we had a concern about the limited number of people at the facility that had recent BWR experience. This concern is addressed what we consider adequately in the license condition. It was also followed up with MP&L retaining BWR-experienced personnel and placing one individual per shift, plus the individual that came from Browns Ferry, with the previous recent BWR experience, who serves as an advisor to the plant manager and as advisor to the corporate vice president.

So we feel that that BWR experience is there today.

We also, along the same line, had a concern based upon the resident inspector findings and the regional personnel about MP&L adherence to procedures and the apparent inability at that time of both the operating and the QA staff to bring about satisfactory resolution to what we consider to be a continuing problem in adherence to procedures.

So to effect resolution of both the BWR experience, staff experience, and adherence to the procedures, we met with MP&L and we reached an agreement which was later confirmed in a confirmation action letter from Region II to MP&L on how this type of problem would be handled.

This went out in a confirmation action letter on June 18th, 1982. Basically, what we asked and what MP&L agreed to was that the corporate safety review committee would conduct, during initial operations at the plant, comprehensive audits on the initial operations which would look at the adherence to procedures at the facility; that they would also assure that the BWR experience that was contained in the consultants and advisors to the shift and the staff was being properly utilized at that facility; also, that the advisor to the corporate vice president would spend a large percentage of his time at the facility in an advisory capacity up through the 25 perce power level.

We also thought that, since they were new into the nuclear operating field, that our recent administrator, General O'Reilly, would meet with senior corporate people and would meet separately with the safety review committee and discuss philosophy of operation and experiences that we have had with other committees in initial startups of plants. This was conducted a couple of weeks ago.

With O'Reilly and Floyd Cantrell here with me, the section chief, we went to the site and discussed the meeting.

We also committed in that letter and have an agreement from MP&L that before the facility increases in power above 5 percent and above 50 percent, that we would conduct a team inspection made up of specialists from the region of the Grand Gulf facility, and at that time we would specifically look at their history of adherence to procedures during the fuel-loading and initial power operation up through 5 percent, and again up to 50 percent; that we would take a look at the proper utilization of the BWR consultants and their advisors; and we would take a look at the entire process of the safety review committee performance and their compliance at all levels with the regulatory and the license conditions.

At this time, of course, the only activity since they have received the license, or the major activity, has been completion of the fuel loading. It has been surveillance testing and upkeep and the maintenance of the equipment.

We still see what we consider to be an undesirable number of instances of failure to follow procedures, and we are scheduling now the team inspection that will take place in late August. We do conclude, however, that we have the necessary tools in the license condition and the confirmation of action letter, and that we have the right level of MP&L corporate attention to satisfactory resolve this procedure adherence problem.

We believe, based on where we are today -- and the senior resident can certainly speak for himself -- that MP&L does have the capacity and controls in place, if they properly implement them, that should result in safe operation of that facility.

MR. OKRENT: Let's see, it is the lead Mark III BWR-6 in the U.S. still?

MR. BENEDICT: Yes.

MR. SIESS: If the Staff has some idea that they want N number of man-years of BWR operating experience for a new plant, do you have any idea whether the existing BWR's are generating those man-years at a rate sufficient to staff the new plants that are coming on line?

MR. BENEDICT: No, we have not made a study of that.

MR. SIESS: Thank you.

MR. EBERSOLE: Can I ask a question? Do you consider the interval of time that they are operating in this relatively low-hazard five percent power level as valuable active operating experience within which you can make an assessment of what's going to take place?

MR. BENEDICT: Before I turn the microphone back to our regional people, I would like to address that very briefly. What we like to see in DHF, Human

Factors, is a program that covers the gamut of human evolution. Certainly when we're talking about keeping consultants on the floor a year or until 100 percent power is reached or until 100 percent warranty runs, 100-A, whatever the warranty run is, we are looking at that as being a period in which most of the plant evolutions will occur.

During just fuel loading, during just the initial stages of startup, in my book would not provide that type of operating experience per se, except for startup type of operations.

Let me turn it back over to Dick Lewis.

MR. LEWIS: I think the answer to the question is yes, we feel that, of course, the people there do have experience. It's the amount of experience that concerns us. It started in our region. The first one we thought we needed to be supplemented on experience was Sequoyah. They retained people with PWR experience because TVA essentially at that time was nothing but a PWR operation.

The consultant that will be consultant to the plant manager and to the corporate staff will be there for a year. The on-shift, per-shift advisors with BWR experience are scheduled to be there through the 100 percent power operation.

So we feel, with that experience, that that should be adequate.

MR. WAGNER: I'm Al Wagner, senior resident inspector.

MP&L has also committed to training evolutions during low power startup. The startup evolutions will be completed on a repetitive basis and will give all of the operating shifts the opportunity to do the evolutions that are one of a kind or evolutions that are not done very frequently in the startup of a BWR. I believe that this will benefit and give some experience to all of the operating shifts and not just a single shift during the startup activity.

MR. OKRENT: Okay. I think this is likely to be a topic that will come back to the full Committee.

I would be interested in hearing from the Staff about why they think that at the end of roughly a year there will be a combined adequate technical strength and operating experience, when this person with considerable experience, the technical advisor, will be leaving, and when the others also leave. It's not quite clear to me why that is magically okay at that point. But let's think on it and convince me tomorrow.

Are there any other questions on this topic today?

(No response.)

MR. OKRENT: If not, I propose we take a five-minute break and then come back to the agenda, wherever we are.

(Recess.)

MR. OKRENT: Our next item is, I believe, the Staff on quality assurance, quality control.

MR. HOUSTON: That was the presentation by Dick Lewis.

MR. OKRENT: Let's see if there are any further questions. Don't let Mr. Lewis leave yet.

And the meeting will reconvene. Let me ask the Staff a leading question, hoping Mr. Bender will follow up. We have been interested, in some of the reactors that we reviewed for OL's lately, in learning what the Staff's assessment was of the quality of the construction and so forth.

I don't think we have got -- at least I don't remember any more that we got -- something that is, let's say, an ad hoc version of this when last we reviewed Grand Gulf. So I thought it would be relevant at the Subcommittee meeting to hear what the Staff's assessment was, and that is in fact the intent of that agenda item.

Okay, can we hear from you?

MR. LEWIS: Dick Lewis again.

Let me see if I can field that. We have of course performed the SALP process on annual basis. By going through that, we have NRR input, plus the regional input, which involves not only the hard data, the number of noncompliances, the reportable events and so forth, but also a lot of subjective input from the inspectors.

In our SALP process we found the Grand Gulf construction to be either average or above average in all aspects. We of course -- part of our inspection program is to take the FSAR and walk down the systems to verify that they are installed as designed, and we found very little to no deficiencies in that area.

And as part of the licensing process, we addressed earlier the requirement that they bring in an independent consultant to verify design to installation. On the plus side, they found no major deficiencies in that area.

MR. BENDER: How many inspectors? There is a resident inspector at the site?

MR. LEWIS: Yes, sir.

MR. BENDER: How many visits do you make on the average to a site over the course of a year?

MR. WAGNER: Last year there were approximately 50 inspections conducted, 12 of which inspections were made by the resident inspector, which is myself. The remainder were made by construction engineering staff out of the Region II office at the site. I would say approximately 36.

This year thus far we have had right at 60 inspections. However, the number of construction inspections have decreased this year, and the number of operational support inspections from the operational staff in the area of procedures, health physics, emergency preparedness, and in the prepare for operations aspects have increased greatly.

MR. BENDER: Setting aside the operational planning business and just looking at the plant construction itself, Mississippi Power & Light has its own quality assurance organization, as I understand it. Is it supplemented by the Bechtel organization?

MR. REEVES: I'm Tom Reeves, manager of QA.

Yes, sir, we have a staff at the present time of 35 professional people. Bechtel, during the course of the construction, has had a staff of approximately 20 QA, at the present time of 8, which they are only maintaining 2 in the preservation mode, so the number is down.

So far the construction activity itself with the Bechtel forces is a first-hand QA look by the

Bechtel internal QA staff. And I had a construction staff resident on site that also overviewed Bechtel and looked at other activities.

MR. BENDER: Your staff is -- that group of people is relatively small compared to some groups. It would seem to us that some of that has come about due to the fact that the early inspection was not all that good.

How long has that QA staff been set up as you described it?

MR. REEVES: Well, the concept of the staff was available when we started work on the LWA. There were only two in the QA group in 1974 in May, when we started work on the LWA. It has grown since that time, as the work progressed.

Let me be sure that I'm talking the terminology correctly. We're talking only of quality assurance engineers, quality assurance representatives, that do audit and surveillance and monitoring from a QA standpoint. In addition to that, Bechtel had up to a maximum of 100 QC inspectors that did the acceptances, the accept-reject inspection to a specified engineering criteria of the actual work that was performed.

Our operation in QA is more programmatic in nature. It is oriented toward both preventative and correctional, as opposed to acceptance.

MR. BENDER: How are nonconformances handled? Who prepared nonconformance reports? Who approved them?

MR. REEVES: Within the Bechtel system, when QC performs an inspection there are two levels of nonconformances. One is what's called a condition report. That is where the nonconformance that has occurred can be dispositioned without having engineering.

Such as removing the forms from the concrete board, as honeycombing that did not exceed a certain depth and rebar did not show. Engineering had in their specification a repair procedure to fix that. That is written on a condition report.

Another item may be a weld that didn't meet specifications. You don't need an engineer to take it and cut it out and reweld it on the form requirements. Then there is a nonconformance report, the entire tier document. That document gives the disposition as it is used on the pad and would require an engineering disposition, and the site field engineering forces made the determination that rather than submitting an engineering evaluation, it would be more prudent to go back and do it right like the specification originally required than a disposition onsite.

So within the Bechtel construction forces, there were those two levels. Now, on our safety-related contractors that we had onsite, for instance, CB&I built the containment. We had the General Electric, INSE and several other national people, NTL, for nondestructive tests, for a total of probably six or eight safety-related contractors to Bechtel on site at one time or another during the construction process. Each one of them had their own nonconformance inspection system, with an overview by Bechtel QC and audit program by both Bechtel QA and MP&L QA.

MR. BENDER: Does Mississippi Power and Light participate in the evaluation of the nonconformance?

MR. REEVES: In the first year of

construction, MP&L was in the approval cycle for dispositions that were used. We later removed ourself from that system and went into a mode of auditing the disposition of nonconformances. My staff onsite for construction has mechanical, instrument and control, electrical, civil, the whole gauntlet of technical expertise within the MP&L QA staff.

They receive a copy of each nonconformance report when it is generated and also a copy of the disposition when it is finally closed. Those are reviewed and that becomes a part of our overviewing of the Bechtel system. We do not sign off as accepting it, but if we see a disposition that we feel is inappropriate and is not thorough enough or a cause was not determined, we investigate that ourselves and have issued our own nonconformance documents that we call corrective action requests because of those type of reviews.

MR. BENDER: Does the Staff look at all the nonconformances?

MR. WAGNER: No, they are not all looked at. They are audited on a sample basis to see that they are properly reviewed and evaluated and corrective action taken.

MR. BENDER: What fraction are looked at? How do you decide what fraction is looked at?

MR. LEWIS: Any nonconformance that results in a construction deficiency report or a reportable event to the NRC is looked at 100 percent. Those that are not of such significance, small significance, that they do not result in a reportable event, that would be formally submitted to the NRC and would come under the inspection program, as Al said, in a sample review that would be conducted by the resident inspector. And the specialists that come out from the field would also be looking at those in their inspection program.

MR. BENDER: Let me ask about a couple of specific things that have shown up in other plants. Has this plant had any bolting problems where the wrong materials were specified or the bolts were overtorqued or where they were exposed to an environment that caused them to deteriorate?

MR. REEVES: Not in those terms. We have had some bolting problems.

MR. BENDER: Every plant has some bolting problems.

MR. REEVES: We had a bolt shear on one of the diesel generators and travel into the generator itself. That is still under evaluation. The bolt has been sent off for a metallurgical examination. As far as any generic problem within the bolting. And I am familiar with what you are talking about, we were not subject to that nonconformance.

MR. BENDER: How do you do?

MR. REEVES: As a result of the problems at other plants. The experience, for instance, in the rebar -- excuse me, the Redhead anchors, the quick bolts that were installed in concrete, we did a very sensitive look at the method we used to control that, the procedures for installation, and had a very heavy audit program in that area.

We keep abreast through EEI QA task force meetings, Southeastern Electric exchange QA task force meetings. We have an active interchange of major problems within utilities. We include that both in our audit program where it is applicable in a special assessment of our mode of operation where that is not subjected to audit.

It happened in the bolting problem that we were early enough in our construction cycle that in conjunction with Bechtel they developed a better performance spec, and we probably would have had, and the other utilities that had the problem did have. So we were forewarned and took action as a result of that.

MR. BENDER: How much hot functional testing has gone on up till now?

MR. MC COY: Could you repeat the question?

MR. BENDER: How much hot functional testing has gone on up until now?

MR. MC COY: We conducted approximately three weeks of hot functional testing, as I recall.

MR. BENDER: Could I ask the Staff whether it monitored the hot functional testing and how the results compare with other plants in terms of what showed up in the way of problems during that time?

MR. WAGNER: We had a specialist inspector from the region over to [illegible] for pipe whips, restraints, and that type of thing, and we had no large problems during it. Unfortunately, I can't make a comparison myself with problems noted at other plants.

MR. BENDER: You didn't find any abnormalities?

MR. CANTRELL: I am Floyd Cantrell. They did bring in a donkey bolt boiler to provide steam for the turbine and possibly the RCI system, but in a boiler, of course, there is not much hot functional testing at all.

MR. BENDER: I am aware you can't do a heck of a lot until you start generating nuclear power, but at least those early test results give some feeling for how many booboos might have shown up in the plant. If I interpret correctly what you are saying, not much was observed that was abnormal, considering that you always have some troubles in any startup. Is that a correct interpretation, that there weren't any unusual problems associated with the startup?

MR. CANTRELL: I don't think you can say any unusual problems without functional testing. They did have problems with pre-op testing and qualifying certain things if they went wrong, but we believe that eventually they completed each pre-op test satisfactorily.

MR. BENDER: Did you issue a construction report on this plant? How will you announce that the plant has been designed and constructed adequately to justify going ahead with the license?

MR. LEWIS: What we do when they complete construction is what we call a 94-300 letter, in which we communicate with NRR, Darrell Eisenhut, and it comes from the regional administrator to Harold Denton. In that letter we make a finding that the plant has been completed in accordance with the applications to the best of our knowledge and that the systems are in place as designed. We do that subsequent to, in this case, MP&L making a similar finding and listing all of those items that remain to be resolved at the time they come for licensing.

We also identify items that then appear as a license condition, which we did on this. In the case of MP&L we did not have any more open items remaining to be resolved as we do on a typical facility.

MR. BENDER: That is all I have, Dave.

MR. OKRENT: Okay. Let me pick up a question on the SER that I had. On page 22-4 there is a paragraph which starts out, "By letter dated June 15 and 25, 1982, MP&L discussed a tentative provision of station emergency procedure 05" et cetera. Are you familiar with that paragraph?

MR. HOUSTON: Right.

MR. OKRENT: How are you going to arrive at resolution of this? It is my impression that right now the Staff may not even be planning to recommend that the Commission have a hearing on severe accidents and so forth. It is at least iffy.

MR. HOUSTON: I believe that is right. The group working with the BWR Owners Group has not yet decided -- this one was concerned with venting of containment when you neared the ultimate containment capacity, and there is, I think, an indecision with the Staff as to whether they will recommend venting or whether they will not. I think that is why that one is still under review and there has been no decision made there.

MR. OKRENT: I am trying to know how you expect to arrive at a decision on this; and are you going to communicate back with the ACRS on this matter or what did you have in mind here?

MR. HOUSTON: I assume, yes, that we would communicate back. The resolution, I believe, will come with the BWR Owners Group or the LRG-2 group with the Staff.

MR. OKRENT: I must confess I missed the letters dated June 25 and June 15 or I am sure they would have caught my eye. I don't recall whether they are very short or whether there is a big backup in them. Do you recall?

MR. HOUSTON: I think they are very short. I don't recall which letter it is, but one letter raised the venting pressure to 50 psi. I believe originally it was 15 psi, which was set at the design limit, and one letter raised it upward to 50. I'm not sure what the other letter discussed, unless I have it back here.

[Pause.]

Oh, right. The first letter, the 15th, did raise the limit from 15 to 50. The second letter more or less indicated that they would abide by the decision forthcoming from the Owners Group.

MR. OKRENT: This was in the event of pressure without radiation or pressure with radiation?

MR. HOUSTON: As I understand it, this would be a pressure following an accident, so it would be with radiation, or possibly with radiation.

MR. OKRENT: Okay. According to the agenda that we have, if I am correct, there is an item on seismic qualification of equipment, which was a potential item.

I am going to ask whether any members want to hear this. The Staff has said they looked at it and with a couple of exceptions they are satisfied. Do any members want to hear this?

MR. EBERSOLE: I might just ask a question.

MR. OKRENT: Okay. Why don't you ask questions on that one?

MR. EBERSOLE: Are there any non-seismically qualified fire protection systems or pieces of apparatus which upon responding in an ambiguous or uncontrolled manner in the presence of an earthquake would embarrass the plant operation?

A case in point recently found would be that spurious activation of carbon dioxide ejection systems into diesel rooms, like commonly occur on all four diesels, whatever, in one case you may know about potential injection of CO_2 into other occupied areas in an uncontrolled manner might quite embarrass life for operators and equipment when they were under duress already.

So have you looked at this in the context not to make the systems work according to the way they should, but rather to prevent them from working in a manner to disruption of what would otherwise be a regular operation?

MR. RICHARDSON: First of all, we do not have Co_2 in our diesel generator rooms, but in general, as far as the fire protection systems, the water suppression systems and those, they are generally located out in the plant in corridors and things.

They are looked at with our engineering review team for potential effects in the case of any potential effects or adverse effects on initiation, if they would adversely affect safety-related equipment or operations that may vent away.

In addition, the criteria we have on the job is that in any cases where it may, in a seismic event, fall and impair some safety-related equipment, it is seismically supported. We call that 2001 criteria. So it is locked at in detail.

MR. EBERSOLE: Do you look at the dampers and the duct work in this context to see that they do not close and bundle up systems which need to be kept open for cooling?

MR. RICHARDSON: Generally it is looked at from the standpoint of -- yes, I guess to answer your question just briefly, it is looked at. That is kind of a general question and also a general answer.

MR. EBERSOLE: Right. But it gets very specific when you talk about closing a damper to a room that requires open flow for ventilation to maintain continuity of shutdown, for instance.

MR. RICHARDSON: Well, generally most of -- for instance, most of the rooms with safety-related equipment and things which would obviously require some cooling of the area or have coolers internal to the rooms where they do not rely on HVAC coming through and, therefore, in isolation the damper would not impair that.

MR. EBERSOLE: But there are exceptions.

MR. RICHARDSON: Off the top of my head I cannot remember any. There may be some, but --

MR. EBERSOLE: Let me suggest you look at the exceptions. That is the only thing I have.

MR. OKRENT: Okay. I am going to propose that we skip the item on containment purge unless somebody is desperate to hear that. Before I go on to the question of do sensor systems meet single failure criteria, let me ask Mr. Schott, do you have any other comments you wanted to me on hydrogen control?

MR. SCHOTT: No.

MR. OKRENT: We have one more item on my agenda. It is do sensor systems meet single failure criteria. I guess we have both NRC and MP&L.

MR. EBERSOLE: Mr. Chairman, may I make a few comments on that so we do not have a lot of extraneous words?

I had to do with generation of this question. It came about from finding certain comments and statements made in several of the SERs connected with this type of plant. In essence, it is this: this system, of course, employes a one-out-of-two twice system, which is in essence a two-channel system with the separate channels operating in coincidence in some sort of logic like A or C or B or D. In short, it requires coincident functions in a separate channel. And in essence it is a two-channel system.

This is not a new issue. It is rather old, but it springs up every so often and it is worth investigating. The specific case where I found a reference to it occurred in the case of common manifolding of one of these projects.

The analysis of the situation here revealed that in the particular case there was common manifolding of certain sensors in a fashion to disable one of the two channels, leaving the opposite channel with its coincident elements functional to execute the mitigating function. In short, the accident itself involved the safety system disablement and produced a hydraulic or, in this case, a steam release that necessitated a safety function. But the only residual safety functions that were left to perform that were simply that offered in the opposite channel, which required coincident -- that is, both elements of the opposite training functioning.

This is less than redundant. The coincidence requirement is only half. The question then comes up: In this plant do we have specific or general cases where I can have disablement of a safety system either in the context of a sensor line, the electrical or electronic aspects, the hydraulics or possibly pneumatics, such that the actual failure of the safety system itself initiates an accident which must be mitigated and simultaneously leave me with a residual system that does no permit a single subsequent random failure?

Now that is the essence of it. A somewhat broader picture of this is do I have an accident which may not involve the protection system per se but it may involve the system being supported. But in this case, the accident results in physical conditions which destroy one of the available, possibly two only channels and thus again destroy my option of having a call to permit a single random failure after the accident.

That is the essence of it. I am talking about failure in protection system. I am not talking about instrument control systems, which are not identified in the safety context. Those are tertiary systems not involved in this question at all.

MR. OKRENT: Are there any questions on the question?

(Laughter.)

MR. EBERSOLE: Is there anyone here -- does anyone understand what I am saying?

MR. RICHARDSON: Yes, sir.

MR. EBERSOLE: One more qualifier.

There is another aspect. In many cases in these designs it is sometimes necessary to invoke coincidence for good reason. You do not want a single system derived from a spurious failure to initiate an action which can be damaging. Therefore, you want a confirmatory signal from some other place before you allow it to be executed.

A case in point here would be, for instance, if I let a single impulse line be fully competent to tell a system the reactor level is low or the reactor pressure level is low, when really it is not low. It is just the impulse line broke and that sensor line sees low pressure.

If that then invokes and is fully competent without coincidence to cause execution of a response function, certain damaging things can occur. For instance, valves can attempt to open which cannot open because of a real differential. The valves have a real differential. The system is highly hypothetical or spurious low pressure.

Do you have any cases where you have excessive confidence that you need to have a coincidence requirement before you allow the response to occur? Is that clear?

MR. RICHARDSON: (Nods in the affirmative.)

MR. EBERSOLE: Have I made clear that you must have coincidence production of critical signals which must be right when they occur? You cannot allow a spurious one to occur. I use the pressure line as a case in point -- a pressure line which at least hypothetically could tell a set of valves from low to high pressure systems to open.

But they cannot open because it is 1100 pounds versus 400 pounds. It cannot open. They try. They attempt to open but run up against the overloads on the breaker set points and lock out.

Yet you may have in fact a small LOCA.

MR. OKRENT: Let's take these one at a time.

MR. EBERSOLE: It may eliminate some extraneous words about the instrumentation aspects of this.

MR. OKRENT: Who wanted to volunteer first? Staff?

MR. ROSSI: I am Ernie Rossi. I am the Section Leader in the Instrumentation and Control Systems Branch.

Let me say a few words that I had planned to say before you explained your question in more detail. I am going to try to say a few words to the philosophy that we use in looking at sensing failures and then I think we can come back and maybe have some dialogue on your particular questions.

The question that was on the agenda was do sensor systems meet single failure criteria. You pointed out that sensor systems that are associated with protection systems primarily.

MR. EBERSOLE: Right.

MR. ROSSI: The basic answer to that is that we intend that they do meet single failure criteria.

MR. EBERSOLE: What do you mean by "intend?"

MR. ROSSI: Well, from the Staff's standpoint, we do an audit review. In our review we look to see that they do and it is our intent that they do. Now I am going to explain what we do and a few words about why we do it that way.

First of all, let me refer a little bit to IEEE 2.79, because that is one of the basic standards for protection systems. I would state that a strict interpretation of IEEE 2.79 does not include sensing lines within its scope. That is because IEEE 2.79 is an electrical standard.

MR. EBERSOLE: Let me make a comment. That was covered in ANS 4.1 about five or six years ago, wherein not only sensing lines were scoped as well as mechanical pneumatical equipment.

MR. ROSSI: There are several other standards that do indeed address sensing lines. I think it is important to talk about IEEE 2.79 because it is a special standard in that it is part of the regulations. That is why I mentioned IEEE 2.79.

MR. EBERSOLE: I am not making comments about that. Unfortunatly, the electrical engineers stop abruptly.

MR. ROSSI: Right. I did want to point that out. A strict interpretation of 2.79 electrical standard does not include sensing. However, the Staff does perform its review of manifolded or common sensing lines on the current plants, using the criteria of IEEE 2.79's guidance, not as a regulation.

Now, that means that we use judgment on the credibility of what constitutes a failure. We use judgment in looking at the consequences of these failures.

MR. EBERSOLE: You do not endorse ANS 4.1?

MR. ROSSI: I am not that familiar with ANS 4.1. I do not think with respect to what I am stating here it probably is not relevant, really. I am just not including that in my discussion because I am not that familiar with it.

What we basically do is we consider a transient that might be initiated by a break or a leak of a sensing line. That can occur in several ways. Maybe the sensing line is large enough that it just creates a loss of coolant or steam line break or something like that. Generally these lines are rather small, so that is probably not the situation.

However, the break or leak also in a sensing line could cause a transient if that sensing line feeds a control system. That will cause a transient. There are cases I could talk about where that is the case.

So we consider a transient initiated by a break or a leak of the sensing line. We look at all the consequences of the break, including consequential failures of sensors feeding the protection system that might be on that same sensing line.

MR. EBERSOLE: Okay.

MR. ROSSI: And then we take an additional random single electrical failure.

MR. EBERSOLE: Electrical failure.

MR. ROSSI: Not the failure of another sensing line. We think it would be unreasonable to take one sensing line failure as your incident and then as your random failure the instantaneous breaking of another sensing line, but we do think it is credible to look at possible single random electrical failures and things like bistables that might have been sitting there for some period of time and are now called upon to work.

MR. EBERSOLE: That might be the last stage where it is fed by the opposite or rendundant sensor line.

MR. ROSSI: Right.

Okay, then we look to convince ourself that there is no safety problem with those assumptions.

MR. EBERSOLE: Doesn't that leave you in a position where one channel gets failed by virtue of the impulse line failure and the other has failed in random configuration?

MR. ROSSI: That could indeed. I think the one out of two system is a little bit more complicated than that, because in many cases it depends on how you assign the sensors to the impulse lines.

All right. If a break or a leak of a sensing line were not to cause a transient that required any kind of protective function, if it is a small leak that might give a large error in the sensors and does not cause any transient or anything, that would count as the single random failure when we look at it.

MR. EBERSOLE: Right. Pardon me just a second. I think we are learning that small one-inch pressure line breaks in fact are quite interesting things to call thermohydraulic transients, especially in PWRs. I am not sure but what they cannot synthesize some interesting things in the instrumentation for boilers, like sensing. Perhaps triple low level might be one of the consequential signals.

MR. ROSSI: Let me discuss some things we have looked at in particular on Grand Gulf. When I say leaks in small breaks, I am thinking about things that are smaller than that that might just cause, for example, the reference leg to bleed away. That is the kind of thing I am talking about.

MR. EBERSOLE: You are not talking about a full one-inch line break?

MR. ROSSI: No. That would clearly be a transient that would require something, in my opinion.

MR. EBERSOLE: In general I am talking about a full one-inch line break.

MR. ROSSI: When I am talking about small, I am talking about something that might give you a large error in the instruments that are associated with the sensing line, but you might not get a transient. But still, the sensing instruments that are associated with that line would not work if you now have another accident.

That would be -- we count that as a random failure that we normally assume.

MR. EBERSOLE: Do you include the complete failure of the sensing line?

MR. ROSSI: Yes, we include that too.

MR. EBERSOLE: You admit that is a transient and something that has to be handled?

MR. ROSSI: Right. It is a transient and something that has to be handled.

The Staff in general would and has allowed credit for manual operator action to mitigate a transient that might be caused by sensing line failure if there is sufficient time for that manual action, and the manual action is sufficiently simple and straightforward and there are sufficient indications available for manual action. So we might not require that the automatic systems all work. We have done that in some cases, manual action, if they are 10 or 30 minutes or whatever. If it is less than 10 minutes, it probably would not. If it is 40 to 30 it probably would.

Now, with respect to Grand Gulf, as you know, our reviews, our audit reviews do not say that we have looked in detail at all sensing lines used for protection system on Grand Gulf. I do know that we looked in particular quite carefully at the level measuring system for the reactor vessel on Grand Gulf. We have been told by the Applicant and we have addressed our ability to verify this ourselves, that you can take a break or a leak in one sensing line. It turns out that if it is the right sensing line, that can turn off the feedwater flow in the reactor vessel because the impulse feeds the level transmitter. You could take the break of that line, to take another single random electrical failure, and you would still get reactor scram. You would still get automatic initiation, sufficient safety equipment --

MR. EBERSOLE: What is sufficient?

MR. ROSSI: I was just about to say that, sufficient safety equipment to keep the core covered.

MR. EBERSOLE: Allowing a random failure.

MR. ROSSI: Allowing a random failure in the electrical system. I have not independently verified this, but I think you could include that failure as a failure of a pump or something like that. So it is a little more than just a straight electrical failure.

Basically what that would mean is you get the failure in the sensing line. Because it happens to feed the feedwater control system that may cause the failures, the right kind of failure, it causes the level to falsely read high, which will then shut off the feedwater flow at the reactor vessel. The level comes down. Eventually I get to the point where there are signals that will lead to an automatic reactor scram.

MR. EBERSOLE: Can you get a similar level signal that will produce triple low?

MR. ROSSI: I don't know if it is a specific level point, but you also willk get automatic initiation of either the HPCI system or the RCIC system which is sufficient to keep the core covered. I don't know how far down the level. The Applicant may have that number here, but --

MR. EBERSOLE: If you have a triple low and you have a sensor line failure, you have enough to pressurize containment. That leaves you in a position to initiate full blowdown.

MR. ROSSI: Well, if you pressurize the containment, you get additional signals for high pressure and so forth.

MR. EBERSOLE: Remember, the system is really not in low pressure. So you are responding to a state of affairs that doesn't exist. You mentioned the pump differentials and the valve differentials. Do you look for the requirement for --

MR. ROSSI: That would be simply the same as any other small -- as far as I know, it would be the same as any other small one-inch break you might get, even if it was in some line someplace that didn't affect the protection of the system at all.

MR. EBERSOLE: I am not sure in this case whether it could synthesize a triple low or not, but if it could, if we could assume that for the moment, then for the small break, the one-inch line, it has the capacity to become a very large break, namely, a semi-automatic blowdown. If that same sensing line break sends a low pressure signal which is erroneous to the low pressure valving components, it will do something it can't do, and it will lock itself out.

Do you look at the coincidence requirements so as not to actuate the critical systems of this sort until you confirm through coincident signals that you really do have low pressures?

MR. ROSSI: I haven't looked at that particular problem recently, but I do know that we have looked in on Grand Gulf. I know we have had discussions on other BWR plants of interlocks used between the low pressure systems and the reactor vessel, and we have been concerned about precisely that kind of problem where you might get a false signal of any sort, and you don't want to open those valves until the actual pressure is down low enough so that you won't overpressurize the low system.

MR. EBERSOLE: Does this plant have this problem?

MR. ROSSI: I don't know about this plant.

MR. EBERSOLE: I am sure the Applicant can tell us.

MR. ROSSI: I didn't look at that. There has been discussion on other BWR plants.

MR. EBERSOLE: Thank you.

MR. ROSSI: I hope that addresses most of your questions. I am not sure we looked at every single aspect of some of the things you have talked about on this plant, but that is intended to try to give you a feel for what we do and don't do.

MR. EBERSOLE: If you go to 4.1, you will find the mechanical equivalent of 2.79.

MR. ROSSI: There is also a recent ISA standard which is out on sensing lines which also does that, and our standards group is in the process of -- and you may have been involved in reviewing that at one point in time, of the regulatory guide which is intended to enforce that. That will also cover in a lot more detail. It brings the sensing line basically under the IEEE 2.79 type criteria. But again, that will be a regulatory guide. It is still something that I consider to be a little different than IEEE 2.79 which is the basic regulation.

MR. EBERSOLE: Thank you.

I guess the Applicant, hearing the benefit of this presentation, the floor is yours.

MR. CESARE: Well, Dr. Ebersole, I am not sure you want to go into it, given the time that we have, but let me just make a few summary statements and then we can answer your specific questions, if there is anything remaining from that. I can answer some of the questions that were left open there.

First of all, let me endorse their conclusion that IEEE 2.79 is an electrical standard and that in the electrical sense it stops short of mechanical sensing lines. In its electrical sense, we need it with regard to protection systems.

However, if you look at the larger picture, the design goals, the intent and requirements that were developed because of those goals, the methods of implementation of that design, if you look at the as-built plant, the summary woul be covering both electrical and mechanical systems.

(Slide.)

MR. CESARE: This is the summary, basically, that we will take a design basis event, the accident, we will take the consequential failures that result from that event and then impose an additional single random failure. We end up with the safety systems required to mitigate the consequences of the design basis events or the accident.

MR. EBERSOLE: Do you qualify that by saying an active failure, that is intentional, of course?

MR. CESARE: Active mechanical or passive electrical, yes, sir.

MR. EBERSOLE: As a matter of fact, if you can say that and that is the way your plant is built, I have no further questions. It is just whether that is realized in real detail.

You see, I found a case in a plant that I will not name where when you first took turbine pressure, that wasn't the case.

MR. CESARE: You don't have to name it. We read it in the transcripts.

MR. EBERSOLE: We found a case where it only had a residual channel. The safety function was truly one of the, what is it, AC or BD, but it was the only thing left. These were in coincident configurations. It says in a sense that plant did not meet that criteria, and I rather -- I though I had seen something like that, and I couldn't put my finger on it, in the text of your SCR.

MR. CESARE: All of the questions you have asked prior to us beginning this discussion, we know of no situations that fail on the direction you describe.

I have to say, though, let me put this slide up.

(Slide.)

MR. CESARE: And tell you how we do meet that summary. That is, I'll skip everything except the meat, which is the middle there. It says protection systems are designed to be separate from control systems to the extent that failure of any common element will leave a protection system, at least one system, to the extent that you satisfy this intent by having reliability, redundancy or diversity or independence.

So in the case where you are having a blowdown in the drywell, I would offer that drywell pressure is diverse and gives you -- the system may be responding to an artificial situation, a leak in a reference leg giving an artificial level. However, the plant is put in a safe condition by the diverse sensing of the LOCA. It may not be a classical LOCA.

MR. EBERSOLE: Well, if you synthesize triple low level and you get a real drywell pressure, you have a combination of signals that says, I believe it says execute ADS, and at the same time it can be that your failure has also synthesized low pressure which doesn't exist in the primary system. And it is called upon, as I mentioned, low to high pressure valving systems to try to do their thing because they cannot do it, because there is a real difference here.

To this extent, do you examine the need for and always include the requirement for coincidence to validate a signal and thereby not call for equipment to attempt an impossible task?

MR. CESARE: I would have to answer that that the reviews we have done to date to verify that we meet this criteria have turned up no such situations.

MR. EBERSOLE: Have you examined the need for and whether you should in fact have confirmatory or coincident signals to actuate to critical equipment?

MR. CESARE: If that confirmatory signal is required to mitigate -- to provide a safety function which mitigates the consequences of an accident, I would assume that we have looked at that and that it is single failure proof.

MR. EBERSOLE: I wonder if it provides a function which is the safety function but which has no chance of being executed because of the presence of conditions in the reactor different from conditions in the sensing lines because one of them has failed.

Do you follow me?

MR. CESARE: I think I am confused now.

MR. EBERSOLE: If I have a single impulse line that generates a pressure signal that is misinterpreted by your system to say the pressure in the reactor is low, and then I call upon systems which say now that the pressure is low, I will do certain things, and yet they cannot, they run into an impossible overload condition which it cannot tolerate because of subsequent delays to reactivate, do you attempt to search for that condition and provide coincidence where you find it?

MR. CESARE: If protective action is required because of that low pressure signal, then I feel that by our design goals and implementation of this criteria, that we do meet that.

MR. EBERSOLE: Why don't you look for me for a case in point where you might synthesize a low pressure condition when in fact it did not exist and you set in motion changes of events which cannot by any stretch of the imagination be accommodated? I think it might be worth both our whiles to do that.

MR. CESARE: We can do that.

MR. EBERSOLE: I don't think you can say it offhand.

The first slide you put up there accomplishes the main thrust of my question, so I have no further comments

MR. OKRENT: Are there any other questions or comments that Subcommittee members want to bring up at this time?

(No response.)

MR. OKRENT: Anything further the staff wants to add at this time on the things that have been discussed?

You may add something.

MR. RICHARDSON: I want to add one brief comment in response to Dr. Ebersole's question about th dampers. A brief look says that there's only two cases, two HVAC systems in the safeguard switch gear control room. The dampers are seismically qualified.

MR. EBERSOLE: I see. Thank you.

MR. OKRENT: All right. I am going to give you a tentative agenda for the meeting with the full committee. I have not had a chance to explore this with the other subcommittee members here, so they may change it after I have given it to you.

Anyway, the full committee may change it, as you well know, but this is what I am going to try.

We will begin with a short subcommittee report, roughly 15 minutes, on Grand Gulf, and then an even shorter subcommittee report on the Fluid Dynamics Subcommittee Meeting on the concerns of that sort, which if we began at 8:45 would get us up to around 9:10 in the morning on my clock.

At that point we would have a short report by the NRC on the status of review which questions I would hope would not take more than 15 minutes, so keep it as short as you can, and then a very short project status report by MP&L just to tell the Committee where you stand as of tomorrow.

Then the first technical discussion which is specific would then begin about 9:30 and would be hydrogen control.

I propose to start with a ten minute summary by the Staff as to where they think it stands and so forth; then roughly five or ten minutes by MP&L adding what they want to to what the Staff has said, and then leave the Committee ten or fifteen minutes for discussion of this topic.

That would get us to about 10:10, at which point we would have a break. You see how precise I am on these very inaccurate things?

The next topic would be one related to your current available experience both in BWR operations and in what I will call BWR behavior. So that means the experience you have in the group that will run the reactor and how you are supplementing it, an also in the technical support operation of MP&L. You may want at that time to give us a short summary also of the broader support organization. I am proposing only ten or fifteen minutes total for your presentation on this topic, with the idea that the thing the Committee would mostly be interested in knowing is that you have taken steps or do have the necessary strengths for the first year and thereafter.

That would get us roughly to 10:45 or 10:50, at which point we would continue, hopefully for not too long, the discussion that we had today on possible effects of a LOCA on hydraulic lines and this having a potential adverse effect on scram capability or not.

I am assuming that the NRC will take up to ten minutes giving a summary of where they think that all stands, and MP&L will be given up to ten minutes to tell where they think it all stands, and leave another ten or so minutes for the Committee to discuss it. I don't plan in this agenda to have more than 30 minutes of that on the agenda.

Then I would like to have a short discussion of this proposed venting of containment. I would very much like to get from somebody a copy of those June letters which I unfortunately have not had a chance to see. So if someone would please bring a copy in sometime before 11:15 on the agenda, I will have had a chance to read it and then maybe introduce the topic to the Committee or whatever.

That would get us to about 11:30. Now, we are scheduled until 12:30, so I have shown "Other" beginning at 11:30, which could mean that we end, it could mean that we haven't scheduled enough time, or it could mean that there are other topics.

Anyway, this is the proposed tentative agenda.

Does the Subcommittee have any comments?

MR. EBERSOLE: Sounds good to me.

MR. MARK: Fine.

MR. OKRENT: Mr. Bender agreed.

Are there any other comments?

Well, if not, I'll thank you all and the meeting is adjourned.

(Whereupon, at 7:32 o'clock p.m., the Subcommittee adjourned.)

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

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in the matter of: ACRS/Subcommittee on Grand Gulf

Date of Proceeding: August 11, 1982

Docket Number: ____________________

Place of Proceeding: Washington, D. C.

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

Jane N. Beach

Official Reporter (Typed)

Jane N. Beach

Official Reporter (Signature)

INTRODUCTORY STATEMENT BY CHAIRMAN

SUBCOMMITTEE MEETING
GRAND GULF
AUGUST 11, 1982

The meeting will now come to order. This is a meeting of the Advisory Committee on Reactor Safeguards Subcommittee on GRAND GULF.

I am D. Okrent

The other ACRS Members present today are : C. Siess, J. Ebersole, M. Bender, C. Mark, M. Plesset and Consultant G. Schott.

The purpose of this meeting is to discuss the Mississippi Power and Light Company's request for an operating license.

The meeting is being conducted in accordance with the provisions of Federal Advisory Committee Act and the Government in the Sunshine Act. H. Alderman is the Designated Federal Employee for the 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 July 28, 1982.

A transcript of the meeting is being kept, and it is requested that each speaker first identify himself and speak with sufficient clarity and volume that he can be readily heard.

T10

We have received no requests for oral statements from members of the public. We have received no written statements from members of the public.

We will proceed with the meeting, and I call upon

GRAND GULF

STATUS OF REVIEW

DEAN HOUSTON

PROJECT MANAGER

NRC

T10

GRAND GULF

CHRONOLOGY

SAFETY EVALUATION REPORT	SEPTEMBER 9, 1981
ACRS SUBCOMMITTEE MEETING	SEPTEMBER 17-18, 1981
ACRS FULL COMMITTEE MEETING	OCTOBER 16, 1981
ACRS INTERIM REPORT	OCTOBER 20, 1981
SER SUPPLEMENT NO. 1	DECEMBER 16, 1981
SER SUPPLEMENT NO. 2	JUNE 16, 1982
OPERATING LICENSE (LOW POWER)	JUNE 16, 1982
SER SUPPLEMENT NO. 3	JULY 21, 1982

GRAND GULF STATUS OF OUTSTANDING ISSUES

	ISSUE	STATUS	SECTION
(1)	Damping value for cable tray design	Resolved	3.7.3 (SSER 1)
(2)	Ultimate containment capacity	Resolved	3.8.1 (SSER 1) II.B.7 (SSER 3)
(3)	Tangential shear - drywell	Resolved	3.8.1, 3.8.4 (SSER 1)
(4)	Hydrodynamic LOCA loads - MARK III	Resolved pending confirmation	3.10, 3.11 (SSER 3) 3.8.1, 6.2.1 (SSER 2)
(5)	Load combination equations	Resolved	3.8.3 (SSER 1) 3.9.3 (SSER 2)
(6)	Electrical equipment qualification	Resolved with license conditions	3.11, 3.10 (SSER 2)
(7)	ODYN Code calculations	Resolved	5.2.2, 15.1 (SSER 1) 4.4.1 (SSER 2)
(8)	Containment isolation	Resolved	6.2.4 (SSER 1)
(9)	Containment purge	Resolved with license conditions	6.2.4.1, II.E.4.2 (SSER 2)
(10)	Single failure in SRV low-low setpoint function	Resolved	7.8 (SSER 1)

Continued

GRAND GULF STATUS OF OUTSTANDING ISSUES

	ISSUE	STATUS	SECTION
(11)	Single sequencer reliability	Resolved	8.4.5 (SSER 2)
(12)	Nonsafety loads on emergency sources	Resolved	8.4.6 (SSER 2)
(13)	Management capability and organization	Resolved with license conditions	13.0, I.A.1.1, and I.A.1.2 (SSER 2)
(14)	Emergency preparedness plan	Resolved (low power)	13.3 (SSER 2)
(15)	Operating and emergency procedures	Resolved	I.C.2, I.C.3, I.C.5, and I.C.6 (SSER 2)
(16)	Control room access and instrumentation	Resolved	I.C.4 (SSER 2)
(17)	Hydrogen igniter system	Resolved for interim operation with licensee condition	II.B.7, II.B.8 (SSER 3)
(18)	Reactor vessel level instrumentation	Resolved	II.K.1.23 (SSER 1)
(19)	Common reference water level instrumentation	Resolved	II.K.3.27 (SSER 1)
(20)	Recent containment concerns	Awaiting information	6.2.9 (SSER 3)

ISSUES INTRODUCED SINCE LAST ACRS MEETING

- LPCI MODIFICATION
- PMP FLOOD ANALYSIS
- CONTAINMENT CONCERNS (HUMPHREY)
- INDEPENDENT DESIGN VERIFICATION
- STAFFING CHANGES - PLANT OPERATING STAFF AND CSRC CONSULTANTS

'Enclosure to MPB-82/0252

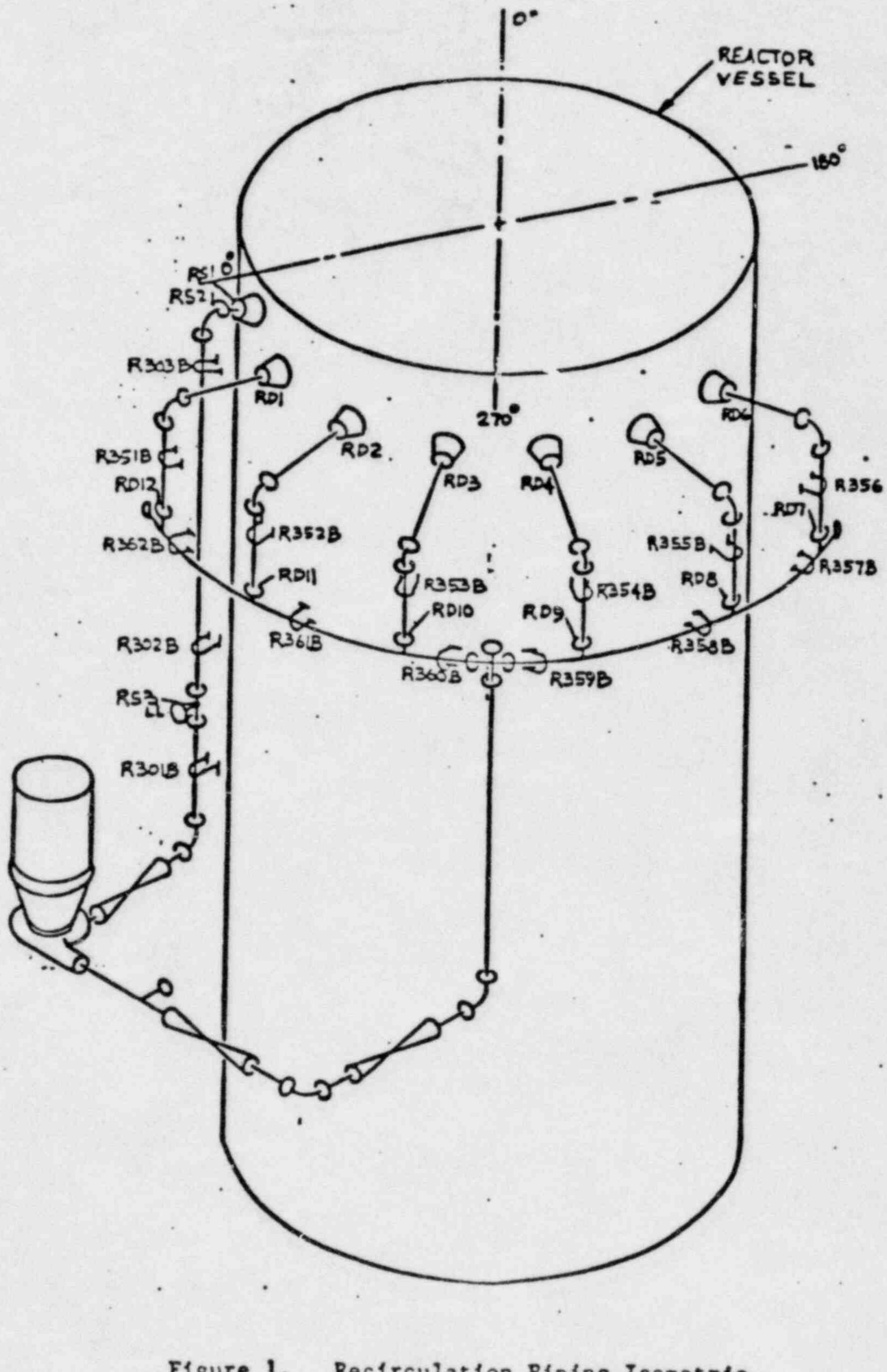


Figure 1. Recirculation Piping Isometric, (General location of whip restraints included.)

T11

HYDROGEN CONTROL

I. SYSTEM DESIGN/QUALIFICATION

II. BASE CASE SELECTION

III. EQUIPMENT SURVIVABILITY

IV. STRUCTURAL CAPABILITY

V. LOCAL DETONATIONS

VI. TESTING

Hobbs
T13

Hydrogen Ignitor System (HIS)

Description

- Ignitors Located in 90 Locations in the Drywell, Wetwell, Containment
  - 18 Ignitors Located in Drywell
  - 11 Ignitors Located in Wetwell
  - 61 Ignitors Located in Upper Containment
  - Distance for Adequate Separation/Coverage
    - One Train-Maximum Separation is 60 ft.
    - Two trains-Maximum Separation is 30 ft.

- Ignitor Assembly
  - GMAC Model 7G Ignitor
  - Welded Metallic Enclosure with a Spray Shield
  - Includes Access Provisions
  - Includes a Transformer for Voltage Stepdown

- Ignitor Power Supply
  - 120 Vac ± 10%, 60 Hz
  - Two ESF Divisions
  - Each Division is Separated into 2 Breakered Circuits
  - Remote Operation by Manual Switches in Control Room

- 1700°F Minimum Glow Plug Surface Temperature

Hydrogen Ignitor System (Cont'd)

Component Qualification

- All Assembly Components will be Qualified for:
  - Seismic and Hydrodynamic Events:
    - Absolute Sum of SSE + LOCA + SRVA
  - Environmental Conditions (IEEE 323-1974/NUREG-0588)
  - Environmental Conditions Resulting From Successive Hydrogen Burns
  - Seismic Qualification Per IEEE 344-1975
- Testing Underway - Expected Completion by End August

Operation

- For Events with Potential for Excessive Hydrogen Releases [That is, for core cooling without level restoration, when water level falls to or below top of active fuel (TAF)], Manual Initiation of:
  - HIS
  - CGCS (purge compressors, vacuum breakers)
  - Containment sprays (temperature mitigation)

BASE CASE SELECTION

- Realistic Initiating Event
- Realistic Scenario
- Basis for Sensitivity Studies
- Basis for Other Evaluations
  - Equipment Survivability
  - Systems Interaction
  - Procedure Application

BASE CASE SELECTION (CONT'D)

- INITIATING EVENTS EVALUATED
- RECOVERY EVENTS EVALUATED
- TWO BASE CASES RESULT:
  - STUCK OPEN RELIEF VALVE (SORV) - SUPPRESSION POOL RELEASE
  - SMALL BREAK LOCA - DRYWELL RELEASE

STUCK OPEN RELIEF VALVE

INITIATING EVENTS

- SYSTEM TRANSIENT
  - LOSS OF FEEDWATER
  - MSIV CLOSURE
- INADVERTENT VALVE OPENING

MITIGATING EVENTS*

- OPEN ADDITIONAL SRVs
- INITIATE CONTAINMENT SPRAY
- ENERGIZE THE HIS
- INITIATE CGCS

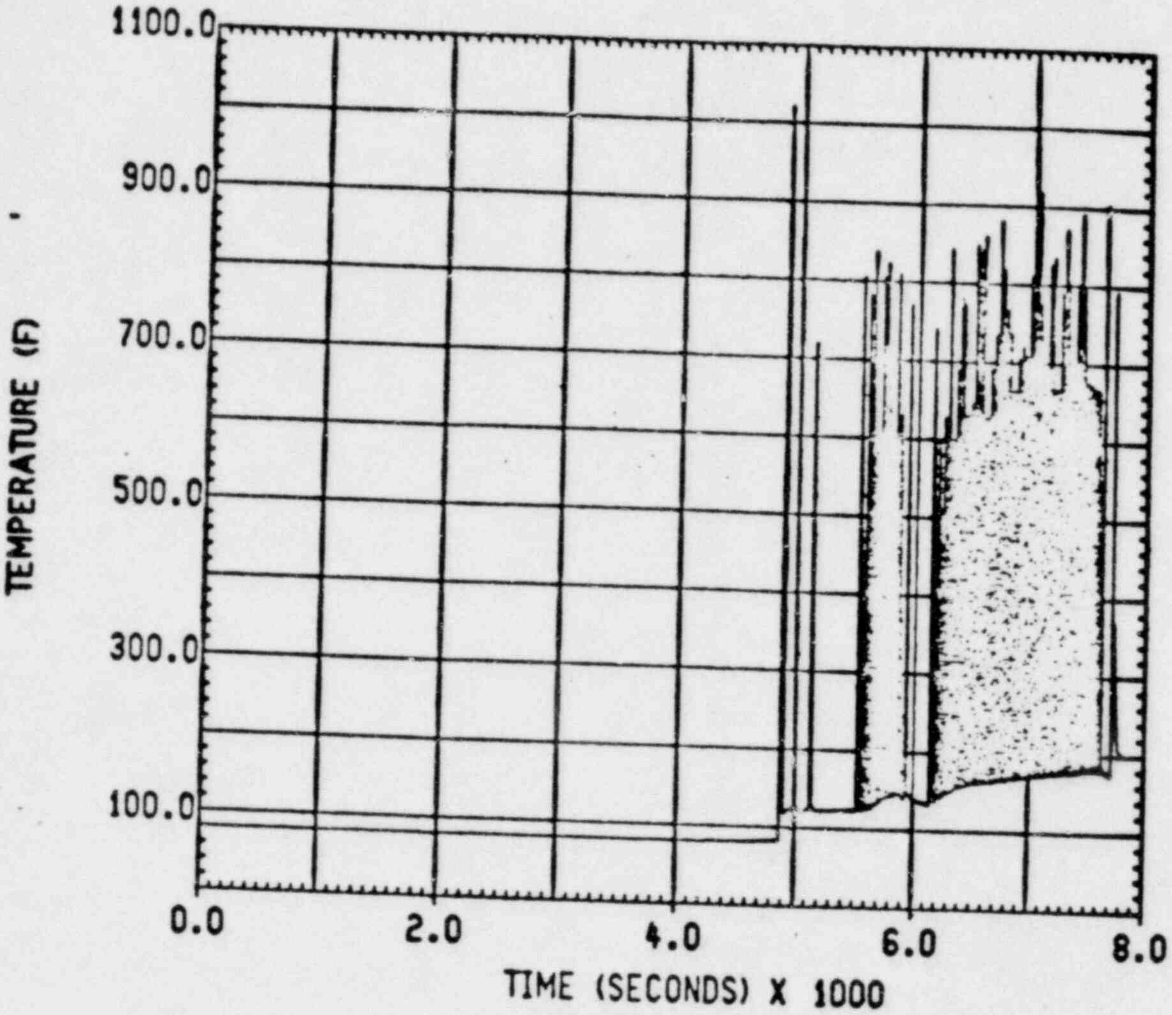
* ASSUMES NO WATER AVAILABLE TO THE CORE

SORV BASE CASE DESCRIPTION

- MARCH Release Rates
- CGCS and Ignitors - Initiated at 20 Minutes
- Upper Pool Dump - Initiated at 30 Minutes
- 8 v/o Ignition and 85% Completion
- 6 ft/sec Flame Speed
- 1 Spray Train - Initiated After First Burn
- Wetwell Spray Carryover
- Forced Containment Burn

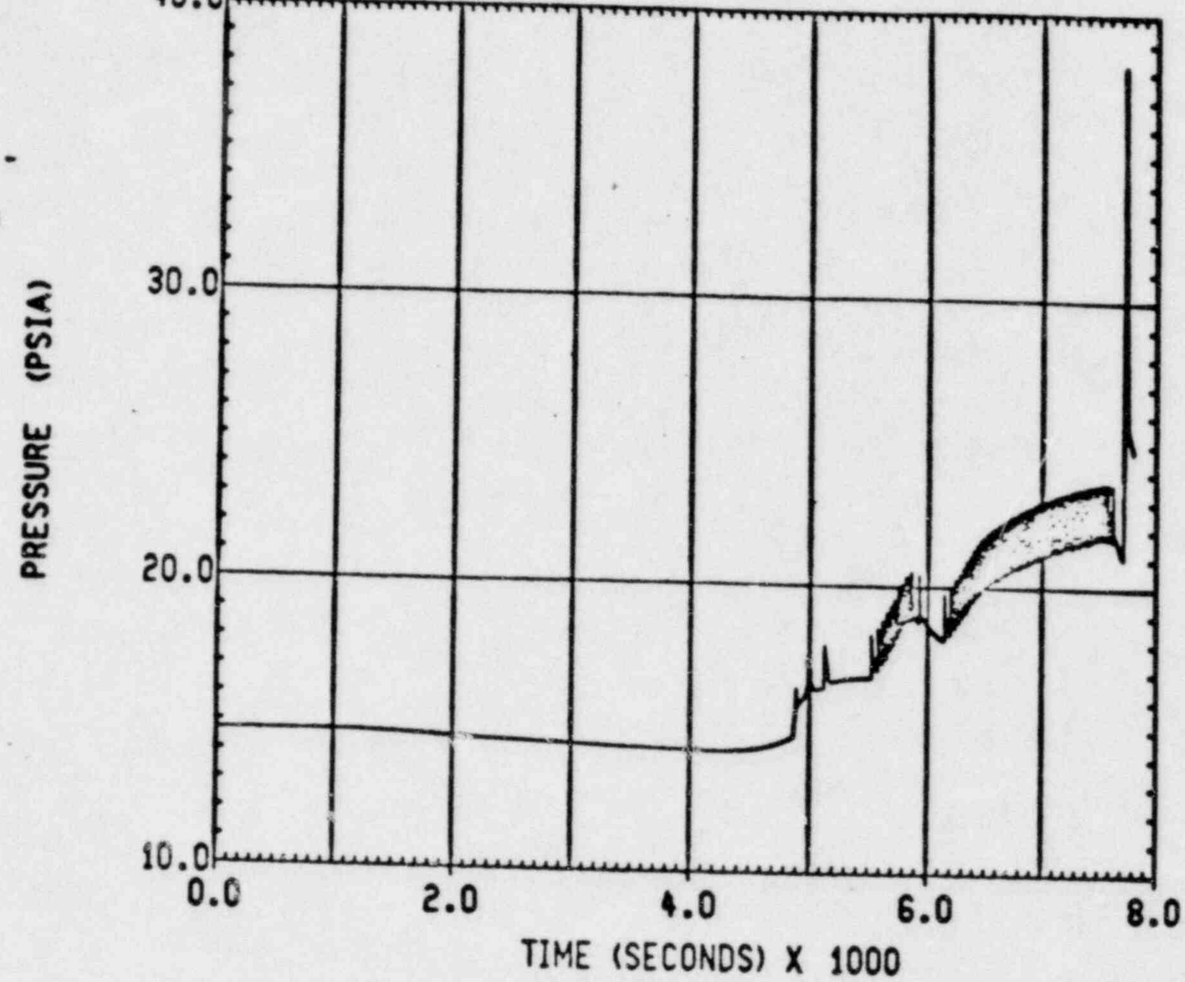
SUMMARY TABLE
SORV BASE CASE

	W/O FORCED BURN	W/FORCED BURN
NUMBER OF BURNS		
DRYWELL	0	
WETWELL	59	
CONTAINMENT	0	(1-FORCED)
PEAK TEMPERATURE (°F)		
DRYWELL	137	(193)
WETWELL	1020	(1020)
CONTAINMENT	197	(681)
PEAK PRESSURE (PSIG)		
DRYWELL	9.6	(18.6)
WETWELL	9.0	(23.5)
CONTAINMENT	8.8	(23.9)
PEAK PRESSURE DIFFERENTIAL (PSI)		
DRYWELL/CONTAINMENT		
FORWARD	4.2	(4.2)
REVERSE	0	(4.8)



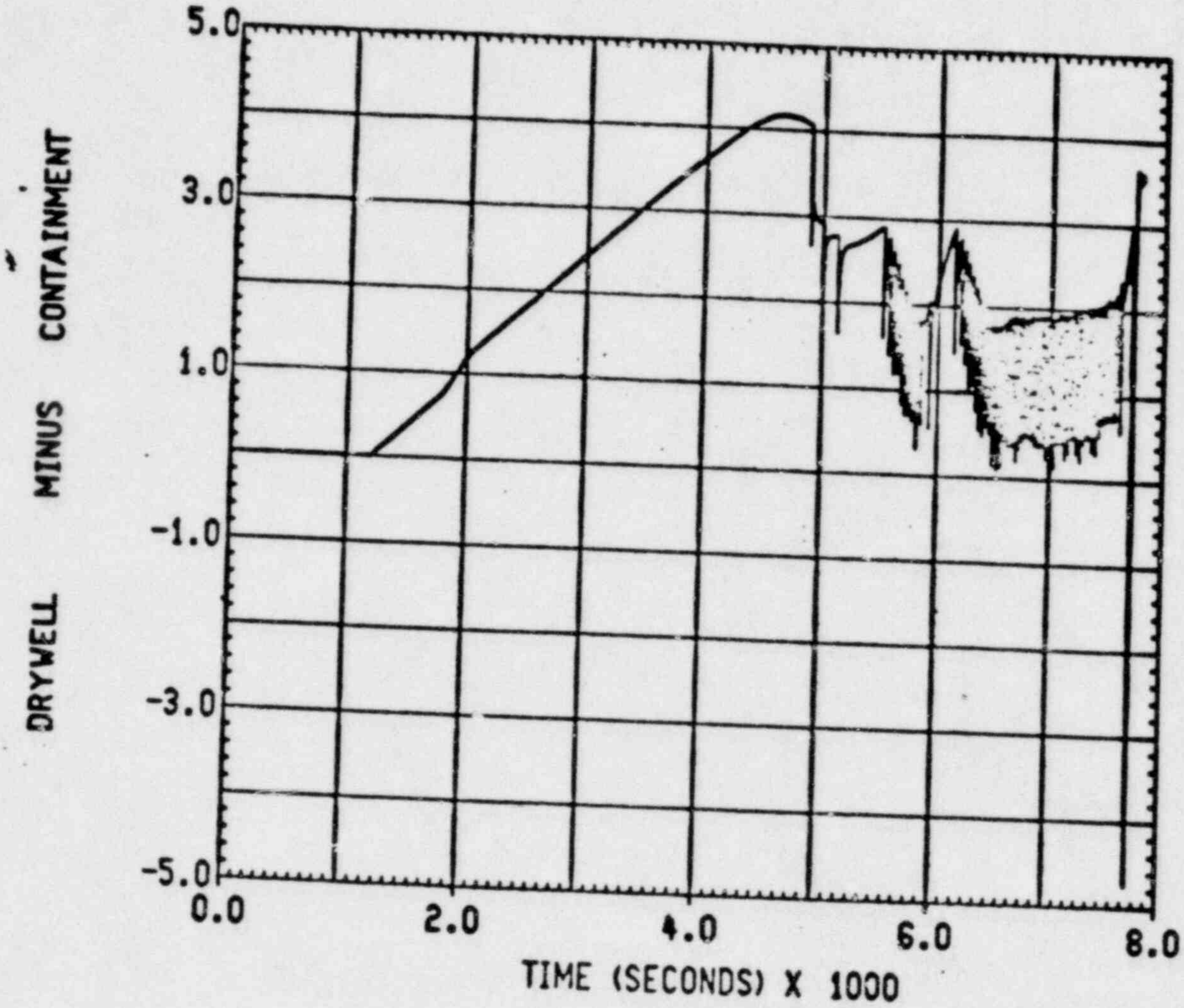
GGNS BASE CASE SORV

WETWELL TEMPERATURE



GGNS BASE CASE SORV

WETWELL PRESSURE



GGNS BASE CASE SORV

DIFFERENTIAL PRESSURE

SMALL BREAK LOCA

INITIATING EVENT

- RUPTURE OF SMALL/INTERMEDIATE SIZE PIPING

MITIGATING EVENTS

- OPEN SRVs
- INITIATE CONTAINMENT SPRAY
- ENERGIZE THE HIS
- INITIATE CGCS

DRYWELL BREAK BASE CASE DESCRIPTION

MARCH RELEASE RATES

50/50 RELEASE RATE SPLIT AT 20 MINUTES

CGCS AND IGNITORS - INITIATED AT 20 MINUTES

UPPER POOL DUMP - INITIATED AT 30 MINUTES

SUPPRESSION POOL DRAWDOWN - INITIATED AT 30 MINUTES

8 v/o IGNITION AND 85% COMPLETION

6 FT/SEC FLAME SPEED

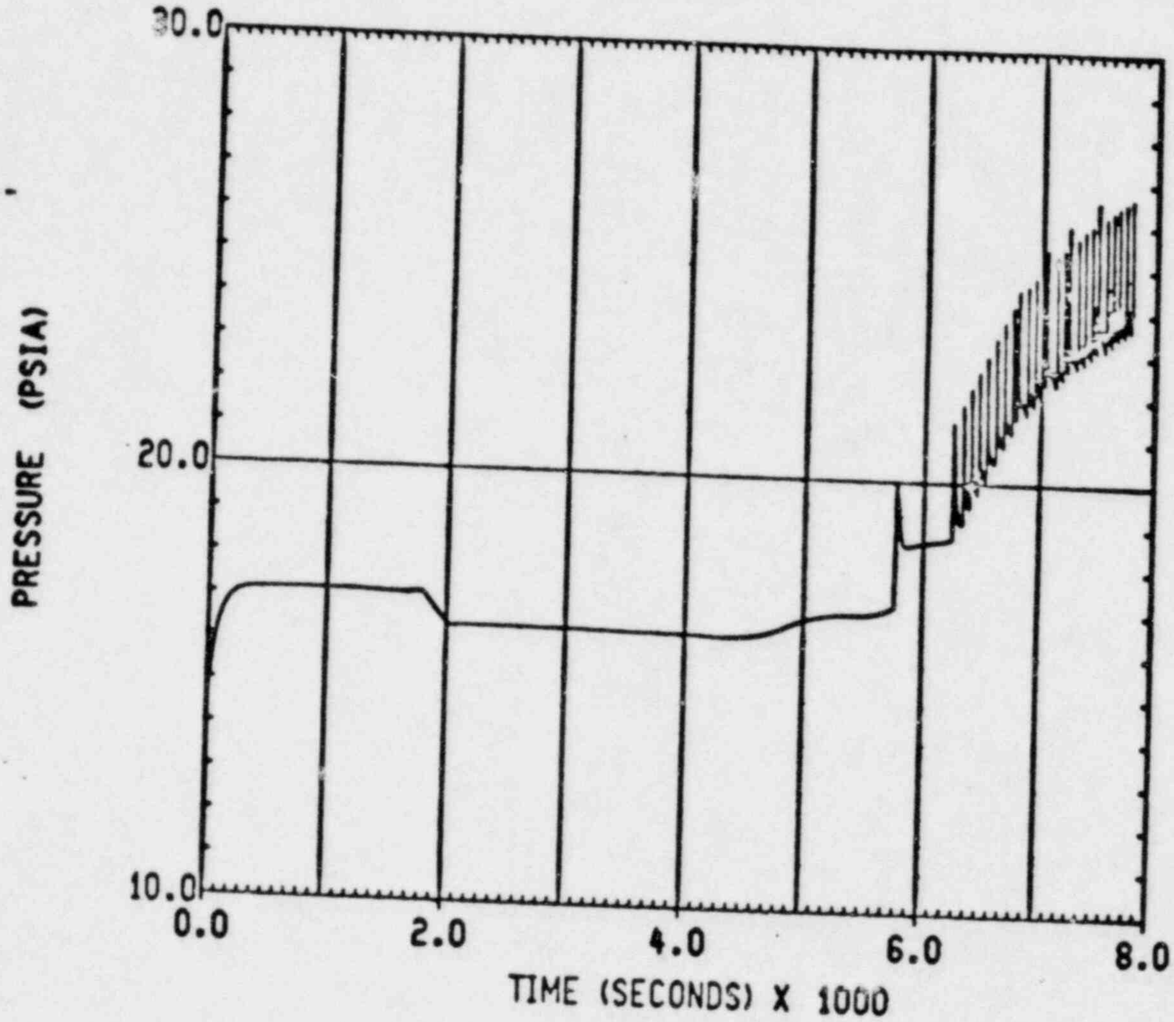
1 SPRAY TRAIN - INITIATED AFTER FIRST BURN

WETWELL SPRAY CARRYOVER

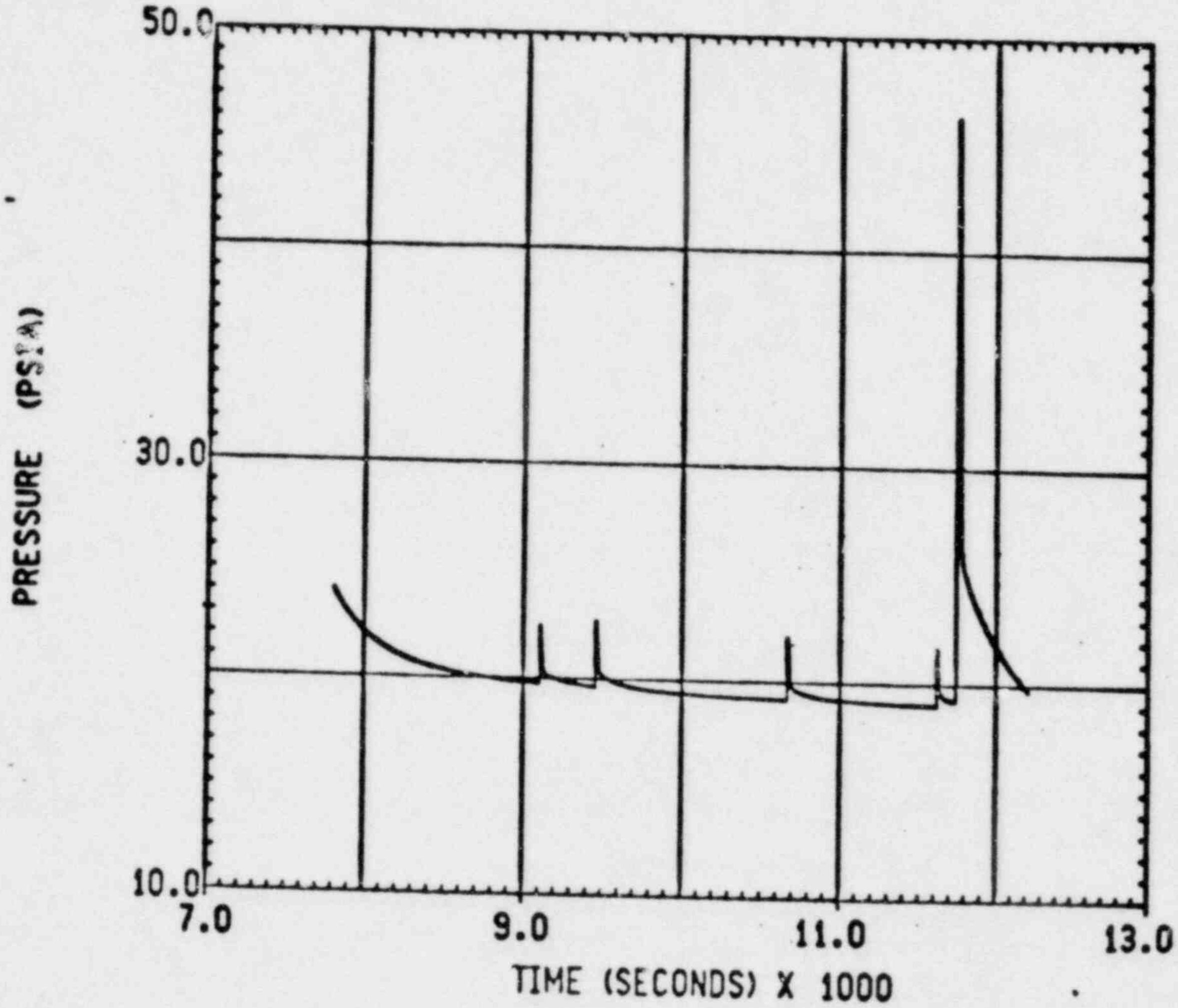
SUMMARY TABLE

Drywell Break Base Case

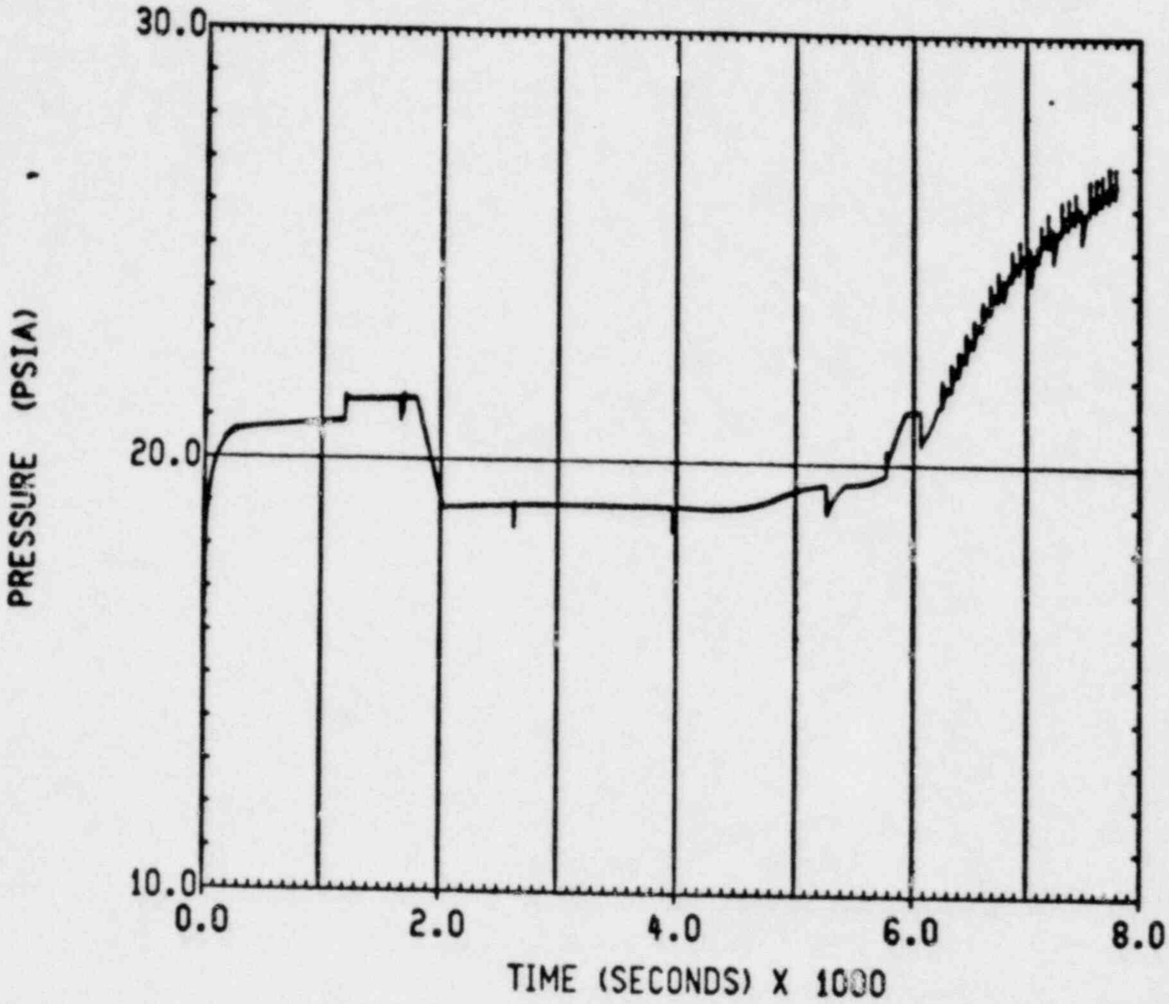
Number of Burns	
Drywell	1
Wetwell	32
Containment	1
Peak Temperature (°F)	
Drywell	707
Wetwell	2295
Containment	860
Peak Pressure (psig)	
Drywell	16.3
Wetwell	31.6
Containment	32.1
Peak Pressure Differential (psi)	
Drywell/Containment	
Forward	8.8
Reverse	17.6



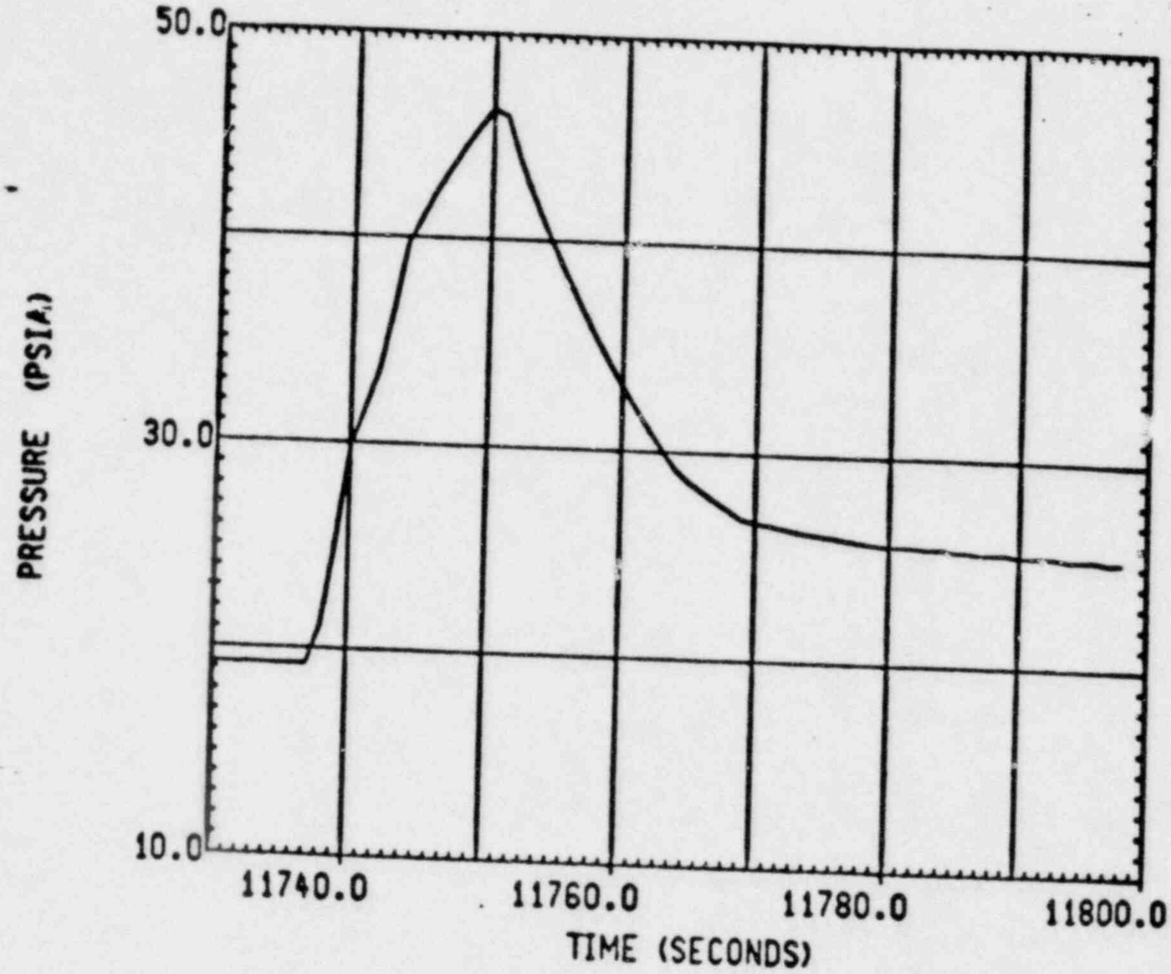
GGNS BASE CASE DRYWELL BREAK
SUPPRESSION POOL DRAW DOWN
WETWELL PRESSURE



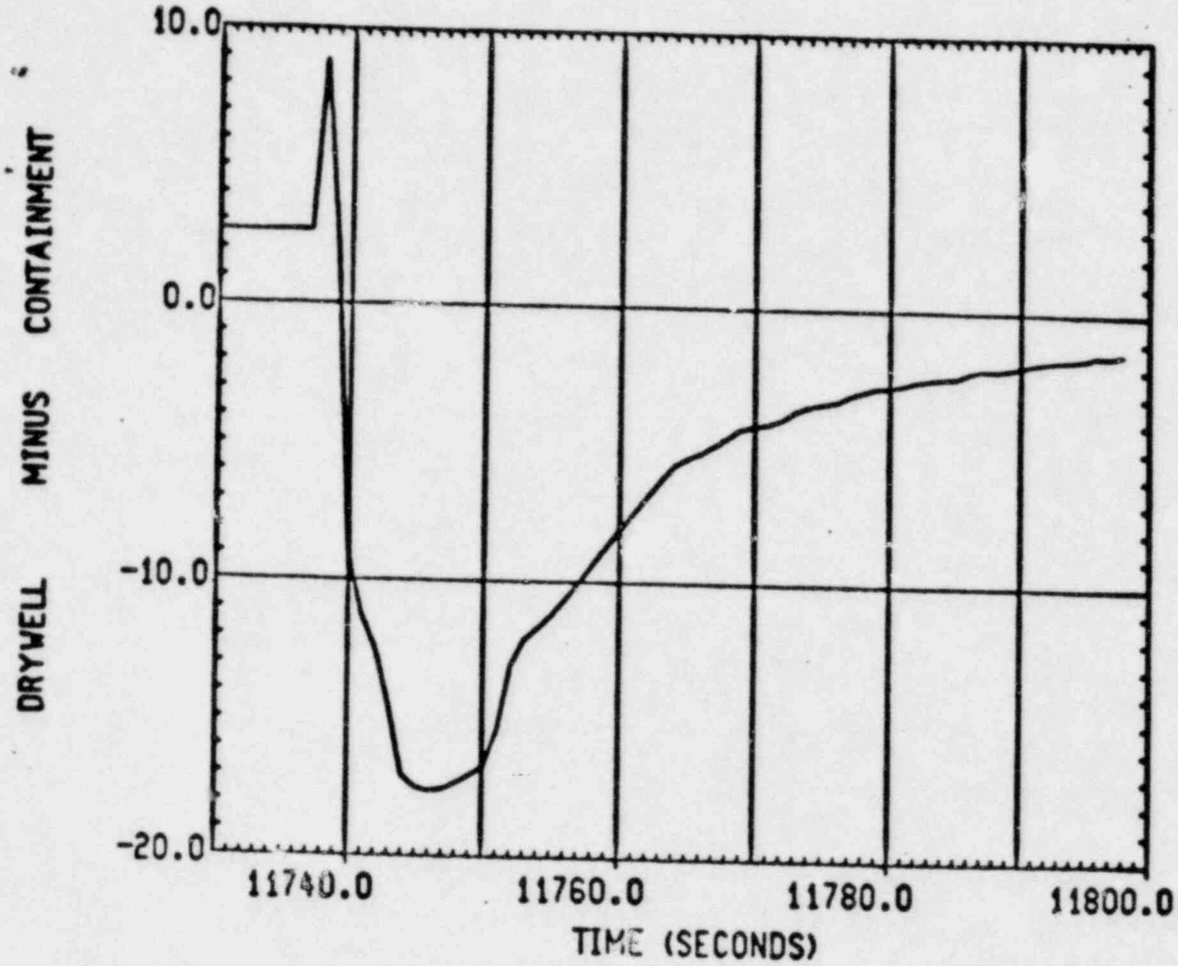
GGNS BASE CASE DRYWELL BREAK
SUPPRESSION POOL DRAW DOWN
WETWELL PRESSURE



GGNS BASE CASE DRYWELL BREAK
SUPPRESSION POOL DRAW DOWN
DRYWELL PRESSURE



GGNS BASE CASE DRYWELL BREAK
CASE DA4 - DRAWDOWN
WETWELL PRESSURE



GGNS BASE CASE DRYWELL BREAK
CASE DA4 - DRAWDOWN
DIFFERENTIAL PRESSURE

GRAND GULF SQRT PROGRAM

- SQRT AUDIT ON JULY 28-30, 1981 AND TRIP REPORT ISSUED OCTOBER 22, 1981

- APRIL 5, 1982, MP&L NOTIFIED EQB THAT 62 PIECES OF NSSS AND 14 PIECES OF BOP EQUIPMENT NOT QUALIFIED TO THE SQRT CRITERIA
  - TOTAL EQUIPMENT QUALIFIED TO SQRT - 98.3%

- SINCE APRIL 5, 1982, MP&L HAS PROVIDED EQB WITH 6 SUBMITTALS JUSTIFYING INTERIM OPERATION OR DOCUMENTATION SHOWING QUALIFICATION

- SINCE APRIL 5, 1982, MP&L HAS MET WITH EQB TWICE

- AS OF AUGUST 1, 1982, 22 PIECES OF NSSS AND 4 PIECES OF BOP EQUIPMENT ARE NOT QUALIFIED TO THE SQRT CRITERIA

- NSSS EQUIPMENT NOT QUALIFIED TO SQRT CRITERIA AS OF AUGUST 1, 1982

  - FUEL HANDING AND AUXILIARY PLATFORMS
  - IN VESSEL RACK
  - DEFECTIVE FUEL STORAGE CONTAINER
  - BOP/PGCC PANELS (40 YEAR AGING)

- BOP EQUIPMENT NOT QUALIFIED TO SQRT CRITERIA AS OF AUGUST 1, 1982

  - SAFETY RELIEF VALVES (OPERABILITY)

OTHER OUTSTANDING ISSUES

- NRC CONTRACTOR PERFORMED AN INDEPENDENT ANALYSIS ON THE HPCS SERVICE WATER PUMP WHICH SHOWED IT TO BE OVERSTRESSED

  - MP&L MAINTAINED IT WAS QUALIFIED AND MET SQRT CRITERIA
  - EVALUATION OF EG&G ANALYSIS INDICATED ERRORS WHICH WHEN CORRECTED SHOWED STRESSES WITHIN ALLOWABLES

- VARIABLE FROTH IMPACT LOAD REQUIRED REVISED RESPONSE SPECTRA AND RE-EVALUATION OF EQUIPMENT QUALIFICATION

  - BOP EVALUATION SHOWED NEED FOR REQUALIFICATION OF PAM THERMOCOUPLES; REQUALIFICATION IS COMPLETE
  - HCU EVALUATION SHOWED QUALIFIED TO REVISED RRS WITH 25% ADDED FOR CONSERVATISM

ORIGINAL DESIGN

- GRAND GULF DESIGNED TO GESSAR II, APPENDIX 3B LOAD DEFINITIONS
  - FROTH IMPACT LOAD OF 15 PSI
  - FROTH IMPACT DURATION OF 100 MSEC
  - FROTH DRAG LOAD OF 11 PSI
- RESPONSE SPECTRA FOR EQUIPMENT QUALIFICATION WAS BASED ON THE GESSAR LOAD DEFINITION

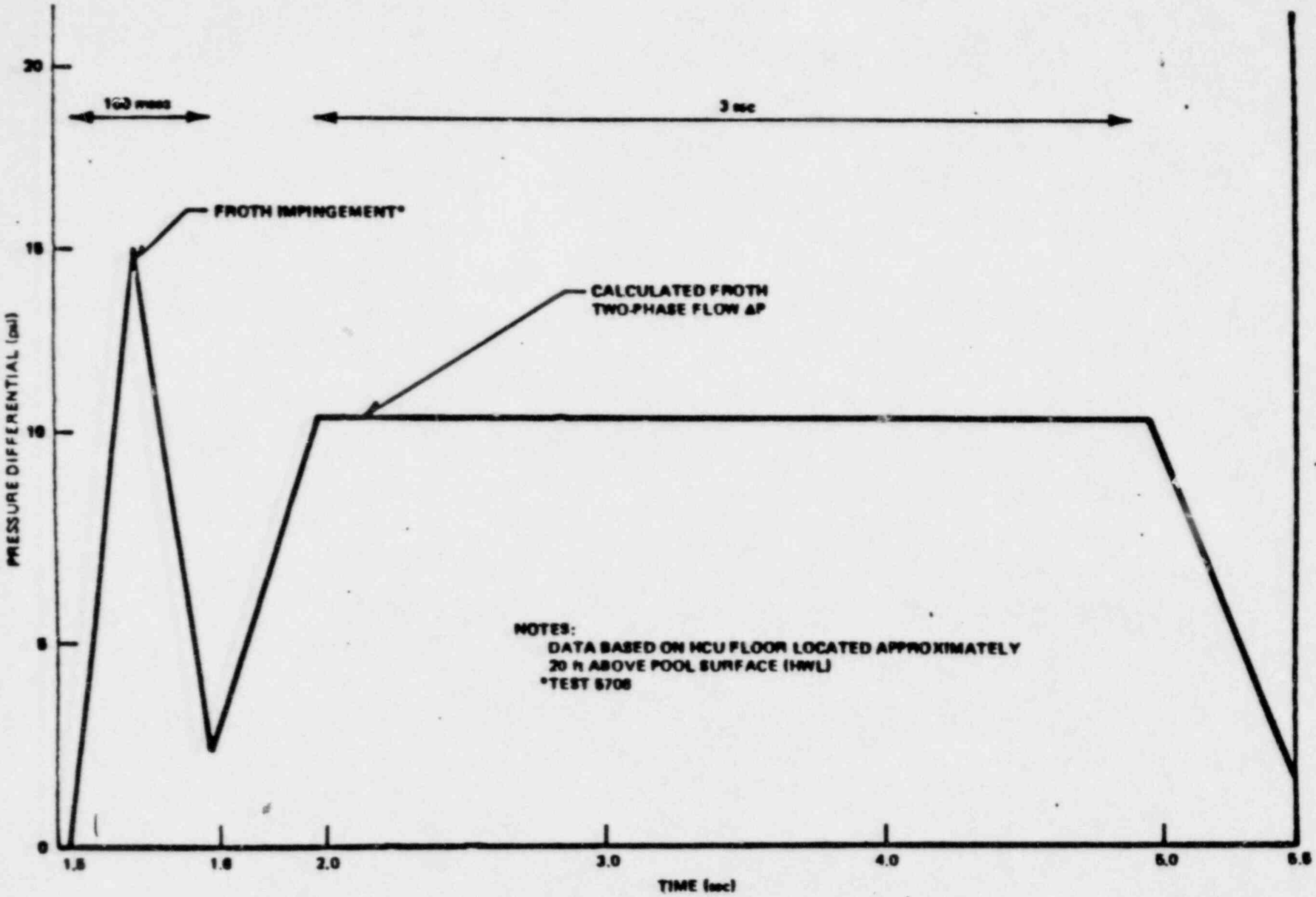


Figure 3B-73. Loads at HCU Floor Elevation Due to Pool-Swell Froth Impact and Two-Phase Flow

VARIABLE POOL SWELL - STRUCTURAL

IN A MEETING ON DECEMBER 16, 1982, MP&L WAS REQUESTED TO EVALUATE THE EFFECT ON THE HCU FLOOR'S STRUCTURAL CAPABILITY OF THE NRC BEST-ESTIMATE METHODOLOGY FOR FROTH IMPACT LOADS.

- FROTH IMPACT LOADS ARE VARIABLE.
  - DECREASE LINEARLY WITH INCREASING HEIGHT OF THE IMPACTED SURFACE ABOVE THE SUPPRESSION POOL.
  - DEVELOPED BY NRC CONSULTANT G. MAISE.
  - 3 PSI CONSERVATISM ADDED TO NRC REQUEST.
- FROTH IMPACT DURATION VARIES BETWEEN 20 AND 220 MSEC.
- FROTH IMPACT PRESSURE VARIES FROM 14.5 PSI TO 19 PSI.
- FROTH DRAG LOAD IS 11 PSI FOR SOLID FLOOR AREAS (CONCRETE) AND 5.5 PSI FOR GRATING.
- EVALUATION INDICATES THAT THE GRAND GULF HCU FLOOR IS CAPABLE OF WITHSTANDING THE REVISED FROTH IMPACT LOADS.

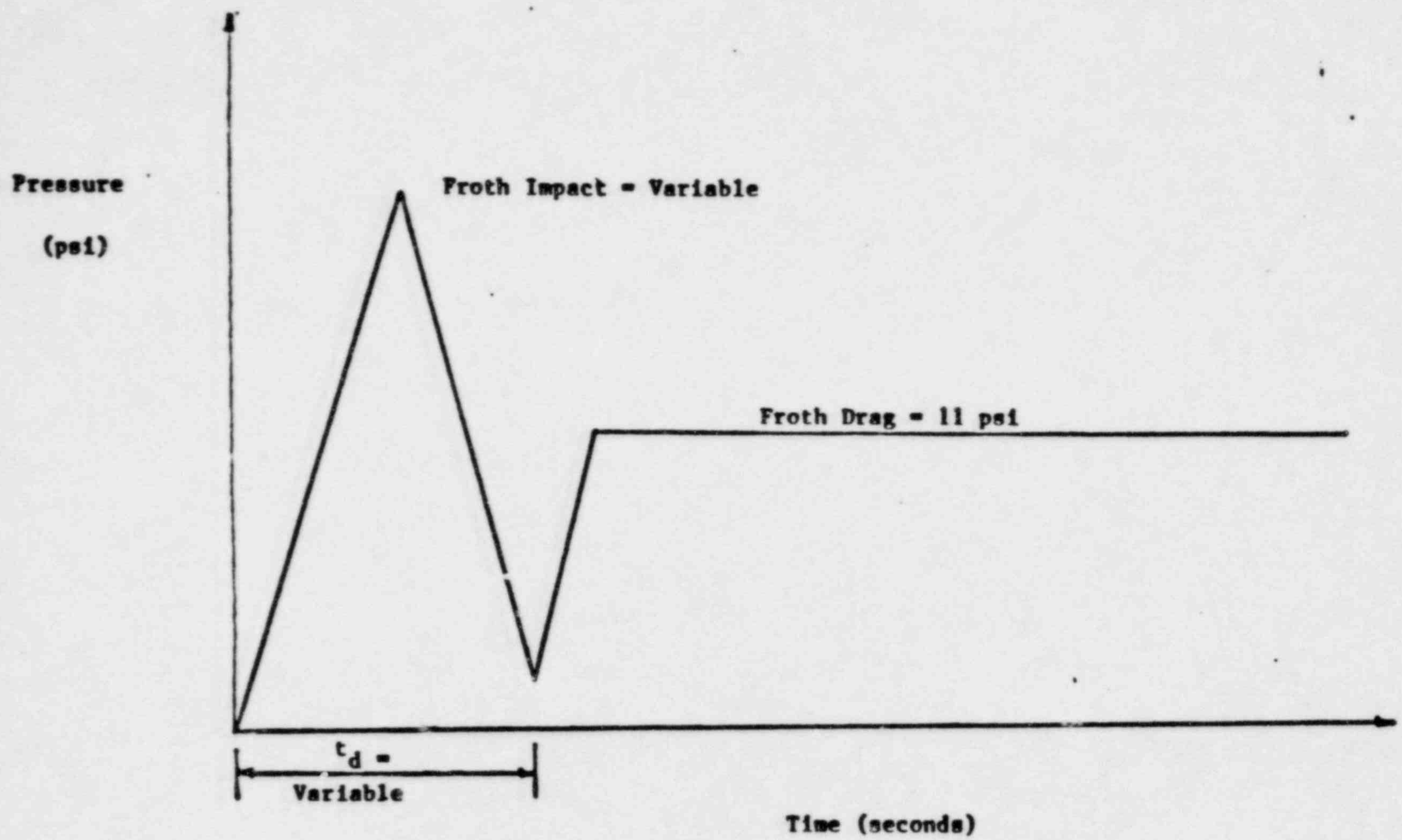

Pressure
(psi)
Froth Impact = Variable
Froth Drag = 11 psi
t_d =
Variable
Time (seconds)

Figure 1

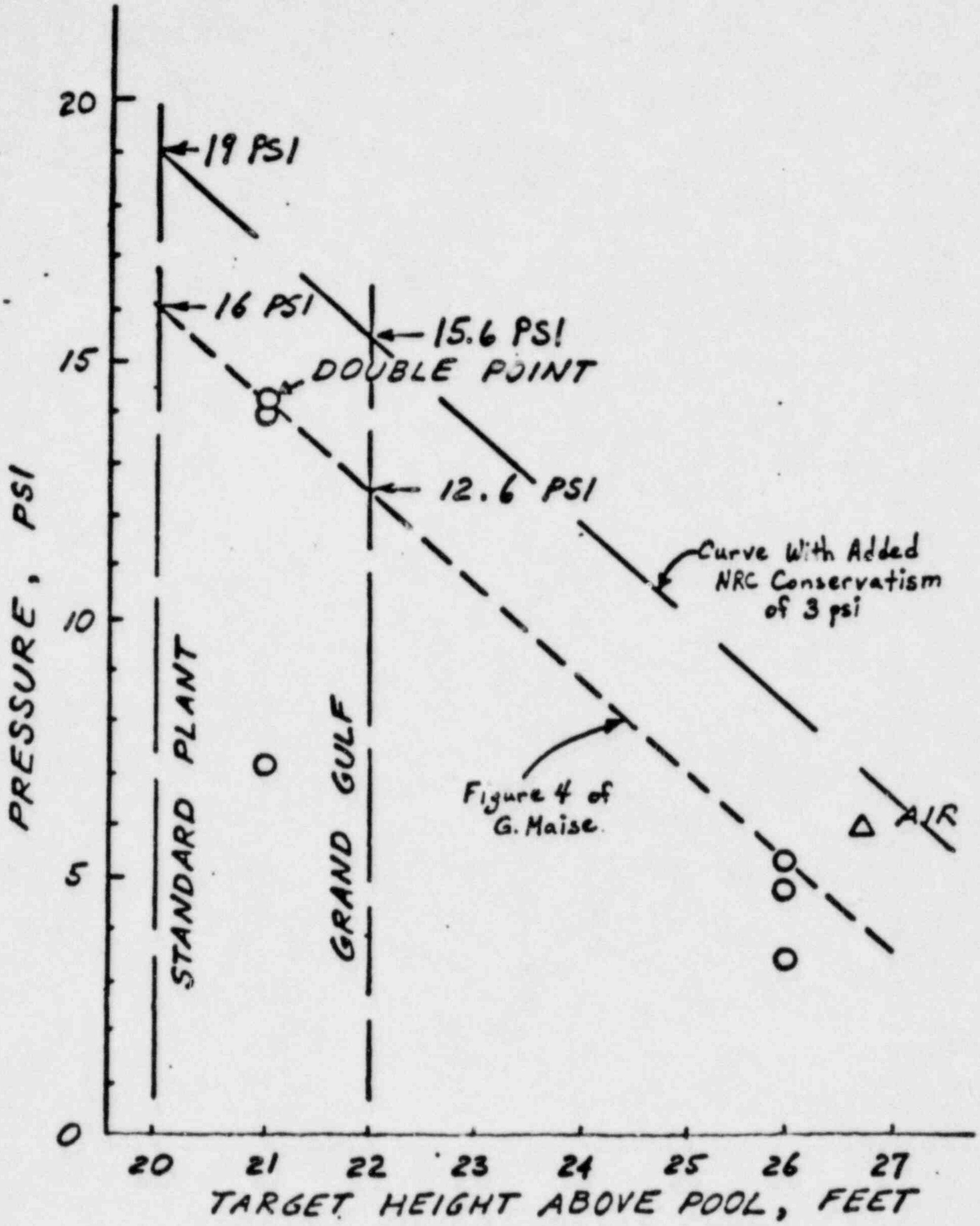


Figure 2. Froth Impact Data From Figure 3 Scaled Up to Full Size Using "Modified Froude Scaling"

<u>VARIABLE POOL SWELL - EQUIPMENT</u>

- FOLLOWING NRC FORMAL ACCEPTANCE OF THE GGNS LOAD DEFINITION, CURVES COMPARING THE NEW VARIABLE POOL SWELL RESPONSE SPECTRA WITH THE ORIGINAL DBA ENVELOPE RESPONSE SPECTRA WERE DEVELOPED.

  - POOL SWELL RESPONSE SPECTRA ENVELOPED WITH PREVIOUS DBA ENVELOPE RESPONSE SPECTRA TO PROVIDE REVISED DBA ENVELOPE RESPONSE SPECTRA FOR EQUIPMENT QUALIFICATION.

  - VARIABLE POOL SWELL RESPONSE SPECTRA DEVELOPED USING GLOBAL AVERAGE OF FROTH IMPACT AND DRAG LOADS.

  - DURING MEETING ON JUNE 7, 1982, NRC REQUESTED ENHANCEMENT BY 25% OF MID-SPAN RESPONSE SPECTRA FOR HCU QUALIFICATION.

- EVALUATION OF SQRT QUALIFICATION OF EQUIPMENT INSIDE CONTAINMENT INDICATED THAT:

  - POST ACCIDENT MONITORING THERMOCOUPLES MUST BE RE-QUALIFIED (COMPLETE).
  - MID-SPAN RESPONSE SPECTRA MUST BE DEVELOPED TO VERIFY HCU QUALIFICATION (COMPLETE).

PERSPECTIVE

ON

HUMPHREY ISSUES

SUMMARY 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.

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.

12. ACRS FLUID DYNAMICS SUBCOMMITTEE MEETING JULY 29 & 30.

MP&L APPROACH TO RESOLUTION OF THESE CONCERNS

1. INITIAL EVALUATION DETERMINED THAT THE CONCERNS DO NOT IMPACT PLANT SAFETY AND ARE DETAILED DESIGN ISSUES

   - 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

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

CONTAINMENT ISSUES OWNERS GROUP

1. OWNERS GROUP INCLUDES:

   - 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 ANALYSIS

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

ACTION PLAN OUTLINE

1. LOCAL ENCROACHMENTS
2. PERTURBATIONS IN LOAD DEFINITION CAUSED BY ANNULAR VENTS
3. UNACCOUNTED FOR RELIEF VALVE EFFECTS
4. SUPPRESSION POOL TEMPERATURE STRATIFICATION
5. DRYWELL TO CONTAINMENT BYPASS LEAKAGE EFFECTS
6. RHR PERMISSIVE ON CONTAINMENT SPRAY
7. CONTAINMENT PRESSURE RESPONSE
8. CONTAINMENT AIRMASS EFFECTS
9. DRYWELL AIRMASS EFFECTS
10. WEIR WALL OVERFLOW
11. OPERATIONAL CONTROL OF DRYWELL TO CONTAINMENT DIFFERENTIAL PRESSURE
12. CONTAINMENT SPRAY BACKFLOW
13. EFFECT OF SUPPRESSION POOL LEVEL ON TEMPERATURE MEASUREMENT
14. EFFECTS OF CHUGGING FROM LOCAL ENCROACHMENTS AND ADDITIONAL SUBMERGENCE
15. LATERAL LOADS DURING D/W NEGATIVE PRESSURE TRANSIENT

SUMMARY

- CONTAINMENT CONCERNS ARE DESIGN REFINEMENTS

- ACTION PLAN HAS BEEN DEVELOPED

- SUPPORTING ANALYSES BEING DEVELOPED

- SUBMITTALS TO NRC

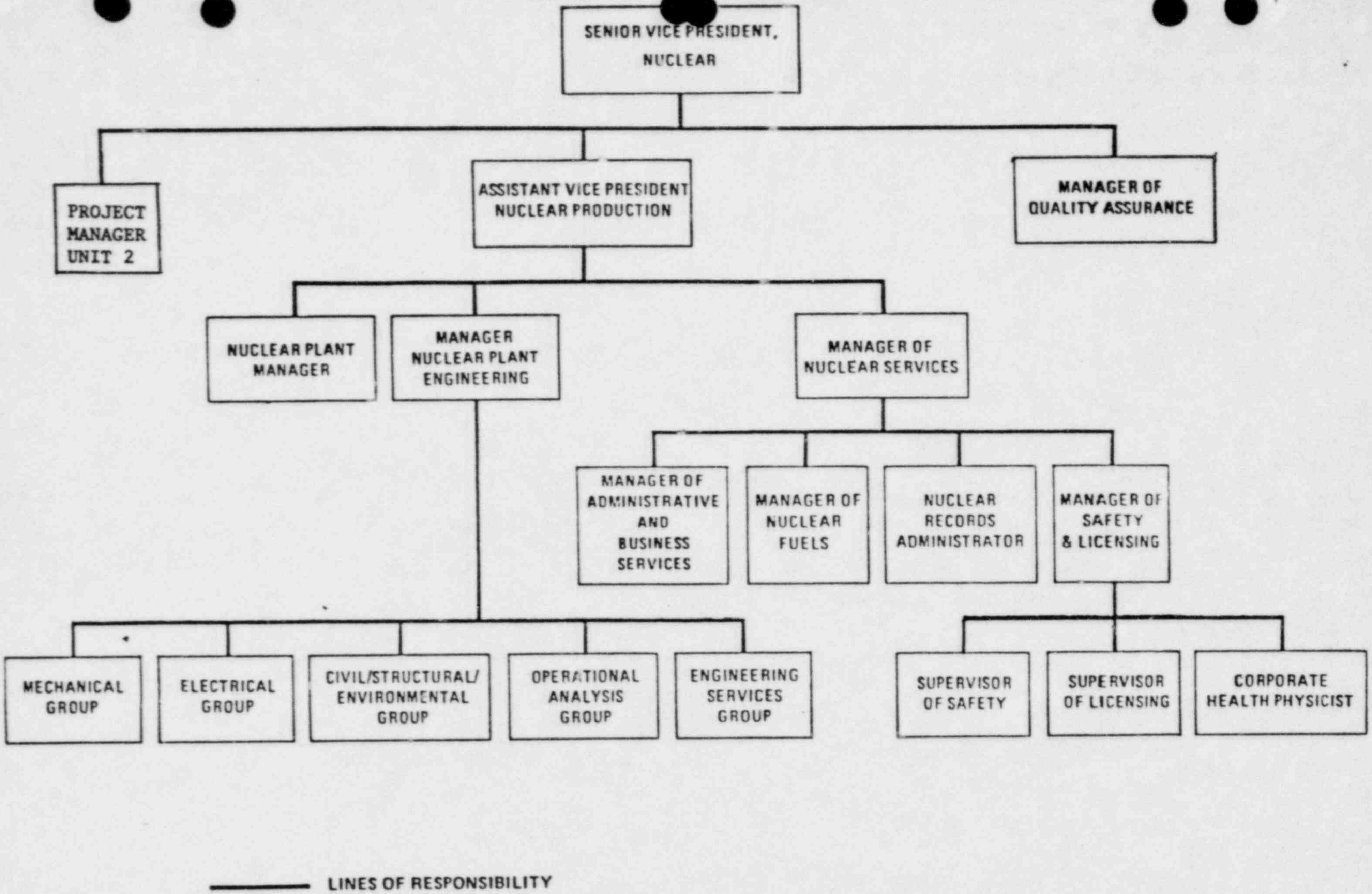
  - AUGUST 19 - INFORMATION TO JUSTIFY FULL POWER LICENSE

  - OCTOBER 1 - ANALYSES

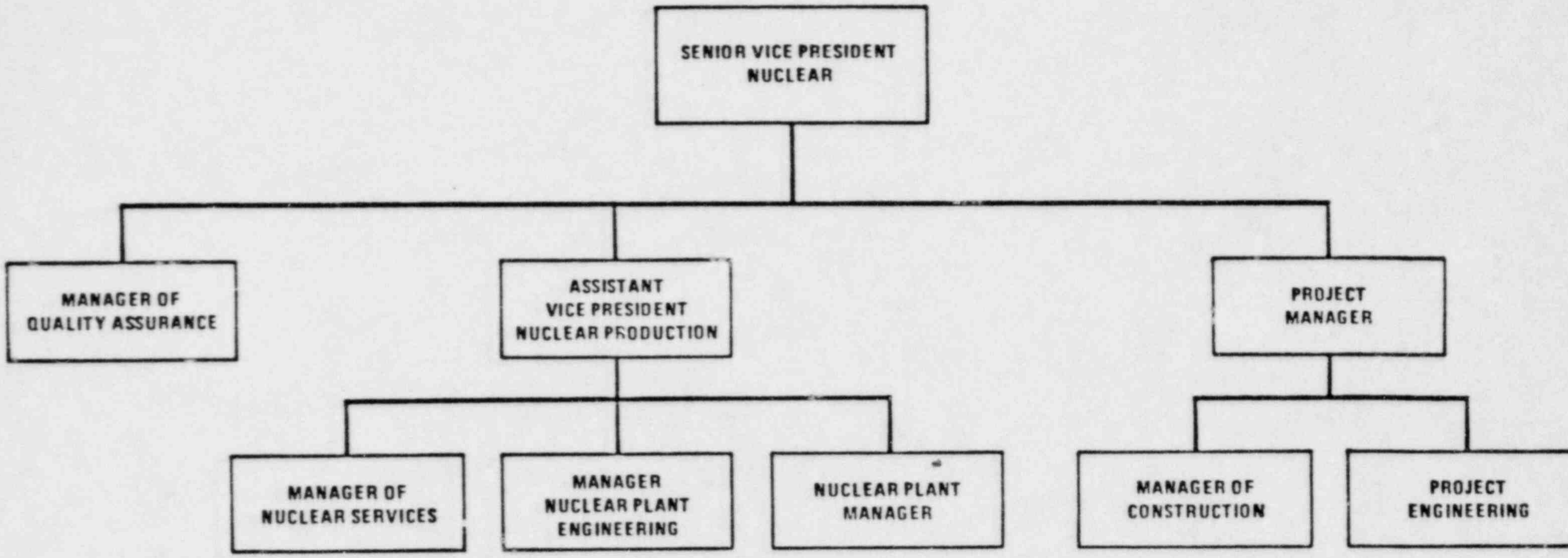
  - NOVEMBER 1 - FINAL DETAILS

- OWNERS GROUP ISSUE RESOLUTION BY EARLY 1983

TECHNICAL SUPPORT ORGANIZATION



TECHNICAL SUPPORT ORGANIZATION
(UNIT TWO OPERATION)



EXPERIENCE OF
MP&L TECHNICAL SUPPORT PERSONNEL
FOR GRAND GULF

Organization	Engr. Degree	Related Science Degree	Other Degrees	Total Profs.	Professional Experience Total	Professional Experience Avg.	Nuclear Experience Total	Nuclear Experience Avg.
Construction	3	3	1	7	127	18	61	8.7
Startup	8	1	-	9	77.8	8.6	58.8	6.5
Project Engineering	2	-	-	2	12	6	9	4.5
NPE	38	4	3	47	354	7.5	225.5	4.8
Nuclear Support	21	9	4	32	284	8.9	162	5.1
Nuclear Services	17	13	7	21	228	10.9	145.5	7
QA	15	7	4	30	362	12	165	6
Subtotal	105	41	25	170	1778	10.5	1052	6.2
MSS	39	11	4	48	580	12	397	8.3
TOTAL	144	52	29	218	2358	11	1449	6.6

STATUS OF REVIEW

AUGUST 11, 1982

ITEMS REQUIRING RESOLUTION PRIOR TO FULL POWER LICENSING

PMP DRAINAGE	UNDER REVIEW
CONTAINMENT ULTIMATE CAPACITY	RESOLVED
SQRT	OUTSTANDING
ENVIRONMENT QUALIFICATION	UNDER REVIEW
CONTAINMENT/DRYWELL PURGE	UNDER REVIEW
CONTAINMENT CONCERNS	OUTSTANDING
IEB 79/27	UNDER REVIEW
IBN 79/22	UNDER REVIEW
CONTROL SYSTEMS FAILURE	UNDER REVIEW
FAILURE RPV LEVEL SENSING	RESOLVED
INTERPLANT COMMUNICATIONS	UNDER REVIEW
DIESEL GENERATOR RELIABILITY	UNDER REVIEW
CONTROL ROOM REVIEW	UNDER REVIEW
POST ACCIDENT SAMPLING	UNDER REVIEW

SINGLE FAILURE DESIGN BASIS

- A DESIGN BASIS EVENT (ACCIDENT)

  PLUS

  - RESULTING FAILURES (CONSEQUENTIAL DAMAGES)

    PLUS

  - A SINGLE FAILURE
    - ACTIVE MECHANICAL FAILURE, OR
    - ACTIVE OR PASSIVE ELECTRICAL FAILURE (IEEE-379)

- SHALL NOT PREVENT REQUIRED SAFETY FUNCTIONS

CONFORMANCE TO GDC-24 AND IEEE-279

FAILURE OF A CONTROL GRADE SYSTEM CAUSING NEED FOR PROTECTIVE ACTION AND ALSO DISABLING A PROTECTION INSTRUMENT CHANNEL REQUIRES THAT AN ADDITIONAL FAILURE WILL NOT DISABLE ANY REQUIRED PROTECTIVE FUNCTIONS.

PROTECTION SYSTEMS ARE DESIGNED TO BE SEPARATE FROM CONTROL SYSTEM TO THE EXTENT THAT:

FAILURE OF ANY COMMON ELEMENT WILL LEAVE A PROTECTION SYSTEM SATISFYING:

- RELIABILITY
- REDUNDANCY OR DIVERSITY
- INDEPENDENCE

FOR PURPOSES OF ASSURING:

- INTEGRITY OF RCPB
- CAPABILITY TO ACHIEVE & MAINTAIN SHUTDOWN
- CAPABILITY TO PREVENT OR MITIGATE CONSEQUENCES OF ACCIDENTS WHICH COULD RESULT IN POTENTIAL OFFSITE EXPOSURES COMPARABLE TO THOSE REFERENCED IN 10 CFR 100.11

DESIGN IMPLEMENTATION

- INSTRUMENT SYSTEMS AND PIPING SYSTEMS ARE ARRANGED SO THAT CONSEQUENTIAL FAILURES IN REDUNDANT OR OTHER INSTRUMENT SYSTEMS AS A RESULT OF ACCIDENTS ARE MINIMIZED

- INSTRUMENT SYSTEMS ARE DESIGNED TO MEET THE SINGLE FAILURE CRITERION, ASSUMING THE FAILURE OF THE SENSING LINE IS INDEPENDENT OF THE EVENT REQUIRING PROTECTIVE ACTION, UNLESS FOUND TO BE OTHERWISE DURING EVALUATIONS.

- EVALUATIONS ARE PERFORMED WHICH REVEAL THOSE PROTECTION SYSTEM SENSING LINES WHICH ARE AFFECTED BY EVENTS THEY MUST MITIGATE (I.E., JET IMPINGEMENT STUDY, ERT, ETC.)

  - EACH CASE IN WHICH A SENSING LINE IS AFFECTED BY THE EVENT IS EVALUATED AND IS ACCEPTABLE IF:

    - THE SENSING LINE CAN SURVIVE THE EVENT, OR
    - DIVERSE BACKUP PROTECTION IS PROVIDED, OR
    - ALL POSSIBLE FAILURE MODES DO NOT PREVENT THE REQUIRED SAFETY ACTION

  - UNACCEPTABLE CASES ARE CORRECTED BY INSTALLATION OF BARRIERS OR OTHER CHANGES TO MEET ACCEPTANCE CRITERIA

CASES OF SHARING OF COMMON INSTRUMENT TAPS

A REVIEW OF THE RPS AND ECCS WAS CONDUCTED TO EVALUATE CASES OF SHARING OF COMMON INSTRUMENT TAPS.

THE CASES FOUND AND EVALUATED WERE:

- SDV LEVEL
- RPV LEVEL
- TURBINE FIRST STAGE PRESSURE
- ADS PERMISSIVE
- CST AND SUPPRESSION POOL LEVEL

THE EVALUATIONS DETERMINED THAT THE SINGLE FAILURE DESIGN BASIS WAS MET AND NO PLANT MODIFICATIONS ARE REQUIRED.

Equipment Survivability

- Determine thermal response of potentially essential equipment exposed to predicted hydrogen burn environments

- Determine ability of this same equipment to withstand the pressures resulting from hydrogen burns

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EQUIPMENT SURVIVABILITY (CONT'D)

EQUIPMENT SELECTION CRITERIA

- MAINTAIN CONTAINMENT PRESSURE BOUNDARY
  - CONTAINMENT PENETRATIONS, LOCKS, HATCHES
  - CONTAINMENT ISOLATION VALVES
  - ASSOCIATED INSTRUMENTATION AND CONTROLS
- RECOVER AND MAINTAIN THE CORE, MITIGATE ACCIDENT CONSEQUENCES
  - HIS
  - SRVs
  - LPCS, LPCI, RHR SYSTEMS
  - CONTAINMENT SPRAYS
  - HYDROGEN RECOMBINERS
  - DRYWELL PURGE COMPRESSORS, VACUUM BREAKERS
  - ASSOCIATED INSTRUMENTATION AND CONTROLS
- MONITOR COURSE OF THE EVENT
  - CTMT AND DRYWELL PRESSURE INSTRS
  - CTMT AND DRYWELL HIGH-RANGE RADIATION MONITORS
  - CTMT AND SUPPRESSION POOL TEMPERATURE INSTRS
  - REACTOR LEVEL AND PRESSURE INSTRS
  - HYDROGEN ANALYZERS
  - ASSOCIATED INSTRUMENTATION AND CONTROLS

Equipment Survivability (cont'd)

Temperature Effects

Evaluation Bases

- Equipment temperature response determined for:
  - Base case wetwell burn
  - Base case ctmt global burn
- More severe wetwell burn environment applied to all equipment regardless of actual location
- Modes of heat transfer - radiation, convection
- Models conservatively constructed to maximize thermal response of limiting component
- No credit taken for contact cooling from containment sprays or thermal shielding
- Equipment assumed to survive if:
  - Max. external surface T $<$ Equip. Qual. T, or
  - Max. internal T of limiting component $<$ Equip. Qual. T, or
  - Limiting component shown to maintain post accident function based on test data
- Conservatism of methodology verified by comparison against results of Fenwal ignitor burn tests (analytical results more severe)

Equipment Survivability (cont'd)

Temperature Effects

Results

- In all cases, equipment identified as potentially essential will survive the predicted hydrogen burn environment
- Considerable margin between calculated equipment temperature and temperature at which equipment operation would be threatened

EQUIPMENT SURVIVABILITY (CONT'D)

PRESSURE EFFECTS

EVALUATION BASES

- EQUIPMENT PRESSURE CAPABILITY EVALUATED FOR:
  - 24 PSIG PEAK PRESSURE
  - 5 PSID PEAK DRYWELL/CTMT DIFFERENTIAL PRESSURE (FROM SORV BASE CASE)
- EQUIPMENT ASSUMED TO SURVIVE IF:
  - QUALIFICATION PRESSURE > BURN PRESSURE
  - DURABLE, RIGID CONSTRUCTION (E.G., VALVE HOUSING) PRECLUDES PRESSURE EFFECTS
- MANY COMPONENTS HAVE PERFORMED FUNCTION WELL BEFORE ONSET OF HYDROGEN COMBUSTION

RESULTS

- NO ADVERSE EFFECTS ON POTENTIALLY ESSENTIAL EQUIPMENT EXPECTED
  - MAJORITY OF EQUIPMENT - QUAL. PRESSURE > BURN PRESSURE
  - PURGE COMPRESSORS, VACUUM BREAKERS EVALUATED UP TO 30 PSID

CONTAINMENT STRUCTURAL CAPABILITY

CONTAINMENT DESIGN PRESSURE: 15 PSIG

DRYWELL INTERNAL DESIGN PRESSURE: 30 PSID

CONTAINMENT ULTIMATE CAPACITY CALCULATIONS:

- USING DESIGN SPECIFIED STRENGTHS - 56 PSIG
- USING ACTUAL STRENGTHS
  - 70 PSIG UPPER BOUND
  - 67 PSIG MEAN
  - 62 PSIG LOWER BOUND

DRYWELL ULTIMATE CAPACITY CALCULATION:

- 67 PSID (INTERNAL)
- GREATER THAN 67 PSID (EXTERNAL)

ULTIMATE PRESSURE CAPACITY FOR CONTAINMENT HATCHES AND AIRLOCKS

- CONTAINMENT EQUIPMENT HATCH - 206.5 PSIG
- LOWER CONTAINMENT AIRLOCK - 77.6 PSIG
- UPPER CONTAINMENT AIRLOCK - 60 PSIG
- DRYWELL PERSONNEL AIRLOCK - 79.2 PSIG
- DRYWELL EQUIPMENT HATCH - 96 PSIG

PENETRATION CLOSURE PLATES ARE CALCULATED AT 60 PSIG

PIPING HAS BEEN EVALUATED AT RETAINING 75 PSIG (EXTERNAL)

DRYWELL HEAD BUCKLING CAPACITY - 89 PSIG (EXTERNAL)

BROOKHAVEN NATIONAL LAB RESULTS FOR CONTAINMENT ULTIMATE CAPACITY - 52 PSIG

LOCAL DETONATIONS

BACKGROUND

- AS STATED BY SANDIA AND COMBEX, DETONATION OF A SUBSTANTIAL VOLUME OF HYDROGEN-AIR MIXTURE IN THE GRAND GULF CONTAINMENT IS UNLIKELY SINCE:

  - ACCUMULATION OF A DETONABLE MIXTURE IS PREVENTED BY THE HYDROGEN IGNITOR SYSTEM (HIS)

  - GEOMETRICAL REQUIREMENTS FOR TRANSITION FROM DEFLAGRATION TO DETONATION DO NOT EXIST

- HOWEVER, AT THE REQUEST OF THE NRC, THE EFFECTS OF POTENTIAL LOCAL DETONATIONS ON STRUCTURAL INTEGRITY WERE EVALUATED FOR GRAND GULF STRUCTURAL COMPONENTS

- STRUCTURAL COMPONENTS EVALUATED

  - DRYWELL WALL

  - CONTAINMENT SHELL

  - LOWER CONTAINMENT PERSONNEL AIRLOCK

  - DRYWELL PERSONNEL AIRLOCK

  - DRYWELL EQUIPMENT HATCH

LOCAL DETONATIONS (CONT'D)

EVALUATION BASES

- GRAND GULF ASSUMPTIONS

  - GAS CLOUD LOCATED DIRECTLY ADJACENT TO STRUCTURAL COMPONENT

  - UNCONFINED DETONATION (TNT EQUIVALENT)

  - HYDROGEN CONCENTRATIONS VARIED FROM 25 TO 50 VOLUME PERCENT

  - VOLUME APPROXIMATELY 525 CUBIC FEET

- SANDIA

  - HYDROGEN CONCENTRATION-28 VOLUME PERCENT

  - PARTIALLY CONFINED DETONATION (CSQ CODE)

  - VOLUME APPROXIMATELY 28,000 CUBIC FEET

LOCAL DETONATIONS (CONT'D)

RESULTS

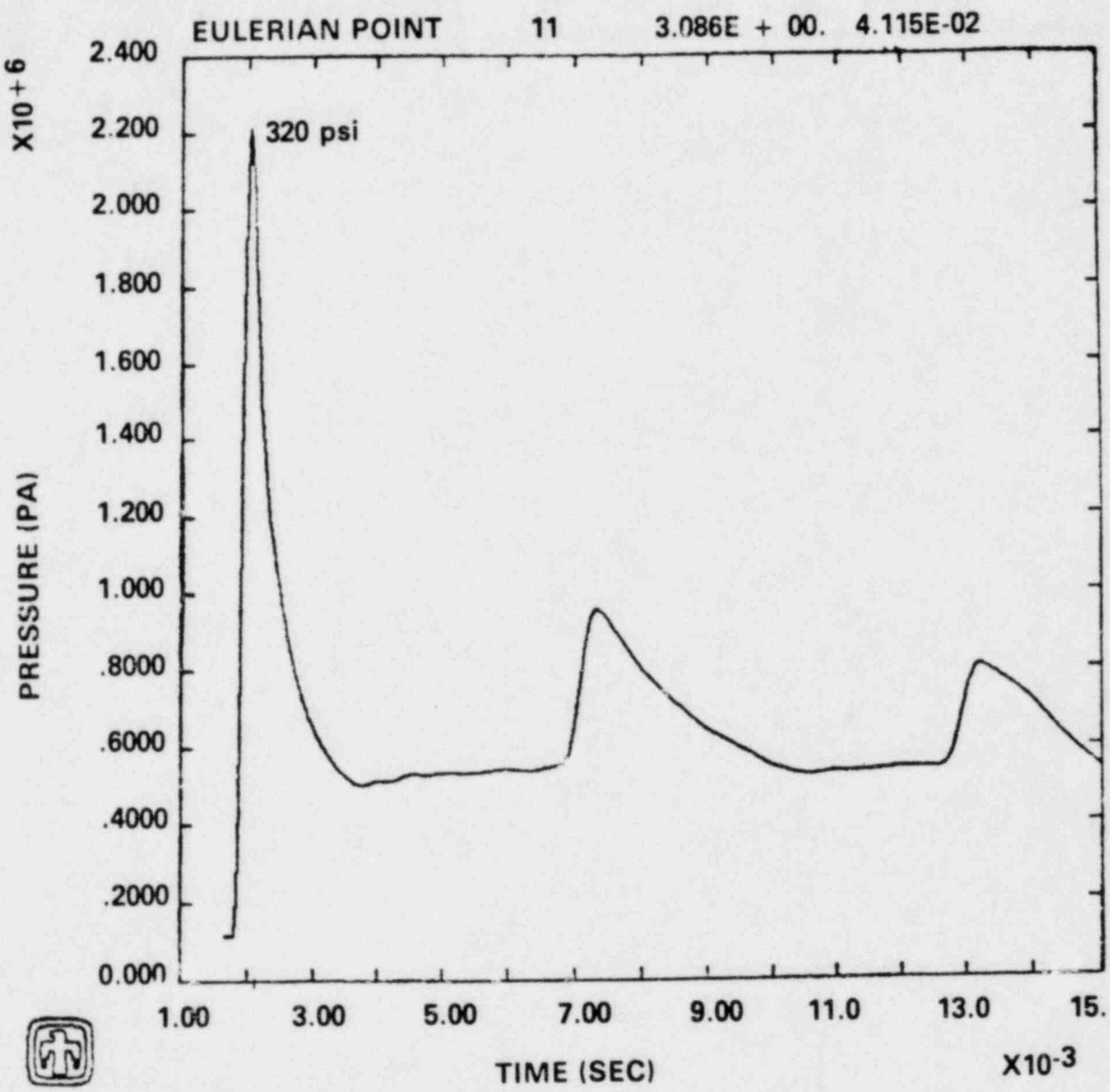
Peak Reflected Impulse for
Detonation of a
25-28 Percent H_2 + Air Mixture

METHODOLOGY	IMPULSE (PSI-SEC)	VOLUME (CU. FT.)
MARK	.043	525
COMBEX	.115	525
GGNS	.176	525
SANDIA	.700	28,000

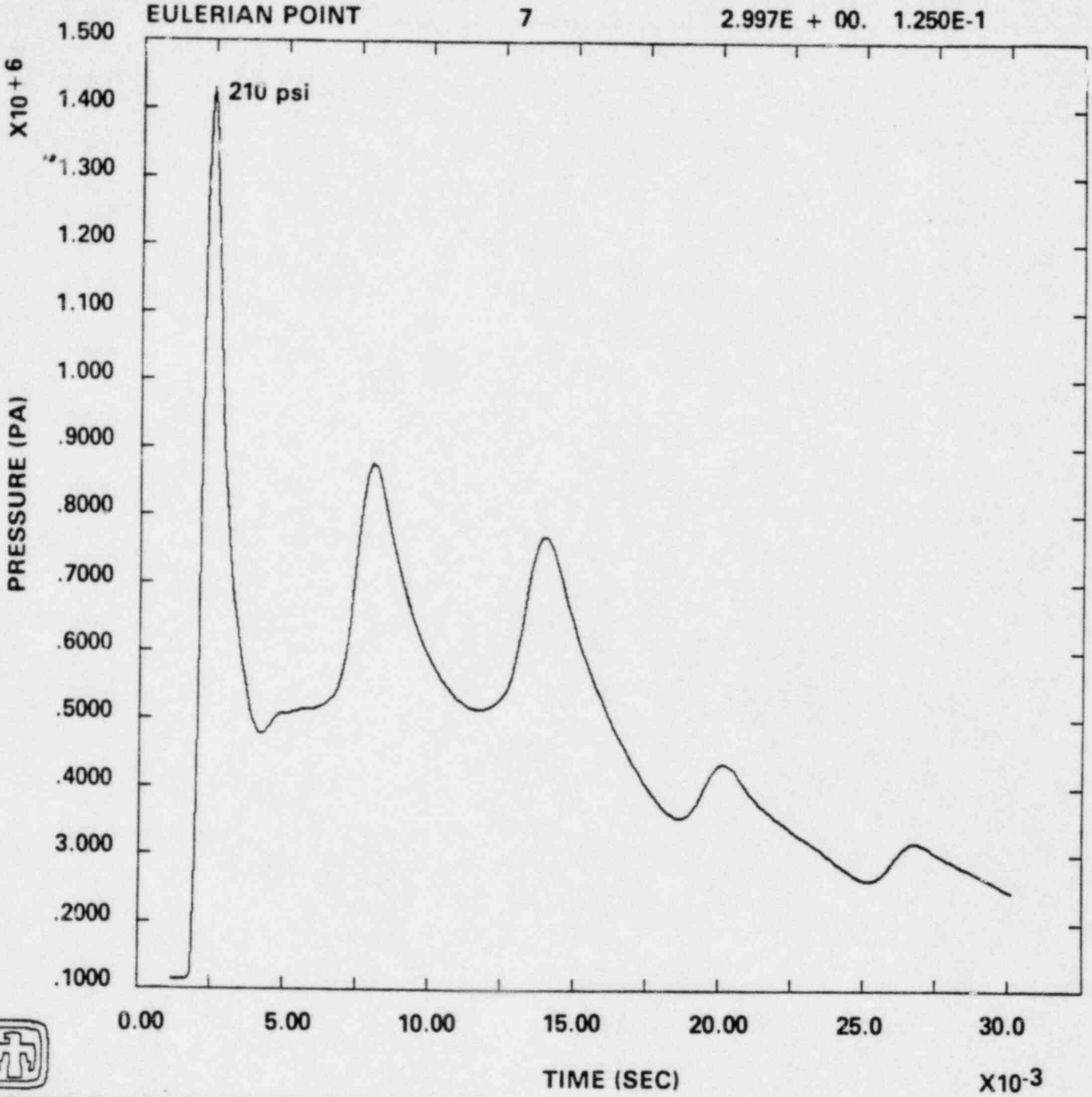
LOCAL DETONATIONS (CONT'D)

CONCLUSIONS

- CONTAINMENT STRUCTURAL COMPONENTS - ADEQUATE CAPACITY
- DRYWELL STRUCTURAL COMPONENTS - ADEQUATE CAPACITY



GRAND GULF 0.28 H2-DRY AIR



GRAND GULF 0.28 H2-DRY AIR (COARSE)

HYDROGEN TESTING PROGRAM

- Hydrogen-Rich Steam/Air
- Burn Testing above the Suppression Pool
- Hydrogen Mixing

HYDROGEN TESTING PROGRAM (CONT'D)

HYDROGEN-RICH TESTING

- AECL WHITESHELL FACILITY
- SMALL SCALE PHENOMENA TESTS
- INVESTIGATE FLAMMABILITY LIMITS IN POTENTIAL DRYWELL ENVIRONMENTS

HYDROGEN TESTING PROGRAM (CONT'D)

BURN TESTS ABOVE THE SUPPRESSION POOL

- NEW FACILITY
- LARGE SCALE
- INVESTIGATE BURNING ABOVE THE SUPPRESSION POOL

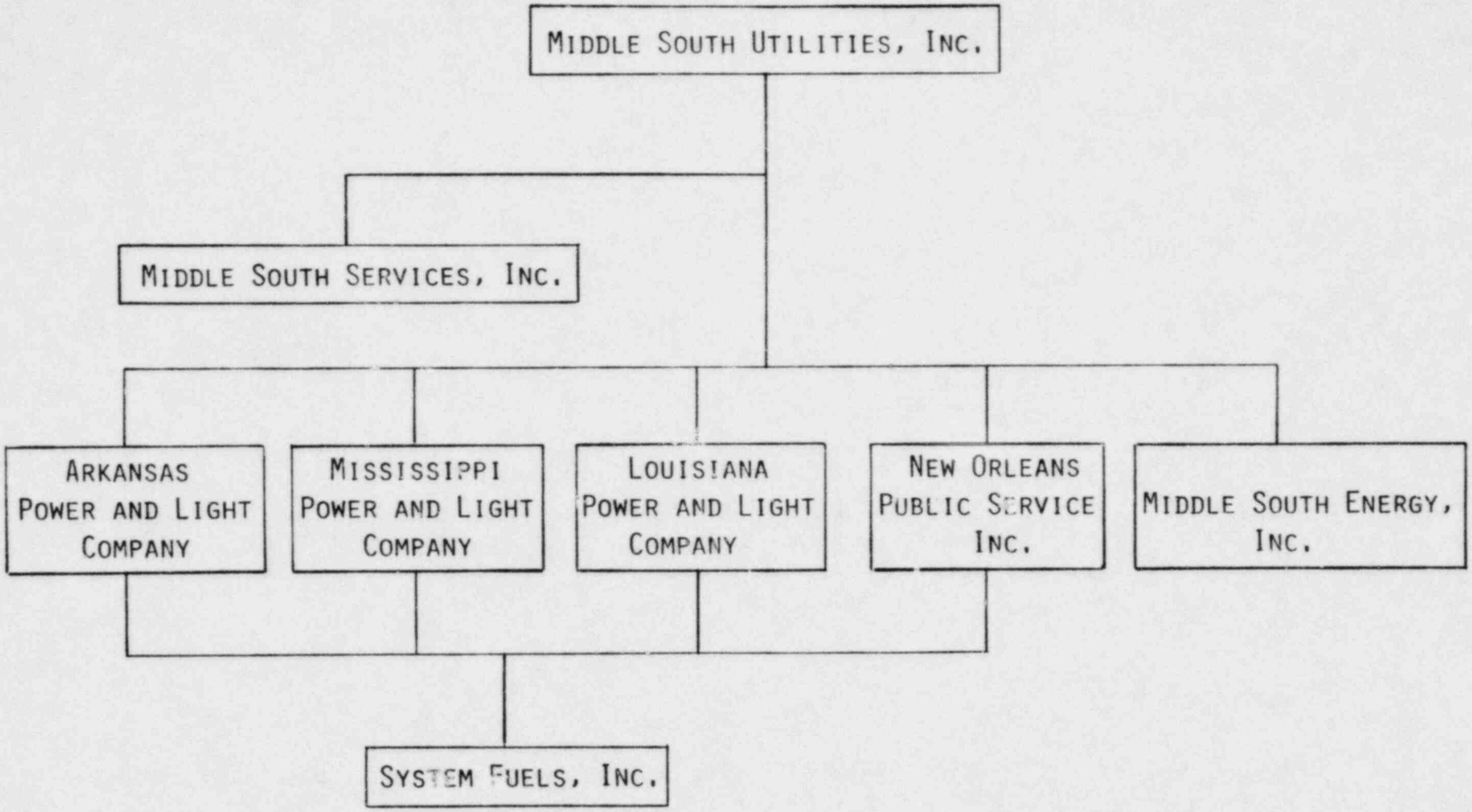
HYDROGEN TESTING PROGRAM (CONT'D)

HYDROGEN MIXING

INVESTIGATE:

- UTILIZATION OF THE HEDL FACILITY
- EVALUATE MIXING IN THE SCALE TEST AND COMPARE WITH AVAILABLE DATA

MIDDLE SOUTH UTILITIES SYSTEM



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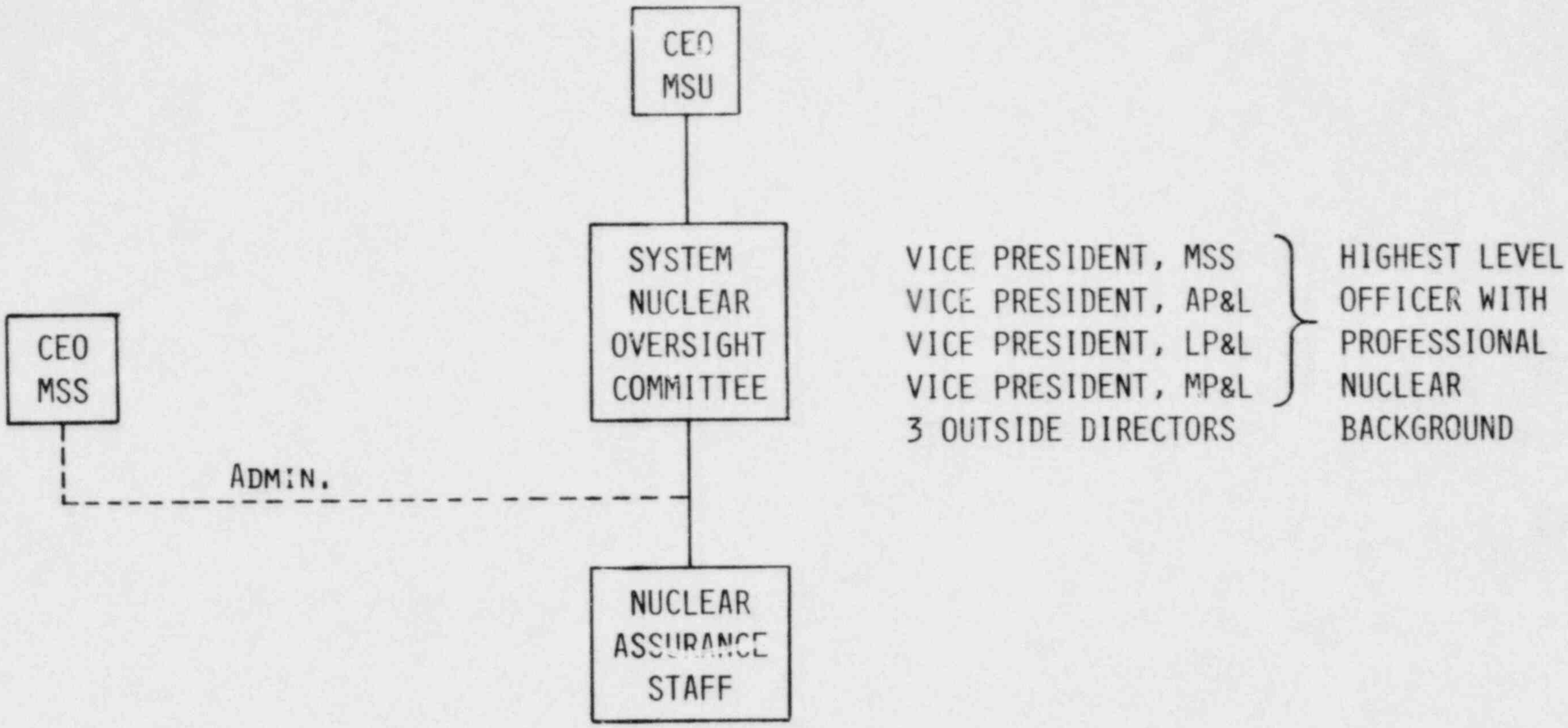
NUCLEAR OVERSIGHT ORGANIZATION



NUCLEAR OVERSIGHT COMMITTEE FUNCTIONS

- OVERVIEW AND GUIDANCE ON SYSTEM-WIDE BASIS
- OVERSIGHT AND APPRAISAL OF NUCLEAR ACTIVITIES OF MSU SYSTEM
- DEVELOP STANDARDS OF PERFORMANCE
- IMPROVE SYSTEM-WIDE RESPONSE TO EMERGENCY CONDITIONS
- IMPROVED, COST EFFECTIVE SUPPORT SERVICES WITH CONTINUITY OF EXPERIENCE

NUCLEAR ASSURANCE ORGANIZATION FUNCTIONS

SUPPORTS NUCLEAR OVERSIGHT COMMITTEE

PROVIDES

. STAFF SUPPORT

. REPRESENTATION ON SAFETY REVIEW COMMITTEES

. NUCLEAR SAFETY OVERSIGHT

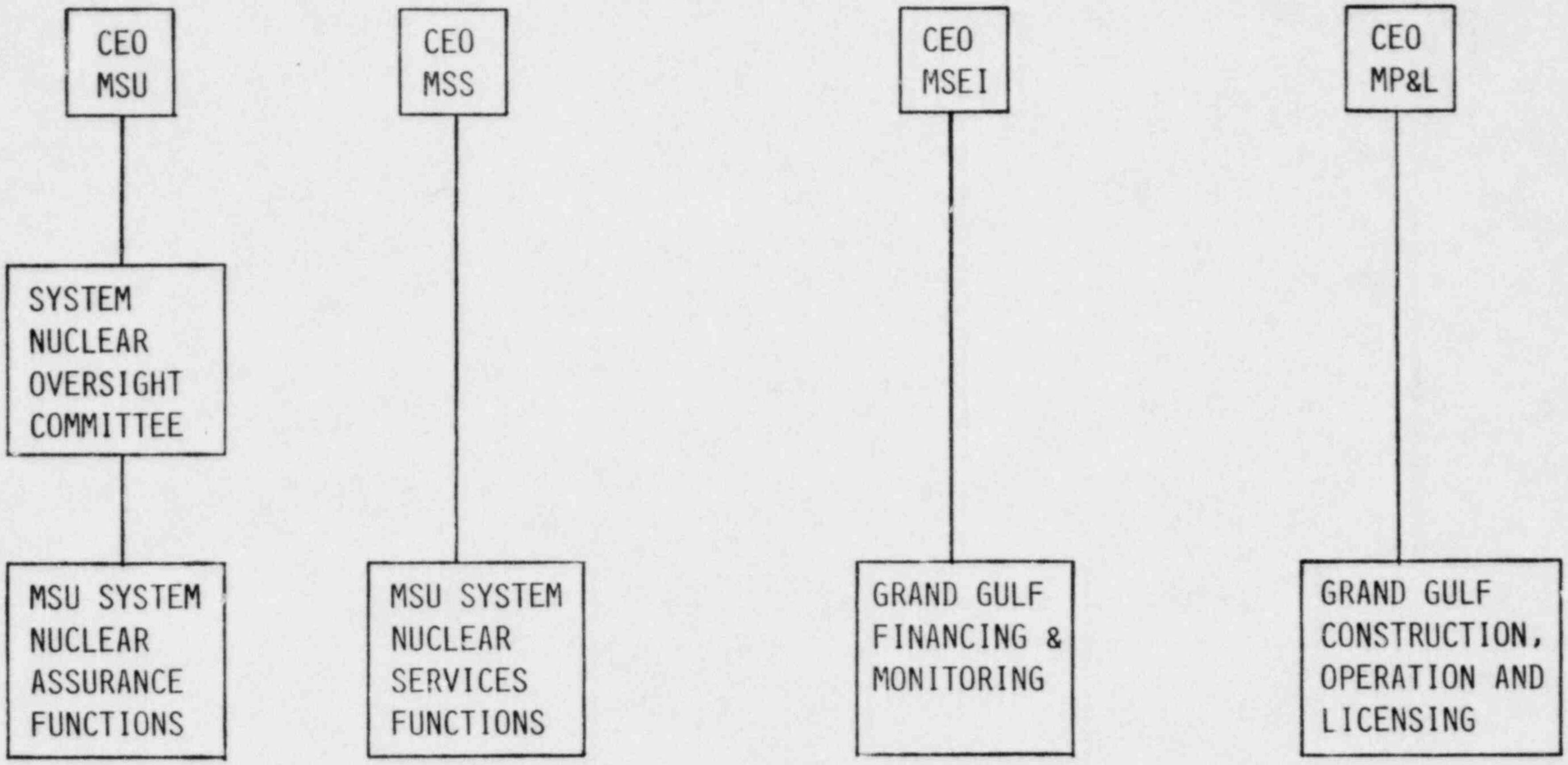
. ASSESSMENT OF RISK CONTROL ACTIVITIES

. SYSTEM CONTACT WITH INPO

NUCLEAR SERVICES ORGANIZATION FUNCTIONS

- NUCLEAR FUEL CYCLE SUPPORT
- FUEL AND REACTOR ENGINEERING/ANALYSIS SUPPORT
- QUALITY ASSURANCE
- SPECIALIZED TECHNICAL SERVICES
- REGULATORY RESPONSE ON GENERIC/SYSTEM ISSUES

GRAND GULF ORGANIZATION RELATIONSHIPS



MISSISSIPPI POWER & LIGHT COMPANY
Helping Build Mississippi
P. O. BOX 1640, JACKSON, MISSISSIPPI 39205

March 2, 1982

NUCLEAR PRODUCTION DEPARTMENT

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Attention: Mr. Harold R. Denton, Director

Dear Mr. Denton:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket Nos.: 50-416 and 50-417
File: 0260/L-8600/0756
Report on "Study of Hydrogen Control in the Grand Gulf Nuclear Station"
AECM-82/25

Enclosed is one copy of the subject report which has been prepared by Bela Karlovitz and Bernard Lewis of Combustion and Explosives Research (COMBEX), Inc. In this report, COMBEX concludes that "The presently designed igniter system is adequate to prevent dangerous accumulation of flammable H_2-air mixtures in the containment." COMBEX further concludes that "...the Grand Gulf Nuclear Station (GGNS) as designed can contain safely the pressures which may develop during burning of hydrogen released by safety relief valves or by a small LOCA. There is no danger of transition of deflagration to detonation because large volumes of H_2-air mixtures with a composition within the detonable range are not allowed to accumulate in geometrical configurations conducive to transition." The enclosed report also contains some recommendations with respect to igniter locations and testing (see Section 9).

As described in Section 4 of the enclosed COMBEX report, hydrogen released into the wetwell either through safety relief valve spargers or through the vents from the drywell will mix with air in the wetwell and burn in the form of a turbulent diffusion flame. This turbulence results in a lower flame height than observed in previous tests in nonturbulent regimes. This lower height is due to an increased burning rate caused by turbulent mixing or entrainment with air. Combustion will continue as long as the supply of hydrogen and oxygen is adequate. In the case of a pipe break in the drywell, as air is introduced into the steam and hydrogen rich drywell atmosphere via the purge compressors or vacuum breakers, combustion will take place in the form of an inverted flame at the air inlet locations.

Combustion such as described above will result in insignificant pressure excursions. However, localized thermal loadings must be carefully evaluated for potential impact on essential equipment. The tests proposed in the attachment to the COMBEX report will provide the necessary data to evaluate the localized thermal environment in the wetwell region. (Performance of

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these recommended tests is under consideration by the BWR Mark III Hydrogen Control Owners Group.) The localized thermal environment in close proximity to the air inlet locations in the drywell is not a concern because no essential equipment is near those locations.

The CLASIX-3 computer program has been utilized by Offshore Power Systems, under contract to Mississippi Power & Light Co., to evaluate the GGNS containment pressure and temperature response to hydrogen deflagration. The nature of the combustion process as modeled in CLASIX-3 is in some respects different from that described in the enclosed COMBEX report and summarized above. The following paragraphs describe these differences and explain the purpose of the CLASIX-3 analyses.

In the CLASIX-3 modeling of hydrogen combustion in the GGNS containment, hydrogen is assumed to be uniformly mixed within any single volume. Ignition is assumed to occur when the hydrogen volume concentration reaches a predetermined value and the oxygen volume concentration is at least 5 percent. This modeling of the combustion process in CLASIX-3 results in many sequential burns in the wetwell volume and in some cases a single burn in the containment volume. Cases which model a drywell pipe break also exhibit a single burn in the drywell volume late in the transient sequence.

Modeling of the combustion process as is done in CLASIX-3 provides conservative pressure calculations for evaluation of the GGNS containment functional capability. It also corresponds, in a conservative way, to the nature of combustion expected to occur if hydrogen flow rates are very low and, therefore, insufficient to support a continuous flame. The CLASIX-3 calculations also allow evaluation of the consequences of hydrogen combustion in various regions of the containment, thereby bounding the range of combustion threats which might be postulated.

Except for localized temperature effects, CLASIX-3 calculations can be used to assess equipment survivability since the integrated energy of combustion is an important parameter over the time frame considered.

In light of the recommendations of Section 9 of the enclosed report, MP&L intends to evaluate each area of consideration. These areas include: 1) location of Ignitors, 2) Evaluation of the phenomena associated with the burning of hydrogen, 3) Tests in rich Hydrogen-air mixtures, and 4) Burn testing above the suppression pool. The above tests are described in a separate transmittal, however MP&L intends to perform such testing in order to address each recommendation of the subject report. It is MP&L's desire to resolve each of these issues in our test program described in AECM-82/60 dated March 2, 1982.

In conclusion, the expected nature of hydrogen combustion in the GGNS containment is described in Section 4 of the enclosed COMBEX report and summarized in the second and third paragraphs of this letter. The CLASIX-3 calculations incorporate a somewhat different modeling of the combustion process which provides conservative pressure calculations for the evaluation of containment functional capability. The CLASIX-3 calculations also provide information for assessing equipment survivability, when supplemented by test results for evaluation of localized temperature effects.

Yours truly,

John Richardson for
L. F. Dale
Manager of Nuclear Services

SHH/JDR:rg

Attachments

cc: Mr. N. L. Stampley (w/a)
Mr. R. B. McGehee (w/a)
Mr. T. B. Conner (w/a)
Mr. G. B. Taylor (w/a)

Mr. Richard C. DeYoung, Director (w/a)
Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

REPORT ON STUDY OF HYDROGEN CONTROL IN THE GRAND GULF NUCLEAR STATION

By

Bela Karlovitz and Bernard Lewis

November 25, 1981

COMBUSTION AND EXPLOSIVES RESEARCH, INC.
1016 Oliver Building, Pittsburgh, Pennsylvania 15222

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Combustion & Explosives Research, Inc., has evaluated the use of a distributed ignition system for the control of hydrogen hazards which may exist in the containment building of the BWR Mark III Containment of the Grand Gulf Nuclear Plant of Mississippi Power & Light Company.

1. Mark III Containment System

a.) Description

The Boiling Water Reactor sits in the center of the Drywell of the Mark III Containment. The drywell is formed by a cylindrical concrete wall and a flat concrete roof, the center opening of which is closed by a removable hemispherical steel cap. The drywell is surrounded by the wetwell which extends to the cylindrical steel shell of the containment. The bottom of the wetwell contains the suppression pool having a normal high water depth of approximately 18 ft. 10 in. The drywell communicates with the wetwell through three rows of horizontal vent openings. Each row contains 45 vent openings of 4.28 $ft.^2$ distributed around the circumference. The water is prevented from flowing into the drywell by a circular weir wall. Gases can flow from the drywell into the wetwell through an annular channel existing between the weir wall and the wall of the drywell. In case of pressure development in the drywell due to steam and/or hydrogen evolution the water in the annular channel is depressed until the horizontal vent openings become exposed.

Above the roof of the drywell is an upper pool containing water. This pool, which covers only a section of the total area of the containment building extends from elevation 184 ft. 6 in. to 208 ft. Above the pool is the dome of the upper containment which houses the crane for refueling operation. The volume of the

Drywell = 270,128 CF

Wetwell = 151,644 CF

Upper Containment = 1,248,588 CF

the total volume being 1,670,300 CF.

b.) <u>Accidental Release of Steam and H_2 in the Containment.</u>

In case of accidental overpressure within the reactor, steam and hydrogen may be vented by safety relief valves through spargers submerged in the suppression pool. There are 20 spargers distributed circumferentially in

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the suppression pool, each sparger having 4 horizontal perforated discharge arms. The discharge arms cover a 9 ft. diameter circle. The discharge is at approximately 98 feet elevation, that is 14 feet below the normal high water level of the suppression pool. In the case of a small LOCA, steam and hydrogen may be released directly into the drywell from a pipe break. Such steam and H_2 pass through the horizontal vent openings into the suppression pool. In either case steam would condense out in the water and hydrogen would bubble up and emerge from the surface of the suppression pool.

c.) Vacuum Breakers and Drywell Purge System.

The pressure in the drywell may increase above atmospheric by venting steam and H_2 into the drywell or it may decrease below atmospheric due to steam condensation. To prevent development of excessive vacuum in the drywell 2 vacuum breakers are provided with a total flow area of 0.545 ft.^{2} to allow flow of air from the upper containment into the drywell. In addition there are 2 purge compressor blowers with a total capacity of 1,180 CFM per compressor. These compressors can be initiated manually or automatically after a LOCA signal and after the drywell pressure falls to within 1 psi above the containment pressure.

2. Accident Scenarios Considered

Base Case SORV	Considers a stuck-open relief valve. According to Table D-2 of the June 19, 1981 report of Mississippi Power & Light to the NRC the maximum H_2 release rate is given as 1.0415 lb/sec. with a total H_2 release of 2,585 lbs.
Base Case SORV with 4 x H_2 Release Rate	Considers a stuck-open relief valve with a hydrogen release rate, 4 times larger than for Base Case. The total amount of H_2 released remains the same - 2,585 lbs.

In both these cases steam and H_2 are vented through 7 to 9 spargers into the suppression pool where steam is condensed and H_2 bubbles up above the 7 to 9 spargers over approximately 8 ft. diameter circles due to contraction of the bubble stream.

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Base Case Small Break with no SRV Release	Considers a small-break LOCA in the drywell, the maximum H_2 release rate being 1.0415 lbs/sec. and the total H_2 release being the same - 2,585 lbs.

In this case steam and hydrogen are vented from the drywell through the partially exposed first row of vent holes into the suppression pool where the steam is condensed and H_2 bubbles up near the wall above the 45 vent holes. Also considered is the case of H_2 release at very low flow rates through the spargers.

3. Hydrogen Ignition (Mitigation) System

To prevent accumulation of large volumes of H_2-air mixtures, potentially with high H_2 concentrations, a large number of igniters are installed over the entire containment system the aim being to ignite and burn the H_2 mixtures as they become flammable. The igniters are General Motors AC Division Model 7G Glow Plugs which are identical to those being used at the Sequoyah and McGuire plants. These plugs have been extensively tested by Fenwal, Inc., and gave reliable ignition in every case tested. The igniter system is designed to operate for a minimum of 168 hours after initiation following an accident. There are two independent sets of igniters and power supplies, the design criterion being that if only one igniter system is operative the maximum distance between igniters shall not exceed 60 ft. The igniters are deployed in sets above the suppression pool and in the drywell at several elevations, also in the upper containment. Two redundant igniters are located in all small chambers where there exists a potential for high concentration of hydrogen to be formed. There are a total of 90 igniters in the entire containment. Of the 90 igniters, 9 igniters constitute the lowest set in the wetwell, approximately 21 ft. above the normal high water level.

4. Hydrogen Flames

a.) Wetwell

The hydrogen released from 7 to 9 spargers or from 45 vent openings into the wetwell bubbles up through the water and emerges from the water surface as a pure hydrogen stream at rather low velocity. The H_2 stream entrains air as it rises and is ignited when a flammable mixture reaches an ignition source. The flame then spreads from the ignition source through the volume of flammable mixture. Subsequently, H_2 emerging from the water burns as it mixes with air in the form of a turbulent diffusion flame.

Diffusion flame designates a type of flame which is formed when a stream of fuel gas issues into air, entrains and mixes with air and burns at a rate which is determined by the rate of mixing. When the magnitude of the fuel stream exceeds some minimum mixing becomes turbulent which accelerates the burning rate and shortens the flame. The height of the flame is determined by the size of the gaseous stream (orifice size) and the flow velocity.

Experimental data available for the flame height of turbulent diffusion flames relate to small orifice diameters and high flow velocities, i.e., fractions of an inch orifice diameter and up to several hundred feet/sec. gas flow velocity. Therefore, these data can provide only very approximate information for the height of turbulent diffusion flames in this case where the diameter of the H_2 stream is several feet and the flow velocity is of the order of 1 foot/sec.

Assuming a total discharge of H_2 of 1 lb/sec. through 8 spargers the average velocity of the H_2 stream emerging from the water surface above each sparger over approximately an 8 foot diameter circle would be about ½ ft./sec. For 4 lbs/sec. H_2 flow rate the average H_2 flow velocity would be about 2 ft./sec.

Air required for the continued burning of hydrogen must flow down from the upper containment through the wetwell to the suppression pool. The minimum crossectional area between the wetwell and the upper containment is approximately 2,100 ft.^{2} The total area of the 8 H_2 streams emerging from the water is

$$8 \times \frac{\pi\ (8)^2}{4} = 402 \text{ ft.}^2$$

Consequently, sufficient crossectional area is available for unimpeded downward flow of air.

The height of the turbulent diffusion flames may be estimated approximately from model experiments carried out by Thompson and Boncore at Aerojet General on bouyancy-controlled turbulent diffusion flames.* The empirical relationship for flame length given in this study is

$$L = 3.73\ (wT)^{0.4}$$

where L is flame height in feet

w is H_2 flow rate, lbs./sec.

T = H_2 temperature, °R.

For a total flow of 1 lb. H_2/sec. through 8 spargers, w = 1/8 lb/sec. With T = 600°R (60°C) the flame height is calculated to be 21 feet. For a total flow of 4 lbs. H_2/sec. the calculated flame height is 36.5 ft.

In the Thompson-Boncore experiments the flames were burning above a pool in the open atmosphere at a low turbulence level. In the containment the downward flow of air is somewhat restricted and the turbulence level will be higher than in the open atmosphere. Consequently, the flames will be shorter than calculated above.

In the case of a small LOCA in the drywell, steam and H_2 would be forced through the top row of 45 vents. At a maximum total H_2 flow rate of 1 lb/sec. = 180 CF/sec. the water level will be only partially depressed in the vent holes and H_2 will bubble through about 6 ft. of water close to the wall. The circumference of the inner wall of the wetwell is 261 ft. and the distance between center lines of vent holes is 5.8 ft. The vent diameter being 2.33 ft. the distance between the holes is 3.47 ft. The H_2 stream though the vent holes covers 40% of the circumference.

Assuming as before .5 ft./sec. average H_2 flow velocity at the water surface the H_2 jets would extend about 3.5 ft. from the wall. As access of air to this row of H_2 columns is restricted essentially to one side we multiply the H_2 flow rate per column by a factor of 4 for estimation of the flame height. Therefore,

$$w = \frac{1\ \text{lb/sec.}}{45} \times 4 = .10\ \text{lb./sec.}$$

Then,

$$L = 3.73 \times (.1 \times 600)^{.4} = 19\ \text{feet.}$$

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*Report by W. R. Thompson and C. S. Boncore, Aerojet General Corp., "Design and Development of a Test Facility for the Disposal of Hydrogen at High Flow Rates". Advances in Cryogenic Engineering, Vol. 12.

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Because of uncertainty in the estimation of flame height we recommend suitable experiments which would allow measurement of the flame height. At the same time the tests would demonstrate stability of the flames. The proposed tests are described in the attachment to this report.

Once ignited, the flames will continue to burn as lifted turbulent diffusion flames stabilized at some distance above the water surface. Combustion takes place in diffusion flames at locations where the mixture ratio is near stoichiometric. In such mixtures the laminar burning velocity is about 8 ft./sec. In a stream where the average flow velocity is less than the laminar burning velocity, the flame will always move upstream to the point where the mixture becomes flammable. The root of the flame will move up and down randomly above the water surface depending upon local variations of mixture composition and velocity.

Ignition of the H_2-air stream will involve some transient pressure development as the flame travels from the igniters through accumulated flammable mixture. The first row of igniters in the wetwell is designed to be about 21' above the normal high water level in the middle region of the annular wetwell. However, upper pool dump, operation of the purge compressors and blowdown from the vessel cause an increase in the normal pool depth of about seven (7) feet prior to significant H_2 release, leaving about 14 feet above the pool surface to the first row of igniters. At the time when a near-limit mixture reaches the igniters an appreciable volume of H_2-air mixture will have accumulated above the water surface. The composition of this mixture will range from 100% H_2 to 100% air. Only a small fraction of this volume is near-stoichiometric. To estimate the transient pressure due to flame passing through this accumulated mixture we assume, conservatively, a volume of stoichiometric mixture covering half of the pool surface and extending to a height of about 14'. The volume of this mixture,

$$V = \frac{6,667}{2} \times 14.0 = 46,669 \text{ CF}$$

which is 3.3% of the 1,400,000 CF of the wetwell and upper containment.

The pressure rise in the entire system due to adiabatic burning of the assumed 46,669CF stoichiometric mixture would be

$$\frac{46.669 \times 106.6 \text{ psia} + 1,353,331 \times 14.7 \text{ psia}}{1,400,000} = 17.76 \text{ psia} = 3.06 \text{ psig},$$

where 106.6 psia is the adiabatic combustion pressure of the stoichiometric mixture. The open crossectional area connecting the wetwell with the upper containment is sufficiently large to allow pressure equalization during the burning. While this transient pressure rise upon ignition is moderate its magnitude could be substantially reduced by arranging igniters closer to the surface of the water level and closer to the inner wall.

For a considerable length of time early into an accident H_2 is released at a very low rate, about .01 lb/sec. at 3,600 sec., rising to about .05 lbs/sec. at 4,200 sec. This flow rate amounts to 18 lbs. H_2 in 600 seconds which could form 32,000 CF of 10% H_2-air mixture. Upon ignition the entire volume of slowly emerging H_2 would be burned and there would not be sufficient H_2 flow to maintain continuity of the flame. Such a low H_2 release ratio would result in a succession of mild ignition puffs. As in the case of large H_2 flow rate the magnitude of the transient ignition pressure would be greatly reduced by placing igniters closer to the water surface above the spargers.

b.) Drywell

In the case of a small LOCA which occurs in the drywell, first steam and later, steam and H_2 flow into the drywell from a pipe break. In the first 2,000 seconds steam enters the drywell at an average flow rate of about 150 lbs/sec. amounting to 6×10^6 CF steam. During this time the 270,000 CF air in the drywell is displaced by steam and blown through the horizontal vent openings into the wetwell and upper containment. After 4,200 seconds the H_2 flow rate increases from very low values to about 0.3 lb./sec., and after 4,800 seconds to about 1 lb/sec., continuing at this rate to approximately 7,800 sec. The total amount of H_2 released is 2,585 lbs. The H_2-containing atmosphere in the drywell is nonflammable since the air content is negligible. Air can enter the drywell from the upper containment through the 2 vacuum breakers or through the 2 purge compressors, each compressor having a maximum flow rate of 19 CF/sec. As air enters the drywell containing a mixture of H_2 and steam at some unknown volume ratio the H_2 concentration in the mixing air jet will change along a straight line such as shown on the attached H_2-steam-air flammability diagram (figure 1). As seen, the composition line may pass through the flammable range. To prevent accumulation of substantial volumes of flammable mixture in the drywell, ignition sources should be placed judiciously near the air inlet ducts.

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5. Vitiation of Air by H_2 Burning

The total amount of H_2 released is given as 2,585 lbs. equal to 464,000 CF. The total amount of air in the containment building is

Drywell =	270,000 CF
Wetwell =	151,600 CF
Upper Containment =	1,248,600 CF
	1,670,000 CF

The amount of air required to burn all the H_2 is 1,110,000 CF. It would appear that all the H_2 could be removed by burning. However, as the combustion products of the flames are mixed with the remaining air the air gradually becomes vitiated i.e., oxygen deficient, as the burning proceeds. The following table gives the O_2 concentration in the remaining "air" after burning given fractions of the total H_2 with or without condensation of the water vapor produced by combustion.

TABLE

Total H_2 = 464,000 CF
Total Air = 1,670,000 CF (349,000 CF O_2)
Assume H_2 and air at same T and P

Fraction of H_2 burned	% O_2 in Vitiated Air: Without Condensation of Steam	% O_2 in Vitiated Air: With Condensation of Steam
50	13.0	15.0
60	11.6	13.7
70	10.2	12.4
80	8.8	11.0
90	7.5	9.6
100	6.2	8.2

Water vapor released from the reactor and water vapor generated by burning hydrogen is ultimately condensed out. Vitiation of air by nitrogen remains. The table shows that the O_2 concentrations in the nitrogen-vitiated air exceed the minimum O_2 concentration of 5.2% for burning H_2 in nitrogen-vitiated air (Figure 1).

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The above calculation assumes the air contained in the drywell is fully involved in burning H_2. In reality this may not be the case depending upon the scenario.

6. Vacuum Created in Containment by Burning of Hydrogen

Burning of hydrogen reduces the total gas volume by an amount equal to one-half of the hydrogen burned when the water remains in vapor form and one and one-half times the hydrogen when the water is condensed.

Releasing H_2 into the containment increases the absolute pressure which is then reduced by consumption of oxygen by the burning H_2 and eventually by condensation of water vapor.

Releasing a total of 2,585 lbs. H_2 = 464,000 CF would increase the pressure in the containment from 1 atm abs to 1.278 atm. abs. equal to 4 psig. Burning all the H_2 released and assuming total condensation of water vapor would result in an absolute pressure of .86 atm = 2 psi vacuum. To restore the pressure to 1 atm. abs. 232,000 CF of air will have to be introduced into the containment.

7. Heat Absorption in the Water Stored in the Suppression and Upper Pools

Upper heat of combustion of 2,585 lbs. of H_2 is 40×10^6 kcal.

Heat content of approximately 453,000 lbs. of steam released is 140×10^6 kcal.

Water contained in wetwell and drywell is

$(6,667 \text{ ft.}^2 + 553 \text{ ft.}^2) \times 18.33$* ft. height = 132,300 CF

Added makeup volume from the upper pool is 36,380 CF

Total CF of water is 168,680 CF = 4,784,000 Kg. H_2O

Temperature rise of the pool water after absorption of the heats of combustion and condensation of water vapor is

$$\frac{180 \times 10^6}{4.784 \times 10^6} = 38°C$$

It appears that the water contained in the suppression pool, after the upper pool dump, can absorb the total heat released in a small LOCA with a moderate temperature rise.

*conservative low value

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8. Conclusions

Our analysis shows that the Grand Gulf Nuclear Station as designed can contain safely the pressures which may develop during burning of hydrogen released by safety relief valves or by a small LOCA.

There is no danger of transition of deflagration to detonation because large volumes of H_2-air mixtures with a composition within the detonable range are not allowed to accumulate in geometrical configurations conducive to transition.

9. Recommendations

1. Location of Igniters

The presently designed igniter system is adequate to prevent dangerous accumulation of flammable H_2-air mixtures in the containment. Nevertheless, some relocation of igniters or the addition of a few more igniters is recommended to reduce further the modest peak pressures which may develop during ignition of hydrogen streams bubbling from the suppression pool. Installation of additional igniters is advisable at the air inlet openings in the drywell.

2. Some consideration should be given to the fact that burning of all hydrogen released in the system may result in a vacuum of the order 2 psi.

3. The reliability of the glow plug igniters has been extensively tested during the past year in lean H_2-air mixtures. Some additional tests should be carried out for the ignition of rich H_2-air limit mixtures and also for establishing the reliability of the igniters exposed to splashing water and sprays.

4. Estimation of the height of turbulent diffusion flames under conditions in the wetwell is subject to uncertainties. We recommend a full-scale test involving a single sparger and three horizontal vent holes in a 20' x 20' x 50' high chamber open at the top including an 18 ft.-deep pool.

This would allow a 1 to 1 scale testing of hydrogen diffusion flames, their ignition and stability. Temperature and hydrogen distribution along the flame should also be measured.

11/25/81

COMBUSTION & EXPLOSIVES RESEARCH, INC.

Bernard Lewis

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Béla Karlovitz

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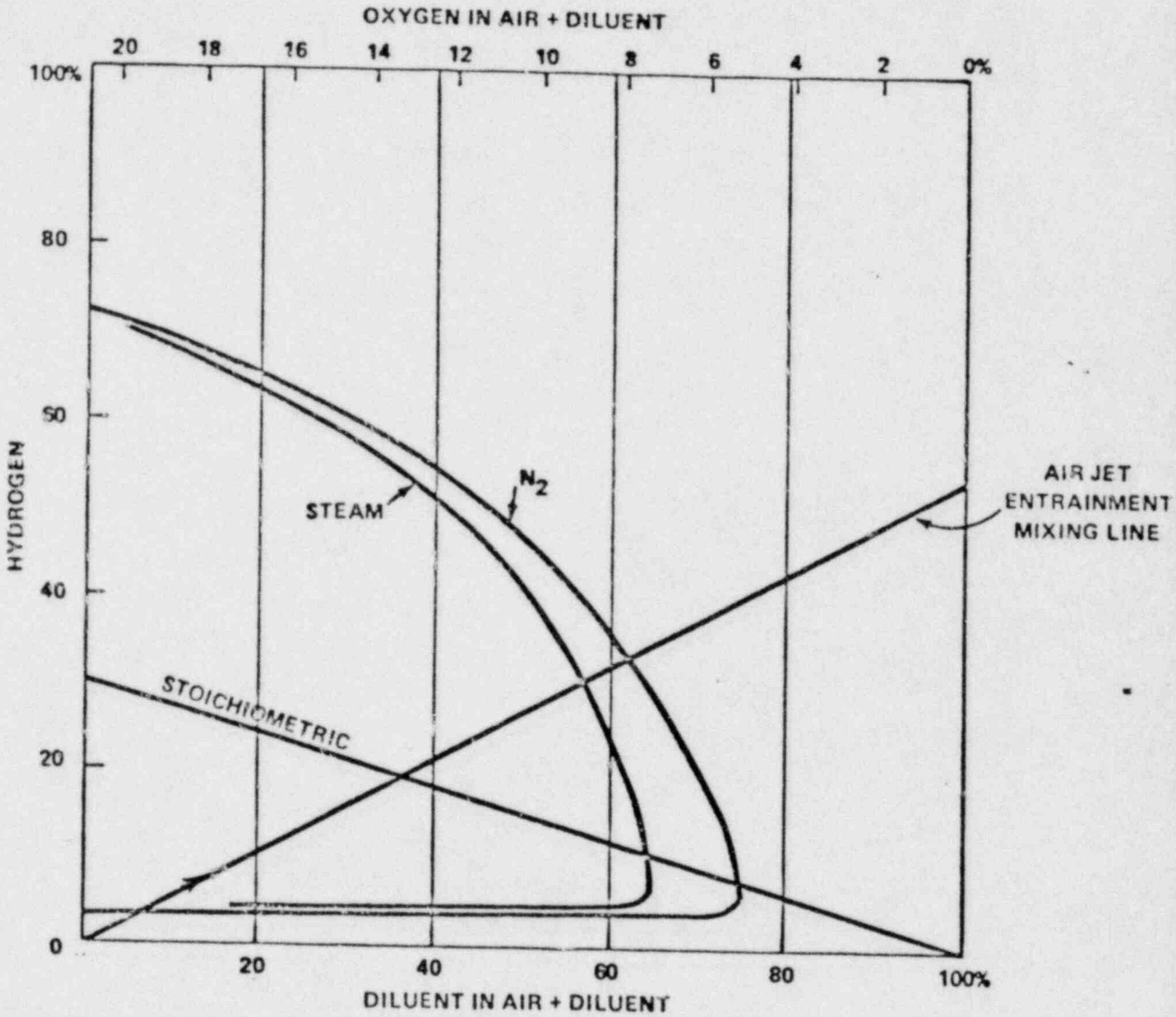


FIGURE 1

FLAMMABILITY DIAGRAM OF H_2 + AIR + DILUENT

ATTACHMENT A

Experimental Study of H_2 Diffusion Flames Burning Above a Pool of Water

While the general character of H_2 diffusion flames burning above a pool of water with restricted air supply can be predicted there is considerable uncertainty regarding the height of such flames. An experimental study of these flames is proposed which will allow the measurement of flame height and temperature, and observation of ignition by glow plugs and of flame stability.

The maximum H_2 flow rate through a single sparger is .5 lb/sec. Thus it is possible to do the experiment at full scale and avoid the scaling problem.

The experimental arrangement would consist of a 20' x 20' x 50' high concrete structure open at the top and containing an 18 foot deep pool of water. A single full scale sparger would be arranged in a position similar to that in the wetwell with three horizontal vent holes representing the connection between the drywell and wetwell (Figure A-1).

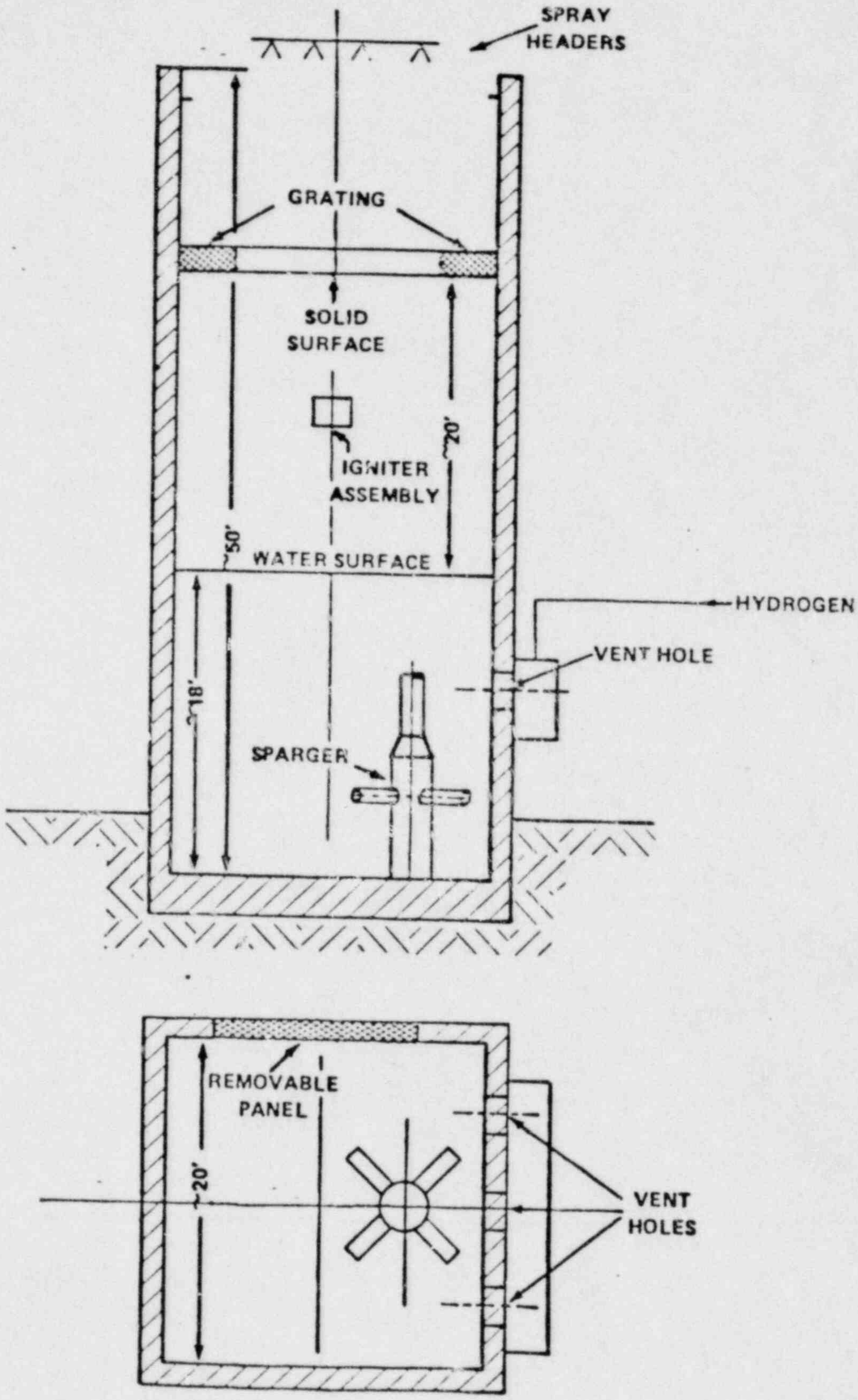
Glow plug igniters will be placed at locations corresponding to those in the wetwell. Observation windows and sampling ports will be arranged in the side walls for measurement of flame height, temperature and H_2 distribution along the flame.

In order to measure the transient ignition pressure the top of the structure m y be closed temporarily with a cover containing an appropriate vent opening.

The experimental system described above will also be suitable to study the effect of splashing water and water sprays on the igniters and on the flame. Also tests of equipment survivability will be possible.

For safety the tests should be carried out at an open site with remote controls.

SIDE VIEW



TOP VIEW

FIGURE A-1
WETWELL TEST CHAMBER

PLANT SAFETY REVIEW COMMITTEE (PSRC)

- FUNCTION - ADVISE PLANT MANAGER ON ALL MATTERS RELATED TO NUCLEAR SAFETY

- COMPOSITION - 7 MEMBERS

- CHAIRMAN	-	ASSISTANT PLANT MANAGER
- VICE CHAIRMAN	-	NUCLEAR SUPPORT MANAGER
- MEMBER	-	OPERATIONS SUPERINTENDENT
- MEMBER	-	TECHNICAL SUPPORT SUPERINTENDENT
- MEMBER	-	QUALITY SUPERINTENDENT
- MEMBER	-	CHEMISTRY AND RADIATION PROTECTION SUPERINTENDENT
- MEMBER	-	MAINTENANCE SUPERINTENDENT

- MEETING FREQUENCY - MONTHLY OR AS CONVENED

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- RESPONSIBILITIES - REVIEW OF:

  - STATION ADMINISTRATIVE PROCEDURES & CHANGES
  - SAFETY EVALUATIONS
  - PROPOSED CHANGES WHICH MAY INVOLVE AN UNREVIEWED SAFETY QUESTION
  - TESTS WHICH MAY INVOLVE UNREVIEWED SAFETY QUESTIONS
  - PROPOSED CHANGES TO TECH SPECS OR OPERATING LICENSE
  - REPORTS OF VIOLATIONS OF CODES OR PROCEDURES HAVING NUCLEAR SAFETY SIGNIFICANCE
  - REPORTS OF DEFICIENT SYSTEMS CONTAINING RADIOACTIVE MATERIAL
  - REPORTS OF OPERATING ABNORMALITIES OR DEVIATIONS
  - EVENTS REQUIRING 24 HOUR COMMISSION NOTIFICATION
  - UNANTICIPATED DESIGN OR OPERATIONAL DEFICIENCIES OF SAFETY-RELATED STRCUTURES, SYSTEMS OR COMPONENTS
  - PLANT SECURITY & CHANGES
  - EMERGENCY PLAN & CHANGES
  - POTENTIAL NUCLEAR SAFETY HAZARDS
  - INVESTIGATIONS OR ANALYSES REQUESTED BY CHAIRMAN OF NSRC
  - UNEXPECTED OFFSITE RELEASES
  - CHANGES TO PROCESS CONTROL PROGRAM DOSE MANUAL AND RADWASTE SYSTEMS

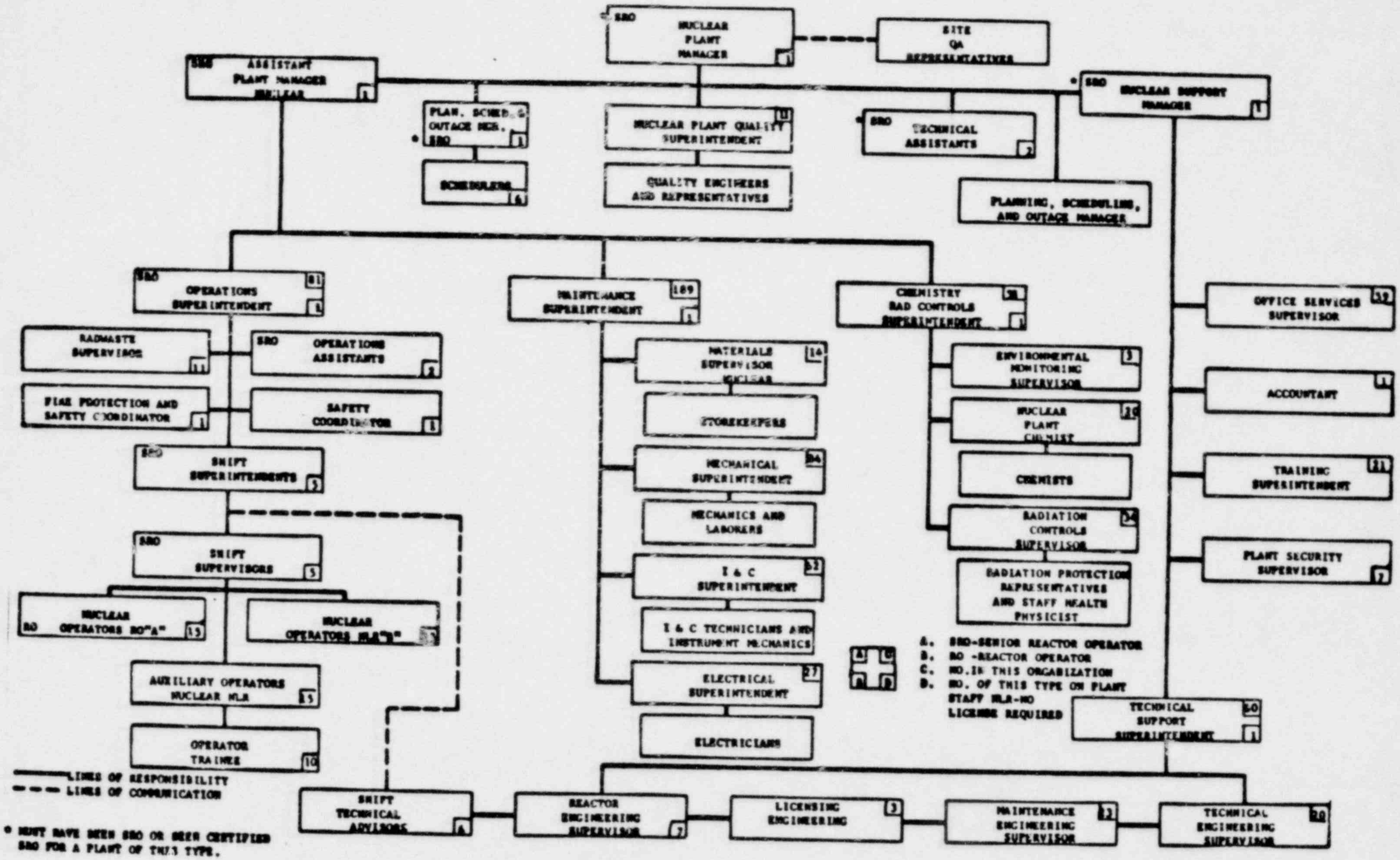
- AUTHORITY - REPORT TO PLANT MANAGER

TECHNICAL REVIEW AND CONTROL

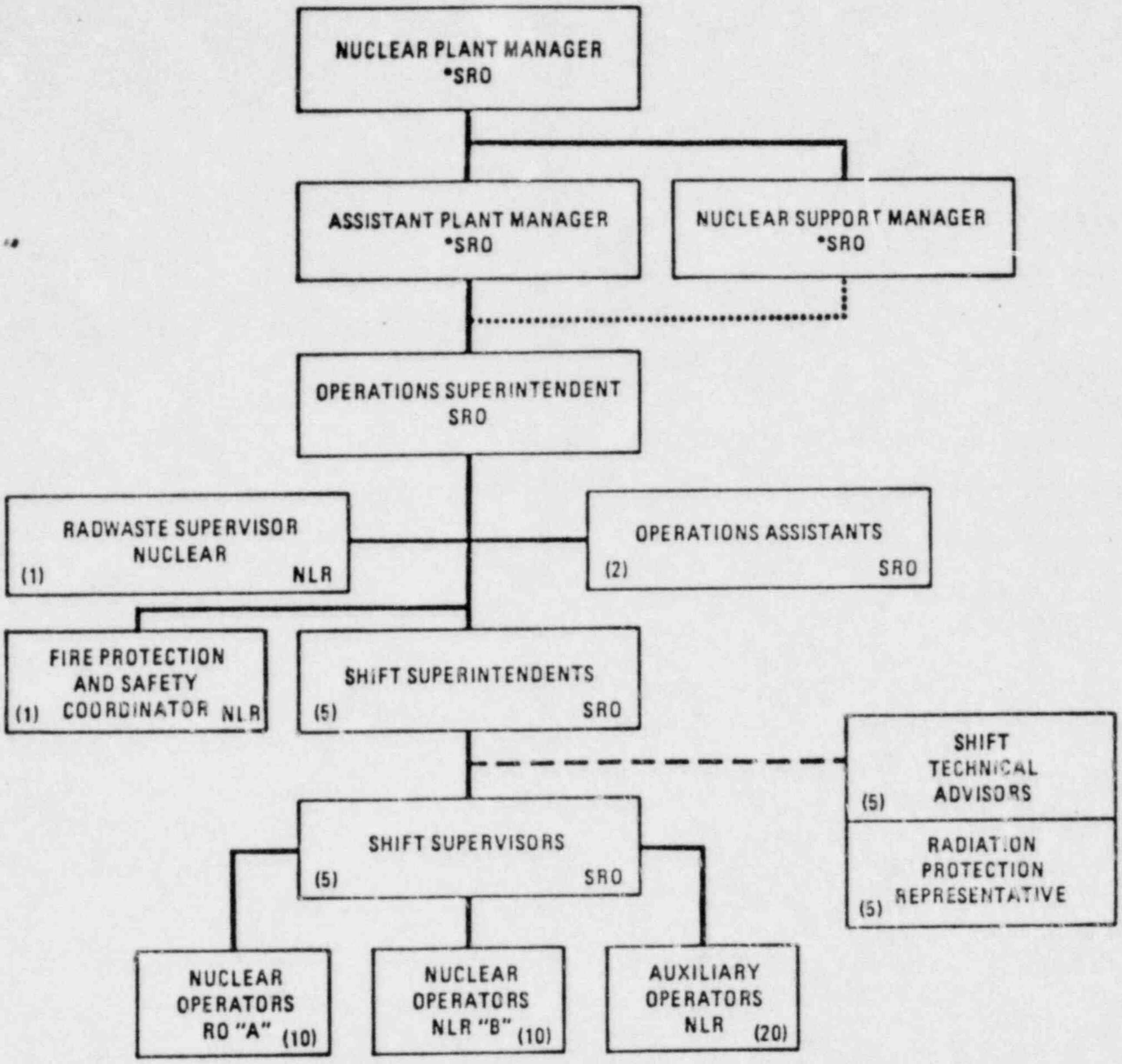
. ACTIVITIES AFFECTING NUCLEAR SAFETY SHALL BE CONDUCTED AS FOLLOWS:

- PROCEDURES WHICH AFFECT PLANT NUCLEAR SAFETY SHALL BE PREPARED, REVIEWED AND APPROVED
  - INDEPENDENT REVIEW
  - PROCEDURES MUST RECEIVE WRITTEN APPROVAL BY PLANT MANAGER
- PROPOSED CHANGES TO PLANT NUCLEAR SAFETY-RELATED SYSTEMS/STRUCTURES/COMPONENTS SHALL RECEIVE REVIEW DESIGNATED BY PLANT MANAGER
  - INDEPENDENT REVIEW
  - IMPLEMENTATION MUST BE APPROVED BY PLANT MANAGER
- PROPOSED TESTS AND EXPERIMENTS WHICH AFFECT PLANT NUCLEAR SAFETY SHALL RECEIVE INDEPENDENT REVIEW
- REPORTABLE OCCURRENCES AND TECH SPEC VIOLATIONS SHALL BE INVESTIGATED WITH RECOMMENDATION TO PLANT MANAGER
- INDIVIDUALS PERFORMING REVIEW SHALL MEET RELATED ANSI STANDARD (18.1-1971)
- REVIEW SHALL DETERMINE WHETHER AN UNRESOLVED SAFETY ISSUE IS INVOLVED
- RECORDS OF ABOVE ACTIVITIES SHALL BE PROVIDED TO STATION MANAGER, PSRC FOR REQUIRED REVIEWS

PLANT STAFF ORGANIZATION AND STAFFING LEVELS



PLANT OPERATIONS ORGANIZATION
(ONE UNIT OPERATION)



NOTES:

SRO - SENIOR REACTOR OPERATOR
RO - REACTOR OPERATOR
NLR - NO LICENSE REQUIRED
(X) - NUMBER OF PLANT PERSONNEL ASSIGNED TO THIS POSITION
— — - SHIFT TECHNICAL ADVISOR COMMUNICATES WITH SRO'S BUT REPORTS TO THE REACTOR ENGINEERING SUPERVISOR
* - THE PLANT MANAGER, THE ASSISTANT PLANT MANAGER, AND THE NUCLEAR SUPPORT MANAGER ARE TRAINED TO SRO LEVEL IN ADDITION TO THOSE IN THE OPERATIONS ORGANIZATION.
.... - TEMPORARY LINE OF SUCCESSION IN THE EVENT OF INCAPACITY OF BOTH THE PLANT MANAGER AND THE ASSISTANT PLANT MANAGER. SEE SUBSECTION 13.1.2.2.1

MISSISSIPPI POWER & LIGHT COMPANY

CORPORATE SAFETY REVIEW COMMITTEE

- FIRST MEETING IN JUNE, 1981
- MONTHLY MEETING FREQUENCY
- EXPANDED FROM 7 TO 11 MEMBERS
- REPORTS TO SENIOR VICE PRESIDENT - NUCLEAR
- OPERATION PER NUCLEAR PRODUCTION DEPARTMENT PROCEDURE 9.2
- FORMAL TRAINING SESSIONS ON DUTIES AND RESPONSIBILITIES
- CHARTER, DUTIES AND AREAS OF REVIEW AS PER TECH SPEC SECTION 6.5.2
- PLANNING TO EXPAND CHARTER AND AREAS OF REVIEW

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SRC COMPOSITION

- ASSISTANT VICE PRESIDENT - NUCLEAR PRODUCTION (CHAIRMAN)
- MANAGER OF NUCLEAR SERVICES (ALTERNATE CHAIRMAN)
- MANAGER OF SAFETY AND LICENSING (SECRETARY)
- MANAGER OF QUALITY ASSURANCE
- MANAGER OF NUCLEAR PLANT ENGINEERING
- NUCLEAR PLANT MANAGER
- CORPORATE HEALTH PHYSICIST
- PRINCIPAL ENGINEER - OPERATIONS ANALYSIS
- MANAGER OF SYSTEM NUCLEAR OPERATIONS, MIDDLE SOUTH SERVICES
- CONSULTANT (DR. J. M. HENDRIE)
- CONSULTANT (DR. D. W. JONES)
- CONSULTANT (J. F. GROVES)
    - ONLY 2 OF 12 ARE LINE MANAGEMENT FOR PLANT OPERATIONS
    - 25% CONSULTANTS / 33% NOT MP&L EMPLOYEES
    - INDIVIDUALLY AND COLLECTIVELY MEET EXPERIENCE AND EXPERTISE REQUIREMENTS OF TECH SPEC SECTION 6.5.2.
    - AVERAGE <u>19 YEARS PROFESSIONAL</u> AND <u>17 YEARS NUCLEAR</u> EXPERIENCE

SRC SPECIAL SUBCOMMITTEE ON

REVIEW OF PLANT OPERATIONAL READINESS

- ORGANIZED TO REVIEW READINESS FOR FUEL LOAD - FEBRUARY, 1982
- COMPOSITION - NO MP&L EMPLOYEES
- REPORT SUBMITTED JUNE 7, 1982
- SUBCOMMITTEE RE-CONVENED JUNE 12, 1982
  - EXPANDED SCOPE
  - ADDED INDUSTRIAL PSYCHOLOGIST TO MEMBERSHIP
- REPORT SUBMITTED JUNE 13, 1982
- LETTER FROM D. C. LUTKEN DIRECTING FURTHER REVIEWS - JUNE 13, 1982
- OPERATING LICENSE CONDITION SPECIFYING FURTHER REVIEWS AND SCOPE OF EACH
  - PRIOR TO 5% OF FULL POWER
  - PRIOR TO 50% OF FULL POWER
  - WITHIN 30 DAYS OF COMPLETION OF WARRANTY RUN
- WILL PERFORM PERIODIC GENERAL ASSESSMENTS OF UNIT OPERATIONS

CONTAINMENT PURGE

THE MARK III CONTAINMENT DESIGN DIFFERS FROM THE MARK I AND MARK II.

*ADVANTAGE	THE MAJORITY OF RELEASES FROM REACTOR COOLANT SUPPORT SYSTEMS ARE IN THE ISOLABLE PRIMARY CONTAINMENT
*DISADVANTAGE	INSPECTION AND MAINTENANCE REQUIREMENTS DURING NORMAL OPERATION REQUIRE MORE FREQUENT PERSONNEL ENTRY INTO CONTAINMENT.

AN EVALUATION PERFORMED BY MP&L CONCLUDES THAT CONTINUOUS FILTERED CONTAINMENT PURGING WILL BE REQUIRED TO KEEP PERSONNEL DOSES ALARA.

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CONTAINMENT PURGE

THE CONTAINMENT VENTILATION AND FILTRATION SYSTEM PROVIDES FOR FILTERED RECIRCULATION AND TWO MODES OF PURGING THE CONTAINMENT ATMOSPHERE:

*THE LOW VOLUME PURGE (LVP) - 500 CFM
*THE HIGH VOLUME PURGE (HVP) - 6000 CFM

THE AMOUNT OF PURGING REQUIRED TO MEET ALARA GUIDELINES WAS ESTIMATED BASED ON THE FOLLOWING ASSUMPTIONS:

*COOLANT LEAKAGE TO THE CONTAINMENT WOULD BE THE EXPECTED VALUES USED FOR DESIGN PURPOSES.

*COOLANT RADIOACTIVITY CONCENTRATIONS ARE DESIGN VALUES BASED ON BWR OPERATING EXPERIENCE.

*PERSONNEL DOSE LIMITS WOULD BE BASED ON THE GUIDELINES OF ICRP PUBLICATION 2 FOR WEEKLY ALLOWABLES AND 10 CFR 20.103.

THE EVALUATION CONCLUDED THAT CONTINUOUS OPERATION OF THE LVP MUST BE SUPPLEMENTED BY INTERMITTENT OPERATION OF THE HVP.

CONTAINMENT PURGE

NRC ACCEPTS UNRESTRICTED USE OF THE LVP BUT LIMITS USE OF THE HVP TO 1000 HOURS PER YEAR UNTIL ACTUAL OPERATING EXPERIENCE CAN BE EVALUATED.

DURING THE FIRST OPERATING CYCLE MP&L WILL COLLECT GRAND GULF SPECIFIC DATA ON THE FOLLOWING:

- OPERATING DURATIONS OF RECIRCULATION AND PURGE MODES.

- OPERATING COOLANT RADIOACTIVITY CONCENTRATIONS.

- AIRBORNE RADIOACTIVITY LEVELS INSIDE CONTAINMENT.

- TIME DURATIONS AND PERSONNEL EXPOSURES FOR INSPECTION AND MAINTENANCE ACTIVITIES DURING NORMAL OPERATION.

THE DATA WILL BE EVALUATED AND ANY PROPOSED REVISIONS FOR THE USE OF THE LVP AND HVP WILL BE SUBMITTED TO THE NRC PRIOR TO STARTUP FOLLOWING THE FIRST REGULARLY SCHEDULED REFUELING OUTAGE.

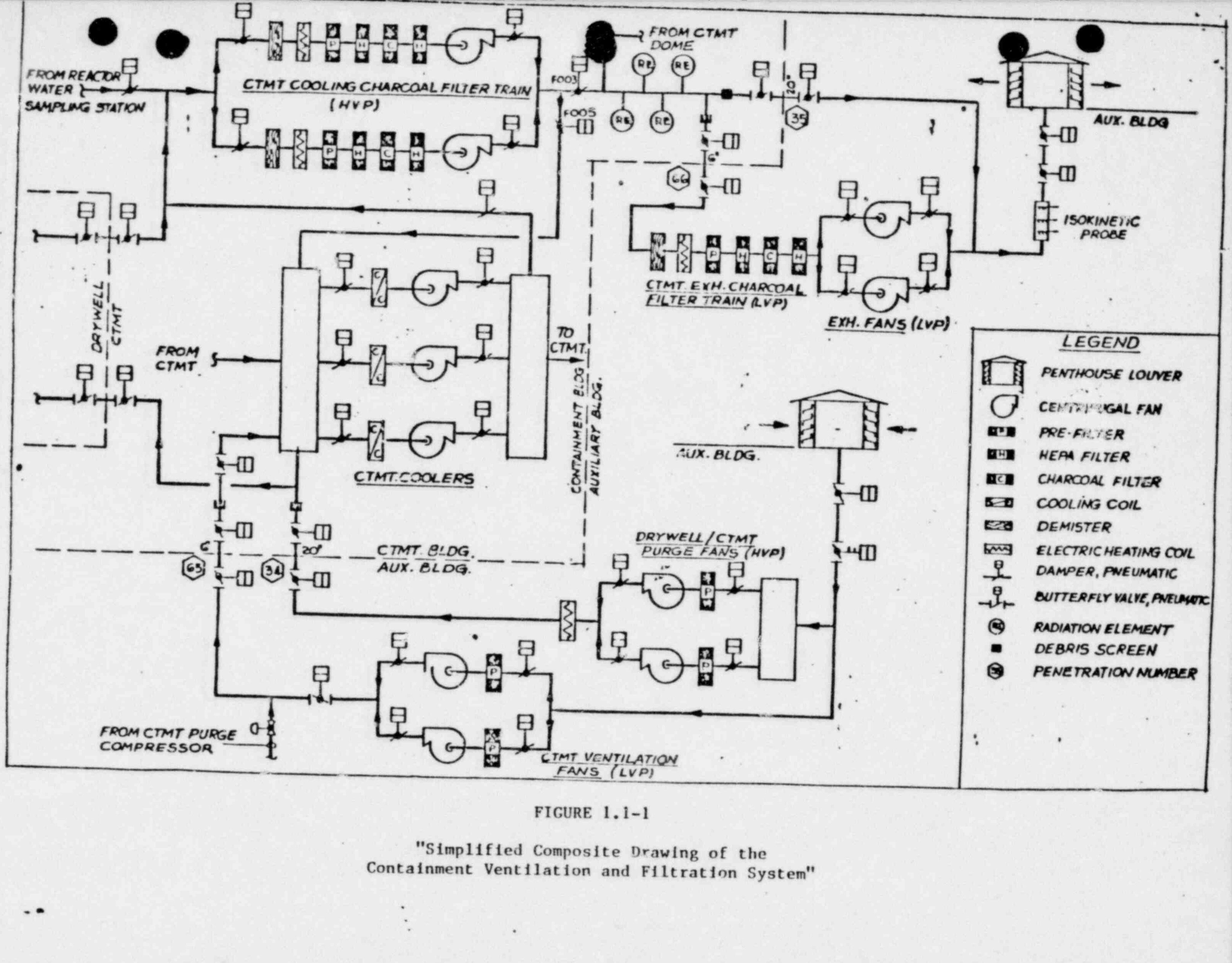

FIGURE 1.1-1

"Simplified Composite Drawing of the Containment Ventilation and Filtration System"

CONTAINMENT PURGE ASSUMPTIONS

- RADIATION DOSE RATE LIMITS:
  - WHOLE BODY/GONADS 1mRem/Hr
  - SKIN/THYROID 4mRem/hr
- AIRBORNE RADIOACTIVITY SOURCES
  - REACTOR STEAM (SAFETY RELIEF VALVES) 2000 lb/hr
  - REACTOR WATER TO CONTAINMENT ATMOSPHERE 50 lb/hr
  - REACTOR STEAM TO CONTAINMENT ATMOSPHERE 5 lb/hr

CONTAINMENT PURGE EVALUATION RESULTS

- EQUILIBRIUM DOSE RATES FOR VARIOUS PURGE RATES

PURGE RATE (CFM)	FILTERED RECIRC. (CFM)	EQUILIBRIUM DOES RATE (M/REM/HR.) THYROID	BETA-SKIN	WHOLE BODY
0	3000	8.2	2.1	0.31
0	6000	4.6	2.1	0.31
500	3000	6.8	1.4	0.24
500	6000	4.1	1.4	0.24
6000	N/A	3.0	0.63	0.11

CONTAINMENT PURGE RESTRICTIONS

- NOT USED FOR TEMPERATURE OR HUMIDITY CONTROL
- NO MORE THAN ONE SUPPLY LINE AND ONE EXHAUST LINE AT THE SAME TIME
- LVP UNRESTRICTED FOR OPERATIONAL CONDITIONS 1 THROUGH 5
- HVP UNRESTRICTED FOR OPERATIONAL CONDITIONS 4 AND 5 AND 1000 HOURS FOR CONDITIONS 1, 2 AND 3.

SURVEILLANCE TESTING

- PERIODIC TESTING FOR CLOSURE TIME AND LEAKAGE
- VALVES INCLUDED IN PUMP AND VALVE ISI PROGRAM
  - MINIMUM TESTING FREQUENCY OF EVERY 92 DAYS FOR LEAK TIGHTNESS
  - CLOSURE TIME EVERY 92 DAYS OR FOLLOWING ANY MAINTENANCE

PURGE VALVE OPERABILITY

- DURING A DESIGN BASIS LOCA IN DRYWELL, WILL DRYWELL PURGE/VENT ISOLATION VALVES CLOSE AGAINST DIFFERENTIAL PRESSURE

- VALVE SUPPLIER ANALYSIS WAS CONSERVATIVE AND CONSIDERED
  - WORST CASE (MSLB) POST-ACCIDENT DRYWELL PRESSURE
  - DELAY TIME FROM START OF DBA TO RECEIPT OF ISOLATION SIGNAL
  - WORST CASE CONFIGURATION (BOUNDING GRAND GULF CONFIGURATION)
  - WORST CASE FLOW AND CLOSURE DIRECTIONS

- ANALYSIS CONFIRMS THAT DRYWELL PURGE/VENT VALVES WILL CLOSE UNDER DBA CONDITIONS

- OPERABILITY ANALYSIS EXTENDED BY VENDOR TO CONTAINMENT HVPS (20") ISOLATION VALVES SINCE
  - CONTAINMENT AND DRYWELL VALVES ARE IDENTICAL
  - ANALYSIS CONFIGURATION BOUNDS CONFIGURATION OF HVPS VALVES

- PURGING DRYWELL DURING OPERATIONAL MODES 1 THROUGH 5 IS JUSTIFIED