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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of:

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

Docket No.

Subcommittee on River Bend

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

Subcommittee on the River Bend Station

Prince Charles Room
Oak Manor Motor Hotel
8181 Airline Highway
Baton Rouge, Louisiana 70815

Thursday, June 7, 1984

The meeting of the Subcommittee on the River Bend Station convened at 1:00 p.m., David Okrent, Chairman of the Subcommittee, presiding.

ACRS Members Present:

D. OKRENT
J. EBERSOLE

ACRS Consultans Present:

M. TRIFUNAC
T. THEOFANOUS

DESIGNATED FEDERAL EMPLOYEE:

G. QUITTSCHREIBER

MEETING PARTICIPANTS:

E. WEINKAM
T. NOVAK
F. ELTAWILA
R. KENDALL
D. ALLISON
J. JAUDON
W. CAHILL
J. KIRKEBO
P. FREEHILL
J. DEDDENS
B. REED
J. BOOKER
C. BOGOLIN
B. McMORELAND
J. PROPOSON
P. BOURNE
J. HAMILTON
T. McINTYRE
B. EBERLY
B. CULP
C. LAMBERT
P. PORTER
D. LORFING
E. ZOCH
T. SZABO
P. GUHA
B. RAUGHLEY
J. QUIRK
M. SHA
M. FULS
D. KNECK

PROCEEDINGS

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

This is a meeting of the Advisory Committee on Reactor Safeguards Subcommittee on the River Bend Station.

I am David Okrent, the Subcommittee Chairman.

The other ACRS Member present today is Mr. Jesse Ebersole on my right. Further to my right is an ACRS Consultant, Dr. Trifuinac, and we will have Dr. Theofanous with us shortly, another ACRS Consultant.

The purpose of the meeting is to discuss the application of Gulf States Utilities Company for a license to operate River Bend Station Unit 1.

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

Mr. Gary Quittschreiber, on my left, is the designated federal official 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 Monday, May 14, 1984.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register notice. It is requested that each speaker first identify himself or herself and speak with sufficient clarity and volume so that he or she can be readily heard.

We have received no written statements or requests for time to make statements from members of the public.

Let me ask, Mr. Ebersole, do you have any comments on the proposed agenda?

MR. EBERSOLE: Not at this time.

MR. OKRENT: If not, we will proceed with the proposed agenda and go on to the report by the NRC staff on the status of the review.

MR. WEINKAM: Good afternoon, ladies and gentlemen. I am Edwin Weincam, the Licensing Project Manager assigned to the River Bend Station operating license application.

From the NRC Office of Nuclear Reactor Regulation today we have Mr. Tom Novak, Assistant Director for Licensing, Mr. Al Schwencer, Chief, Licensing Branch No. 2, Dr. Faruk Eltawila, Containment Systems Branch, Mr. Rick Kendall, Instrumentation and Control Systems Branch, and tomorrow we will be joined by Mr. Jeff Kimball from the Geosciences Branch.

From the Office of Inspection and Enforcement, Mr. Dennis Allison and Mr. Ralph Architzel from the Independent Design Inspection Team.

From NRC Region IV, Mr. Johns Jaudon, the Chief of the Reactor Project Branch responsible for the River Bend Station operating license application, Mr. Dwight Chamberlain, Senior Resident Inspector for Operations, Mr. Bob Farrell, Senior Resident Inspector for Construction.

MR. OKRENT: Before you proceed, I wonder if you could try to get a message, if it is still possible, to your member from the Geosciences Branch. We would be interested in hearing what results are available from the recent study being performed at Livermore National Laboratory on eastern sites. I think there is either a report or a draft report out. The SER says that the SER was written before the report was available, but we would like to have that report.

MR. WEINKAM: Dr. Okrent, I believe he is prepared to discuss that.

MR. OKRENT: Thank you.

(Slide.)

MR. WEINKAM: These are the major licensing milestones, past and future, for River Bend Station.

Additionally, I would like to highlight that the Board of Directors of Gulf States Utilities Company announced the cancellation of River Bend Station Unit 2 on January 5th, 1984. GSU is scheduled to provide by June

30th their plans and schedules to close out the OL application for Unit 2.

The staff review was conducted for a single unit license. GUS is updating the FSAR to reflect only a single-unit application. Unit 2 was less than one percent complete at the time of the cancellation.

As another item of interest, the prehearing conference for the 12 filed contentions by the joint intervenors on off-site emergency preparedness is scheduled for June 19th, 1984 in Baton Rouge.

Two issues have already been admitted by the Hearing Board for litigation in October 1984.

MR. OKRENT: What are they?

MR. WEINKAM: The two admitted issues are on Asiatic clams, biofouling of condensers, and the second is on a failure of the old river control structure, which is diversionary structure upstream of River Bend Station.

MR. WEINKAM: I have two slides which highlight some of the key features of the facility. It is a comparison of the BWR Mark III's which have previously been reviewed by the ACRS and for comparison that River Bend Station most closely resembles Clinton.

(Slide.)

This is Table 1.2 from the SER.

(Slide.)

And just a continuation of the table.

(Slide.)

I would like to now highlight several key features of the facility and some of these items will be discussed in more detail by the applicant during the course of this meeting.

The first feature of interest is the presence of safety grade containment unit coolers. These coolers are provided with service water from the normal service water system at all times, except under accident conditions and/or loss of off-site power. Under these conditions the water is provided by the standby service water system from the ultimate heat sink.

It should also be noted that River Bend Station does not employ a containment spray mode in the residual heat removal system. These unit coolers are discussed further in the reference sections of the safety evaluation report.

(Slide.)

The next feature of interest is the drywell reverse pressure design. River Bend Station does not use drywell vacuum breakers. The drywell is designed for a maximum pressure differential of 20 psid, and under the conservatively assumed worst case conditions, the maximum reverse pressure differential achieved is 19.4 pounds differential.

(Slide.)

Anther feature of interest is the fact that River Bend Station does not need the upper containment fuel pool water dump capability to assure long-term ECCS recirculation.

As the result of a shorter weir wall inside the drywell and concrete fill in the drywell below the reactor vessel pedistal, the makeup water provided by the fuel pool is not required. Sufficient net positive suction head is still available for the emergency core cooling system pumps.

(Slide.)

MR. OKRENT: Excuse me. Does the change in design that you just referred to affect other things in some way, for example, loads above the wetwell or so forth?

MR. WEINKAM: Dr. Eltawila, could you address that?

MR. ELTAWILA: Dr. Eltawila from the Containment Systems Branch. The plan will be designed for reverse loads in the drywell. Any component or structure that is located in the drywell would be designed for a dynamic load due to the reverse flow from the containment to the drywell. So there would be a shift with that reverse flow.

Since you don't have a vacuum breaker between the drywell and the containment, the contents will come through the downcomer.

MR. WEINKAM: I think, Dr. Eltawila, the question was on the no upper pool dump.

Is that the question?

MR. OKRENT: Yes, it was.

MR. WEINKAM: And not the vacuum breaker.

MR. ELTAWILA: From what we have observed, we have enough water for recitation for the ECCS.

MR. OKRENT: There is less total water?

MR. ELTAWILA: They have enough water. According to the design criteria, they have enough water because they don't have water entrapped in the drywell. They are not using the containment spray. So they have sufficient water in the pool that they don't need the upper pool dump.

MR. OKRENT: So if I can reiterate what I think I heard you say, despite the bad acoustics, the changed wetwell design does not modify significantly loads on components above the wetwell.

MR. ELTAWILA: That is correct.

MR. OKRENT: And there remains an ample margin of water in the wetwell for essential purposes.

MR. ELTAWILA: That is correct.

MR. EBERSOLE: May I ask a question. You have some modifications to this containment which are significant. I would like to have you state are any of those in the direction of increasing the possibility of suppression pool bypass? I noticed you had some ventilation paths which apparently couple the drywell to the containment proper, and I am aways interested in bypassing the suppression pool, the steam flow, because if you do it, you have a problem with rising pressures in the secondary side and here you don't have sprays to knock that down.

So can you tell me in comparison say to Grand Gulf that you reduced or increased the possibility of suppression bypass?

MR. WEINKAM: Sir, I can't answer that question specifically.

Dr. Eltawila, can you.

MR. ELTAWILA: Having no vacuum breaker flows reduces the possibility.

MR. EBERSOLE: That reduces it.

MR. ELTAWILA: That reduces it.

MR. EBERSOLE: I am interested in the other side of the coin.

MR. ELTAWILA: The other side is that you have the hydrogen mixing system on River Bend is connected between the air space and ---

MR. EBERSOLE: And I notice you claim the redundant mechanical features which are quite coincident, but I am struck with the balance here that I have seen too many incidences of simple mechanican redundancy where the dependence on that concept was too heavy.

MR. ELTAWILA: But the two valves you have in the ECCS are isolated at all times and they are not used during normal plant operation.

MR. EBERSOLE: Will we get some sort of a picture of the critical aspects of that design in respect to avoiding containment bypass, a sketch or a slide or something? I just want to be able to assess the mechanical nature of it against the terrible responsibility it has.

MR. ELTAWILA: I don't have any slides. Maybe the applicant has some.

MR. WEINKAM: Mr. Ebersole, I believe the applicant is going to address that.

MR. ELTAWILA: I would like to add one thing, that the plant is designed to bypass through that valve.

MR. EBERSOLE: I have some reluctance in trusting simple mechanical redundancy of certain kinds.

(Slide.)

MR. WEINKAM: River Bend Station uses a leakage control system for the main steasm isolation valves and certain penetration valves. These systems minimize the release of fission products from process lines that penetrate the containment and could bypass the standby gas treatment system and the fuel building charcoal filtation system following a loss-of-coolant accident. The leakage control systems use category one air compressors. These systems are manually actuated by the control room operators.

(Slide.)

As a final feature of interest, I would like to highlight the standby cooling tower which serves the facility as the ultimate heat sink. This mechanical draft seismic category one tornado missile protected cooling tower incorporates a six-and-a-half million gallon basin of water. This inventory of water provides River Bend Station the capability to safety and reliably reach and maintain cold shutdown even if the normal service water system provided by the four mechanical draft cooling towers is unavailable. These towers and their associated basin are provided makeup water from the Mississippi River.

Various sources of makeup water to the ultimate heat sink are available, including shallow and deep wells and the Mississippi River.

MR. EBERSOLE: Is all of this water used in its normally cooled mode, or do you have to refrigerate any of it for some of your cooled components?

MR. WEINKAM: It is in a normally cooled mode, sir, and no refrigeration is required.

MR. EBERSOLE: And you have no class one refrigeration systems?

MR. WEINKAM: No, sir, I don't believe River Bend has that.

MR. WEINKAM: I would like now to discuss some of the open items in the safety evaluation report.

Issues are classified as outstanding issues in the safety evaluation report if the issues have not been resolved by the applicant at the time of issuance of the safety evaluation report.

Of the 18 open issues in the safety evaluation report, none have been closed out since the SER was published less than a month ago. However, the staff and applicant are now in substantial agreement on the path to resolution of all issues.

(Slide.)

I have three slides summarizing the issues, and I would just like to go right ahead and highlight some of the issues of interest. There are summary sheets in your package on all 18 issues.

The staff is currently reviewing submittals by Gulf States Utilities on three issues:

Open Item 1, hydrostatic loading of safety related structures as the result of probable maximum precipitation accumulating in the Unit 2 excavation.

(Slide.)

Item 14, the availability of adequate communications following the seismic event and/or loss of off-site power.

(Slide.)

And Item 15, the adequacy of emergency lighting in safety related areas following the seismic event.

I believe that these issues will be resolved in the next few weeks.

MR. OKRENT: Could I ask a question. Somewhere in the SER there is a discussion of local precipitation and I believe a statement by the staff that they are not satisfied in that regard. Do I remember something incorrectly?

MR. WEINKAM: The applicant initially had calculated his probable maximum precipitation based upon Hydrometeorological Report 51. Recently the applicant has updated it to HMR 52, and that is the basis that we are using for PMP.

MR. OKRENT: Well, I am just trying to understand the statement on page 2-10 which says "Thus, the staff finds that the applicant has not demonstrated that safety related facilities are adequately protected against the effects of local PMP on the site."

MR. WEINKAM: Yes, sir. That open Item No. 1, the hydrostatic loading. Part of that concern arises from the fact that West Creek, I belive it is, which is to the west side of the facility, we are looking now at the plant runoff accumulating in the Unit 2 excavation and the result in hydrostatic loading which occurs as a result of that.

Gulf States has provided some information to show that the expected precipitation conservatively, which would accumulate in the Unit 2 excavation, would not exceed the hydrostatic loading predicted for the structures for which they were designed, the safety related structures adjacent to the Unit 2 excavation. So that is essentially what that issue is about, sir.

MR. EBERSOLE: Let me mention a few topics so we can set the stage for some answers that might come later.

I wondered what model you might be using to analyze the Appendix R problem as you go about the plant, and let me just collect these, I am not looking for answers. And this just comes from walking through your paper here.

I notice you have extremely low bypass and it suggests you are going to, without fail, that you are going to have a number of stuck safeties in the first year or two. I understand you are putting additional bypass in later, and I would like to hear about your intended plan to cope with stuck SRV's which you are sure to experience.

This plant has unusual features. It has got main feedwater pumps which are electric and there are no booster pumps. I don't see the equivalent of the old standby coolant pumps which get water into the reactor via the main feedwater system by some low pressure pump complex, and you might tell us whether you have any or not.

I noticed that you have upgraded RCIC from standard commercial grade to safety grade, and I wondered what you actually did to do that.

In view of these changes in design, can you give us sort of a summary of how many ways you can get water into the loop if you can successfully depressurize it with the SRV's. Evidentially you cannot do it in as many ways has as been done in the past.

That is all I have momentarily.

(Slide.)

MR. WEINKAM: The staff and applicant met earlier this week in Bethesda to discuss open issue No. 9, bypassed and inoperable indication. GSU will be submitting to the staff by the end of July proposals for control room benchboard modifications and procedural requirements to close this issue.

The proposed resolution of this issue will also be reviewed by the Human Factors Engineering Branch during the control room design review audit tenatatively scheduled for late July.

The staff has met with Gulf States Utilities to discuss the applicant's program for the qualification for nuclear services of the two Trans-American Delaval R-48 diesel generators used at the River Bend Station as standby diesel generators.

This qualification and the implementation of NUREG CR-0660, diesel generator reliability enhancements, are included in Open Item No. 10. Gulf States Utilities is a member of the TDI owners group working toward a generic resolution of the TDI diesel generator qualification questions.

I believe GSU will discuss in depth later in this meeting their program for the qualification of the TDI diesels.

(Slide.)

Mr. Ebersole, I believe you earlier questioned about Appendix R for River Bend. The staff and GSU has discussed Open Item 13, which is ultimate shutdown of the plant following a fire which completely destroys the control room. This issue has remained open as a result of differenes between the staff and the applicant concerning the magnitude and the time it takes for a fire to spread and engulf the entire control room.

River Bend does not electrically isolate from the control all systems required for shutdown. Those systems which operate without operator control, such as the ventilation system, are not isolated. Those systems which require operator control are available on the remote shutdown panels and are electrically isolatable.

Recent discussions between the staff and the applicant have clarified the criteria of Branch Techical Position 9.51 with regard to the active failures of equipment and the analyses required. Gulf States Utilities will be making a submittal by the end of July addressing how River Bend will meet this position and therefore satisfy the ultimate shutdown capability concern.

MR. OKRENT: I am sorry. I missed your last sentence. Would you mind saying it again.

MR. WEINKAM: GSU will be making a submittal by the end of July discussing the criteria of Branch Technical Position 9.51 for ultimate shutdown capability and should satisfy the staff's concerns.

The question of the electrical isolatability and the single failures in the control room causing a single worst case event of a system will require some procedures and possibly some hardware modification to meet the ultimate shutdown capability from outside the control room.

MR. OKRENT: So you still expect to require electrical isolation for all system required for shutdown or not?

MR. WEINKAM: No, sir. Procedure modifications may be able to resolve the concern from a worst failure or multiple failures causing, for instance, in the RHR suction line there are two motor operated valves, and a single failure of those could cause a fire induced LOCA, in other words, from a reactor coolant system into the RHR system which is a lower pressure system.

There are fixes for that. You could just rack out one of the breakers so that even if you did have a hot short, that valve would not open. Other concerns might be an ADS actuation as a result of a fire and there may be hardware changes or procedural modifications to tech specs or things like that which would fix those concerns.

MR. EBERSOLE: Well, in the final analysis do you take issue with any of the current requirements of Appendix R? I guess that is the gist of it?

MR. WEINKAM: Does the applicant?

MR. EBERSOLE: Yes.

MR. WEINKAM: I do not believe the applicant believes our postulated fire which engulfs the control room instantaneously essentially, but I believe that Gulf States will be able to work out to the staff's satisfaction the concern in spite of that disagreement.

MR. EBERSOLE: We noticed the auxiliary shutdown systems, and they seem to be comparatively close to the scenes of potential trouble. Is the degree of isolation in the physical context of those emergency shutdown panels and centers adequate? Have you examined that?

MR. WEINKAM: I can't answer that question, sir. I will find out.

That is all I have on the open issues, if you have any other questions.

MR. EBERSOLE: I might comment on why I raise that question. On page 1.4 of the SER the remote shutdown panel is said to compensate for conditions wherein the control room is uninhabitable but not damaged, and that, as you know, is inadequate.

MR. WEINKAM: I am sorry, sir?

MR. EBERSOLE: The lack of habitability is not the problem. The problem is compounded damage

MR. WEINKAM: Yes, sir.

MR. THEOFANOUS: Excuse me. Maybe I missed it. Was it not an open issue, the velocity of the pool swell because the present design is a little higher, and there was some thought given to the idea of using a lower velocity than in other designs?

MR. WEINKAM: You mean for containment pool swell?

MR. THEOFANOUS: Yes.

MR. WEINKAM: Yes, sir.

MR. THEOFANOUS: Is it closed now?

MR. WEINKAM: No, sir, it is not closed now.

MR. THEOFANOUS: Okay. So probably I missed it because I came in late.

MR. WEINKAM: I didn't highlight that one.

MR. THEOFANOUS: Oh, you did not highlight it.

MR. WEINKAM: Open Item No. 7, containment loads references three sections of the SER, and that has to do with, Dr. Eltawila correct me, the pool swell concern, SRV actuation and it is in your package.

MR. THEOFANOUS: That is okay. But I think just to clarify, I thought that you talked about the open issues here, but you only chose to choose some of them.

MR. WEINKAM: Yes, sir. I don't believe we are going to have any difficulty closing these issues. The applicant is due to submit that later this year I believe, in late '84 or early '85.

MR. THEOFANOUS: How are you planning to close it, by some analysis?

MR. WEINKAM: Dr. Eltawila.

MR. ELTAWILA: We are going to have an analysis done by our subcontractor. The acceptance criteria is out now and the applicant is assessing its plan against the acceptance criteria. Once they provide their answer, we will know where they stand on each issue.

MR. THEOFANOUS: So your consultant is going to provide the analysis or GSU is also going to provide the analysis?

MR. ELTAWILA: GSU has to provide us first with their response to the acceptance criteria, their position to the acceptance criteria.

MR. THEOFANOUS: And you are going to have your technical consultant on that issue.

MR. ELTAWILA: That is correct.

(Slide.)

MR. WEINKAM: There are 64 confirmatory issues identified for River Bend Station. Confirmatory items are items that have essentially been resolved to the staff's satisfation but for which the applicant has not yet provided certain conformatory information.

If this confirmatory information does not confirm preliminary conclusions, the item will be treated as open and the staff will put it on its resolution in the supplement to the safety evaluation report. Many of these issues require staff confirmation of procedural implementation, test results and drawing revisions for closure.

MR. OKRENT: Before you take that away, I am trying to understand why No. 19 on this list is confirmatory.

MR. WEINKAM: The hydrogen control issue has been a generic issue, and a result Gulf States is participating with the hydrogen control owners group. If the owners group has not achieved a satisfactory closure of the issue by the time of licensing, Gulf States will be required to provide some interim facilities for a hydrogen control, and as a result, we are in substantial agreement that they will either provide it or the issue will be closed.

MR. OKRENT: I find that a completely unsatisfactory definition of a confirmatory item. Your lawyer may like it or someone on the staff may like it, but to me it just hides an issue.

Are there any others on your list that are similar in character? In other words, where in fact it is not clear how the issue will be resolved technically, but you have put it in here under some kind of wording?

MR. WEINKAM: Dr. Okrent, let me get back to you on that. I wouldn't want to make that blanket statement right off.

MR. OKRENT: All right.

MR. WEINKAM: But I am of the opinion right now, if that is your interpretation, that, no, sir, that is the only one that I am aware of right now, but I will verify that and get back to you later during the meeting.

MR. OKRENT: In other words, I really want to know whether you mean it when you say by confirmatory the words you used at the beginning of your statement, and I would like to know it for each of the things that you call confirmatory because, in my opinion, it just doesn't apply for hydrogen.

MR. WEINKAM: Yes, sir.

MR. OKRENT: And it shouldn't have been applied to hydrogen either.

MR. EBERSOLE: May I ask a question. What is the status of the matter of hydrostatic uplift and so forth in the structures? That is not yet fully resolved, is it?

MR. WEINKAM: Hydrostatic uplift of the structures?

MR. EBERSOLE: Yes, the groundwater problem and the effective fill of the local No. 2 unit excavation.

MR. WEINKAM: Sir, that is an open issue. That is Open Issue 1.

MR. EBERSOLE: Another thing I noticed that seems to be curiously different from Grand Gulf is in your examination of potential floods you looked at few hundred miles upstream at the potential for dam breaks.

MR. WEINKAM: Yes, sir.

MR. EBERSOLE: And I noticed you never did get to Kentucky, and I thought, as I recall, that a Kentucky dam failure posed a substantial problem in the matter of going over the levers for Grand Gulf.

MR. WEINKAM: Well, the River Bend Station is located on a bluff.

MR. EBERSOLE: Is that the difference?

MR. WEINKAM: The west side of the river I believe is elevations 57 and ---

MR. EBERSOLE: Say no more. You are different from Grand Gulf in that aspect.

MR. WEINKAM: Yes, sir.

(Slide.)

Eight licensed conditions have been identified for the River Bend Station. Conditions 4 and 5 will be required to be completed prior to exceeding five percent power.

Item 4 is a demonstration that engineered safety features remain in the emergency mode following removal of the actuating signal or reset of the signal.

Item 5 requires a post-accident sampling system, procedures and training meeting staff criteria prior to operation in excess of five percent power.

MR. OKRENT: I would like to understand something about Item 3. Has the staff decided that it is crucial that rod internal pressure not exceed system pressure and, if so, do the fuel element designers agree that this is crucial or just what is the technical status of the issue as aside from the licensing status?

MR. WEINKAM: I believe the issue as originally defined was that the fuel rod internal pressure was not addressed specifically by General Electric as a concern, you know, the difference in the reator coolant system pressure to the eventual pressure due to some conservative analyses. As a result, since that had not been directly assessed, the staff is of the opinion that some conservatism was involved in that.

However, recently some information has come in showing that this information may not have been as conservative, and as a result now up to the second cycle of operation the plant will operate satisfactorily, but the analysis will be required for the longer term operation.

I am not sure I answered your question.

MR. OKRENT: Do you expect GE's technical position to be that it is acceptable for internal pressure to exceed system pressure by some amount, or that over the long term they will agree that it is necessary to keep internal pressure below system pressure?

MR. WEINKAM: I don't have an answer for that, sir. I will find out.

(Slide.)

The final three licensed conditions are as identified.

That is all I have, sir. I will turn it over now to Mr. Johns Jaudon, the Chief of the Reactor Section responsible for River Bend who will speak on enforcement and SALP.

MR. OKRENT: Let see if there are any further questions at this time.

(No response.)

MR. OKRENT: By the way, I should ask are there any disagreements within the staff on technical issues concerning River Bend?

MR. WEINKAM: No, sir, there are not.

MR. JAUDON: Good afternoon, ladies and gentlemen. I am Johns Jaudon, the Chief of the Reactor Projects, Section A, in Region IV.

(Slide.)

With regard to enforcement history, this slide shows the number of violations by year that have been given to River Bend. A review of these indicates no particular significance, including the year 1980 in which there were obviously more violations.

They were primarily, or the greatest single number of them were in the area of failure to follow procedure in concrete placement. However, that was the principal subject being inspected in 1980 at the plant.

The severity level of the violations breaks down as such.

(Slide.)

I have arbitrarily said that infraction and deficiency, which were older definitions, were quivalent to 4's and 5's today, severity levels.

The one level three violation had to do with failure to properly report a potential construction deficiency under 10 CFR 50.55(e). No civil penalty was assessed on the basis of prompt licensee action and at the discretion of the region which was permissible at that time.

(Slide.)

The correlation between violations and the number of inspection hours also is not particularly significant since the number of violations have not gone up as the number of on-site inspection hours at River Bend have gone up over the last few years.

In mid-1980 the first resident inspector was assigned, and that accounts for the increasing number of hours. In late 1983 a second resident inspector was assigned and, hence, we expect the number of inspection hours on site between the residents and the regional staff to increase through '84 and '85.

Any questions on the enforcement history?

MR. OKRENT: Are you giving us your assessment of licensee performance at the moment?

MR. JAUDON: No. I am going to get to the SALP in a moment.

MR. OKRENT: I just wanted to understand.

MR. JAUDON: Yes, sir.

(Slide.)

This represents the assessment for 1983 and for 1982, and those areas were rated by the Systematic Assessment License Performance Board.

Category 1 nominally means reduced NRC surveillance will be required, Category 2 means that you stay at the same level and Category 3 means increased licensee performance and NRC assessment or inspection is required.

For the last two assessment periods there have been no category three areas identified at River Bend, and there were in fact two areas up there under Category 1 at the last assessment which was conducted last fall or late summer actually when the period closed.

Of perhaps most significance is the Region's finding or the Board's finding, which includes NRR of course. The management control was Category 1, because that is, in our judgment, the most significant single category on the assessment.

MR. OKRENT: What do you mean when you say 1 for design control?

MR. JAUDON: What we meant was that we thought the design control process for our inspections, the sum total of them, was working well, the correct documents were getting in the field, that the work was being performed to those documents, that the design process when they found problems and had to get changes made at the craft level was being carried out well, the feedback loops were working and the process was under control and they knew what they were building.

This does not mean that we always technically agreed with them, but they had control of their process they were carrying out.

MR. OKRENT: Let's see, in view of what I see here, would you be surprised if between now and 12 months from now a reasonably large number of significant deficiencies in quality turned up?

MR. JAUDON: No, sir, I would not be very surprised for a couple of reasons.

One, the plant is getting to that point in construction where something that has been hidden in the past is going to show up in the test program. We have two very aggressive residents on site now and I hope to have a lot more support for them from the regional staff down here. I think we are going to have a lot more inspection hours and we are at a point when it is, in my experience, easier to find what is wrong.

When you are running water in systems and putting power on systems you find out if there is something wrong that got missed before somehow.

MR. OKRENT: Well, when I think back over some of the deficiences that have surfaced on some other plants and have led to at least considerable discussion, if not delay, they were not necessarily things that the NRC inspectors would find. In fact, I think they were things that surfaced for other reasons. So I am not at the moment sure I know why I should be satisfied just because you are going aggressive inspectors.

MR. JAUDON: Up to this point I would also say that a lot of that 1 in management control has been that the applicant's organization has appeared to the region to be aggressive in their pursuit of quality problems and getting them resolved. Obviously, all we do is sample and the onus is certainly -- I mean two residents to watch four or five thousand people is ludicrous unless we just sample. They have to have the organization that watches and the systems in place that make it correct.

MR. EBERSOLE: May I ask a question. I think as an example what Dave is talking about is with a SALP assessment, but with no other pressures, you probably would never have required that they put backup control centers with the main control room, would you?

MR. JAUDON: The SALP by itself, the process by itself, no, sir, I don't think I would.

MR. EBERSOLE: It would not, therefore, disclose, and I don't take that as a salient weakness, but it wouldn't disclose a design deficiency.

MR. JAUDON: No, sir. The SALP process is not designed to find design deficiencies.

MR. EBERSOLE: It is really just an examination of the applicant's performance against established standards.

MR. EBERSOLE: NRR makes an input, but it is primarily based on the regional experience with the licensee in the inspection mode.

MR. EBERSOLE: It wouldn't have criticized the 10 percent bypass.

MR. JAUDON: Only if that came out of NRR as an issue they had trouble resolving with them, or the licensee was not responsive in resolving problems.

MR. EBERSOLE: What we know is that is going to trigger a great number of SAR functions, requirements that they function. That is going to lead to sticking valves because they all stick. That is as safety problem.

MR. JAUDON: Yes, sir.

MR. EBERSOLE: Now SALP doesn't do critiques like that.

MR. JAUDON: SALP does not. SALP looks at the performance of the plant, an operating plant, and many of these things are changed by such things as training and how they prepare LER's, how they handle what problems they do have and review them.

MR. EBERSOLE: It is the ritual.

MR. NOVAK: We don't disagree with you. My view of design and control is the applicant's ability to implement his design program, his quality assurance program, that he is following his program. If there is a mistake there, he is going to follow it, if he follows it to the letter.

The other programs that the NRC has had, and really I think you could say they been very small in nature are the requirements of an independent design verification program and some independent design inspections, which you will hear something more about by Mr. Allison.

It certainly doesn't answer your question. I think good design practice is in the design office, and we have not been able to independently verify it.

MR. JAUDON: If there are no more questions, let me call on Mr. Dennis Allison of the Office of Inspection and Enforcement.

MR. NOVAK: I think one thing to go back to would be to go back to the Grand Gulf experience where only after they did their hot functional testing did they establish that there were some deficiencies in the design of the containment cooling, and it was there only because she saw the temperatures in the containment rise, and whether it could have been caught by an indendent design or some other QA.

I think the applicant here, that it is a fair question to him as to what he may have learned from earlier BWR 6 MARK III designs.

MR. ALLISON: My name is Dennis Allison. I was the Inspection Team Leader for an integrated design inspection that we recently did at the River Bend facility.

What I planned to do, but I want to ask you first if this is what you have in mind, is to spend a few minutes describing the inspection, and if you want to spend additional time, I can spend a few more minutes discussing a few of the more interesting findings that we have from that inspection.

Does that sound about right?

MR. OKRENT: We can try it.

MR. ALLISON: Okay. On the inspection process itself, this is a pretty substantial and expensive effort. This team had 13 members. They will be working most of the time for about four months to complete the process. That includes four weeks of direct inspection, and in counting overtime and subtracting travel, that is about 2,000 hours of direct inspection time. So you can compare that with I think it was about 1,800 that the residents put in in the normal construction of the plant in a year.

We pick a sample system, and for this

inspection it was the RHR sytem in the LPCI mode in the ADS system. We looked at as many details as we could in the time available to generally see if all of these details that we look at are correct and straight.

We looked in five disciplines, mechanical systems design, mechanical components or mechanical engineering, civil engineering, electric power systems and instrumentation and control systems.

We kind of like to use the sample system or the vertical slice approach. For our purposes it seems to give the team a focus for the different disciplines and we talk to each other about issues.

MR. EBERSOLE: You speak of sampling systems, and let me mention one that you might think about. If this plant ultimate overall safety depends on anything very much, it is on the ADS depressurization valves. These are typically qualified by type testing, one out of "X" hundred. I have yet to hear of an applicant or the NRC doing a few grab samples out of the pile that is in the warehouse and confirming whether the type testing function works, and I am highly suspicious of the viability of these in fact beyond the type testing mode of getting that reliability.

Do you do anything like that?

MR. ALLISON: No. We seldom come up with an issue like that which is really a basic question about the validity of the type testing process as opposed to something that is related to reliability.

MR. EBERSOLE: You recall that these are energized solenoid valves that have to stay operative for months in a hostile environment.

MR. ALLISON: Yes, sir, but in this inspection we focused mostly on whether they did what they were supposed to do. So if they did a good type test, that is the requirement and we wouldn't normally raise the question about whether type testing was a good way to qualify something or to prove that it will work.

MR. EBERSOLE: Well, do you go back and then confirm that the rigidity and discipline in the production line ensures the type would be reproduced?

MR. ALLISON: No, we don't. That would be a good thing for us to look at. We sometimes go into vendors' shops, but we haven't done that in this issue. If we had time to get more detail, that would be a very good thing and it would fit.

Okay. Well, as I said, we emphasized looking at details, at calculations, drawings, the design product and seeing if it is adequate. We necessarily do a fair amount of procedure review, program review to understand who is doing what so we know where to test interfaces, but we are really trying to test the design and control process in a different way. The programs have been reviewed before and we are trying to test it by looking at the product of it. The bottom line would be the same of course whether the design process appears to be controlled.

The acceptance standard when you look at a calculation or a drawing is kind of broad. It is did the licensee or did the architect engineer do what he was supposed to to meet the regulations, the FSAR commitments and is it consistent with the project specifications with what other design orgnaizations have used and so on for the same numbers.

In the end when we issue the report we will make conclusions on whether the design process appeared to be controlled.

The River Bend field work started April 9th and it ended May 18th and we had an exit meeting with the licensee on June 1st. The first drafts of the report are in, but I haven't reviewed them.

I can talk about some of the more interesting factual findings. I really can't speculate on what the conclusions might be because they haven't been made yet.

Launching into then the findings, I should first mention the positive because the rest of the thing will be mistakes taht were made.

We did see a lot of high quality work in this inspection and a lot of competent and motivated people working, and I want to mention that before I start talking about mistakes, errors or other things that we found during the inspection.

One finding had to do with ball joints in the ADS discharge lines. Those lines have ball joints in them which are basically intended to take some of the loads off of the discharge nozzle of the ADS valves in the main steam piping that they are attached to.

The stress analysis for this particular line was not handled well in a lot of different respects. For instance, you know, one of the main purposes of the analysis was to show that those ball joints would get the discharge nozzle loads down below the GE interface requirement. The results exceeded the requirement and the analyst ignored it or overlooked it I should say and didn't notice it, although they were referenced. It wasn't that he wasn't aware of them.

There were problems with modeling the ball joints, installation criteria, getting them installed in such a way that when you are operating you want to have enough clearance on either side before you hit the stops, and a number of things like that.

I guess in the bottom line this was a unique situation, a pipeline with ball joints in it. It wasn't handled well, and it is kind of an anomaly because it appeared to us that the other stress packages that we looked at were handled well.

So that is all I have to say on that one right now.

MR. EBERSOLE: These downcomers from these valves, in any case do they traverse the wetwell air space?

MR. ALLISON: I don't know.

MR. EBERSOLE: I want to really know what the responsibility level of the ball joints is. If they blow inside of the drywell, it is just another intermittent LOCA. Do they traverse a space such that they could affect the containment bypass if they failed, the suppression bypass.

MR. ELTAWILA: It must be that the safety relief valves enters at an angle under the water level.

MR. EBERSOLE: It never traverses the secondary side, right?

MR. ELTAWILA: Right.

MR. EBERSOLE: Thank you.

MR. ALLISON: In the civil discipline we raised some substantial questions about the design of the sheer reinforcement in the shield building.

This reinforcement, according to the ACI code and the tensions under the concrete, should have been hooked around a horizontal scale and it was not. So in our view, it just does not meet the ACI code.

In addition, the tail pieces are pretty short. So that again, in our view, it doesn't meet the length requirements of the ACI code to develop the strength of the bar which basically keeps it from pulling out of the concrete.

Stone and Webster believes that they can perform some reanalysis and show that it is nevertheless technically adequate. In part that reanalysis will be based on some reduction in the sheer loads that has been made possible due to another fix of pouring concrete in the bottom 20 feet or so of the annulus.

We looked at several other wells where this sheer reinforcement was used on River Bend, and on those walls we also found, in our view, that it doesn't meet the ACI code. It is not wrapped around horizontal steel. However, in those cases it does meet the length requirements or nearly so. So that we don't have questions about the technical adequacy of those other walls.

There is one factor I ought to mention here. This particular design, although we have come along now and we don't agree with it. In fact, we think it is a bad design. It was known. It wasn't a case of an analyst making a blunder and the supervisor not knowing about it. It is clearly marked on the calculations, you know, words to the effect that this approach isn't explicitly addressed in the code, but we think it is all right. It was all documented there. It wasn't something that slipped through the process. It was a knowing decision, which is a plus.

We have another question about sheer reinforcement in the auxiliary building basemat. There isn't any there, but we have some questions about the calculation that justified the lack of sheer reinforcement there. Basically to make that story very short, I guess in the ACI code there are two ways to check for sheer, depending on whether you treat a slab as a two-way slab or one-way slab.

The designers used a third way that wasn't the same as either of the two ways talked about in the code. When you look at the details, there will be spots on the mat, I am pretty sure, where there are problems in meeting the code requirements.

Like with the first one, Stone and Webster intends to provide an analysis to show that it is technically adequate, and we will review that when they provide it to us.

In the mechanical systems discipline, there were some problems in RHR flow rate calculations. In particular, the designers were working to a GE interface requirement that said put orifices as necessary to limit the runout flow to 6,060 gallons per minute and that will take care of cavitation problems or prevent them.

The calculation had some errors in handling the pump curves in it and it came up with a flow of 5,700 and something gallons per minute. The correct answer should have been 6,000, which for the width of a pencil is the same as 6,060.

When you look at that situation and you go back and consider that the friction factors used were not conservative for this purpose and so on, when the whole thing is reanalyzed there is a chance, but not a certainty that in fact orifices will be needed.

The next one in that discipline is there were some errors in the calculation of post-LOCA flooding effects. One part of the calculation had to do with the RHR pump room, and it was determining the time that it would take for the operator to be warned of a pump leak or packing leak or what-have-you in that room so he could close the isolation valve and take care of it.

The calculation failed to note that there are some pumps in that room that had a capacity greater than the assumed leak rate. So the analyst started off with an 80 gallon-a-minute leak rate and said it will take so many minutes until the operator is warned. However, there are two 50 gallon-a-minute sump pumps in that room. So that was an error in analysis an that will have to be done over. Theoretically I suppose the operator would never be warned and he would just keep pumping out of the sump pumps.

The second one is that one of the objectives of that calculation was to address packing leakage in the first isolation valve. That objective was just totally not met by the calculation because the valve is outside of the room.

Those two problems will require some design changes at least in the area of instrumentation to let the operator know about the leak and possibly more, but I don't know just exactly where that one is going.

Finally, the final instance I will mention has to do with the pneumatic air supply to the ADS valves. We have a whole slew of specific findings, none of which seems to mean very much by itself about what a check valve specification said and so on.

What it all amounts to on the bottom line though is that the designers bought safety-related air compressors to provide the long-term air supply for the ADS valves. When they did that, they made the assumption, and erroneously, that that took care of everything and there was no need for the accumulator check valves to be leak tight and things like this they didn't specify for leak tight checking.

We can't see right now though where any equipment changes will be required. They will have to have tech specs that keep the accumulators at 150 psi and leak testing on the check valves that hold the air in the accumulators.

I have to give GUS credit that GSU engineers, they hadn't identified the errors that we found, but they had identified the issue of tech specs and leak testing as something that needed to be dealt with in the start of test program and in the tech specs.

MR. EBERSOLE: May I ask you a question. When they bought those safety grade compressors, what did they use for jacket cooling on those compressors?

MR. ALLISON: I don't know. The problem that I am aware of is that they don't provide a high enough air supply and they fail to notice that you are going to lose one of them if you lose the diesel and that doesn't give you enough ADS valves.

MR. EBERSOLE: So they still have the local, individualized air suppy at each SRV, or are they manifolded?

MR. ALLISON: Yes. The accumulators are there and there is a non-safety grade air compressor that provides enough pressure. But I would have to ask the licensee what he used for jacket cooling, or you will have to ask him.

Okay. I think I will stop there. We have some others that have design implications, but I think that I have covered the most interesting ones first.

MR. OKRENT: What implications, if any, does the staff get from a set of results such as you have just reported?

MR. ALLISON: Well, do you mean for this plant, Dr. Okrent, or in general.

MR. OKRENT: Right now we are talking about this plant.

MR. ALLISON: Well, that really sounds like what the conclusions of the report might be which I am not going to speculate on. But what we will in general try to do is we will try to draw threads through different findings and we have a lot more that, you know, weren't on the interesting list, and try to identify whether there is a systematic weakness or a weak group or a weak discipline or whether the stress analyst can't be trusted to handle unusual situations and things like that.

Then in the report we will say that and make recommendations. If we should think an area is not good enough or wasn't controlled well enough, we will make a recommendation that is rather clear to the NRC management that something ought to be done about that.

MR. OKRENT: Well, I assume behind the basic idea of doing a sampling investigation is that there is some measure that says either the results of this sample are such that further sampling is not needed or it is.

I am trying to understand is there such a measure and, if so, what it is. I gather you are not prepared to say where this one falls, but is there such a measure?

MR. ALLISON: Yes, there is, but it is really judgmental. It is based on experience that team members have design experience in a wide diversity of organizations. It is really a judgmental standard or it relies on one's judgment.

MR. OKRENT: So you are saying there is no measure and it is applied in an ad hoc fashion.

MR. ALLISON: Yes, that is right. The system is fairly uniform. You stack up the mistakes you find and ask yourself whether that seems to be too many or not.

Okay?

MR. OKRENT: Okay for now.

Dr. Trifunac: Is it an appropriate time to ask now about this filling between the concrete and steel shell or not?

MR. OKRENT: I am going to suggest that we delay this, and I will tell you why in a minute. If I understand Dr. Theofanous' schedule correctly, he has to leave here at a quarter to five today. So I am going to in a minute propose we take a short break and then deviate from the printed agenda to deal with the issues closest to Dr. Theofanous' heart which I will assume, and he can correct me, are MARK III containment issues as one, and possibly hydrogen control issues as a second, but I will let him tell me which issues he would like to hear today.

MR. THEOFANOUS: That is fine.

MR. OKRENT: So if you will permit me to modify the agenda to accommodate one particular travel schedule, we will not take a 10-minute break and reconvene promptly in 10 minutes and go on to those issues. Then we will come back and pick up where we were and, Dr. Trifunac, you can put in your question then.

(Recess.)

MR. OKRENT: The meeting will reconvene.

We will go to the item called containment systems.

MR. REED: First of all, I would like to introduce myself. I am Bill Reed, the Director of Licensing for Gulf States.

As you pointed out, we are into Item B(a) on containment systems. Dave Lorfing is a nuclear engineer is in our Nuclear Plant Engineering Department. He has been with Gulf States for six years and has been involved in River Bend for the last four years. He has a bachelor of science and nuclear engineering degree from Texas A&M Univeristy and also a master of engineering degree in nuclear engineering from Texas A&M.

Dave.

MR. LORFING: All right. I am going to discuss today the differences in the River Bend containment and the other MARK III containments, the other MARK III's being Grand Gulf, Clinton, Perry and General Electric standard safety analysis report design.

(Slide.)

I think this morning on the tour you got an idea of the basic design of the MARK III containment. So I am not going to go through any of the overview here unless you wish.

MR. THEOFANOUS: Excuse me. Let me ask a question. The way that this picture is shown over there, maybe I am mistaken, but I saw that after the floor of the drywell, below the floor of the drywell, in looking inside the pedestal area I saw a very bid cavity. Is that to scale there, or is it not paying attention to this detail?

MR. LORFING: Is this area?

MR. THEOFANOUS: Inside the pedestal. Inside the pedestal I was sitting on the drywell floor and I went back in and I saw a rather deep cavity going down deep. Is that to scale there or this is only schematic and it is not shown.

MR. LORFING: I am not sure on the design of that. This is Tom Szabo of Stone and Webster.

MR. SZABO: Tom Szabo, Stone and Webster Engineering Corporation. Right in here under the pedestal you are talking about. Yes, there is a cavity under there and that is for removing your control rod drives and servicing your control rod drive mechanism.

MR. THEOFANOUS: What I am asking you is that by looking at this picture I am getting a perspective of what is the geometry of that cavity inside the pedestal. I guess what I am saying is, and it is possible that it was my own eyes or my perspective, but what I saw this morning was rather different with that cavity being much deeper than the diameter. When you sit on the on the drywell floor ---

MR. SZABO: Well, of course, this drawing is not drawn to scale.

MR. THEOFANOUS: So this is only schematic.

MR. SZABO: Yes.

MR. THEOFANOUS: Okay. So it is a very, very deep space going down.

MR. SZABO: Yes, it is relatively deeper than it would look here.

MR. THEOFANOUS: Thank you. That is all I wanted to check.

MR. EBERSOLE: Well, against that drawing or on a later drawing are you going to show us the mechanisms which couple the drywell to the containment proper. In particular, those piping systems I think you have a mixed ---

MR. LORFING: We will discuss steam bypass.

MR. EBERSOLE: Okay.

MR. LORFING: I don't have a drawing that shows all the penetrations of the drywell, but I will discuss that.

MR. THEOFANOUS: What I would like and the reason I bring it up is I would like to suggest, although I don't think it is proper to discuss it here, is for people who are concerned on PRA's and on severe accidents, when they look at sketches like that, they form a totally wrong perspective as far as what will be happening in that cavity there. So I would recommend that you make it more like what it is.

MR. LORFING: All right.

I am going to be discussing the four design features today.

(Slide.)

The first design feature is containment heat removal, and more specifically suppression pool bypass or steam bypass drywell leakage.

All MARK III containments use suppression pool cooling as the primary means of containment heat removal, that is, any steam would be directed through the drywell and suppression pool. Then we have a suppression pool cooling system for containment heat removal. In addition, we must deal with steam bypass which has the potential for containment pressurization.

River Bend is designed with two safety related unit coolers. In addition, the passive heat sinks in containment provide for the mitigation of this containment pressurization or mitigate the effects of steam bypass. The other MARK III's do use containment sprays.

You asked about the hydrogen mixing system in particular. The hydrogen mixing system has four penetrations through the drywell, two six-inch inlet lines and two six-inch exit lines.

The River Bend drywell analysis or bypass analysis, in that analysis we can handle one of those lines being opened and still meet the design requirement of one square foot, A over the square root of K.

MR. EBERSOLE: Is this a network of valves really that permits the single failure criteria to be applied?

MR. LORFING: Could you repeat that?

MR. EBERSOLE: I say is this a set of valves that enable you to postulate failure to open and failure to close?

MR. LORFING: All right. Each penetration in the hydrogen mixing system has two motor operated valves on those lines for isolation.

MR. EBERSOLE: It is a set of four valves?

MR. LORFING: No, it would only be two valves in series on each line.

MR. EBERSOLE: I see. So there are four all told.

MR. LORFING: There are four penetrations. So there would be eight isolation valves, two on each penetration.

(Slide.)

MR. EBERSOLE: Is sounds like there are eight, but they are reduced to two when you look at system supplies; am I correct?

MR. LORFING: When you look at?

MR. EBERSOLE: When you look at the system supplies to run the valves.

MR. LORFING: That is correct. It is two divisional power supplies. The power supply for the motor operated valves comes from two divisions, two separate redundant divisions.

MR. EBERSOLE: The valves are normally opened or normally closed?

MR. LORFING: They are normally closed valves.

MR. EBERSOLE: And they stay in position when they are de-energized?

MR. LORFING: The valves can be used for equalization of pressure between drywell and containment if the drywell is at a lower pressure than containment on a negative pressure type event. So they can be used during operation.

MR. EBERSOLE: If the valves are inadvertently left open, you have excessive containment bypass, right?

MR. LORFING: According to the analysis, and the analysis has been done with one line open.

MR. EBERSOLE: And with more than one, then it is beyond the analysis.

MR. LORFING: That would be correct.

(Slide.)

This next item is the containment external pressure design. That is the containment must be designed for events which cause negative internal pressure. The River Bend event, which causes this negative pressure transient, is the failure of the containment unit coolers to stop operation on low containment temperature. In other words, if they were required to cycle off and they did not cycle off and continued to cool down containment.

In the other MARK III's this negative pressure transient is caused by containment spray actuation, inadvertent actuation of containment sprays.

The River Bend transient, the inadvertent operation of the unit coolers is a much slower and milder transient and takes a much longer period of time to occur. In addition to that, the cooling water supply is isolated to the unit coolers on low differential pressure beween the annulus and containment. So this is an automatic feature that these unit coolers will be isolated on low containment pressure.

MR. LORFING: In a case like that can those automatic interlocks be bypassed at the will of the operator, and that is just a generic question I am asking.

MR. LORFING: Can the automatic interlocks be bypassed by the operator?

MR. EBERSOLE: Yes. Does the operator have the option, should the interlocks stop him from doing something, of going in and bypassing the interlocks as a policy of design?

MR. LORFING: I would have to refer that to our controls engineer.

MR. GUHA: Once it interlocks you cannot override the system.

MR. EBERSOLE: He cannot override bypasses?

MR. GUHA: No.

MR. EBERSOLE: As a matter of policy, the operator cannot insert himself into interlocks and bypass them?

MR. GUHA: No.

MR. EBERSOLE: So he is effectively locked out by interlocks.

MR. OKRENT: Would you give your name, please.

MR. GUHA: Pranab Guha from Stone and Webster.

MR. LORFING: All right. The result of all this is that the River Bend containment structure can withstand these transients without the use of vacuum breakers. So we do not have containment vacuum breakers.

MR. OKRENT: Could you tell me how it was that River Bend chose fan coolers instead of sprays? Was it that one went through an analysis such as you are showing here and arrived at some kind of risk and cost balance or just what was the decision analysis?

MR. LORFING: The River Bend design never included containment sprays. When steam bypass became an issue, River Bend chose to upgrade its unit coolers to safety grade design for an active bypass mitigation system.

In addition to that, we do have passive heat sinks which we do rely on, you know, concrete structural steel in containment which acts as a passive heat sink in containment.

MR. OKRENT: Let's see, if I heard correctly, you said originally you had sprays ---

MR. LORFING: No. We have never had containment sprays.

MR. OKRENT: Oh, you have never had.

MR. LORFING: No.

MR. OKRENT: Why would, and I will have to say most since I don't know if it is all, of the other MARK III's use the sprays and not River Bend?

MR. BOOKER: This is Joe Booker with Gulf States. Let me see if I can help Dave to answer Dr. Okrent. When Gulf States was working on the initial design of River Bend, the people in the Gulf States Engineering Department had concerns about vacuum breakers and the leakage of vacuum breakers that the industry was experiencing about that time.

We asked Stone and Webster what type of alternate design from the standard GE design could they come up with that will eliminate vacuum breakers. If you have containment sprays as meet the standards, you have got to have vacuum breakers. So the alternative was to look at other means of cooling the containment.

We came up with containment coolers. Once we installed the containment coolers then we eliminated the vacuum breakers, and that was the real reason for the change on River Bend.

MR. OKRENT: What year was that decision made?

MR. BOOKER: In the early 70's, probably '72 or '73.

MR. OKRENT: Thank you.

MR. EBERSOLE: But I understand that the vacuum breakers were there to avoid excess differential pressure which you have now proven that you are not going to have anyway because you have got a 20 psid differential.

MR. LORFING: I was speaking of the containment. The 20 psid you are speaking of is the drywell I believe.

MR. LORFING: Oh, you are talking about the external containment.

MR. LORFING: I am speaking of the free standing, one-and-a-half inch concrete.

MR. EBERSOLE: Oh, the external containment. I was talking about the drywell.

MR. LORFING: Right.

MR. EBERSOLE: Were you talking about the drywell?

MR. OKRENT: I was trying to understand why they didn't have sprays and why the used the unit cooler. So the answer came as it did.

MR. EBERSOLE: So this was the vacuum breakers on the main external containment wall and not the vacuum breakers on the drywell.

MR. LORFING: Well, that was the reason for containment coolers rather than containment sprays for the external containment wall, that is correct.

MR. EBERSOLE: What is the maximum resistive capability of the external pressure in your design? I noticed you have a .43 to achieve differentials now. At what point will it fail considering that it is unstable when it does?

MR. LORFING: The negative differential pressure?

MR. EBERSOLE: The negative differential pressure.

MR. LORFING: For containment it is a negative .6 psi.

MR. EBERSOLE: It is negative .6 and then it is unstable ---

MR. LORFING: That is the design limit.

MR. EBERSOLE: And you are driving it to .43?

MR. LORFING: The containment unit coolers are isolated at .4 psi differential.

MR. EBERSOLE: So you are two-thirds of the way to its ultimate failure point?

MR. LORFING: We have about 40 percent margin between atmospheric. Okay. You have got .4. We isolate it at .4, and we get an alarm at .4. The design limit is .6. So we have approximately 50 percent margin on negative pressure. It is a slow transient.

MR. EBERSOLE: Yes, much slower than with the sprays.

MR. LORFING: That is true.

MR. EBERSOLE: That is the saving grace. Do you ever use refrigerated water in those coolers. It felt mighty pleasant up there today.

MR. LORFING: Do we ever?

MR. EBERSOLE: Use refrigerated water ---

MR. LORFING: Yes.

MR. EBERSOLE: That is the normal mode.

MR. LORFING: Yes. The normal mode of operation uses chilled water, the turbine building chilled water system. On a LOCA signal, those unit coolers would receive water from the standby service water system of the ultimate heat sink.

MR. EBERSOLE: Thank you.

MR. OKRENT: Would the staff remind me which of the other MARK III's uses the freestanding steel containment?

MR. ELTAWILA: We have Perry and GESSAR and River Bend of course using steel.

MR. OKRENT: You said Perry, River Bend ---

MR. WEINKAM: Perry, GESSAR and River Bend.

MR. OKRENT: GESSAR though is a proposal.

MR. LORFING: Right. Grand Gulf and Clinton are concrete containments.

MR. OKRENT: Yes. Perry has sprays, does it?

MR. ELTAWILA: That is correct. River Bend is the only MARK III plant that does not have spray. You are correct about that.

MR. OKRENT: Does Perry have a problem on negative pressure for its steel containment?

MR. ELTAWILA: No.

MR. OKRENT: Do they use vacuum breakers?

MR. ELTAWILA: They use vacuum breakers, yes.

MR. OKRENT: Thank you.

MR. THEOFANOUS: Excuse me. Have you looked into or are there any possibilities, any sequences or scenarios. You come up in pressure and you turn on the fan coolers and you come down to .4. Now you turn it off, but you have all the heat sinks on and you keep on condensing on the heat sinks. Can that drive you down to where you don't want to be by passive condensation from that point on?

MR. LORFING: I might call on Stone and Webster to address that.

MR. EBERLY: My name is Bill Eberly from Stone and Webster. We analyzed the negative pressure in an emergency cooldown and it was a very slow process and automatically the unit coolers are isolated and the fans are turned off.

We further analyzed the conditions of a post-LOCA condition whereby we were not using chilled water any more for cooling in the unit coolers, but using standby surface water, and even in that case, and your concern is relative to additional condensation of steam, with the heat sinks model and the additional unit coolers, the transient took something in the order of 1.7 hours to reduce it from minus five inches of water down to a minus 12 inches of water where those are normally islated. So in our mind there is no concern with a rapid condensation of steam driving this pressure down.

MR. LORFING: The next item is the drywell design for external pressure or a negative internal pressure event. I think we talked a little bit about this already, the drywell vacuum breakers.

(Slide.)

River Bend drywell is designed for negative internal pressure and for containment pressure or drywell external pressure without the use of drywell vacuum breakers, while the other MARK III designs do use drywell vacuum breakers.

In this event of a negative pressure in drywell, the suppression pool level inside the drywell rises and the suppression pool level in containment drops, the reverse condition of a loss-of coolant accident, until the vent structure in the suppression pool is cleared in the reverse direction and thus relieving the pressure.

River Bend is designed for this analysis. The drywell is designed for a 20 psid. I think the analysis showed a negative pressure or a negative differential pressure of 19.4, in that area. So we are designed for these conditions without relying on vacuum breakers.

MR. EBERSOLE: You really don't need that air return to the drywell feature, do you? I thought you could take the negative pressure even if it didn't occur. I am thinking about the rate question, the rate of depressurization of the drywell. That is a slow process to get the water down in the external. I thought you designed for a 20 psid, the theoretical differential, is that true?

MR. LORFING: Right, differential pressure. The design differential pressure between containment and drywell is 20 psid, and the maximum pressure reached in this event is 19 and a half approximately.

(Slide.)

MR. EBERSOLE: Could you explain to me when and if you ever have a hydrogen burn which consumes "X" percent of the oxygen of the total environment what then rapid pressure changes take place when that is condensed?

MR. LORFING: That will be addressed in the hydrogen control, and I would rather put that off because he is planning to discuss that.

MR. EBERSOLE: Okay.

The last item is design requirement for suppression pool vent coverage and emergency core cooling system pump net positive suction head during a blowdown event. This requires that adequate cooldown inventory be maintained following a loss of coolant accident while the emergency core cooling system pumps are drawing down the suppression pool level. We have the ECCS pumps pumping water from the suppression pool into the reactor vessel.

The minimum suppression pool level is reached when reactor vessel and the drywell holdup volume are filled. This drywell holdup volume is the volume inside of the weir wall. It is the bottom portion of the drywell inside the weir wall.

When this drywell holdup volume is filled, the water will flow over the weir wall back into the suppression pool. At this point the path is complete. The ECCS pumps are drawing down the suppression pool, water is going into the reactor vessel, spilling out the break and into the drywell and over the weir wall. So we have the suppression pool at its minimum level at that point.

At that point, that minimum level, both of these design requirements must be met, the suppression pool vent coverage and the ECCS pump net positive suction head.

The River Bend suppression pool is designed so that no automatic makeup to the pool is required during this event. The other MARK III containments do require upper pool dump. Upper pool dump is an automatic dump of the upper pool into the suppression pool.

The primary reason that River Bend does not require upper pool dump is that the drywell holdup volume has been reduced, or it is much smaller than the other MARK III designs. This has been done by using concrete fill in the lower portions of the drywell, in other words, raising up the floor of the drywell.

In addition, the height of the weir wall has been reduced, it is not as high as in the other MARK III designs, and also the reactor pedestal area has been sealed from the drywell volume so that the area underneath the reactor vessel is not a portion of the drywell holdup volume, and these three items reduce the effective size of the drywell.

MR. THEOFANOUS: That is what I was trying to ask before. You say it has been sealed. I saw a door this morning, a little door that is level with the floor in the drywell. Is that door supposed to be sealed during operation?

MR. LORFING: I would expect it is going to be sealed. It is going to be sealed.

MR. THEOFANOUS: How?

MR. LAND: Fred Land with Gulf States. That is a construction temporary door right now, and we will be installing a permanent pressure-tight, water-tight door in the near future which will close off the area from the suppression pool.

MR. THEOFANOUS: In this connection, and maybe this question in inappropriate and, if it is, let me know, but as you try to decide those things, are you also keeping an eye into the future where you may have to do some work for civilian accidents and what the implications might be?

MR. LAND: I personally couldn't answer that question.

MR. THEOFANOUS: As you try to decide what to do with the door, leave it open or closed, you know these days a number of reactors are going through severe accident analysis, and in fact many of them contemplate doing some changes.

MR. LORFING: You are talking about modifications in design?

MR. THEOFANOUS: Well, some reactors talk about modifications in the plant itself that is already operating. This has come up again and again, and I think from your point of view now is a good time to anticipate it a little bit so you don't get things done and then maybe have to re-evaluate or make changes.

I think specifically in this case if you seal the door, then you have got to worry about what happens to that big cavity that I was trying to indicate before. If you dump the molten core in there, where is the pressure going to go and where are the gases going to go.

Personally it will not bother me to leave it open from the point of view of the severe accident analysis, although in that case I think at least for some people you have to assess the question of steam explosions under there.

But if you have to leave it open, then what does that mean for the need to have automatic makeup? Is it a foregone conclusion that if it was open then you would need to have the makeup?

MR. LORFING: We would have to do the analysis. I am not familiar with the volumes. We would have to look at the specific design.

MR. THEOFANOUS: It looked like a pretty substantial volume there, but I thought that maybe not enough to cause you trouble ---

MR. LORFING: Our drywell holdup volume was reduced in several ways by using the concrete fill in the bottom of the drywell, reducing the weir wall height and also sealing the pedestal, and I am not sure what the contribution of sealing the pedestal was.

MR. THEOFANOUS: Well, in any case I think you might like to keep that in mind. At some point you will be asked to consider what the effects of sealing the pedestal is to a PRA treatment of a severe accident.

MR. LORFING: I wonder if I could ask you was there a particular reason that you just didn't fill it up with water instead of concrete?

MR. LORFING: And operate with water in the drywell?

MR. EBERSOLE: Yes, prefilled.

MR. LORFING: Can anybody address that? Would that have any effect on drywell equipment?

MR. EBERSOLE: The humidity.

MR. LORFING: I am not sure.

MR. McMORELAND: Bob McMoreland from Stone and Webster. As I understand the question, you are asking why did we not prefill the bottom of the drywell?

MR. EBERSOLE: Yes. Where you poured the concrete why didn't you just pour water?

MR. McMORELAND: The concrete that he is talking about that we used to reduce the water inventory was basically laid on the floor of the drywell. The drywell does not have a uniform top of concrete elevation. We raised the concrete up as much as we could and still achieve the equipment arrangement that we needed.

So we would have been faced with water in the bottom of the drywell, No. 1 and, No. 2, we didn't put it underneath the pedestal because that area has to be vacated for CRD maintenance during refueling and there wasn't any point to having water sitting in the bottom of the pedestal.

Also with the BWR-6 design, that is the low point inside the drywell in the containment for locating the sumps. So there is an ultimate low point sump in that area. If we had put water in there, we would have had problems then relative to leak detection, CRD leakage, and that type of thing that would have been masked.

MR. EBERSOLE: Right. Thank you.

MR. OKRENT: Excuse me. The sump at the bottom of the cavity below the vessel, that is not a general purpose sump I assume, is it?

MR. McMORELAND: No, it is only for the cavity.

MR. OKRENT: So the leaks might arise in the pedestal ---

MR. McMORELAND: Within the pedestal itself.

MR. LORFING: All right, this concludes my presentation.

MR. REED: The next item on the agenda is the MARK III containment issues. We have Mr. Craig Lambert who introduced himself earlier. Craig's title is Supervisor of Design Engineering. He has been with Gulf States for approximately five years, and prior to that he had ten years experience with Wisconsin Electric Power. He has a bachelor of science degree in civil engineering from Markette University.

MR. LAMBERT: Good afternoon. The subject of my presentation today is River Bend Station containment evaluation for new loads.

(Slide.)

New loads is a term that is commonly, as I am sure you are certainly aware, a common term to define those hydrodynamic loads that are associated with safety relief valve discharge events and a loss-of-coolant accident or a LOCA event.

The manner in which I intend to go through my presentation this afternoon is I will briefly touch on the various types of new loads or hydrodynamic loads. I will discuss our reactor building configuration and then follow that up with an evaluation that we have conducted to date.

(Slide.)

New loads can be defined as two basic conditions, a safety relief valve discharge, which would occur during operating conditions and a LOCA type event.

For safety relief valve events, we have looked at a number of valve cases, a number of valve discharge cases, one valve, two valve, seven valve, which would be the automatic depressurization system and 16 valve discharge cases. The 16-valve case as defined in Chapter 15 of our FSAR, that would occur based on a mainsteam isolation valve closure where all 16 valves would open and within approximately 12 seconds sequentially the valves would begin to close until we would have one valve controlling reactor pressure.

MR. EBERSOLE: May I ask again about frequency. How often do you have valves open beginning with a turbine trip?

MR. LAMBERT: How often would we have valves open?

MR. EBERSOLE: Yes. In a full-load turbine trip do all these valves open?

MR. LAMBERT: I can't answer that question.

MR. EBERSOLE: Can anyone answer that?

MR. EBERLY: On an isolation event we predict a group of eight valves.

MR. EBERSOLE: That is on each turbine trip?

MR. EBERLY: Yes. We hope initially to terminate the initial pressure spike and then subsequently close on their lower set pressures. Following that the full-load reset logic comes into play and controls one valve.

MR. EBERSOLE: Thank you.

MR. LAMBERT: Depending upon the number of valves that would open and release steam into the suppression pool, we would see pressures in the 10 to 18 psi range on the boundary of the suppression pool. That will last for approximately three-quarters of a second and that would be followed by condensation oscillation loads of approximately three psi.

The other type of hydrodynamic or new loads that we have analyzed the containment for are the LOCA loads. The dominant load would be either a recirculation line double ended break or a main steamline double ended break.

That would create annulus pressurization loads which would be asymmetric pressure between the primary shield wall and the reactor itself, and also loads upon the steel frame that frames into the primary shield wall.

Following the large line break, our drywell would fill with steam and the steam would be dissipated through the vents in the drywell wall into the suppression pool. We would see condensation oscillation loads as well pool swell loads, bulk pool swell, and as the pool rises we would also see froth drag and froth impact loads on structures as much as 30 feet above the suppression pool. Chugging would also occur.

(Slide.)

Dave Lorfing has touched on a number of the containment features, and I would like to address several during my presentation.

River Bend is a standard General Electric 218 plant with a 218 inch reactor pressure vessel. We have a freestanding steel containment which is one and a half inches thick with structural steel stiffeners in the lower 20 foot of the containment welded to the outside.

In addition, we have placed annulus concrete fill to reduce the dynamic acceleration associated with SRV discharge events.

I have a cross-section of the containment and I think that would facilitate describing a number of the configurations that we do have.

(Slide.)

I would like to point out that this is a cross-section through the reactor building. The SRV downcomers are actually on the outside of the primary shield wall, and the configuration really is not as shown here. They are routed in various configurations and then come down along the edge.

We have 16 safety relief valve discharge lines heading into the suppression pool and these are connected to the GEX type quenchers. To each of the quenchers we installed two horizontal struts back to the drywell wall to take the high forces that exist during the various actuations.

We have also got a slightly higher hydraulic control unit floor as compared to the GE standard plant.

Our hydraulic control unit floor is located approximately 24 feet above the high water line to the suppression pool.

As I indicated, we have a free standing steel containment. In the late '70s we added significant structural steel stiffening and several years later as the SRV loads were better understood, we embarked on evaluation to reduce the significant responses that result from SRV actuations and ended up placing 25 feet of concrete fill, which fills the entire space between the steel containment and shield wall. I pointed it out to you this morning during our tour.

Dave Lorfing had also touched on drywell maximum pressures. Our maximum negative differential pressure for the drywell is minus 20 psid. Our calculated pressure is minus 19.4, which is slightly less than the GE standard evaluation. A positive pressure following a LOCA is approximately 18.6 psid.

MR. OKRENT: Would you remind me again how you got that 19. something negative.

MR. LAMBERT: Well, I couldn't address it specifically how we got that. Stone and Webster did the calcuation and I would like to have them address how they arrived at that specific calculation.

MR. EBERLY: The analysis was an end point calculation in which we purged the air from the drywell and quenched all of the steam in the drywell instantaneously to 140 degrees saturation condition corresponding to the suppression pool temperature that we predict at the end of reactor blowdown.

The calculation took no credit for reverse air flow through the vent system such as a bounding end point condition. Similar GESSAR analysis yields something like 21.8 psid for a 25 psid negative differential design. We have the 20 psid differential design and calculate 19.4.

MR. THEOFANOUS: Are there any situations where you would be condensing the drywell at the lower pool temperature, that is prior to having a full blowdown in the reactor primary system?

MR. EBERLY: I can't conceive of any.

MR. THEOFANOUS: You could have a small break and you carry all of the air out of the drywell and you turn on the sprays.

MR. EBERLY: We don't have sprays, first of all.

MR. THEOFANOUS: Don't you have sprays in the drywell?

MR. EBERLY: No, we do not have any spray systems.

MR. THEOFANOUS: Why I thought I saw them in one of the pictures. Sorry about that.

MR. EBERLY: Some of the RHR system diagrams show what look like a spray header, and those are spargers that are actually in this upper refueling pool. The RHR system ---

MR. THEOFANOUS: What is the difference between a sparger and a spray?

MR. EBERLY: The spray system normally found in a MARK II or MARK I BWR is an atmosphere spray system which incorporates nozzles and sprays water into the air volume.

MR. THEOFANOUS: What does the sparger do?

MR. EBERLY: The sparger is submerged in this upper pool, refueling pool.

MR. THEOFANOUS: Oh, I see. Okay.

MR. EBERLY: So we don't have a spray system to rapidly quench the steam in the drywell, and our small break accident analysis shows that a considerable amount of time is required to purge the air for a small break and also the pool temperature rises due to SRV operation and so forth.

MR. EBERSOLE: You used an expression I am not familiar with. You said the end point calculation. This is not a working negative pressure. Is this the estimated pressure at which it will collapse?

MR. EBERLY: This is not the estimated pressure at which it will collapse, no.

MR. EBERSOLE: What is that number?

MR. EBERLY: I would have to defer to our structural people. You want to know what the ultimate negative pressure is.

MR. EBERSOLE: Just considering the unstable performance of a vessel under negative pressure loads, I just wondering how far away you were from the estimated collapse pressure. You don't intend to test this, I guess.

(Laughter.)

MR. EBERLY: No.

MR. LAMBERT: One other feature of containment, and it really doesn't show very well on this slide, but we have three rows of horizontal vents through a drywell wall. There are 43 vents for each of the horizontal cirferential locations for a total 129 vents and each of the vents 27.5 inches in diameter.

It submerges from the high water elevation of the pool, which in our case would be elevation 90, to the top of the top vent at approximately seven and a half feet.

(Slide.)

I would like to address our evaluation to date. The evaluation for new loads is composed of essentially two programs, a program conducted by General

Electric through their NSSS new loads adequacy evaluation program and the work that is done by Stone and Webster for balance of plant structures, piping and equipment.

The new loads program being done by General Electric is very close to being complete. Part of the program in the reactor pressure vessel, RVP, internals and associated equipment, mainsteam piping, recirculation piping, hydraulic control units and other associated equipment are evaluated through this program.

Based on the evaluation that has been done to date, GE has confirmed that the equipment is in fact adequate for those combinations of seismic and hydrodynamic loads based on River Bend's specific response spectra.

The only work that is really remaining in that program is an as-built verification of the mainsteam and recirculation piping. There are several branch connections that have not been installed yet, but the piping has in fact been confirmed adequate based on an as-designed basis.

(Slide.)

Regarding the Stone and Webster portion of the evaluation, the balance of plant structures, piping and equipment are analyzed by dynamic analysis considering all events from SRV and LOCA type loads.

As I indicated when I had the cross-section of the containment up, the SRV loads have necessitated a number of modifications to our steel containment. Stiffeners were added in the late '70s and we also added concrete annulus fill to reduce the dynamic responses. This was a needed reduction strictly from a piping and equipment qualification standpoint. The structure itself was acceptable as a freestanding containment.

The other loads would be the LOCA loads that are being evaluated. Condensation oscillation and chugging are considered to be not significant from a load evaluation standpoint. Fatigue effects associated with those events are considered in the equipment qualification program.

Pool swell and its associated loads and the annulus pressurization loads are considered significant.

(Slide.)

Regarding the pool swell loads, I would like to talk in a little bit more detail about those loads. I prefer not to address at this time the SRV loads. That definition has been in existence for some time and we comply with the criteria in GESSAR 2, Appendix 3B, as well as the NUREG 802 criteria for safety relief valve loads.

Our original design basis for pool swell froth impact loads was based on GESSAR Appendix 3B. At that time the definition was that the bulk pool swell following a LOCA, a large line break, that the velocity of the bulk pool swell is defined as 40 feet per second.

The froth impact was defined as 15 psi on our hydraulic control unit floor. The froth drag differential pressure was then defined as 11 psi, and we had applied that over only the solid areas on our hydraulic control unit floor.

The work that had gone on since the original GESSAR definition has now shown up in GESSAR 2, Appendix 3B as well as the draft NUREG 0978 criteria.

The important difference is that the pool swell velocity has been increased by 50 feet per second. The froth drag is essentially the same for our hydraulic control unit floor which the impact at the bottom of the floor would be approximately 15 psi, but the froth drag is now applied over the full surface of the hydraulic control unit floor.

With the incorporation of the draft NUREG 0978 criteria and the GESSAR 2 Appendix 3B, which we are in fact generally adopting at River Bend, we have had to make a number of modifications due to the higher pool swell velocity as well as the drag loags on our hydraulic control unit floor.

We have shielded all of the instrumentation lines, the safety related instrumentation lines that would be in the impact zone of the suppression pool. We have also made a number of structural modifications to the structural steel grading in the impact zone.

At elevation 95, which is five feet above our suppression pool, we have done local stiffening as well as at elevation 114, which is our hydraulic control unit, for we have recently confirmed that we will change the grade to a heavier thickness.

In addition, we have seen increased piping responses and support reaction due to the pool swell effects.

MR. THEOFANOUS: Let me ask you. You said that you are adopting NUREG 978. Does this mean also that you agree with it or you are only adopting it?

MR. LAMBERT: Well, that is kind of a hard question. I think GE certainly spent a great deal of time working with the staff in coming up with criteria that is placed in the NUREG.

We have gone ahead assuming that those are the requirements and in fact have and are in the process of analyzing our structures, piping and equipment that would be in that zone for the loads defined in the draft NUREG.

MR. THEOFANOUS: Does anyone from GSU have a personal involvement in the technical aspects of this matter or more or less you take whatever GE gives you in this area?

MR. LAMBERT: I have participated as an observer during a number of the presentations between General Electric and the staff back in the early '80s.

MR. EBERSOLE: Could you tell me in respect to the HCU's what sort of chronology do we have here? By the time the impact gets to the them, have they done their thing?

MR. LAMBERT: The bulk pool swell and following froth drag and impact loads occur within seconds after a large steamline or recirculation break.

MR. EBERSOLE: Well, so does the response to the HCU's. So how do they tie them up together?

MR. LAMBERT: I would have to defer that question to someone that is more familiar with the operating conditions of our hydraulic control units.

MR. McINTYRE: I am Jerry McIntyre from General Electric. The scram is well underway by the time the water froth reaches the HCU points. It is about three-quarters of the way complete. It is not quite that by the time the froth reaches that point.

MR. EBERSOLE: Thank you.

MR. THEOFANOUS: I want to clarify that one more time. I was under the impression that you had a difference of opinion on the velocities because your floor is higher. We heard earlier that you submitted a different analysis which is now evaluated by the staff. Now what you are saying is something different. Is that a difference or a change of approach that happened since these documents you are looking at?

MR. LAMBERT: We have not revised our FSAR. We are in the process of doing that right now to incorporate Appendix 6A which discusses the hydrodynamic loads.

MR. THEOFANOUS: I know, but I still don't know where you stand with respect to accepting what is in the generic MARK III containment walls versus coming up with some new analysis specific to River Bend which argues that the velocities would be less as applied to some higher floor elevations. What is the case?

MR. LAMBERT: Well, our hydraulic control unit is in fact higher than the GE standard. From the standpoint of the bulk pool swell loads, the 40 versus 50 feet, that occurs up to 18 feet. Above 18 feet we see breakthrough. We really don't see that the 40 versus 50 being a significant event. We have to shield whatever is in that pool swell bulk impact zone at 40 feet. So the increment of 50 feet really doesn't make that much difference.

MR. THEOFANOUS: So I don't understand still the point of dispute. If it doesn't make any difference, why does the stuff have to go to Brookhaven to do an analysis to confirm what you proposed in the first place? I am trying to figure out what is the point of dispute.

MR. ELTAWILA: He indicated to you that the information has not been submitted in the FSAR yet. So this information that he is presenting at this time is not part of the FSAR and the staff has not had the chance to review this information.

MR. THEOFANOUS: I thought you told me earlier that you received the information and you have been evaluating it. Did I misunderstand?

MR. ELTAWILA: No, I think you misunderstood me.

MR. THEOFANOUS: So what was the reference to BNL? After the information is submitted then you are going to submit it.

MR. ELTAWILA: That is correct.

MR. THEOFANOUS: But if the information is anticipated to be the generic MARK III logs which already the people have gone over and over, why do you anticipate a point of contention here? Still I don't understand whether there is a point of contention or not.

MR. ELTAWILA: I think you are misunderstanding the point here. The applicant, at the time we reviewed the

FSAR and we wrote the SER, they were proposing a different methodology. Now they are saying that they are going to adopt the generic methodology. The staff has not seen this information yet.

MR. THEOFANOUS: Okay. Well, that is what I was trying to ask you before. Apparently you had changed your mind on seeing the FSAR and instead of going ahead with the new methodology, now you find it easier to go with the established and accepted, is that correct?

MR. LAMBERT: Well, I am not sure if I would say it is easier, but we feel that it is more productive to adopt the criteria and go ahead with our construction.

MR. THEOFANOUS: Okay. Now I understand. Thank you.

MR. LAMBERT: I think the only area that we are looking at a River Bend specific criteria is in the area of reverse vent clearing. The definition of the reverse vent clearing is conservative as compared to a specific River Bend evaluation for reverse vent clearing.

MR. THEOFANOUS: Okay. So in all other respects you accept the established MARK III and in that area you are submitting a new analysis?

MR. LAMBERT: That will be addressed in our submittal of the FSAR. We have completed totally our evaluation of the reverse vent clearing impact within our drywell.

MR. THEOFANOUS: But you are going to do that.

MR. LAMBERT: That is correct. It is ongoing right now.

That concludes my presentation.

MR. OKRENT: Any other questions in this area?

(No response.)

MR. REED: The next topic then will be addressed by Mr. Less England. Less is a Supervisor in our Licensing Group and has been with Gulf States Utilities for approximately 10 years. He has worked on River Bend for seven years and has a bachelor of science and nuclear engineering degree from the Texas A&M University.

MR. ENGLAND: Good afternoon.

My presentation this afternoon will address briefly the activities that we have underway to address the issues rised by Mr. Humphreys about a year ago.

(Slide.)

I will assume that you are generally familiar with those issues since you did have a subcommittee meeting with him at about the time the issues were raised.

In summary, Mr. Humphreys identified 22 areas of concern and a total of 66 issues. When grouped together they boil down to about 22 different areas of concern.

These areas are being addressed in

approximately 50 action plans.

We were requested to respond to the issues raised by Mr. Humphreys in two letters which we received from the NRC on the dates indicated.

We provided four responses and have one to go.

Our first response basically indicated our involvement in owners group activities to address the generic issues and also indicated which areas were plant specific.

In December we submitted our plant specific and general action plans in some detail, and provided two updates, as indicated, and anticipate how a final report next month. This final report will provide all the information we believe is necessary for the staff to close these issues.

The feedback to date is basically contained in the SER. There were two areas identified in there that the staff had some continuing concern on.

One of those areas will be addressed in our July submittal with a revised analysis which we believe will resolve their concerns in that area.

The area of principal interest right now is in the tenth scale test to resolve local encroachment analysis concerns. Briefly in this area the owners group had done generic studies using a solid VOF computer code to demonstrate that the pool rise around an encroachment was not an area of concern.

There were some questions raised by the staff on some of the parameters and assumptions used in that analysis, particularly with regard to bubble equalization time, which are the principal parameter which drives the transient.

At the staff's insistance we embarked on a tenth scale testing program which has been completed in the last couple of months. Data analysis is ongoing. The final results have not been published just, but the analysis is ongoing at this moment.

MR. THEOFANOUS: Let me ask you this. What is the approach in using this one-tenth scale test? Are you approaching it strictly from a computer code point of view and do you have some computer codes that are going to try to calculate that as a verification tool, or has anybody also looked into the scaling aspects of the process itself?

MR. ENGLAND: I think there are two parts to that answer. The principal purpose of the test is a computer verification or validation. And in doing that we use a tenth scale facility. We take high-speed movies of the transient and we look at the velocities and then we use a computer program to predict the velocities and then compare the data, and those model data comparisons are ongoing at this time.

MR. THEOFANOUS: Only velocities or also pressures?

MR. ENGLAND: We initially attempted to measure pressures, but in the time frames of interest and because of the dynamic nature of the phenomenon we found that that was impossible to do.

MR. THEOFANOUS: I don't know what Mr. Humphreys was after, but I had raised that question also before him and I was concerned more about pressures than velocities. It is a shame that you have done a whole experiment and you have not been able to get pressures. What was the problem?

MR. ENGLAND: I would like to introduce at this time the GE Test Program Manager who can give a better and more detailed overview of the status of the analysis that is ongoing at this time perhaps and perhaps answer some of those questions.

Terry McIntyre.

MR. McINTYRE: I am Terry McIntyre, and I am Manager of Containment Loads Engineering for General Electric.

I see a lot of friendly faces over here and we have talked about this a couple of times before.

(Slide.)

Some of this Less has already covered, but I think it might be worthwhile going back over it again because it gives you a brief overview of the test program, of how we did it and what the results are.

Less mentioned a year ago, and it was almost two years ago that John brought up this Humphreys issues. We discussed the elements of encroachments on pool swell with you at that time and we all kind of came to the conclusion that it really wasn't the issue and we didn't expect that the presence of encroachments would perturb pool swell to the point where the design modes would be exceeded.

What we did is we went back and we developed an analytical model in 1983. This is a model based on the EOF code that was built by Los Alamos Scientific Labs. We modified it slightly by the addition of a vent flow and bubble thermodynamics model. So this is a first principles model of the drywell pressure to preduct pool swell.

We benchmarked that code against existing clean pool test data and found that it did an excellent job of predicting the data. We then went back and did ---

MR. THEOFANOUS: What data?

MR. McINTYRE: What data?

MR. THEOFANOUS: What data did they predict, that the rise velocities weren't able to predict breakthroughs?

MR. McINTYRE: The code will not predict breakthrough. That is really beyond the state of the art today. The code does an excellent job of predicting General Electric pressure suppression test facility data in both the full scale, one-third and one-ninth scale tests. The particular pieces of information that we correlated against were velocity as a function of elevation and the wall pressures at several locations.

We then went back and did plant unique calculations for most of the existing MARK III's given the actual encroachment characteristics that those plants have. The one plant where we did not do a unique calculation was River Bend.

The reason River Bend did not have its own calculation was because the encroachment configuration is very similar to Grand Gulf and we thought that the Grand Gulf case would apply to it.

As Less mentioned, we discussed those results with the NRC and they asked us to run a confirmatory test.

MR. THEOFANOUS: Excuse me. The principal aspect of the loads, is it before? Did the loads develop principally before the breakthrough or after the breakthrough?

MR. McINTYRE: That is a difficult question to answer. In terms of clean pool pool swell, bulk pool swell, i.e. before breakthrough, the loads are much more significant than post-breakthrough. Solid water gives you higher loads than froth loads.

In terms of the encroached calculations, what we expected was that breakthrough would in fact not occur, that you would get breakthrough in the clean pool earlier than you would in the encroached pool, and the encroached pool would rise up and stop as a bulk flow and that there would not be any froth flow in the region around the encroachment.

As I mentioned, the NRC did ask us to run a confirmatory test. The test was run at San Jose using Fraud scaling in a one-tenth scale test.

MR. THEOFANOUS: I asked this question before and you answered it, but I was asking for a different issue.

MR. McINTYRE: Okay.

MR. THEOFANOUS: If you cannot claim that the loads developed before breakthrough and if you have a code that cannot calculate breakthrough, then I am wondering what is the implication with respect to using this code to calculate the loads with encroachments present?

MR. McINTYRE: Well, what we did is the code results shows that solid water would go up and stop. The pressure above the water ligament was higher than the pressure below the water ligament. So in fact we did not expect breakthrough to occur in the encroached calculations. So although the code could not handle breakthrough, we didn't think breakthrough would occur.

MR. THEOFANOUS: But it will occur, will it not? Although the code did not calculate breakthrough, I suspect that breakthrough will occur.

MR. McINTYRE: I think you are getting a little bit ahead of me into the test, but I think the answer is yes, it will. Let me hold that off for a second because I am going to show you some test results.

We ran the test in the tenth scale with Fraud scale configurations exactly as was done for MARK I, and what we developed was curves of velocity versus elevation based on high-speed movies.

When we did that and drive the model to maximum test data, what we found was at high elevations that the model did in fact underpredict the test data by between 20 and 30 percent, and the other prediction varies with the different encroachment geometries we ran on the test program.

MR. THEOFANOUS: These were geometric models that were scaled exactly on a geometrical basis?

MR. McINTYRE: No, they were not. The test tank itself was a rectangular tank scaled to the mid-plane dimensions of the pressure suppression test facility. We ran three different encroachment geometries. They were a one cell, 50 percent across the pool encroachment, cell meaning stack and vents. The test tank had six vents and we put an encroachment in one corner using essentially a plane of symmetry scaling. So we had a one cell, 50 percent, a three-cell, 25 percent and a three-cell, 50 percent encroachment.

MR. THEOFANOUS: Are you going to show us anything on this?

MR. McINTYRE: Actually I don't have a picture of it with me. I am sorry.

MR. THEOFANOUS: Have you written a document on this?

MR. McINTYRE: Excuse me?

MR. THEOFANOUS: Have you written a document on this?

MR. McINTYRE: There is a test report in preparation. It is not out yet. It is pretty close.

Less, we do have a picture of the encroachment some place?

MR. THEOFANOUS: Would you please send me a copy of this report? I suppose that it also discussed the analysis in it or not?

MR. McINTYRE: Yes, it will. We have a commitment to talk with the NRC about those results in the middle of July, and I suspect we could get you a copy of it after it comes out.

With respect to the tank itself, it is a rectangular tank. It is roughly two feet wide, four feet deep and six feet long. It has the associated dry well volume and weir and vent system scaled to the pressure suppression test facility. The entire tank was put in the PSGF drywell and the test was started at 1.5 psi absolute. So that pressure was scaled correctly.

When we went into this test program, there is a basic difference between MARK III pool swell and the MARK 1-2 pool swell that we don't get pressurization in the air space. The MARK III pool swell velocity is maximum at the point of breakthrough.

We know in these tests, being a one-tenth scale test, the effects of surface tension are about a hundred times too big, and we are fairly sure that breakthrough would not be correctly scaled in a test. We have talked with the staff and they have agreed with that.

Therefore, I think our test is really pretty conservative. They are run with FSAR pressures and we don't get breakthrough the way we should.

The test results, if you compare clean pool pool swell with pool swell in the encroached regions, it gives us results which show that the encroached pool swell is always at a lower velocity at a given elevation of the clean pool swell.

(Slide.)

We know we have unscaled surface tension and therefore breakthrough is not correctly simulated in the test. We get clean pool elevations at breakthrough which are much higher than full scale. You get very thin water ligaments that essentially you get very tall skinny bubbles instead of breaking up into a froth in the test.

MR. THEOFANOUS: Those long, skinny bubbles that you are talking about, those are because you are pressurizing the space at the bottom of the encroachment and instabilities develop because of back pressure into the liquid. That is exactly the reason that you were asking all those questions.

MR. McINTYRE: Yes, you are right. That is exactly what is happening. It is happening in the clean pool also.

MR. THEOFANOUS: Yes. So it doesn't have so much to do with the normal breakthrough process that ---

MR. McINTYRE: The breakthrough process is essentially full scale is what is going on.

MR. THEOFANOUS: Right.

MR. McINTYRE: Consequently, we are getting clean pool velocities higher than one would expect from a full scale test out of this test.

MR. THEOFANOUS: But the pressures will be higher in the experiment.

MR. McINTYRE: Yes. Again, although this test was run primarily to validate the model, we don't get a hundred percent agreement between the test and the model. We see that over a wide range of encroachment sizes that in fact the clean pool is always worse and therefore the loads should be bounding.

MR. THEOFANOUS: Can I understand this point. You said that the velocities are higher, but the rises are higher in the clean pool test. But I would expect that the pressures would be higher, the pressures above the pool will be higher in the encroached pool case.

MR. McINTYRE: Yes, that is a true statement.

MR. THEOFANOUS: And if we are interested in the pressures, it doesn't follow, at least in my thinking, that the clean pool case is conservative.

MR. McINTYRE: The pressures in fact are higher under the encroachment. The bubble pressures remain higher than they do in the clean pool. However, there is sufficient margin in the GESSAR load definition such that the GESSAR load definition is not exceeded in the encroached portion of the pool. The pressures are higher due to encroachments.

MR. THEOFANOUS: So that is the main thing that we were after when we were asking these questions quite a few years ago. Now the question is, now that we have found experimentally that that is what happens, how does that alter, if it does, the approach in defining loads, because the velocity by itself is not appropriate it sounds like.

MR. McINTYRE: Well, the velocity is appropriate in terms of prediction of impact loads on structures above the pool.

MR. THEOFANOUS: Right.

MR. McINTYRE: For the loads on the boundaries of the suppression pool itself, the bubble pressure is appropriate and we have investigated that and we have found that there is sufficient margin in the GESSAR load definition to account for those effects.

MR. THEOFANOUS: So does that define then a new load now? As a result of these tests you came up with a new load definition for ---

MR. McINTYRE: No. What we are saying is we have looked at it and we said that the GESSAR definition is still bounding. In terms of velocity, this is actual test data. I don't have any scales on it because I wanted to keep the presentation not proprietary.

(Slide.)

This is the GESSAR load definition as modified to meet the NRC acceptance criteria. These are two pieces of test data, velocity versus elevation, for two of our encroachment configurations which may have bound the River Bend case. River Bend has an encroachment which goes out about 40 percent across the pool and covers four cells. This is a 50 percent. The A-1 is six cells covered and the B-1 is two cells covered.

MR. THEOFANOUS: That is what percent of the area?

MR. McINTYRE: In our test tank they are 25 percent total and one-third of that, 8 percent.

MR. THEOFANOUS: Do you have any other tests with more of the floor covered, more of the area covered?

MR. McINTYRE: No. This A encroachment was the largest one we ran.

MR. THEOFANOUS: What is the total area covered in the plant?

MR. McINTYRE: It is on the order of three or four percent. It is much smaller than was done in the test. Basically what we see is at this point we have reached our maximum velocity. The actual data actually carries on down. What we feel is going on here is due to the unscaled breakthrough, that this point is about appropriate. If it was a full scale test, you would get instabilities forming in the surface and a great deal of froth. As you can see, we are substantially less than the GESSAR mode definition at that time. So that we really don't think encroached pool swell is an issue for River Bend or for any other MARK III for that matter.

I guess that would conclude my presentation unless you have any further questions.

(Slide.)

MR. ENGLAND: In conclusion, for the remaining Humphreys issues we have acceptable analysis results for all issues. We did make one minor design change to prevent a containment low error mass scenario that was identified during our investigation into these areas and we are continuing to work with the owners group to resolve the encroached pool swell issues.

As Terry pointed out, we have a meeting scheduled with the staff in mid-July and there is an owners group meeting scheduled in late June so that we can learn in a little greater detail some of the things that Terry presented here today.

The final issue relating to the second concern raised in the SER, we have revised the analysis in accordance with the comments received on our previous analysis and the revised analysis still shows that the conditions are bounded and we feel that that issue will be no longer of concern to the staff.

MR. REED: The next topic on the agenda is hydrogen control. Erwin Zoch, Supervisor of Nuclear Engineering, has been with Gulf States Utilities for 11 years and has been involved in River Bend for those 11 years. He has a bachelor of science degree in nuclear engineering from Texas A&M University.

MR. ZOCH: Good afternoon.

(Slide.)

My presentation is entitled the River Bend Station Hydrogen Control Program. This slide gives the overview that I want to give you this afternoon in my presentation.

I will address two major areas. I will address the hydrogen control systems that we have at River Bend and I will also address our plan for resolution of the hydrogen control issue and then there is a brief summary at the end.

(Slide.)

Concerning the hydrogen control systems at River Bend, these functions are provided. We monitor the hydrogen concentration and then we control the concentration of hydrogen in the drywell and containment through these four ways. We mix the drywell with the containment atmospheres, we reduce the amount of hydrogen with recombiners, we reduce the amount of hydrogen with igniters through controlled ignition and as a backup we purge the containment atmosphere.

The systems that are provided are given here on the next slide.

(Slide.)

We have the hydrogen monitoring system as part of the containment atmosphere monitoring system. The hydrogen mixing system that you heard about earlier consists of two redundant trains and an inlet line and an outlet line and a fan blower for purging the drywell atmosphere into the containment atmosphere.

The next item is the hydrogen recombiner systems. It consists of two separate safety related totally redundant hydrogen recombiners. They are located on the refueling floor and they reprocess at 100 SEFM.

As mentioned earlier, the hydrogen igniter system has been added to the combustible gas control system to address the degraded core hydrogen generation event and, finally, as mentioned earlier, the containment hydrogen purge system.

(Slide.)

This slide gives some additional details about the hydrogen igniter system. There are 104 distributed igniters within the containment and drywell of the River Bend Station. Half of these igniters are on each divisional power supply.

Our location criteria that we use in locating these igniters is given here. There is a maximum of 30 feet separating between operable igniters when both divisional power supplies are operable and there is a maximum of 60 feet separation between operable igniters when one divisional power supply is operable. There are also a minimum of two igniters, one from each divisional power supply in each subcompartment.

(Slide.)

Continuing with the second major area of my discussion ---

MR. OKRENT: Excuse me. These are all AC, are they not?

MR. ZOCH: They are AC powered, yes.

MR. OKRENT: Thank you.

MR. ZOCH: Continuing with the next major area of my discussion, and that is our program to address the hydrogen control issues for degraded core accidents at River Bend, it consists of these elements.

It consists of the hydrogen control owners group, and I will go into further details on each one of these items following this slide.

It consists of our River Bend specific containment ultimate capacity analysis. There were some questions that came up earlier concerning design values and ultimate withstand capabilities, and I will address some of those in this.

Of course, as mentioned, we have added the hydrogen igniter system to address the additional hydrogen from degrated core accidents.

And, finally, our program to ensure survivability of the central equipment.

(Slide.)

Some of the past programs of the hydrogen control owners group are given here. These items have been completed. GSU joined in and supported the participation of these activities.

The first one that was completed early on in our program was the GE study of accident scenarios and source terms. It also identified a basic list of the central equipment.

The next major item was the MARK III containment hydrogen burn response analysis and a topical report was prepared by Offshore Power Systems for that code and submitted to the NRC staff for their review.

This analysis, this hydrogen burn analysis was conducted to determine the temperature and pressure response for a distributed hydrogen ignition system as the hydrogen was released into the drywell or suppression pool.

The next item is the 20th scale model MARK III containment burn tests. This test program was conducted to get a visualization of the characteristics of the hydrogen flame. Later on we instrumented that test facility and recorded temperature information from the hydrogen burns. We also determined that the threshold for diffusion flames was around 4/10ths to 5/10ths of a pound per second.

The final item here is the ignition limits testing conducted in conjunction with the AECL and Whiteshell Lab. This was done in Canada and it was supported by the hydrogen control owners group. The purpose of that test program was to confirm the ability of the igniter to ignite hydrogen rich mixtures and also in steam rich environments, and the results of that test confirm that the igniter is indeed effective in igniting hydrogen under rich conditions, both hydrogen rich and steam rich environments.

(Slide.)

The ongoing programs of the hydrogen control owners group are given here consisting of three major areas.

One is the hydrogen source term analysis. This is the work being conducted by the IDCOR and EPRI group to develop the BWR heatup code to determine what the hydrogen source terms are more realistically. That work is getting nearer to be complete and we hope to have some source term information for use.

The next item, which is the quarter scale model test program, it models a MARK III containment and the purpose is to characterize the thermal environment inside a MARK III containment resulting from hydrogen releases into the suppression pool through spargers and through simulated LOCA events through the drywell wall.

(Slide.)

An item that was mentioned earlier was the River Bend Station containment ultimate capacity analysis. This slide gives the design values for the steel containment and drywell for internal pressure conditions. They are 15 psi for the steel containment and 25 psi for the drywell.

(Slide.)

We have completed an ultimate pressure capacity analysis in response to a request by the staff, and the results of this analysis for internal pressure conditions are given here under the first item.

The most limiting pressure here is the 56 psig. That is the lowest value that we calculated for any of these items.

For the steel containment again it is 56 psig. For the drywell the ultimate pressure would withstand capabilities of 80 psig. For the personnel airlock it is 72, for the equipment hatch it is 56 and other penetrations were also analyzed and determined to be 100 psig or greater.

MR. THEOFANOUS: Sometimes in hydrogen programs of this type the temperature value is more important than pressure value. Have you looked into the temperature?

MR. ZOCH: Well, that is the purpose of the quarter scale test program to characterize the thermal environments and get a better idea of what those thermal environments are.

MR. THEOFANOUS: What those are, but have you done the equivalent exercise for temperatures that you have done here for pressures?

MR. ZOCH: We haven't done that yet. We are in the process of doing that. That will be part of the essential equipment survivability evaluation.

MR. THEOFANOUS: Who does that? Do you do that or somebody else?

MR. ZOCH: Stone and Webster will do a portion of that work and we will do a portion of that work, and there may be others involved.

MR. OKRENT: What is the definition of failure, I guess, when you say 56 psig for the steel containment?

MR. ZOCH: I am sorry, I didn't understand you.

MR. OKRENT: What definition of failure comes in when you say ultimate pressure for a steel containment is 56 psig?

MR. ZOCH: That is a point where a generally stated yield develops in the steel containment.

Is that correct? Maybe I should refer the question to the Stone and Webster who have conducted the analysis.

MR. SHA: My name is Mahindra Sha and I am from Stone and Webster. The failure of the internal pressure is due to buckling in the torus area. It is a general yielding in the torus area.

MR. OKRENT: Okay. Thank you.

MR. ZOCH: The next item here concerns the River Bend specific Clasix-3 analysis. The purpose of this study is to analyze what the resulting pressures are in the containment as a result of burning the hydrogen off.

Those analyses have been completed and we have some preliminary results at this time. Our preliminary results we will be reporting later perhaps right after June, at the end of June. They indicate that there is sufficient margin between these ultimate capacities and what we see due to the hydrogen burn. We see roughly about 15 to 18 psig over pressure resulting from hydrogen.

MR. THEOFANOUS: How much hydrogen are you burning, or in terms of equivalent oxidation of materials what percent?

MR. ZOCH: It is the equivalent of a 75 percent metal water reaction.

MR. THEOFANOUS: Everything?

MR. ZOCH: No. It is the cladding surrounding the active region of the fuel.

MR. THEOFANOUS: Seventy-five percent?

MR. ZOCH: Seventy-five percent metal water reaction, yes.

MR. THEOFANOUS: How much pressure do you get?

MR. ZOCH: Eighteen psi, and that is an approximate value.

MR. THEOFANOUS: What about the temperatures?

MR. ZOCH: Temperatures, the results of that analysis show an intermittent type burn, that is a temperature and pressure spikes. So I feel that giving you what the peak temperatures are doesn't represent the real case. I think that varies from maybe 400 degrees to an upper peak of, I would have to guess, somewhere around 1200 or 1500 degrees.

MR. THEOFANOUS: Do you observe any local starvation of the reactants? I don't know this Clasix model. Can it account for special effects in the containment and maybe local starvation from oxygen?

MR. ZOCH: Okay. Let me refer that question to Dr. Marty Fuls from Offshore Power.

Let me back up though and say that the temperatures I gave you there, I was thinking about some of the earlier numbers that were calculated for the hydrogen control owners group. I haven't looked at what the numbers are for River Bend yet.

Marty.

MR. FULS: Martin Fuls, Offshore Power Systems. The individual compartments are compared continuously throughout the transient to look at the individual components and their concentrations. These are variable inputs that you can specify that the lower limit on oxygen combustion, which is normally around five percent, and ignition of hydrogen around eight percent. Those are the criteria that we are using in this analysis.

MR. THEOFANOUS: What I am saying is do you observe any starvation?

MR. FULS: Yes. With a drywell break case, by the time you get hydrogen in there you have a steam atmosphere. So when you start to release hydrogen, it is strictly hydrogen and steam.

When you arc releasing a lot of it through the safety relief valves or the ADS system, you get some initial burns and then you burn out some of the oxygen and it does not meet the criteria. So that you do have starvation in local areas.

MR. THEOFANOUS: Okay. So most of the burning then occurs in the top of the pool?

MR. FULS: Most of it does, yes.

MR. OKRENT: And, excuse me, the Delta P I think I heard mentioned was about 15 psi, is that right?

MR. FULS: Delta P is up there around 18 psi.

MR. OKRENT: That is not putting all 75 percent of the hydrogen into a single burn I assume.

MR. FULS: No, sir.

MR. OKRENT: What fraction of the hydrogen is in the burn?

MR. FULS: Oh, in a wetwell burn you are probably only burning around 100 to 150 pounds per burn. We have the information in a table, and I can get it for you and give you an average of what accumulates in burns, in an individual puff burn.

MR. OKRENT: And then you are allowing for some heat removal before the next burn, is that it?

MR. FULS: Yes.

MR. OKRENT: What is the staff position concerning an accident where you lose all AC power?

MR. NOVAK: Well, you question is just generally what is our position on the likelihood of a total loss of AC power?

MR. OKRENT: Yes, and then it comes back on of course, but you now have hydrogen sitting there.

MR. NOVAK: I don't know specifically that we have connected the two. I know we have an unresolved safety issue which is specifically looking at the likelihood and the response to a station blackout. I think it ties in very closely to the decay heat removal concept also. I don't have a specific answer to tie into hydrogen. Perhaps somebody on the staff here can help.

(Pause.)

We will try to address it at the full committee meeting, if you wish.

MR. OKRENT: Sure, and you might even tell us how it relates to source term thinking.

(Slide.)

MR. ZOCH: Continuing on with the next item, with respect to the ultimate capacity analysis, this slide and the next slide address the negative pressure conditions. The design base that was mentioned earlier for the containment, .6 psi, for the drywell, it is 20 psi.

We have an analysis underway at this time to address a letter that we have received from the staff requesting that we evaluate the ultimate negative pressure capacity of the containment. We expect those results to be available shortly and to be filed with the staff by the end of June.

Let me back up and say that we have received preliminary results for these analyses and the indications are that for the steel containment the value is about 4.8 psi.

The second item here that we were asked to address is for the situation where we have the total hydrogen representing a 75 percent metal water reaction is burned off and then cooled down to ambient conditions. The results of that analysis show that a negative pressure of about 3.3 psi. So we feel that we have margin between these areas, too.

MR. OKRENT: Excuse me. I missed something. What was your last 3. something psi?

MR. ZOCH: 3.3 psi. That is for this cooldown vent that is on the steel containment. That is not the value of the drywell. That is the value for the steel containment, with a value of about 4.8 as the ultimate negative pressure capacity.

MR. OKRENT: In contrast to the design of .6?

MR. ZOCH: And in contrast to the design of 6 psi.

MR. OKRENT: Now you are quoting numbers here and earlier on ultimate capacity, but you haven't give us any feel for the uncertainty, if any, in these numbers. Are you going to supply such information at some time?

MR. ZOCH: I perhaps should refer that question to some of the people that were involved in the analysis. Perhaps if they tell you how the analysis was conducted, it might address your question.

Can someone from Stone and Webster address that?

MR. SHA: The numbers which I gave of the 56 psi for the containment internal pressure is actually the lower bound based on the design or the specified end strength of material. There is no post buckling strenth considered here. So the actual strength will be even higher than this if you consider the redistribution stresses.

MR. OKRENT: Would the existence of flaws matter in such an analysis, weld flaws and welded joints?

MR. SHA: That is not considered in this analysis. This is based on the one and a half inch thick material and the proven capacity.

MR. OKRENT: As you know, when one looks at pressure vessel reliability, if one assumed there were no flaws and if you can keep the temperature high enough, it is hard to calculate failure. So flaws enter on pressure vessels.

MR. SHA: That is the reason we have margins compared to our design capacity to consider those uncertainties.

MR. OKRENT: I would suggest that you do in fact think about what the uncertainties are. They will swing around both sides I suspect of your calculation.

How about on the capability to withstand a vacuum for the steel containment, are there any kinds of departures from your model of the building that could lead to a lesser capacity to accept a vacuum?

MR. SHA: The model is based on a standard shell model.

MR. OKRENT: Suppose I gave you a different job and you weren't working for Stone and Webster, but you were working for the NRC, and it was your job to figure out what things might have gone along differently in the fabrication that could lead to a lesser capacity than 4. something.

MR. SHA: As you mentioned, some of the possible uncertainties in the weld capacities would be one. The material strength may be lower, but based on the material test report, the strength is usually more than the specified end strength of the material. So I feel that the capacities we have computed are lower bound considering even the uncertainties.

MR. OKRENT: You are acting like you are working for Stone and Webster, and I said no.

(Laughter.)

MR. SHA: No, I am giving my engineering opinion.

(Laughter.)

VOICE: Are you going to pay him now?

(Laughter.)

MR. OKRENT: I will pay him the ususal rate.

(Laughter.)

Well, anyway, I think you would do well to think in this area because when we try to get serious about these things, it is going to be relevant.

(Slide.)

MR. ZOCH: The last item that I had as part of our program to address and resolve the hydrogen control issue for River Bend is the essential equipment survivability evaluation.

The major elements of this program are to define criteria for essential equipment and to develop essential equipment listings. The first item has been completed and the second item is in process.

We will then evaluate the essential equipment survivability based upon the ClasiX-3 thermal environments that we are receiving. We will compare those thermal environments to the qualification thermal environment.

Then we will evaluate the essential equipment survivability based upon the quarter scale test results. The quarter scale test program is scheduled to begin shakedown testing in September and we expect results around October through the December time frame. The final report will be issued later and we will use those parameters then in the evaluation of our essential equipment.

Finally, we will provide whatever essential equipment protection measures are required.

MR. OKRENT: Now do you have enough analysis in hand that you can say that the environment for River Bend, the postulated accident involving 75 percent clad reaction with steam, that this thermal environment is similar to another MARK III, but one which has sprays, or it could be significantly different? Can you say that?

MR. ZOCH: I would not expect them to be significantly different, but I believe that there may be some differences. I think that perhaps our wetwell temperatures may be higher, slightly higher.

MR. OKRENT: Will this scale test go into the range that you need definitely?

MR. ZOCH: Well, I believe that it will. We haven't identified all of the test matrixes yet to be included in the quarter scale test, but we intend to include several scenarios there.

MR. NOVAK: I wonder if I might ask one question on this subject.

MR. OKRENT: Why not.

MR. NOVAK: Just one. Would you care to comment on how the igniter performance might vary depending on whether or not you have sprays?

MR. ZOCH: Pardon me?

MR. NOVAK: The hydrogen igniter system, would you care to comment on how it might behave compared to other plants that have sprays?

MR. ZOCH: The igniter system is very similar in design to that of Grand Gulf. We have about the same number of igniters, the location criteria is very and we added some additional criteria to the location of igniters that came out of the Sandia report of the Grand Gulf system. They made some suggestions and we incorporated some of those to limit the number of igniters per circuit and those were incorporated.

(Slide.)

In summary, I feel we have an integrated program to address hydrogen control for River Bend. We are integrating the results of generic efforts and test programs analyses. We have integrated this into the design and other analyses for River Bend.

We have provided multiple systems in River Bend to control the hydrogen, as I mentioned earlier. The containment integrity ---

MR. OKRENT: Excuse me, can I interrupt you for a moment. In an earlier slide, much earlier in your presentation, you mentioned a backup system to igniters.

MR. ZOCH: Yes.

MR. OKRENT: But you haven't discussed it. Is it going to be discussed in a future slide?

MR. ZOCH: No. The containment purge system is provided to address the Reg. Guide 1.7 requirements that existed at the time of the River Bend design. Those requirements required that monitoring be provided, that a mixing system between the drywell and containment be provided and that recombiners be provided either internally or externally.

And, in addition, as a backup it asked us to provide a containment purge system. That system will only be used if necessary perhaps only for pressure control, if at all. There is no intend, I would say now, to use that system for anything.

MR. OKRENT: It is not a hydrogen combustion suppression system?

MR. ZOCH: Not a suppression system, no. It would be used to remove it from the containment.

MR. OKRENT: So you are counting on igniters?

MR. ZOCH: Yes, we are counting on our igniters.

MR. OKRENT: The reason I ask is there was one MARK III that was reviewed for a constuction permit that proposed to use a suppression of combustion rather than an ignition, and I thought maybe that was what you were talking about.

MR. ZOCH: No.

MR. OKRENT: It is not.

MR. ZOCH: The third item is the containment integrity will be assured for both positive and negative pressure conditions. We expect that to come out of the analysis result. It has been shown for the positive pressure conditions and we expect that to be true for the negative pressure as well.

The next item is essential equipment survivability will be assured for deflagration and diffusion hydrogen combustion.

Finally, we have, as I had mentioned earlier, additional confirmatory analysis and testing underway to resolve the hydrogen control issues, both on a generic basis and for River Bend specifically.

MR. OKRENT: What is the status of your calculations of pressure and temperature for a range of hydrogen generation scenarios? Are they all reported or are they doing them and have to report them, or where does that stand?

MR. ZOCH: We have a preliminary copy of that report in our house. It is currently under review and we intend to submit a report to the NRC later perhaps in July or toward the end of July.

That concludes my presentation. Are there any other additional questions or comments?

MR. OKRENT: Just a minute, please.

(Pause.)

MR. OKRENT: I don't think there are any further questions.

Let's see, it looks like it is about two hours since we took our last break and it is not exactly chilly in here.

(Laughter.)

So why don't we take another ten minutes.

(Recess.)

MR. OKRENT: The meeting will reconvene.

We will go back to where we were in the agenda before we leaped ahead, as it were. So I think we are at the point where we were going to learn whether the applicant has any comments on what we heard from the staff concerning the various kinds of open issues, et cete~

MR. REED: Fine. To address that we have Jim Booker, Manager of Engineering Nuclear Fuels and Licensing for Gulf States to respond to that.

Just basically though quickly, Mr. Booker has been with Gulf States Utilities for approximately 28 years. He has been involved in the River Bend project since its inception for approximately the last 12 years. He has a bachelor of science degrees in industrial engineering and mechanical engineering from Lamar University.

MR. BOOKER: Gulf States feels that the staff has presented a very accurate picture of the status of their review of our license at this time.

We are continuing to work with the staff to resolve these open issues, and in fact we had meetings up there in Wasington this Monday and Tuesday. We feel very confident that we can resolve these some 18 open items in a timely fashion to support our licensing schedule. We do not think that any of them are that significant that we cannot work out a solution to these open items.

MR. OKRENT: Well, I guess we will go on to agenda item No. 3, which again is by the applicant.

MR. REED: Yes, sir.

All right, at this time we would like to pick up 3(a) which was the introduction by Mr. Cahill. Bill Cahill is the Senior Vice President of the River Bend Nuclear Group. He has been with Gulf States Utilities for approximately the last four years. He brings with him 26 years of prior nuclear experience to Gulf States where he had held positions in the executive offices for Consolidated Edison in New York and had responsibilities at Indian Point 1, 2 and 3 nuclear units. He has a bachelor of science and mechanical engineering degree from Polytechnical Institute in Brooklyn, New York.

MR. CAHILL: Good afternoon.

I really intended this to sort of get you into the right ball park and here we are about the fifth inning. So some of this is really inappropriate, but just so you know what Gulf States Utilities' area is served, it is shown on the map here.

We cover an area that goes to the north and west of Houston for a strip about 200 miles wide and 100 miles deep over to the east of Baton Rouge. We serve the Cities of Beaumont, Port Arthur, Orange, Baton Rouge, Lafayette and Lake Charles.

(Slide.)

This shows the major generating stations of the company. It has a capacity of 6,600,000 kilowats.

(Slide.)

T.is certainly is anticlimax, but there are the basic statistics on River Bend and I think you all heard those before from other presentations.

(Slide.)

This is an artist's rendering of the plant which you have seen this morning. It shows the tornado approved seismically designed standby cooling tower, the MARK III containment and the turbine building. It is a radial design which I remember was a big issue many years ago. The mechanical cooling towers with natural assist are relatively low silhouette.

We are about two miles from the river where makeup water for these cooling towers is provided. As mentioned, these cooling towers also get makeup from wells.

(Slide.)

The private history, like so many projects, it started in the early '70s, was delayed for developing the design and adjusting to changes in requirements for nuclear plants, and finally got a construction permit in March of '77.

Because of uncertainties on requirements and other reasons, the construction program really didn't start at a high pace until August of 1979. We originally had a fuel load date that was 50 months from then and we were confident that that was a possible date because so much of the design requirements had been defined and the design was well along and we have enjoyed a very favorable arrangement with the construction trades called a nuclear stabilization agreement.

That has been copied now by many of the utilities that are constructing nuclear plants. It basically provides for no strikes and it encourages innovation in construction methods and also work arrangements. We have worked since August of '79 until now on a two-crew arrangement. One crew works four days, ten hours a day and then alternates with the second crew. So we never stop work except for six or seven holidays a year and we have made good progress.

However, we did shift to a 68-months schedule in 1981 primarily because that pace drew too heavily on the financing for the project and also tended to pull ahead of design.

We have maintained the present schedule and we are still within sight of the target of loading fuel next year and achieving commercial operation by the end of the year. We are about 88 percent complete now.

If you have any questions about the presentation or the project, I would be glad to address them.

(No response.)

MR. REED: At this time then we will proceed back into the technical presentations. We will be on Item B, A Discussion of Selected Plant Systems, which is subitem little "c", Offsite and Onsite AC/DC Power Sytems.

The first presenter will be Mr. John Proposon. John is a new hire with GSU and he is our Supervisor of Electric Engineering in our Nuclear Plant Engineering Department. He brings with him 11 years prior experience with Brown and Root, Burns and Row and Washington Public Power Supply System. He has worked at Brunswick 1 and 2, the South Texas Project and WNP No. 2. He has a bachelor of science degree in electrical engineering from Milwaukee School of Engineering.

MR. PROPOSON: Good afternoon. I am John Proposon, Supervisor of Electrical Engineering with Gulf States Utilities.

The topic that we are about to discuss deals with offsite and onsite AC and DC power distribution and its reliability assessment. We will be making this presentation basically in four phases.

The first phase will be addressed by myself, and I will be discussing the onsite AC and DC distributrion system.

The second phase will be discussed by Mr. Pat Bourne who will make a presentration on grid reliability.

The third phase will be the discussion or topic of the adequacy of the DC power supplies and station blackout, which will be made by myself.

And the fourth phase will be on the Trans-America DeLaval diesel generators which will be presented by Mr. John Hamilton.

(Slide.)

This first slide depicts and represents the station one line diagram. As you can see, and of note on this particular diagram, you have three lines that tie between the River Bend Station and the switchyard, the 230 KV switchyard at Fancy Point.

Of those three tielines as are indicated here, here and here, one of them is used as the output supply from our unit to Fancy Point Substation. The other ties, shown here and here, are fed back into the plant and are used for preferred supplies to feed our emergency buses.

We go via the 230 KV supplies through our preferred station transverse performers and then down to the bus itself.

MR. EBERSOLE: Let me ask, in other words, you do not depend on unit output for your preferred AC supply?

MR. PROPOSON: That is correct.

MR. EBERSOLE: I congratulate you for that.

MR. PROPOSON: Thank you.

(Slide.)

This again shows our AC distribution system. As we saw earlier, our preferred supply would be coming in on this bus. We do have an alternate supply that exists here. So that in the even that we took our our main preferred bus for maintenance work, we could in fact switch over and provide power in this way. We also have our diesel generator tied directly to that bus.

Downstream we go through our 480 volt center and we supply power to our battery charger and other loads in the plant.

(Slide.)

This is our Class IE DC distribution system. As we discussed, we have a 480 volt load center providing power normally through our battery charger to our 125 volt DC bus. The battery charger is sized such that it can carry a full load on that bus and charge our 125 volt battery system.

We have also provided a second backup battery charger so that in the event that we want to take out this charger for maintenance purposes, we basically take this breaker out, reinstitute it here and can keep this bus on flow.

MR. EBERSOLE: May I ask you a question. In the AC system you just talked about you had the offsite power coming in and then you have two diesels for the station. So you really have a normal source of supply and then when you enter a transient condition you have redundant supplies of AC for the transient recovery.

MR. PROPOSON: Let me back up just a second. I think I need to clarify something here.

What I showed you was one of three systems that we used. This system is really redundant. We have a division one, which is basically shown here, and this is what is depicted in this region. We also have a division two, which is redundant to this division one. Then we have a third division which is our HPCS division.

MR. EBERSOLE: Yes. I am saying you have a flexible AC system.

MR. PROPOSON: That is correct.

MR. EBERSOLE: Now I want to interpret what you have there against what you have in the DC system.

MR. PROPOSON: Okay.

MR. EBERSOLE: There you have apparently only two DC sources, and when you enter some transient phase, which you may develop by failing one of these DC sources, apparently you have only one residual DC system with which to come out of the transient condition. Is that correct?

MR. PROPOSON: That is correct. You also have a third DC system strictly for the HPCS.

MR. EBERSOLE: Oh, you do?

MR. PROPOSON: Yes, sir.

MR. EBERSOLE: I didn't understand that. Thank you.

MR. PROPOSON: In the event that we do lose 480 volt power, we also have our 125 volt battery system. That system is maintained and floated at a full charge condition.

We have also two 480 volt supplies, and these supplies normally supply power to our interruptable power supply, which is then transferred out onto our 120 volt uninterruptible power supply panels.

MR. EBERSOLE: May I ask, when you have to do equalization charging on the battery and you have to increase the voltage above the normal voltage to do it, do you allow the system to stay fully on line when you do that?

MR. PROPOSON: I would like to defer that question, if I may, to Stone and Webster.

MR. RAUGHLEY: Bill Raughley, Stone and Webster

Engineering. Yes, the system is designed to work to 140 volts.

MR. EBERSOLE: So you can equalize without ---

MR. RAUGHLEY: You can equalize that bus to the design of the system.

MR. EBERSOLE: Another question. When the battery is fully discharged, now can you hold a normal voltage on the bus with a charger while it is recharging the fully discharged battery?

MR. PROPOSON: That is correct.

MR. EBERSOLE: Thank you.

MR. PROPOSON: During a loss of 480 volt power, or in the event that we have a loss of 480 volt power, we would supply power from this 125 volt DC bus through the uninterruptible power supply via an internal inverter. There is an automatic static transfer switch that makes the transfer automatically.

(Slide.)

The loads that we have on our DC system are as shown on this slide, and you will note on here that one of those loads is our interruptible power supply, and on our uninterruptible power supply we have the following loads.

This concludes this phase of my presentation.

MR. REED: The next area then in the agenda following through in the same topic area is grid reliability. Mr. Pat Bourne, Director of our Transmission Planning will address that issue. He has been with Gulf States Utilities for approximately 16 years and has a bachelor of science and electrical engineering degree from the University of Arkansas.

MR. BOURNE: I would like to talk about the transmission system of Gulf States and put River Bend in perspective on it.

(Slide.)

Gulf States is a member of the Southwest Power Pool, and the Southwest Power Pool consists of about 60,000 megawatts of capability. Gulf States has an operating capability of about 6500 megawatts presently. Gulf States is the largest operating utility in the Southwest Power Pool.

Our service area, as Mr. Cahill illustrated, extends across South Louisiana. This illustration shows how we are connected on an EHV basis to the other companies in the system.

(Slide.)

We have 19 high voltage interconnections, and this is a little tighter view of the EHV system that constitutes our predominant interconnections. This system has been in development since 1967, and the latest addition to it is our 500 KV line to Plant Daniel out of our McKnight Substation to the Mississippi Power Company near Mobile, Alabama.

As you can see, this consists of five major external interconnections and a 500 KV system across our system. Also illustrated are major plants that are in close proximity to Gulf States.

Of interest to River Bend, of course, is the 500 KV loop around the Baton Rouge area.

(Slide.)

In the Baton Rouge vicinity we also have a type 230 KV network underlying the 500 KV system and it is supplied at three points, Willow Glen, Coly and at Fancy Point Substation from 500 and 230 KV Substations. So the essence of this network then is four incoming 500 KV lines, one to the Mississippi Power and Light, one to the Southern Companies, one to Louisiana Power and Light and then a line across our system out of our Weber Substation.

Fancy Point Substation is the substation into which the River Bend's Unit 1 is tied.

(Slide.)

Within this system we also have four existing plants, our Willow Glen plant, approximately 1900 megawatts, our Louisiana Station plant, 277 megawatts and then Big Cajun 1 and Big Cajun 2 which are on 230 and 500 KV systems respectively immediately west of the River Bend site.

(Slide.)

Talking specifically about the Fancy Point Substation, we have two incoming 500 KV lines serving a 500 KV ring bus substation. We have a 500/230 KV 1200 MBA transformer which has a spare pole.

The 230 KV substation into which the unit is connected consists of a breaker and a half substation with four incoming 230 KV lines and two independent station service leads. The substation is constructed with a redundant line transformer and bus differential relays. There is also redundant control batteries for the station power.

(Slide.)

This is a schematic of the substation itself.

(Slide.)

To assure the reliability of our system, we conduct annual load flow studies and stability studies. Our 500 KV system, which is the backbone of the system, is designed and has performed to a criteria of better than one outage per hundred miles of line per year.

The averag. grid outage to existing plants on the system over their lifetime has consisted of one event per 21.5 plant years.

(Slide.)

This is an illustration of the history that we have had on our plants, the listing of the plants, the commercial operation date, the number of plant years that we have had and the number of isolation instances that we have experienced.

MR. EBERSOLE: How long are these instances in time?

MR. BOURNE: All of these instances, barring two, are less than an hour or less. Once instance was approximately six hours and one instance was approximately 12 hours.

MR. EBERSOLE: Thank you.

MR. BOURNE: Two of the stations on the list are on two line connections to the grid which are not typical of River Bend. They are owned by Cajun Electric Power, which I mentioned a minute ago.

I will like to illustrate the reliability record on the plants that are operated by Gulf States.

(Slide.)

This is a record of seven events and 220 plant years, which is equal to one event per 31.4 plant years.

MR. EBERSOLE: The problem is over the years you have been adding units which are a heck of a lot bigger than the older units.

MR. BOURNE: Could you repeat the question?

MR. EBERSOLE: Bigger, much larger. So if you look at this picture against the largest unit now on the grid and try to forecast the possibility of cascade, when it trips and what kind of number do you get then?

MR. BOURNE: Okay. These outages are not related typically to the cascading of the units. As I think of it, there are two of these outages that were related to cascading of units.

In our stability studies we do analyze the loss of generation and the consequences of it and, you know, we do not know of any problem relating to the loss of generation.

MR. EBERSOLE: Do you do that on sort of a PRA basis?

MR. BOURNE: No, we do not. Our techniques are primarily deterministic.

MR. EBERSOLE: Do they include acknowledging the possibility of one or two additional failures when you lose a big one?

MR. BOURNE: Several diesel failures do you say?

MR. EBERSOLE: No, no, some relying problems.

MR. BOURNE: Some relying problems. Well, a number of these particular outages right here were related to relay malfunctions. Relay malfunctions would be first or second in terms of causes of such plant outages. Well, I have got to say they are really first. If we have proper relay performance, in my opinion, we wouldn't have any.

MR. OKRENT: Could you put the first viewgraph in your series back on, please.

MR. BOURNE: Okay. The one of the overall Southwest Power Pool system?

MR. OKRENT: Yes.

(Slide.)

If I understand this then correctly, the states that are tied in include Louisiana, Mississippi, Arkansas, Missouri, Kentucky, Oklahoma, Texas, parts of Kansas and so forth, is that correct?

MR. BOURNE: Yes. Well, we are essentially tied to the entire eastern United States. We are not tied west into the core of Texas.

MR. OKRENT: Now suppose we had a severe earthquake in New Madrid and presumably it would knock out a considerable number of power stations within the vicinity of the epicenter, and I don't know how far it would reach with regard to switchyards and so forth. Does that kind of event threaten the stability of your grid, or can you just disconnect or what? What happens then?

MR. BOURNE: Well, I couldn't rule out the possibility of our separating from the rest of the grid or going black in the event of an earthquake. We of course haven't experienced one.

MR. OKRENT: I am sorry, separating or?

MR. BOURNE: Or going black.

MR. BOOKER: Don't we have underfrequency relays on our interconnections so that if they did go down, all their power plants, that we would separate from them?

MR. BOURNE: Well, we do not have underfrequency relays, but the characteristics of the impedence relays that do tie us to adjacent utilities are such that in an extremely severe disturbance we would naturally separate at key points within the system and that would typically at the perimeters of the companies, although it is our general practice to all try to hang together.

MR. OKRENT: Would you expect your switchyard at River Bend to operate during and after the design basis safe shutdown earthquake even though it is not a design basis. I am just curious what you think your standard equipment can withstand?

MR. BOURNE: As a matter of my judgment I would say yes, but I can't say that from an analytic approach. I have not done an analysis of that. There is just such a multitude of equipment in the station, in the first place, that with the various paths I have back into the plant something should survive.

MR. EBERSOLE: When you lose the principle load off the main generator do you try to pass over and hold back some of the ---

MR. BOURNE: The question is relating to the trip of the unit?

MR. EBERSOLE: Yes, the trip of the high voltage side of the transformer.

MR. BOURNE: You are talking about the tripping of the 500 KV transformer?

MR. EBERSOLE: Yes, right.

MR. BOURNE: Okay. Well, the system is designed such that the unit can feed into either the 500 KV system or the 230 KV system and we would have no trouble with the stability of the unit on loss of any such component. Our load flow instability analysis includes loss of major loads as well as loss of major generation.

MR. EBERSOLE: But you attempt to cut back just to carry loads from the main generator?

MR. BOURNE: No, we would not. We would expect the unit to continue to generate into the grid with relatively little disturbance.

MR. OKRENT: Are you the individual who looks within the plant to see whether there are things within the emergency AC power system that might ---

MR. BOURNE: I do not go beyond the 230 KV into the plant, no.

Are there any other questions?

MR. EBERSOLE: I guess I would like to hear how you reached that I think fine decision not to put the loads on the turbine output.

MR. REED: If I may interject, Mr. Ebersole, at this point. Pat's major background in this area is grid reliability in the offsite aspects, and in getting back onto the onsite, maybe we should kick this question back to someone who is either going to speak or has currently spoken.

MR. RAUGHLEY: Bill Raughley from Stone and Webster Engineering Corporation. Upon loss of the generator we would automatically transfer the loads from the generator to the preferred station power supply which would be fed from the grid.

MR. EBERSOLE: I understood that your normal source of supply is from offsite to the critical load.

MR. RAUGHLEY: Yes. When the unit is running at full load, you would run off the genrator output at approximately ---

MR. EBERSOLE: Oh. Well then I am back to step one.

(Laughter.)

Why do you put the critical loads on a system that is guaranteed to fail?

MR. RAUGHLEY: The critical loads would also be on the offsite, but the station loads would be on the normal ---

MR. EBERSOLE: Now I am back in place again.

(Laughter.)

MR. RAUGHLEY: Okay. We are talking two different vocabularies.

MR. EBERSOLE: See, the normal design leaves the critical loads on the turbine outputs, unfortunately, and there is always a transfer necessary in the typical designs we see today which necessitates a transfer when you lose the turbine. But you don't have to make a transfer of the critical loads if you are already on.

MR. RAUGHLEY· That is correct.

MR. EBERSOLE: I just asked how did you make that decision since it is not the common decision that we find in examining these?

MR. RAUGHLEY: That was done way before my time.

MR. EBERSOLE: Thank you.

MR. BOURNE: Now John Proposon will continue his discussion on the in station supply.

MR. REED: That is correct. The next topic on the station blackout is again with John Proposon, Supervisor of Electric Engineering.

MR. PROPOSON: The first portion of this that I would like to address will apply to the adequacy of DC power supplies.

(Slide.)

NUREG 0666 was done to assess and address the adequacy of DC power supplies and their effects on core damage and probability events.

As a result of that study, two things came out of it. One was in order to do this study, they assumed a model or created a model battery. This model battery basically encompassed all of the various plants and enveloped all of the systems that were available at that time. Based on that model they made six recommendations.

We at River Bend incorporate all six of the recommendations that they made as a result of that particular report. In addition to this, we have some extensive training of our personnel that we feel will improve the system even further. These are the six criteria you see here before you and we do incorporate them in our design.

MR. EBERSOLE: Would you put that back up again?

MR. PROPOSON: Sure.

MR. EBERSOLE: Implicit in that first statement there is a notion that a division is integrally competent to take out decay heat out of the containment and out of the reactor. Is that really true?

MR. PROPOSON: I am not sure I really understood your question.

MR. EBERSOLE: It says "per safety related decision," and you have got three divisions.

MR. PROPOSON: Okay. We have two redundant divisions, and the third one is really our high-pressure core spray system.

MR. EBERSOLE: So the third division is not integrally competent to take the heat out of the station, is it? It just pours water into the reactor primary side.

MR. PROPOSON: That is correct.

MR. EBERSOLE: It does not contain the elements of the heat removal function out of the containment.

MR. PROPOSON: That is true.

MR. EBERSOLE: It does get the water to the first place, but it doesn't handle it beyond that.

MR. PROPOSON: That is correct. The original recommendation that was made by the panel was not to have three independent, but to ensure that you had at least independent battery systems and supplies.

(Slide.)

In order to do our evaluation and in the process of doing NUREG 0666, they generated what was known as a failure modes and effects analysis of FEMA.

When we did the River Bend Station analysis, we took it one stage further than that. We went as far as they did in 0666 and we did address on a system basis FEMA.

In addition to that, we also went on the individual component level. All of our FEMA results have been submitted as part of our FSAR.

(Slide.)

What you are seeing here is the load profile for our batteries. The area that you see that is cross-hatched would be that load that our batteries would be subjected to in the event that we had a LOCA condition, and these batteries are designed to operate for four hours.

The other solid profile that you see is in fact the load that our batteries would be subject to in the event we had what is commonly known as station blackout or loss of AC power.

We have done an analysis and review and we have come to the conclusion that our batteries will maintain themselves in an operable level for approximately

15 hours.

(Slide.)

MR. OKRENT: Is this because your batteries have more capacity that other people's batteries or you have less load on your batteries or they would get 15 hours if they analyzed it the same way you did?

MR. PROPOSON: They would get a lot more capacity out of their batteries if they took a look at their actual loads. The capacity of the battery, as you see with this increased load, is significantly less. But what we did in this analysis is we looked at the actual load that would be on the battery at the time of a station blackout situation and that load is less than we would see in a LOCA condition.

Therefore, we analyzed and reviewed how long our batteries were capable of handling that load and that is where we got the extended life from.

MR. OKRENT: By the way, if there an emergency operator procedure that discusses this?

MR. PROPOSON: An emergency operator procedure? I would have to defer that to someone from our staff.

MR. BOGOLIN: I am Chuck Bogolin. It is an abnormal operating procedure to address the loss of power.

MR. OKRENT: Okay, I will accept that.

MR. EBERSOLE: When you lose one of these two batteries, and I will pick the worst one, what is the worst station transient that occurs, anything?

MR. PROPOSON: If we lose one of the three?

MR. EBERSOLE: One of the three.

MR. PROPOSON: If we lose one of our redundant systems, the other redundant system would fully be capable of handling the event.

MR. EBERSOLE: I know, but does the turbine trip off or does the plant trip or does the reactor trip? What happens when you lose the DC supply on one of the systems, the worst system?

MR. PROPOSON: I think I would have to defer that to one of our staff.

MR. RAUGHLEY: Upon a loss of one of the three divisional batteries, the unit would not trip.

MR. EBERSOLE: So a given battery is not supporting any vital function which will initiate a turbine trip or some other loss of function to cause you to shut down?

MR. RAUGHLEY: That is right, loss one of these batteries will not generate the turbine trip.

MR. EBERSOLE: This implies that you have taken a multiple license to single function some place. Have you done that with different DC power supplies?

MR. GUHA: I didn't follow your question, sir.

Would you repeat that?

MR. EBERSOLE: The usual answer we get to that question is sure you have a transient when you lose the DC power supply, but you have another battery now which will not be cascaded into overload because there is no transfer switches so that you can come out of a transient. But here you say that if you lose one of these DC power supplies that your station keeps running. I find that a little hard to swallow.

MR. GUHA: My name is Pranab Guha from Stone and Webster. For the turbine generator you have a category two batter system which is totally independent of the category one battery systems. Looking at the division one and division two battery systems both, they both fit into the RPS system. If you lose only one division, you would not cause a reactor trip.

MR. EBERSOLE: Thank you.

MR. PROPOSON: That brings us to the next subject matter, and that is station blackout.

(Slide.)

Because of the interest that has been generated in this area recently, we approached our architect engineer, Stone and Webster, and asked them to do a study on it. The slides that I am presenting now are basically a synopsis of that study.

What you are seeing here are the assumptions that were used in this analysis. There was a loss of all AC power, both onsite as well as offsite. If there was a scram at time T equals zero, we would in fact be able to maintain our RCIC system. The SRVs would automatically maintain the reactor pressure and there would be no active heat removal.

I would like to point out that on this next slide we assumed that we would have this condition existing for 12 hours. We arbitrarily chose the 12 hours since our past history, as was pointed out by Pat, included no offsite power loss greater than 12 hours.

In that event we had the following results.

MR. OKRENT: Could you leave it on a minute?

MR. PROPOSON: Sure. Again, I would like to point out that this is for a 12 hour situation, which we would not postulate, but based on our operating data, this was what we considered worst case.

MR. OKRENT: What is the battery room temperature? Is there any problem there?

MR. PROPOSON: On the battery room temperature itself? No, sir, there are not. In the discharge cycle our power consumption in the batteries is relatively small and there is no problem with that.

MR. EBERSOLE: At the time all this chaos started you probably had a turbine trip.

MR. PROPOSON: That is correct.

MR. EBERSOLE: And the SRVs functioned and one of them stuck open and now where are you?

MR. PROPOSON: That I would have to defer ---

MR. EBERSOLE: I think you have had it because you don't have any steam pressure to the RCIC.

MR. PROPOSON: I would have to defer that to our architect engineer.

MR. EBERSOLE: It may be the straw that breaks the camel's back.

MR. EBERLY: This analysis was performed recently as a preliminary analysis, and I want to qualify these results up front here. It was a study. The assumptions as stated, one of them was that the safety relief valves would control reactor pressure around the relief valve setpoints, the open and close setpoints. So you are up around full reactor pressure and just maintaining that condition, and we did not on top of that add a stuck open relief valve.

MR. EBERSOLE: No, because it would have killed the RCIC.

MR. EBERLY: Right. You would continue to depressurize the reactor in that case.

MR. EBERSOLE: You don't have a little diesel pump some place somewhere that would do what the RCIC ought to do, do you?

MR. EBERLY: I can speak to that. We have a high-pressure core spray that has its own diesel generator.

MR. EBERSOLE: See, I am kind of worried about the sparcity of means whereby you get water in this primary loop.

MR. EBERLY: Well, that is why we have the high-pressure core spray pump with a dedicated diesel generator.

MR. EBERSOLE: Oh, by the way, your blackout did include hypothesizing that that diesel went with the others.

MR. EBERLY: That is right.

MR. EBERSOLE: But normally isn't it not connected to the AC system and is operated as an isolated function?

MR. EBERLY: I can't answer that question, sir.

MR. PROPOSON: Could you repeat that, please?

MR. EBERSOLE: Isn't normally the output of the core spray diesel dedicated just to that pump?

MR. PROPOSON: That is correct.

MR. EBERSOLE: And it doesn't hook into anything into which it can cascade?

MR. PROPOSON: That is correct. It is strictly an independent system.

MR. EBERSOLE: Is that system automatically transferred or do you manually transfer it to make it look into the so-called AC system? The question is how independent is it?

MR. PROPOSON: I am not sure what you are driving at. You mean in the loss of AC power?

MR. EBERSOLE: Isn't there any copper between the output of that diesel and the ordinary AC system and you might have thought it wasn't part of the station electrical system?

MR. PROPOSON: I think what your question essentially is is how does it know that there is a loss of offsite AC power?

MR. EBERSOLE: That is right.

MR. PROPOSON: It has an undervoltage relay that will sense -- it is powered off of one of the --let me backup ---

MR. EBERSOLE: Wouldn't you be better off if you just cut off its access in any directional sense so that it could look into the main AC system?

MR. PROPOSON: Well, let me back up to a slide here, the original one I put up in my first presentation.

(Slide.)

Again, we have the 230 feed that feeds our preferred service station transformers. Each of those do in fact have the capability of providing power supply to that division three HPCS bus. On sense of loss of voltage or undervoltage at the HPCS bus, it is an automatic start signal to energize that system.

MR. EBERSOLE: But I am asking by what means to you guarantee that that diesel doesn't look into a failing AC system so that it never is a part of a cascade?

MR. PROPOSON: Are you suggesting that we modify the design such that it would have no interface with the AC system?

MR. EBERSOLE: Well, you can have an interface, but just be sure it is unidirectional.

MR. PROPOSON: Okay.

MR. EBERSOLE: And whac do you do now to be sure it is unidirectional? I am sure you tried to make it that way. It cannot look out into a failing grid, but it can look inward as an alternate source. In other words, you take advantage of the presence of the AC supply, but you never, never let that diesel look upward into the failing grid.

MR. PROPOSON: That is correct. What you are saying is that when these breakers trip under a low voltage situation you have isolated that system.

MR. EBERSOLE: Lock it out and disconnect it.

MR. PROPOSON: At that time. Procedurally do you mean?

MR. EBERSOLE: Whatever, right. I am trying to get that diesel out of the AC picture.

MR. PROPOSON: You are saying once you have that loss of AC power you made the transfer to actually go back and create a procedure to lock those up.

MR. EBERSOLE: Let me ask the staff, is it common that this AC supply for the dedicated spray system be considered as part of the AC system, and I didn't know it was a part of the backout, if it were properly non-connected? I don't know what the standard interpretation has been, but I could certainly conceive that you could say this is not part of the AC grid if it is properly isolated.

MR. RAUGHLEY: Sir, maybe I could help clarify. The first thing that would happen is you would isolate from the grid so that the HPCS would separate from the normal power supply after which you would start the diesel and then 10 seconds later you would close the diesel breaker. So it would be isolated from anything else.

MR. EBERSOLE: I want to eliminate completely the possibility that it would connect back to the grid.

MR. RAUGHLEY: That has to be done manually.

MR. EBERSOLE: Is that part of the operation?

MR. RAUGHLEY: Yes. Upon restoration of the grid you would manually parallel.

MR. EBERSOLE: Yes, but when you disconnect from the AC grid and the diesel starts, you then manually guarantee that the disconnect will be maintained?

MR. RAUGHLEY: Yes, the disconnect is maintained until you manually reclose the breaker.

MR. EBERSOLE: It is a philosophical problem. It is the degree of independence that I am looking for.

(Slide.)

MR. PROPOSON: The conclusions that we have drawn based on the data that we have shown and also again assuming that 12-hour station blackout condition are as follows.

The drywell pressure, the containment pressure and the drywell temperature all will result in levels that are less than the design quantities. The containment temperature will be exceeded by eight degrees and we are in the process of performing an evaluation to determine what that eight degrees really means. This is still underneath our ultimate value, but over the design value.

The pool temperature will still be 32 degrees below the saturation temperature and we would have maintained adequate quenching and net positive suction head.

MR. OKRENT: Are there any places like the control room or some other room that reach temperatures that are so high that you would have concern for the equipment in that room being operational?

MR. PROPOSON: We still are in the process of evaluating that portion of our study. There are some areas that will become warm and we will address that as part of our equipment qualification program.

MR. OKRENT: Let's assume you restore power and you will be then relying on some other kinds of equipment.

MR. PROPOSON: Understood.

MR. OKRENT: And I can't tell whether you looked at all that you need under that.

MR. EBERSOLE: Well, I will tell you a case in point is the reactor seals on the main coolant pumps. They may be degrading because of high temperatures at your full pressure and their static which makes them leak worse anyway.

MR. PROPOSON: Okay.

MR. EBERSOLE: But in a BWR or a LOCA is just another place where the steam goes anyway. So I guess it is not a serious consequence if you lose these seals there. It is on a PWR.

How about the RCIC pump itself? You do have AC valves on the steamlines, but they are normally open.

MR. RAUGHLEY: It is electrically controlled apparently.

MR. EBERSOLE: Well, the mainsteam valve I saw on a diagram, is that correct?

MR. RAUGHLEY: As far as the RCIC system itself, all the valving being controlled is DC.

MR. EBERSOLE: Yes, but I am talking about the mainsteam valve.

MR. CULP: Bill Culp, Stone and Webster. Yes, they are AC powered, the containment isolation valves, but they would stay open during the ---

MR. EBERSOLE: Is that the reason you keep them open all the time so that you don't have to face the AC failure problem?

MR. CULP: Yes.

MR. EBERSOLE: What do you do when you do that? Do you buy the presence of a pressurized steam line meandering around in the equipment room?

MR. CULP: That is evaluated as part of the high-energy line break evaluation.

MR. EBERSOLE: Are you happy with the potentiality that that steamline may break and you don't close it because of the valve malfunctions?

MR. CULP: We do take credit for isolation of the lines by one of the two valves, the one which is inside the containment and not really subject to the environmental conditions.

MR. EBERSOLE: Would you agree if you don't close the line you are going to have a lot of problems?

MR. CULP: Yes, sir.

MR. EBERSOLE: So are you looking at valves reliability for those valves operating at a full blown mode at full flow? You know, most valve tests don't accommodate the full flow mode or are never in situ tested to show their competence subsequent to installation, but these valves have a somewhat higher responsibility. I just wondered what the quality of your surveillance and testing of these valves was since you leave them open all the time.

MR. CULP: I would like to address that later in the meeting.

MR. EBERSOLE: Okay. There are some worse ones than that on the old steam turbine driven HPCIs.

MR. PROPOSON: That concludes my presentation.

MR. EBERSOLE: Before we entirely drop the DC system, let me ask what the AD logic is? Is that a two trane logic, the ADS? If one DC supply system fails, is that half of the ADS that fails?

MR. GUHA: Yes.

MR. EBERSOLE: Is that certain? Do the ADS valves have two solenoids or one solenoid?

MR. GUHA: Two solenoids.

MR. EBERSOLE: Will either one of those energize the ADS?

MR. GUHA: That is correct.

MR. EBERSOLE: And is each of those derived from a. alternate DC supply?

MR. GUHA: That is correct.

MR. EBERSOLE: So you keep all of your ADS.

MR. GUHA: Yes.

MR. EBERSOLE: Thank you.

MR. REED: The next item on the agenda will be the Trans-America DeLaval diesel generator reliability issues. Mr. John Hamilton, Supervisor of Site Engineering, has been with Gulf States Utilities as little over a year and he brings with him 16 years prior experience with Babcock and Wilcox. He has a bachelor of science and mechanical engineering degree from the University of Arkansas and a master of science in nuclear engineering from the University of Tennessee.

MR. HAMILTON: The subject of my presentation is the program that we have undertaken to qualify the Trans-America DeLaval standby diesel generators.

(Slide.)

This is a program that was initiated by Gulf States Utilities last November. The objective of the program is to evaluate the Trans-Americar DeLaval diesel engines at River Bend and determine what is necessary to assure reliable standby power.

The resources that we have brought to the program include both the owners group participation in the DeLaval Owners Group and the program that we have in place at River Bend.

We instituted the program as a result of the component failures at other facilities and the audits and evaluations of Trans-America DeLaval which revealed weaknesses in their quality programs.

The purpose of the program is to address the known problems of the Trans-America DeLaval engines and to perform work to discover any latent problems that may still exist in those engines.

(Slide.)

The resources that we have brought to this program include those of Gulf State Utilities, Stone and Webster Engineering Company, Trans-America DeLaval, Failure Analysis Associates and Southwest Research Institute, in addition to our participation in the DeLaval Owners Group.

Starting from the left, the testing activity is carried on by Stone and Webster.

The engineering review activity is directed by a Gulf States employee but is carried out by a combination of Gulf States and Stone and Webster people.

The licensing is done by Gulf States.

Failure Analysis Associates is a stress analysis consultant and is responsible for transfer of the owners group technology to River Bend. They are under contract to Gulf States and also works for the owners group and does work for us in that mode as well.

Trans-America DeLaval has designated a representative to participate in our program. We use the resources of the Stone and Webster office in Cherry Hill and in Boston.

We have also retained Southwest Research because of their engine design expertise and to perform responsibilities that generally parallel those of Failure Analysis Associates.

MR. EBERSOLE: May I ask, did these engines have a successful working record before all this flap started?

MR. HAMILTON: There are a number of engines in non-nuclear service and in nuclear service. There have been a number of component failures in marine and stationery installations as well as in nuclear service.

MR. EBERSOLE: So this is not a sudden growth of problems, but it is a long-standing quality problem?

MR. HAMILTON: Let me qualify the answer to that by saying that the service and maintenance history of the engines and other service is difficult to establish. So it is difficult to make comparisons. There have been failures of components. Most of the component failures we see in nuclear installations have also occurred in stationery or marine installations, but to what extent that is characteristic of the design or manufacture and to what extent it is characteristic of the operation, I can't say.

(Slide.)

The program activities include a design review activity which is carried on both within the owners group and as part of the Gulf States and Stone and Webster work at River Bend. This includes the owners group generic evaluations and our own work.

The industry experience includes review of the owners group information and the information that we have obtained by visits to other plants and a program of extensive pre-service inspection.

Those three activities all lead to a effort which involves modification and rework of the engines which is going on today, and you observed some of it in your tour this morning.

Following the completion of our preservice inspection and rework activities we will test the engines and then form a post-test inspection. We currently expect that program to be successful and lead to successful qualification of the engines, after which we will institute a surveillance and monitoring program to continue to keep an eye on them.

MR. EBERSOLE: In contrast, the core spray diesel engine is another design.

MR. HAMILTON: Yes.

MR. EBERSOLE: Now then how about comparing the performance of that engine with the Trans-America DeLaval in past years?

MR. HAMILTON: I don't have that data. We can get it for you.

MR. EBERSOLE: I just want to know if this is an engine like the DC-10 that has problems?

MR. HAMILTON: I find it difficult to make that kind of comparison. To compare the DeLaval engine to the high-pressure core spray engine, I don't know of problems with the high-pressure core spray engine that are as severe or as numerous as the Trans-America DeLaval engine.

There has been a history of turbocharger failures in the high-pressure core spray engine and we have addressed that by purchasing a modification from the manufacturer which we believe will correct that particular problem.

There have been a number of instances of turbocharger problems with the EMD engines, but I don't recall any other severe problems.

(Slide.)

To review the activities in a little more detail that were shown on the previous slide, our design review activities includes the owners group work, which includes the review of the 16 generic problems in the Phase I design review that is being conducted by the owners group.

There will also be a River Bend specific design rev ew, which is what we call the Phase II design review, and that will be done by the owners group.

The River Bend activities include of course assimilation of the results of the owners group work and the special investigation that will be performed by GSU, Stone and Webster and our consultant. This will also include a review and independent verification of the Trans-America DeLaval qualification which we have not yet approved.

The industry experience activity involves accumulation of data by the owners group and the observations of post-test inspections at other facilities. We have had teams that visited Comanche Peak, Shoreham, Catawba and have otherwise interchanged information with other users of DeLaval engines.

(Slide.)

Our preservice inspection program includes inspections by the manufacturers of the major components. This has included Trans-American DeLaval, Electric Products who manufactured the generator, Woodward who manufactured the governor and RTE Delta who is the manufacturer of the switch gear.

We performed preliminary testing of the individual components and subsystems and we have performed with the engine assembled, we have performed preservice inspection of over 60 items that there were found to be problems in at other plants. These are predominantly visual inspections.

We are now undertaking a program of preservice disassembly and inspection, and these inspections are performed in accordance with the owners group criteria and a number of methods are employed based on the results of the design review. As appropriate to the component, we perform either a visual inspection, a liquid penetrant inspection, a magnetic particle inspection, eddy current or radiography, and those inspections are going on at the present time.

MR. EBERSOLE: Isn't the problem that in the typical nuclear plant you simply can't get many hours on these engines?

MR. HAMILTON: I am sorry, I couldn't hear your question.

MR. EBERSOLE: You can't get many hours on these engines with the present constraints and you just can't put much time on them.

MR. HAMILTON: Well, in tests we have the capability to tie the engines to the grid and we can test them.

MR. EBERSOLE: Oh, you do?

MR. HAMILTON: Our current test plan calls for that mode of operation.

MR. EBERSOLE: I see.

MR. HAMILTON: It would not be a normal mode of operation, but we can test them on a preservice basis in that way.

MR. OKRENT: Is it assured that the root cause of the trouble with these diesels is known?

MR. HAMILTON: The root cause of the problems, we are not making any preconceived assumptions of what the root cause is. Our presumption is that there could be a defect in any of the components that we look at. So we are not necessarily closing our minds. In other words, one of the purposes of the program is to look for latent defects not previously identified. We don't want to make the assumption as to what the root cause is because it is difficult to say what went on because of the breakdown in the QA program at DeLaval.

MR. OKRENT: Well, what I am trying to understand is if one isn't sure he has a handle on I will say all of the root causes, how can he be sure that just assuring that there are no flaws in components will lead to reliability? I can think of systems which would show failure after some hours of operation, and I am sure you can, too, where no flaws were evident in inspection, and in fact no flaws in design until they understood the failures.

MR. HAMILTON: Well, our program does take account of that, and following our rework activities to rectify the known problems, we have a testing program which will reveal other defects. If we haven't found any additional defects in the testing program, it would do that, followed by the post-test inspection. And after that we would institute a program of continued surveillance and monitoring which would perform continuing inspection and use monitoring instrumentation to keep us aware of any developing problems with the engine.

MR. EBERSOLE: Do you have any way in these engines to detect incipient or progressive failures before you have real trouble like magnetic particle pickup or weld analysis or things typical of the aviation business?

MR. HAMILTON: We do use oil analysis that would detect magnetic particles in the oil. We would detect any leakage from the cooling system. We can perform visual inspections to detect abnormal wear. It is easy in these engines to look inside the crank case because there are simply covers on the side of the engines and you can take them off and look inside and see the connecting rods, the pistons and the liners. You can look into the cyclinders with a boroscope from both directions to the crank case and through the cyclinder heads.

And there are additional monitoring instrumentation that we will develop as part of the surveillance and monitoring program that we use.

MR. EBERSOLE: Have the failures that have occurred so far advertised themselves amply in advance?

MR. HAMILTON: Well, the Shoreham crank case failure certainly did. Most of the other failures, the turbocharger failures, you will know those, but not necessarily in advance. The other failures that have happened have been detected by inspection and have not led to a failure of the engine in general.

(Slide.)

This is a summary of the rework activities that we have undertaken. We have purchased upgrades in a number of areas, including the pistons and piston rings, the valve pushrods and we have performed rework in the cyclinder head sruds and we have performed rework on the cyclinder liners. We will be modifying the turbocharger bearing lubrication system, the jacket water pump, we will be stiffening the turbocharger bracket to prevent vibration, we will obtain an improved fuel injection tubing from DeLaval when that becomes available in an a heavier fuel injection pump return line, new fuel inspection nozzle tips and an idler gear locknut replacement.

Our design reviews are continuing and it is possible that other items may be identified.

(Slide.)

I referred earlier to the testing program and that will include a crankshaft tortional vibration test and a crankshaft bending stress test that will be performed using dynamic strain gauges inside the operating engine on the crankshaft.

We will provide instrumentation to monitor general engine vibration. We will take engine performance data and will perform an engine performance testing, including start testing and power runs. We are at the present time defining the scope of that program and we will be submitting that program to the staff in the next week or so in advance of our conduct of that test.

We will conduct testing and take data from our instrumentation to assess the turbocharger lubrication and cooling performance and we will take data on the turbocharger bracket vibration.

We will perform a post test inspection, and that likewise is a program that we are presently in the process of defining and we will submit that to the staff in advance of testing.

We will likewise develop a program of inservice test surveillance and monitoring which will in part depend on the results of the foregoing activities. So we have not as yet done a great deal of work on that particular part of it.

MR. EBERSOLE: You know, the whole thesis of having diesels is of course based on a hypothesis years ago that you are going to have a large LOCA and you will instantaneously lose power. So you had to have 10-second startup.

Our current thinking says that with some good reasons you needn't postulate AC power loss coincident with a very unlikely event like a LOCA which revived the question of why don't you have a gas turbine out there some place. It takes a little more time to start up before it is on line, but it is independent.

Have you all ever considered that sort of thing? Some plants have this.

MR. HAMILTON: We have not considered it. Our feeling at the present time is that when we finish this program, we will have reliable diesel engines and, as the previous presentation indicated, we will have a reliable source of off-site power. So we have not at this point considered any additional way.

MR. EBERSOLE: I think if you looked at the probabilities, the probabilities of a large LOCA and a coincident power loss, and PRA is popular nowaday and there is a place where it might look pretty good.

MR. HAMILTON: Yes. I think the combined probability or the combined likelihood of those two events would be low.

(Slide.)

The conclusion of the program is that we do consider the qualification of the Trans-America DeLaval engines to be feasible. A resolution of the major failures we believe will be provided by the owners group.

We believe our program of inspection, plus testing, plus inspection, plus in-service surveillance and monitoring will identify any additional problems and we will develop that program of in-service surveillance and monitoring.

The other step that we have taken is one not mentioned on the slide. We have asked Stone and Webster to review the caculations that established the design load on the engines and they have found some conservativism in those loads and we will be modifying the FSAR to reflect a reduction in the design load on the engine.

We currently in the FSAR show a maximum load of 3700 kilowatts which is within the two-hour rate of the engine. We will be reducing that load to the 3500 kilowatt continuous rating of the engine.

MR. OKRENT: I can't recall. What is the staff position with regard to a new plant starting operation when it has this kind of diesel? Would you remind me.

MR. NOVAK: Well, we have a number of new plants to choose from. Today if I would take the Catawba plant as a specific plant, the power company decided to go ahead and form what we will call an endurance run. They took one of the diesels and run it for approximately 750 hours.

I think most stress analysts agree that after you have run this long that you have demonstrated that the system is not vulnerable to fatigue type failures. You have gotten the number of cycles established. This engine has been disassembled and an inspection is forthcoming on the diesel itself.

The same thing is undergoing right now on the Grand Gulf Station. By order the Grand Gulf unit was ordered to tear down one of the diesels and early this week the staff and its consultants were reviewing inspection results from the Grand Gulf unit.

The best indication I can give you now is we would consider acceptable results on either of these engines to be interim until the owners group is complete. As you mentioned earlier, there may be several root causes for problems. There were some design concerns on the Shoreham engine and we believe there is a generic quality control in the manufacture of the engines.

To some degree this could vary, depending on the QA program of each of the applicants. They are responsible for auditing the QA program at the vendors' facilities and in certain cases we have seen indications where there may be better than average performance in that case. That may give some indication of the quality, but no assurance that the engines are acceptable and would satisfy general design criterion 17.

The short answer is it is evolving. We have decided that, for example, that licensees who currently today have TDI diesels do not satisfy general design criterion 17. So Grand Gulf was requested to file for exemption. This is more of a legal requirement than what I would envision as a safety requirement at that time since they are limited to only five percent power.

I have tried to give you just a summary of where we are today in terms of the TDI diesel. We are putting a lot of effort in. There were a number of concerns about how do you know that the engine continues to perform acceptably.

For example, one test that wasn't indicated was the roll test, every 24 hours to worry about water leakage into a cyclinder. We require, for example, on the Grand Gulf inspection that they would continue to test the water in leakage into the piston cyclinders themselves.

So I think it is fair to say that the concerns for the TDI diesels will continue for the next several months until the owners group program is resolved and the reliability of the TDI diesels can be re-established. It will include complete design review by the owners group. As was mentioned, there are some 16 critical parts where a complete design review will be done. This came out of the Shoreham experience.

There will be specific quality control inspections. Components will have to be inspected again.

This is part of I think the Grand Gulf teardown right now and the River Bend teardown to establish if the installed components are acceptable for continued operation.

So I think it is just an answer that says we are going to be watching it very carefully and only after the owners group program is complete and the implementation suggested from that owners group is put back into each diesel will the reliability of the TDI diesels be re-established.

MR. OKRENT: Thank you.

I guess we are ready for Item D.

MR. REED: Fine. We will move on to D at this time then on decay heat removal systems. Mr. Dave Lorfing, who you have been introduced to earlier, a nuclear engineer in our Nuclear Engineering Department will address that topic.

MR. LORFING: I am going to be discussing the River Bend Station decay heat removal systems.

(Slide.)

I am going to discuss it in two different areas, systems which transfer decay heat to the ultimate heat sink and, secondly, systems which provide makeup water to the reactor vessel.

(Slide.)

River Bend has two primary means of

transferring decay heat from the reactor vessel and from containment. Under normal conditions when all systems are available we use the main condenser to condense steam from the reactor vessel and transfer the the heat to the normal cooling towers.

If the condenser is not available, we use the residual heat removal system heat exchangers to transfer heat to either the normal or the standby cooling towers to either the normal or standby service water system.

Using the residual heat removal heat exchangers and the standby cooling towers is the safety related method of decay heat removal. This is the system used following the design basis accident.

MR. EBERSOLE: May I ask you a question about the normal cooling towers and the condenser circulating water pumps. When you are pumping circ water back to the towers and on up into the normal cooling towers, do you have booster pumps to get the water going up into the towers? The circ water pumps just pump it back to the basement, don't they?

MR. LORFING: No. The circulating water pumps take suction on the basin and pump the water through the condenser and back to the cooling tower.

MR. EBERSOLE: Back to the cooling tower.

MR. LORFING: Back to the cooling tower and up to the top of the cooling tower, right.

MR. EBERSOLE: Well, when a trip out occurs with the loss of AC power, does the hot water run back down in your face and cause any problems?

MR. LORFING: I believe there are check valves that prevent that water in the line, the head, from coming back through the condenser. I might have to verify that.

MR. EBERSOLE: In the long run, I would ask if there is any reverse flow like that, would it do anything to the safety of the cooling systems?

MR. LORFING: I don't see that it would have an effect. It would have an effect on the condenser if you had a reverse flow.

MR. EBERSOLE: But it would not harm the safety of the standby system?

MR. LORFING: No, it is completely independent of the standby cooling tower.

(Slide.)

Now I am going to discuss some of the functions of the residual heat removal system. We did go through the RHR system this morning and we looked at the loop B cubicle.

The RHR system again is a multi-purpose system and includes three low-pressure pumps and two independent heat exchanger loops. This mode of operation shown here is the shutdown cooling function, and in the shutdown cooling function we have only two loops, in other words, two of the RHR pumps have heat exchangers associated with them.

The RHR pumps in this mode of operation takes suction on the reactor recirc suction line. They pump through the heat exchangers and then back to the vessel through the feedwater line, through the head vent, shown up on the top of the reactor vessel, and they can also pump back through those spargers located in the upper pool in the event of refueling when the reactor head has been removed.

(Slide.)

The second mode of operation, and this is the decay heat removal mode of operation of the residual heat removal system, is the steam condensing function. In this function only the RHR heat exchangers are used as far as the RHR system is concerned.

The steam is taken off the main steamline, goes through a pressure reducing station, that is item 6, the steam passes through both heat exchangers and the condensate from the heat exchangers is returned to the vessel using the RCIC pump, and the RCIC pump is a high-pressure pump.

This system is used primarily if the reactor has been isolated from the condenser and you need some steam condensing function.

MR. OKRENT: Does either this mode or one of the modes shown on the previous slide offer a potential for water hammer?

MR. LORFING: Water hammer in what respect? I am not sure exactly what your question is.

MR. EBERSOLE: I have heard of making a transition in these modes for using the RHR exchangers as a full flow cooler or to a condensing function, and there is a rich opportunity to have water hammer in there.

Is that what you are talking about?

MR. OKRENT: You are having a change in flow conditions and you are having pipes, but you didn't have steam and then have steam admitted, and I am asking in fact whether you have examined each of these what I will call non-normal operational conditions to see whether they include a potential for water hammer.

MR. McMORELAND: Bob McMoreland, Stone and Webster. We do have a program in conjunction with our pipe stress and pipe support people where we go through and we do evaluate all of these modes of operation for water hammer potential and also for steam hammer potential where applicable. So it is evaluated case by case, system by system and mode by mode for the ECCS systems.

MR. OKRENT: And your conclusion was what for the things we have just looked at?

MR. McMORELAND: I don't have the conclusions with me. We could certainly find out in a specific case or across the board in some cases. We have the standard ECCS subsystem fill pump to avoid that historical potential for water hammer. In other cases we do evaluate injection lines for partially drained conditions.

So there is a potential like in the LPCI mode and the HPCS injection. There is a potential for water hammer and that is factored into the pipe stress analysis and pipe support designs.

MR. OKRENT: I guess it might be interesting, if it is possible, to hear a short summary of the situations wherein you feel that a potential for water hammer does exist and how then you decide what magnitude of water hammer to factor into design, not today, but we are going to meet again.

MR. EBERSOLE: This mode of operation makes me a little bit nervous. You all know the WASH 1400 B event and you know the tremendous precautions we take to interlock the suction valves so that we don't cause a high pressure system to look a low pressure system.

The pressure of the low pressure system here I heard earlier on was quite low, isn't it, 150 pounds or thereabouts?

MR. LORFING: You are talking about the service water system?

MR. EBERSOLE: That as well as the RHR system on both sides.

MR. LORFING: The service water system pressure is lower than the RHR side.

MR. EBERSOLE: In the RHR system it is very low indeed.

MR. LORFING: The RHR pressure is higher than the service water pressure.

MR. EBERSOLE: So it leaks outward?

MR. LORFING: Right. It does have ---

MR. EBERSOLE: Well, I heard the reverse in the shop over there.

MR. LORFING: The pressures are very close, but the potential does exist.

MR. EBERSOLE: Just give me the static pressure capabilities of the two systems. Can you give me the static pressure, the ratings of the two systems?

MR. LORFING: I don't have the numbers with me.

MR. SZABO: Offhand, I don't know what the pressures are, but they are in the FSAR and I will pick them up tomorrow.

MR. EBERSOLE: Well, I heard over at the plant that it is something like 125 to 160 psi, and I also heard that it has been designed so that the service water would flow into the primary coolant. That is the story I got.

MR. OKRENT: I heard that, too.

MR. LORFING: In some modes of operation that may be true.

MR. EBERSOLE: Well, in any case, it is a low-pressue system. Now with all the precautions you take to prevent it from looking into an 1100 psi system, I now see this what I would call unreliable pressure control valve which I am going to automatically prop wide open, and I am asking you tell me what happens.

MR. LORFING: All right. I believe there are relief valves on the RHR heat exchanger inlet lines that would relieve back to the suppression pool.

MR. EBERSOLE: Are the consistent with the maximum potential flow through the throat of that pressure control valve?

MR. LORFING: I would have to ask the designer.

MR. SCABO: Yes, we analyzed assuming that the pressure control valve fails to wide open and relief valves are sized to pass the flow associated with that condition.

MR. EBERSOLE: Thank you.

MR. LORFING: The third mode of operation in the residual heat removal system is the suppression pool cooling function. In this function the RHR pumps take suction on the suppression pool, water passes through the heat exchangers and back to the suppression pool. So that this provides cooling of that pool.

MR. EBERSOLE: Now in that mode in the meantime what is putting water into the reactor?

MR. LORFING: Well, you can use this system. You could break it up. You could use one pump to pump water into the reactor vessel and use one of the loops for suppression pool cooling.

In addition, you have high pressure core spray, RCIC, low pressure core spray and there are other systems available to provide makeup water to the reactor vessel.

MR. EBERSOLE: Now let me ask you this. In this condition, and this is a post-accident condition, isn't it?

MR. LORFING: That is correct.

MR. EBERSOLE: I wonder if you could tell me what is the hypothetical activity of the water that you used to design for seal leakage and seal dosage and other components in the system. Considering that you are pumping post-accident water that is highly contaminated, and further considering that in view of the single failure criteria you started doing this and one of them didn't start, or one of them failed later and you only have got two, are you going to hang on to the one remaining, or are you going to go back in and maintain one for the next three months that you are going to have to pump water like in TMI-2?

MR. EBERSOLE: We assumed the failure of one of these loops. So there are two hundred percent loops. Your question about the radioactivity concentration, do I have anyone? I do not know the answer to that.

MR. EBERSOLE: The water is hypothetically dirty probably through an arbitrary source and it has potential for damage to other parts of the system. I wonder what is your rationale since you only have two tracks to deal with that situation?. The pipe that I am familiar with had four tracks. So you just let it degrade one at a time, but you have got two.

So is your philosophy that you will maintain these as they become inoperable over a long span of time, or you will hope that the one that is left will keep on running?

MR. LORFING: I would think if we lost one trane that we would try to get that loop back into operation. We wouldn't just maintain it inoperable. We would try to regain that loop.

MR. EBERSOLE: Does it have shielding and cleanup facilities to enhance your chance to do that?

MR. LORFING: In the RHR cubicles themselves?

MR. OKRENT: I think we saw that today.

MR. EBERSOLE: I didn't see any such provisions for post-accident restoration function. So these have to be good enough to last the duration even if there is only one the way I saw it.

MR. LORFING: If it was a pump failure or motor failure, you are right, that we probably would not be able to get in there to do any maintenance on them. However, if it was a failure of a power supply, we could try to restore it.

MR. EBERSOLE: Well, the end of result of this is you have got be sure they remain fixed.

MR. OKRENT: I would like to ask the staff what they think these systems are qualified to take in the form of radiation?

(Pause.)

MR. WEINKAM: Dr. Okrent, we have just recently received some updates to be in the qualification program for Gulf States. In the long term we will be satisfied with these pumps and all the other equipment would be qualified to the environment that they would see for the extended period.

Does that answer your question?

MR. OKRENT: No. I would say you haven't told me what are the environments they will see. That is what my question was.

MR. WEINKAM: Off the top of my head I don't have that available. I believe it would be a harsh environment. Now that is an undefined term quantitatively. I can answer that later for you.

MR. SCABO: We used the standard DBA system out of Reg. Guide 1.3 to calculate the environments that we qualified equipment for. So the RHR pumps and the RHR equipment is qualified for the duration of the accident.

Suppression pool cooling, you basically get the pool temperature under control in less than a day, and at that point you may only have to cycle it intermittently to control the pool temperature, if at all. At that time you can keep your other loop of RHR in shutdown cooling.

MR. OKRENT: Do you recall what those DBA radiation limits were, or are they some fraction of the core inventory?

MR. SCABO: We don't have our radiation people here. We can get that distinction for you. Are you looking for it in terms of microcuries or milliliters or what?

MR. OKRENT: It would help me to think in terms of, for example, what fraction of the core iodine and cesium since those are things that people may end up in water or largely in water, et cetera. That is just one example.

MR. KNECK:I am Donald Kneck with General Electric. My memory is a little vague on it, but as I remember it, it is about 1 percent of cesium and about 50 percent of the iodine.

MR. OKRENT: Well, that doesn't sound too bad and it may indeed be what the systems are qualified for. I must confess, I recall some concern back in I guess it was 1979 as to whether pumps that have to take some highly radioactive water could be depended on. This is why I am just trying to understand what the real situation.

MR. EBERSOLE: Do you have any criteria for seal leakage at this point on these things that you are handling dirty water that acknowledges the presence of radioactive fluids?

MR. CULP: Yes, we do. We have allowed leakage that we considered in the analysis of five gallons per hour from the seal leakage of these pumps.

MR. EBERSOLE: Of water contaminated to what level?

MR. CULP: To the levels indicated in the report, one percent of the solids and 50 percent.

MR. EBERSOLE: Can you give me a round number as to what the dosage would be in the vicinity of these pumps?

MR. CULP: We can get that information later.

MR. EBERSOLE: Okay. Thank you.

(Slide.)

Now I will discuss the makeup water systems. These are the systems listed here on this slide. They are used to deliver water to the vessel under normal and emergency conditions. Under normal conditions following a turbine trip and decay heat in the reactor vessel, we use the condensate and feedwater systems to provide makeup water to the vessel from the condenser hotwell.

MR. EBERSOLE: To do this do you use the main feedwater pumps?

MR. LORFING: That is correct, the condensate pumps and the main feedwater pumps.

MR. EBERSOLE: And you don't have booster pumps, which are motor driven?

MR. LORFING: They are motor driven.

MR. EBERSOLE: And you pinch off the flow with valves to control the level, is that what you do?

MR. LORFING: I believe we would use the normal feedwater control system to control level in the reactor vessel.

MR. EBERSOLE: And will they control down to that low level or low amount of flow?

MR. LORFING: It would be a reduced flow from the 100 percent feedwater flow.

MR. EBERSOLE: What do you do with the other part of the flow? Do you bypass it or run it around? How do you keep from boiling it?

MR. LORFING: You can throttle those pumps back I do believe.

MR. EBERSOLE: You can't do that without overheating the pumps, can you?

MR. LORFING: You are getting into the feedwater design, and I might have to ---

MR. EBERSOLE: What you have now is such a low fraction of normal feedwater flow that I am having trouble finding out whether your main feedwater pumps can supply it. That is my problem.

MR. OKRENT: We are talking about a few percent?

MR. LORFING: That is correct.

Can anyone address that? I can't.

MR. McMORELAND: I don't know what the actual percent of feedwater flow is offhand that we could maintain say an automatic flow mode. We do have a substantial feedwater flow bypass capability back to the condenser.

We can find out for you both on the manual and on the automatic type mode.

MR. EBERSOLE: Do you follow my problem?

MR. McMORELAND: Yes, I do.

MR. EBERSOLE: Now, let's see, that is the only water that can go into the core via the main feedwater line, which is that which comes from the main feedwater pumps, right? There are no other pumps somewhere back in the system. Well, what about the condensate pumps, will pump through the main feedwater pump and deliver some pressure to the reactor?

MR. LORFING: Yes, you can use the condensate pumps without the feedwater pumps.

MR. EBERSOLE: Through the pumps.

MR. LORFING: I believe there is a feedwater pump bypass line. I am not completely familiar with the feedwater system, but I believe there is a bypass around those pumps.

MR. OKRENT: Can I ask for the kinds of modes of decay removal we have been discussing, and in particular the one currently under discussion, do you have abnormal procedures or emergency operating procedures written that cover each of these modes?

MR. LORFING: Chuck Bogolin?

I was looking for our Operations Supervisor to answer that question. We do have normal operating procedures which would control normal events, and then I believe we enter abnormal -- here he comes. He is much more familiar with the abnormal procedures and emergency operating procedures.

MR. BOGOLIN: I am Chuck Bogolin, the Operations Supervisor. Can I hear the question, please?

MR. OKRENT: We have been hearing discussion on the decay heat removal, and there have been a few slides before this one, but right now we happen to be talking about condensate feedwater systems as a way of reactor vessel makeup water.

What I asked is whether there exists either abnormal procedures or emergency operating procedures that deal with each of the proposed modes of operation that have been presented here or are being presented here?

MR. BOGOLIN: Yes, sir. We have developed our emergency operating procedures according to the BWR Owners Group which we are a participant in, and presently our procedures are written. We have ended up with 11 EOPs and of that five of them are main control guidelines.

One would address the reactor pressure vessel level. The other would address reactor vessel pressure. We talk about containment control, secondary containment control and that involves the pressure and the temperature, depending on what the parameters tell the operator.

In the use of these systems here, they primarily fall within the reactor pressure vessel level guideline, and they function within the emergency operator procedures.

When you talk about the condensating feedwater system and where that might fall in that area, in trying to put water in that reactor vessel, you start with your most likely system to be available, which would be your HPCS, and then you go down the line with the others that are supplying the diesels.

Now if we haven't lost offsite power, our condensating feedwater systems are available to us to add water to our reactor vessel because the feedwater pumps are motor driven and not steam. So they are available, and we can bypass the feedwater pumps with the condensate pumps providing reactor vessel pressure is dropped to approximately 550 pounds. We can put water in with the condensate pumps.

So in using these systems, the HPCS and the RCIC which work together on an isolated vessel, and once we drop the pressure, the low-pressure systems come into play to maintain the reactor water level for us then.

MR. OKRENT: Well, if we are for the moment talking about the condensate feedwater system, let me postulate that we are at high pressure for some reason where you need your main feedwater pumps. What does the emergency operating procedure say, what cautions are there and how does the operator control to get the right amount of feedwater and are there limitations on minimum flow or maximum flow?

MR. BOGOLIN: Yes, sir, there is. On the feedwater pumps themselves, and we will talk about them, we have a minimum suction pressure, 275 pounds, which has to be available for it to even run which must be supplied by the condenate pump.

As far as, you know, in our procedures, we talk about if the feedwater system is available and you have an event, you use the feedwater system. You can't put water in there any faster than you can with the feedwater system.

MR. EBERSOLE: But on a turbine trip when the water flow rate has got to drop to one to five percent real quick, is the transient response of this electric system such that it will follow down to that flow rate or will in effect you not lose it?

MR. BOGOLIN: No, sir. With our 13-8 bus, we can a fast transfer to the preferred source. This transfer is supposed to be such that we wouldn't drop the feedwater pumps say it was running, and there is no, such as high level, that would force a trip of the feedwater pump.

MR. EBERSOLE: Well, what throttles its flow down to the very low percentage which now has?

MR. BOGOLIN: The level control system is level predominant. It would force the feedwater control valves closed to maintain the level.

MR. EBERSOLE: Is there a bypass then for the surplus water?

MR. BOGOLIN: Sir?

MR. EBERSOLE: Is there a bypass for the surplus water? That is going to be only a small percent of the total ---

MR. BOGOLIN: Yes, sir. As the flow drops on the feed pumps it would recirc back to the condenser. We have an automatic recirc valve that dumps it back to the hotwell.

MR. EBERSOLE: Okay. That is what I was looking for.

MR. OKRENT: What fraction of full flow does the recirculation line take?

MR. BOGOLIN: If I remember correctly, about 25 percent.

MR. EBERSOLE: Wait a minute. You only need one to five percent of water flow now. That is power level.

MR. BOGOLIN: Yes, sir, and you wouldn't need all these feed pumps at this time either.

MR. EBERSOLE: No, you don't.

MR. BOGOLIN: Within the procedure the operator would be directed to back off on the equipment he has feeding water to the reactor vessel.

MR. EBERSOLE: Does that mean he would shut down two of these pumps?

MR. LORFING: If he needed to, yes, sir. More than likely he would because he wouldn't have any place for that steam.

MR. EBERSOLE: It sounds like you have to prodigious bypasses back to the condenser on these pumps because of this small fraction you really need from the main feed pumps to maintain level.

MR. BOGOLIN: I am thinking it is about a 10-inch line.

MR. EBERSOLE: To go back to the condenser?

MR. BOGOLIN: Yes, sir.

MR. EBERSOLE: I wouldn't be surprised.

MR. BOGOLIN: Yes, sir.

MR. EBERSOLE: Anyway, the gist of it is when you have a turbine trip and reactor scram, but you don't lose AC power, that can be a benign event in that it doesn't challenge the safety system.

MR. BOGOLIN: Exactly right. Exactly. These safety systems come into play on certain signals from the reactor vessel level or high drywell pressure. They would not even come into play. The feed pumps would handle it and the condensate pumps would be there. So we are in good shape.

MR. OKRENT: Is the feedwater pump at fixed speed or variable speed?

MR. BOGOLIN: It has got a speed increaser on it. The motor runs at a set speed with a speed increaser for the pump.

MR. EBERSOLE: Oh, it has got a hydraulic coupler, is that right?

MR. BOGOLIN: Yes, sir.

MR. EBERSOLE: That explains lots of things.

MR. BOGOLIN: I guess if you want to call it a hydraulic coupler, yes.

MR. EBERSOLE: Okay. I didn't know that. I thought it was a straight couple pump.

MR. BOGOLIN: No, sir.

MR. EBERSOLE: Okay. Thank you.

MR. BOGOLIN: Are there any other questions?

MR. EBERSOLE: No. I am done with that.

MR. BOGOLIN: I will talk more about EOPs tomorrow.

(Laughter.)

MR. EBERSOLE: I believe you were just up to the RCIC.

MR. KIRKEBO: John Kirkebo from Stone and Webster. I think they may have given you the wrong impression on the feed pumps and their couplings and being variable speed. I would like to clarify that in a few moments after we confirm it.

MR. EBERSOLE: Okay.

MR. LORFING: All right. In the event that we lose feedwater supply and we lose the condenser as a heat sink, we use the RCIC system to provide makeup water to the vessel.

This pump is a steam turbine driven pump and can take suction on either the suppression pool or the condensate storage tank. The first source of water would be the condensate storage tank because it is a demineralized water supply.

MR. EBERSOLE: Before you throw that picture down, can I look at it just a second?

MR. LORFING: All right.

MR. EBERSOLE: You take steam out at some pressure which is higher than how many pounds, 150 pounds or thereabouts? It can't get any lower.

MR. LORFING: Right. The RCIC system can operate from full reactor pressure down to some lower limit, and I believe it is around 100 pounds. I do not know the limit, but there is some cutoff. It cannot operate all the way down to atmospheric. There is some steam pressure required to drive that steam turbine driven pump.

MR. EBERSOLE: And it has really got two isolation valves in the steamline where you just show one?

MR. LORFING: On this line?

MR. EBERSOLE: Yes.

MR. LORFING: I believe that is correct. Is that right, Bill?

MR. SZABO: Yes, there are two isolation valves.

MR. EBERSOLE: Now it goes down to the first stage and goes via the exhaust, and I understand you have a relief blowout panel on the exhaust stage of that.

MR. LORFING: On the exhaust of the turbine?

MR. EBERSOLE: Yes, and where does it discharge?

MR. LORFING: I am not sure. I am not familiar with that.

MR. EBERSOLE: If it blows where does the steam come go?

MR. LORFING: A ruptured disk or something?

MR. EBERSOLE: Yes.

MR. LORFING: I am not familiar with that design.

MR. CULP: That would be into RCIC pump room cubicle ---

MR. EBERSOLE: Into the pump room.

MR. CULP: Into the auxiliar pump room.

MR. EBERSOLE: And prolonged flow of that is stopped by what means?

MR. CULP: There are temperature elements that sense steam in that cubicle, that sense the rate of rise in the cubicle and isolate the two AC valves that were talked about earlier.

MR. EBERSOLE: That valve I see in the discharge, what kind of valve is that?

MR. CULP: We will have to find out for you.

MR. EBERSOLE: All right. I wouldn't want to see it shut.

(Laughter.)

MR. EBERSOLE: On this system, may I ask a GE representative, if you reach back into the history, the RCIC system was not categorized as a safety system, and I wonder if you could tell me at what point in time it all at once got this glorified status? It wasn't at Peach Bottom and it wasn't at Browns Ferry, it wasn't in Dresden and somewhere along the line is suddenly got punched up.

MR. QUIRK: My name is Joe Quirk from General Electric. The RCIC was upgraded as an engineered safety system on the BWR-6 on the GESSAR design, and some BWR-6 plants have adopted that.

MR. EBERSOLE: And when that happened, what did you do in a material context to make it all that much better?

MR. QUIRK: Actually very, very little. In fact, the system was already designed to ASME Class 2 and was Seismic 1 and was on the division one diesel. There were just some elements out in the turbine area that were not safety grade and they still aren't. They still are not safety grade, because we have shown that the system will still perform its function if that equipment fails.

MR. EBERSOLE: So it was really just a paper exercise to raise it up?

MR. QUIRK: Mostly it was a paper exercise, but there may be some minor changes.

MR. EBERSOLE: But it was put on the tech specs whereas it is not on old plants?

MR. QUIRK: I think it is on the tech specs on older plants.

MR. EBERSOLE: It is on the Q list, you know al those lists?

MR. QUIRK: It is now, I will tell you that. I don't know about the earlier ones.

MR. EBERSOLE: Okay. Thank you.

MR. LORFING: In addition to the RCIC system, we have the high-pressure core spray system which can also deliver makeup water to the vessel at high pressures at up to full reactor pressure.

The high pressure core spray system consists of one electric motor driven pump and it takes suction on either the condensate storage tank, shown in Item 6, or on the suppression pool.

High-pressure core spray is a part of the emergency core cooling system, it is safety related and receives its power supply from its own diesel generator, the division three diesel generator.

MR. EBERSOLE: That is a pretty big system there there, isn't it, because it is designed for small LOCAs. The flow capacity is pretty large.

MR. LORFING: The flow capacity at high pressures is approximately 500 gallons a minute. At full reactor pressure, if the reactor pressure is reduced, it will fall back down on the pump curve, and I think it supplies approximately 5,000 gallons a minute at low reactor pressures.

MR. EBERSOLE: Does that follow simultaneously for both this pump as well as RCIC?

MR. LORFING: That is correct.

MR. EBERSOLE: This one enthusiastically fills the vessel and what turns it off so it doesn't kill RCIC with water?

MR. LORFING: High pressure core spray and the RCIC pump, the injection valves are isolated on a level eight signal, which is a high level in the reactor vessel.

MR. EBERSOLE: Is that a safety grade redundant signal?

MR. LORFING: Yes, I believe it is. So both systems will isolate and control the level between level 8 and their normal point that they turn on.

So far we have been discussing primarily the systems that can provide water at high reactor pressures or at full reactor pressure.

In addition, we have several systems which can provide water at lower system pressures.

(Slide.)

This is the residual heat removal system low pressure coolant injection function. In this mode of operation we have three loops, A, B and C. The third loop of RHR does not have a heat exchanger associated with it. In fact, in this mode of operation, the heat exchangers are not used. Flow bypasses the heat exchangers in this mode of operation. This mode is a part of the emergency core cooling function and is used in design basis events.

MR. EBERSOLE: But in this case there is no heat going out of the containment.

MR. LORFING: That is right. This is a makeup water system to the reactor vessel.

MR. EBERSOLE: And the operator has to get into the act pretty quick.

MR. LORFING: Right. This system would not come on until level one, a level below high-pressure core spray or RCIC. So they are primarily used in the analysis for a large-break accident to reflood the core.

MR. EBERSOLE: Could you tell me why you bypass the heat exchangers down there on the bottom and what did you gain by doing that?

MR. LORFING: The suppression pool is approximately 90 degrees at the beginning of the event or it is at a low temperature. So you receive no heat removal.

MR. EBERSOLE: Yes, but what was the advantage. You wouldn't have gotten any good out of it, but neither would you have had any harm. So I am asking why did you put the bypass on when you could have run it on through there anyway? I just want to know why that valve is there? It sounds like it is one of these things you don't need and it just makes life tough. What is the function of that bypass?

MR. LORFING: I am not sure if it has to do with pressure drop. You know, there may be a pressure drop across the heat exchanger. I am not that familiar with the basis of the design.

MR. EBERSOLE: Was it to get a higher flow?

MR. LORFING: We can get that answer later.

MR. EBERSOLE: Well, I am thinking about later on you are going to have to close it. If it weren't there you wouldn't have to.

MR. McMORELAND: In response to that question relative to why we bypass the heat exchanger, it is actually a GE system design and GE would have to justify that answer.

(Laughter.)

And consistent with what I have seen of their philosophy, it give you, No. 1, the shortest path vessel. In the immediate post-accident mode it gives you the shortest path to the vessel which gives you minimum pressure drop. It also minimizes the number of potential components if you want to postulate all types of single failure type phenomena because you minimize the number of motor operated valves that you have to go through and everything.

MR. EBERSOLE: But I have a problem later on which is just as important, and I have got to close the valves to containment. If I took the water through there first, I wouldn't have to do that. So unless you have got a substantial advantage in pressure drop, they are in the way.

MR. McMORELAND: Well, I am sure there is a considerable pressure drop advantage.

MR. EBERSOLE: Well, why don't we just let that be something you can develop later.

MR. McMORELAND: All right.

(Slide.)

MR. LORFING: This diagram shows the low-pressure core spray system. It functions very similar to the RHR/LPCI mode in that the low-pressure core spray pump takes suction on the suppression pool and pumps water directly to the reactor vessel.

In addition, it does pump the water through a spray header located above the core. It functions very similar though to the RHR system and provides a redundant system of providing makeup water.

This concludes the basic systems that supply makeup water to the reactor vessel.

MR. EBERSOLE: You didn't even mention the ADS system.

MR. LORFING: That is right. The ADS system is required to function in some events where the low-pressure systems are required to make up water to the vessel and the reactor is still at a high pressure.

MR. EBERSOLE: I believe I read in the FSAR that you can use the ADS system as a sensible heat transport path as well as evaporating or cooling the core. Is that correct?

MR. LORFING: In the event that the shutdown cooling mode of the RHR system does not function, our alternate path for shutdown cooling is to provide makeup water to the vessel, fill up the vessel to the main steamline and pass the water out of the relief valve and back to the suppression pool. We put one loop of RHR into the suppression heat removal from the suppression pool. That would be the alternate path for shutdown cooling.

MR. KIRKEBO: I would like to clarify on the main feed pumps. The main feed pumps are not variable speed, nor do they have speed reducers. Unfortunately, we don't have anyone here today that can go into detail on level control and bypass, but we will be prepared to go into detail on that with you in the future.

MR. OKRENT: I want to note that when we began this subject, we were only a few minutes behind schedule.

(Laughter.)

I do plan to finish today about at the time stated because it has been a long day. So I think we will take up Item E and indeed we will allot 15 minutes to it. If we don't finish it, we will take it on tomorrow, and I am assuming we will run at least one hour extra tomorrow.

Maybe what we will do is take the items at the end of today and put them in at the end of tomorrow or at some convenient spot. We will start off tomorrow morning with the items shown for tomorrow morning.

Okay, Item E.

MR. REED: The next topic is the instrumentation to follow the course of a severe accident. Mr. Phil Porter, Senior Electrical Engineer in our Nuclear Plant Engineering Department has been with Gulf States for three years. His ten years prior experience includes the Washington Public Power System. He has a bachelor of science and electric engineering degree from the University of Washington and a master of science in nuclear engineering from also the University of Washington.

MR. PORTER: Good afternoon, or perhaps I should say good evening.

(Laughter.)

It is obvious from the TMI event that the industry and the NRC staff developed a heightened awareness to the need for instrumentation to follow the course of an accident as witnessed by the actions which the TMI operators took in trying to mitigate that accident or even recognized that they had an accident.

As a consequence, the staff originally issued Revision 2 to Regulatory Guide 197 and subsequently a Revision 3 to Regulatory Guide 197, giving the industry direction in regards to what type of instrumentation the staff would like to see to be able to follow the course of an accident, both the accident developing and to give the operator diagnostic tools to be able to mitigate that accident.

The staff direction was in the regards of telling us that for certain categories of instrumentation it should be redundant, it should be on Class IE power supplies, it should be human factor engineers as far as the displays and so forth.

The also provided the industry with what they considered to be a minimum list of parameters to monitor to be able to follow the course of an accident both for PWRs and BWRs.

River Bend took that minimum list and basically what we tried to do was we tried to come up with what we consider to be a necessary and sufficient list. In other words, the operator needs a certain amount of necessary information to be able to mitigate and follow the course of an accident. And not only that, but he need sufficient information. If he only had one channel and that channel failed, then he would not have sufficient information.

(Slide.)

So what River Bend did, GSU performed an analysis and what we did was we took Reg. Guide 197 as a source input and that was the staff's list. That was the methodology from which basically they derived their variable list of things to monitor, and that was based upon their own experience as well as industry feedback. And also that was based on the Three Mile Island accident.

We also took out of emergency operating procedures, which we have for this unit, and we looked at the information needs which the operator was requesting out of the emergency operator procedures.

It turns out the Probabilistic Standards Branch had also requested that EG&G Idaho do two studies based on event trees. And what they did is they did this for a PWR and they were so successful that they also did it for a BWR.

What they did was to take five accident sequences which were considered to be significant risk contributors to a degraded core event. From that they went through and developed operator action event trees and then from that they were able to determine instrumentation needs.

So we basically took that study which was a NUREG. It was a contrator's report, 2100, and basically fitted that to the River Bend Station.

What we did was we came up with three variable lists which were derived from what I would say were totally different methodologies. This one was based on experience, this one was also somewhat based on operators' experience and this was based on the event tree analysis for those five accident sequences.

We then came up with a composite variable list, and for those variables which were not identified by the Reg. Guide 197 list, we went through and categorized those in accordance with the Reg. Guide 197 definitions.

We took that variable list and we also added range, location data as to what our specific plant had, instrument ID's and we also had SPDS signal ID's.

I will show you an excerpt from that report.

(Slide.)

As you can see, here we have reactor vessel water level. We identified the source of that variable. WE also identified the instrument ID's. By the way, this report has been submitted to the NRC staff for review. Here was the categorization of that and here is our main control room display benchboard. Here are the safety parameter display signal points and these are GE numbers which we used that are unique identifiers. Then here we have some various ranges and we also had some technical notes over here in the back of the report, the reference notes.

(Slide.)

Now what we did was we came down after we had generated this and we took the licensing and technical requirements like what we found in Reg. Guide 197. Instead of variable, they should be Category 1, and we identified that we were only furnishing a Category 2. So that generated a discrepancy or what we term a finding, and that was subsequently documented within that report and was subsequently channeled to the detailed control design review.

We do not want to make arbitrary changes in the control rooms. So we are using our detailed control room design review people to physically add this kind of a clearinghouse for all control room changes. They review those changes, categorize them, and Mr. Don Chase will address our DCRDR program.

This is where we basically are having the changes made where we identify the discrepancies.

MR. OKRENT: Excuse me.

MR. PORTER: Yes.

MR. OKRENT: From the first viewgraph that you had up there should I draw the inference that you are including at River Bend the recommendations from all three of those sources, or that some of these are being discarded?

MR. PORTER: Yes. We are ---

MR. OKRENT: Yes, what?

MR. PORTER: We are using the recommendations from all these sources. What you will find is that in a lot of cases, and I have a slide to show you the results of that, in a lot of cases all three sources identified we should monitor that particular parameter.

Now the results of the study were interesting in that we identified 68 parameters total that we felt as if the operator should have in the control room for displays.

It turns out that a little more than half of those parameters were identified by at least two or three of those particular methodologies. It turns out that Reg. Guide 1.97 identified eight parameters which should be monitored that were not identified by any of the other studies.

The event tree identified the most at 15, and the River Bend emergency procedures identified 10.

Primarily the emergency operating procedures asked the operator to verify things like scram, and as a consequence he is asked to look for what caused the scram. That was't identified in either Reg. Guide 1.97 or the event tree analysis. So we came up with our 68 parameters that we felt should be monitored to give us a necessary and sufficient parameter list.

One of the reasons for doing that was we wanted to give input to the detailed control room design review and also to be able to give us a clear picture of how we complied with Reg. Guide 1.97.

(Slide.)

Once the detailed control room design review has categorized our findings where we did have discrepancies, we will have a resolution of those discrepancies. And when they are incorporated into the control room design, we will comply with the requirements, or should I say the guidance of Regulatory Guide 1.97, Revision 3 as identified in the staff position.

That concludes my presentation.

MR. EBERSOLE: My I ask a question. In respect to the general nature of what you are looking at, soon or later you come up with whether you need the redundant signals for a given parameter or not. I look on page 712 and 713 where the topic happens to be reactor sensing lines.

MR. PORTER: Yes.

MR. EBERSOLE: I am just going to use it as a model for more or less generic questions.

Is your philosophy here in following the course of an accident that subsequent to that accident I have redundant configurations left which admit to a random failure, and the response is it gives me at least one single one that works.

MR. PORTER: Let me put this slide back up.

(Slide.)

MR. EBERSOLE: And then I will apply that to the sensing line logic of when the sensing line fails do I have residual redundancy?

MR. PORTER: What we have done is that first of all our primary objection has to first of all identify a parameter list that was necessary and sufficient. We feel like we have made an extremely good approximation of that with our 68 parameters.

When we went back through the categorization study here, category one requires that these be redundant, and if for some reason failure of a redundant channel would thow you into an obscure condition, then the regulatory guide request that you either have a third channel to be able to check that against, or you have a diverse means of backup.

We went through each one of these and feel as though we have for all of our category one variables, as well as some of our catetory two, that we do have a diverse backup to be able to, if one channel was to fail, we could look at the on failed channel with other data in the control room and be able to extrapolate with a reasonable amount of assurance as to what was happening during the course of the event.

MR. EBERSOLE: So if you have done that, then you would say if a sensing line fails, which loses a bank of instruments, I have residual redundancy or diversity with which to cope with that accident.

MR. PORTER: We have diversity, that is correct.

MR. EBERSOLE: Or if I have a pipe failure which blows out a bank of instruments, I have residual redundancy to cope with that accident.

MR. PORTER: Well, our analysis did not cover that specific sort of event where we actually went in and would lose a line and did we go back and actually look at the effects on this report.

MR. EBERSOLE: Well, unless you do that, how do you claim that you have post-accident redundancy unless you go look at the phenomena that takes out the instrumentation?

MR. PORTER: Well, the plant tries to maintain independence. There is an assumption made within this report that we build independence, like in our sensing lines. Like on the reactor waterway, these are located 90 degrees apart.

MR. EBERSOLE: Well, if they are 90 degrees apart and I have an accident that takes out one set ---

MR. PORTER: Well, I mean actually they are located 90 degrees, 180, 270 and 360.

MR. EBERSOLE: So there are four of them.

MR. PORTER: That is correct.

MR. EBERSOLE: So if I take out one set, are you telling me I have got three left?

MR. PORTER: That is correct. And in most cases if we did lose one channel, we would have the other channels by virtue of physical independence.

MR. EBERSOLE: I heard you say you had one channel left.

MR. PORTER: That is correct.

MR. EBERSOLE: If you say that how do you claim residual redundancy if there is only one left?

MR. PORTER: Well, we use diverse indications to be able to extrapolate ---

MR. EBERSOLE: You will find an equivalent or another signal somewhere else?

MR. PORTER: Yes, we have to. That is correct.

MR. EBERSOLE: Okay.

MR. PORTER: And that was one of the reasons that we tried to make the set necessary and sufficient.

MR. OKRENT: Thank you.

I think as I promised, I am going to recess this subcommittee until tomorrow morning at 8:30.

Thank you all.

(Whereupon, at 6:55 p.m., the subcommittee recessed, to reconvene at 8:30 a.m., Friday, June 8, 1984.)

- - -

CERTIFICATE OF PROCEEDINGS

This is to certify that the attached proceedings before the NRC COMMISSION

In the matter of: ACRS on River Bend

Date of Proceeding: 7 June 1984

Place of Proceeding: Baton Rouge, Louisiana

were held as herein appears, and that this is the original transcript for the file of the Commission.

Mary C. Simons

Official Reporter - Typed

Mary C. Simons

Official Reporter - Signature

RIVERBEND

ENFORCEMENT HISTORY

YEAR	NUMBER OF VIOLATIONS
1977	1
1978	1 (PLUS 1 DEVIATION)
1979	6
1980	12
1981	7
1982	6
1983	3
1984	4 (THORUGH APRIL 30, 1984)

RIVERBEND

DISTRIBUTION OF VIOLATIONS BY SEVERITY LEVEL

LEVEL	NUMBER
I	0
II	0
III	1 - NO CP ASSESSED
IV (INFRACTION)	27
V (DEFICIENCY *)	11
VI *	1

*OLDER SYSTEM OF CLASSIFICATION

RIVERBEND

INSPECTION HOURS

YEAR	NUMBER OF HOURS
1977	98
1978	71
1979	335
1980	766
1981	1535
1982	1653
1983	1819
1984	512 (THROUGH APRIL 30)

RIVERBEND

SALP

FUNCTIONAL AREA	1983	1982
. SOILS AND FOUNDATIONS	NA	NA
. CONTAINMENT & SAFETY STRUCTURES	2	2
. PIPING SYSTEM & SUPPORTS	2	2
. SAFETY RELATED COMPONENTS	2	2
. SUPPORT SYSTEM	2	NA
. ELECTRICAL POWER SUPPLY/DIST	2	2
. I&C	2	NA
. LICENSING ACTIVITIES	2	2
. CORRECTIVE ACTION & REPORTING	2	2
. MANAGEMENT CONTROL	1	2
. QUALITY ASSURANCE	2	NA
. DESIGN CONTROL	1	NA

RIVER BEND STATION

MAJOR MILESTONES

CONSTRUCTION PERMIT ISSUED	MARCH 1977
OL APPLICATION/FSAR DOCKETED	AUGUST 1981
SER ISSUED	MAY 1984
DES ISSUANCE	JUNE 1984
FES ISSUANCE	SEPTEMBER 1984
SAFETY HEARINGS	OCTOBER 1984
EMERGENCY PLANNING HEARINGS	JANUARY 1985
ASLB INITIAL DECISION	MARCH 1985
READY FOR FUEL LOAD (APPLICANT)	APRIL 1985

Table 1.2 Comparison of principal design features of River Bend and other BWR/6 facilities

Design feature	River Bend	Perry	Clinton	Grand Gulf
Containment type	Mark III	Mark III	Mark III	Mark III
Rated thermal power, MWt	2894	3579	2894	3833
Gross electrical output, MWe	991	1252	985	1306
Main steam flowrate, lb/hr	12,453,000	15,400,000	12,453,000	16,491,000
Total core flowrate, lb/hr	84,500,000	104,000,000	84,500,000	112,500,000
System pressure, nominal in steam dome, psia	1040	1040	1040	1040
Fuel lattice	8x8	8x8	8x8	8x8
Number of fuel assemblies	624	748	624	800
Number of fuel rods per fuel assembly	62	62	62	62
Number of movable control rods	145	177	145	193
Reactor vessel inside diameter, in.	218	238	218	251
Reactor vessel inside height, ft-in.	69-4	70-5	69-4	73-0
Reactor vessel design pressure, psig	1250	1250	1250	1250
Reactor vessel basemetal minimum wall thickness, in.	5.40	6.00	5.20	6.14
Reactor vessel minimum cladding thickness, in.	0.125	0.125	0.125	0.125
Number of recirculation loops	2	2	2	2

Table 1.2 (continued)

Design feature	River Bend	Perry	Clinton	Grand Gulf
Recirculation locp pipe inside diameter, in.	20	24	20	24
Recirculation pump flowrate, gpm	32,500	42,000	32,500	44,900
Number of jet pumps	20	20	20	24
Number of high-pressure core spray loops	1	1	1	1
Number of low-pressure core spray loops	1	1	1	1
Number of low-pressure coolant injection loops	3	3	3	3
Maximum heat flux, $Btu/ft^2/hr$	361,600	361,600	361,600	362,000
Maximum power per fuel rod length, kW/ft	13.4	13.4	13.4	13.4
Maximum centerline fuel temperature, °F	3435	3435	3435	3430
Minimum critical power ratio	1.18	1.20	1.20	1.23
Total peaking factor	2.33	2.21	2.33	2.26

KEY FEATURES OF PLANT

1) SAFETY - GRADE CONTAINMENT UNIT COOLERS

- TWO SAFETY-RELATED CONTAINMENT UNIT COOLERS

- AUTOMATICALLY INITATED ON HIGH CONTAINMENT PRESSURE; INTERLOCKED TO DELAY INITIATION 10 MINUTES AFTER HIGH DRYWELL PRESSURE SIGNAL

- WATER SUPPLIED FROM STANDBY SERVICE WATER SYSTEM (UHS)

- CONTAINMENT UNIT COOLERS AUTOMATICALLY ISOLATED AT -0.43 PSIG IN THE CONTAINMENT

- 6 DIFFERENTAL PRESSURE TRANSMITTERS, 2 DIVISIONS, 2-OUT-OF-3 LOGIC FOR ISOLATION OF WATER SUPPLY TO COOLERS

SER SECTION	6.2.1.4
	6.2.1.5
	6.2.2
	6.5.2

2) <u>DRYWELL REVERSE PRESSURE DESIGN</u>

- NO VACUUM BREAKERS

- DRYWELL CONSERVATIVELY DESIGNED TO WITHSTAND -20 PSID

  °DRYWELL LOCA BREAK STEAM ASSUMED TO CONDENSE INSTANTANEOUSLY

  °ECCS FLOW FROM REACTOR VESSEL TO DRYWELL ASSUMED AT SUPRESSION POOL TEMPERATURE

  °ALL AIR ASSUMED PURGED FROM DRYWELL

SER SECTION 6.2.1.5

3) DRYWELL/SUPPRESSION POOL DESIGN

- NO UPPER POOL DUMP NEEDED TO ASSURE LONG TERM ECCS RECIRCULATION

  °WEIR WALL OVERTOPPED PRIOR TO UNCOVERING ECCS SUCTION LINES IN SUPPRESSION POOL

  SER SECTION 6.2.1.4

4) <u>LEAKAGE CONTROL SYSTEMS</u>

- VALVE LEAKAGE CONTROL SYSTEMS (LCS)
  - °PVLCS - PENETRATION VALVE LCS
    - *MINIMIZE RELEASE OF FISSION PRODUCTS FROM PROCESS LINES THAT PENETRATE CONTAINMENT AND THUS COULD BYPASS STANDBY GAS TREATMENT SYSTEM AND FUEL BUILDING CHARCOAL FILTRATION SYSTEM FOLLOWING A LOCA
  - °MSPLCS - MAIN STEAM POSITIVE LCS
    - *PREVENTS RELEASE OF FISSION PRODUCTS FROM MSIVs AND MAIN STEAM DRAIN LINES WHICH COULD BYPASS SGTS AND FUEL BUILDING CHARCOAL FILTRATION SYSTEM FOLLOWING A LOCA.

- FEATURES OF LCS
  - °USES CATEGORY I AIR COMPRESSORS
  - °MANUALLY ACTUATED
  - °8.5 PSI DIFFERENTAL MAINTAINED BETWEEN PRESSURIZED LINE AND REACTOR VESSEL

SER SECTION 6.2.3, 6.2.6.3, 6.5.3, 6.7, 7.6.2.1

5) <u>ULTIMATE HEAT SINK</u>

- PROVIDES 30 DAY INVENTORY OF EMERGENCY SOURCE OF SERVICE WATER AS REQUIRED FOR SAFE SHUTDOWN UNDER ACCIDENT CONDITIONS

- SESIMIC CATEGORY I, TORNADO PROTECTED MECHANICAL DRAFT COOLING TOWER (ONLY 2 OF 4 FAN CELLS REQUIRED FOR SAFE SHUTDOWN)

- VARIOUS SOURCES OF MAKEUP WATER AVAILABLE

SER SECTION 9.2.5

OUTSTANDING ISSUES

1) HYDROSTATIC LOADING OF SAFETY - RELATED STRUCTURES AS A RESULT OF PROBABLE MAXIMUM PRECIPITATION ACCUMULATING IN THE UNIT 2 EXCAVATION. (7/84)

2) ANALYSIS OF EFFECTS OF A MODERATE ENERGY LINE BREAK IN CONTROL BUILDING AND OTHER LINE BREAKS. (1/85)

3) ANALYSIS OF EFFECTS OF HIGH ENERGY LINE BREAK. (1/85)

4) IN-SERVICE INSPECTION PROGRAM FOR PUMPS AND VALVES AND VALVE LEAK RATE TEST PROGRAM. (10/84)

5) ENVIRONMENTAL (ELECTRICAL AND MECHANICAL) AND SEISMIC QUALIFICATION AND PUMP AND VALVE OPERABILITY. (11/84)

6) PRE-SERVICE INSPECTION PROGRAM FOR REACTOR COOLANT PRESSURE BOUNDARY AND AUGMENTED ISI PROGRAM. (10/84)

7) REVERSE VENT CLEARING, SRV AND HYDRODYNAMIC LOAD ASSESSMENTS. (2/85)

OUTSTANDING ISSUES (CON'T)

8) PLANT SPECIFIC ANALYSIS OF ECCS PERFORMANCE UNDER LOCA CONDITIONS (10/84)

9) BY-PASSED AND INOPERABLE STATUS INDICATION FOR SAFETY SYSTEM AS A RESULT OF LOSS OF ESSENTIAL AUXILIARY OR SUPPORTING SYSTEM (8/84)

10) DIESEL GENERATOR INFORMATION TO SUPPORT QUALIFICATION TESTS AND NUREG/CR-0660 RECOMMENDATIONS (1/85)

11) ANALYSIS TO DETERMINE EFFECTS OF LOCA FLOODING ON SAFETY AND NON-SAFETY ELECTRICAL EQUIPMENT. (1/85)

12) COMPLIANCE REPORT ON NUREG-0612 "CONTROL OF HEAVY LOADS AT NUCLEAR POWER PLANTS". (10/84)

13) SHOW THAT PLANT CAN REACH AND MAINTAIN COLD SHUTDOWN FOLLOWING A FIRE WHICH DESTROYS THE CONTROL ROOM (7/84)

14) SHOW THAT ADEQUATE COMMUNICATIONS WILL BE MAINTAINED FOLLOWING SEISMIC EVENT AND/OR LOSS OF OFFSITE POWER (LONGER THAN 4 HOURS) (7/84)

OUTSTANDING ISSUES (CON'T)

15) SHOW THAT ADEQUATE LIGHTING WILL BE AVAILABLE IN SAFETY - RELATED AREAS FOLLOWING DESIGN BASIS SEISMIC EVENT (7/84)

16) INFORMATION TO SHOW OPERABILITY AND RELIABILITY OF HPCS DIESEL GENERATOR (7/84)

17) DEMONSTRATE PREVENTION OF OR PROTECTION AGAINST CORROSION PRODUCTS INSIDE FUEL OIL STORAGE TANK TO PREVENT FOULING OF DIESEL GENERATORS. (7/84)

18) INFORMATION TO SHOW ACCEPT[illegible] OF EMERGENCY PLANNING PROVISIONS. (12/84)

ITEM - 1) HYDROSTATIC LOADING

ISSUE STAFF IS REVIEWING GSU CALCULATIONS INTENDED TO SHOW THAT SAFETY - RELATED STRUCTURES ARE ADEQUATELY PROTECTED AGAINST FLOODING EFFECTS OF LOCAL PMP USING HMR 52

SER SECTION 2.4.2.2
2.4.12.2

RESOLUTION EXPECTED - JULY, 1984

ITEM - 2) MODERATE ENERGY LINE BREAK

ISSUE -PROVIDE ANALYSES CONSIDERING EFFECTS OF MODERATE ENERGY LINE BREAK IN

- ° CONTROL BUILDING
- ° TURBINE PLANT COMPONENT COOLING WATER SYSTEM
- ° VENTILATION CHILLED WATER SYSTEM
- ° COOLING TOWER MAKEUP WATER SYSTEM

SER SECTION 3.4.1

9.2.8

9.2.9

9.2.11

RESOLUTION EXPECTED - JANUARY, 1985

ITEM - 3) HIGH ENERGY LINE BREAK

ISSUE -COMPLETE ANALYSIS OF HELB EFFECTS

- o PIPE WHIP
- o JET IMPINGEMENT

SER STATION 3.6.1

RESOLUTION EXPECTED - JANUARY, 1985

ITEM - 4) IN-SERVICE INSPECTION/BOUNDARY VALVE LEAKAGE

ISSUE

-PROVIDE, FOR STAFF REVIEW, PUMP AND VALVE PRESERVICE AND INSERVICE TESTING PER ASME CODE SECTION XI

-PROVIDE A DESCISION OF HOW LEAK RATE TEST PROGRAM CONFORMS TO 1 GPM CRITERION AND PERIODICITY REQUIREMENTS

SER SECTION 3.9.6

RESOLUTION EXPECTED - OCTOBER, 1984

ITEM - 5) EQUIPMENT QUALIFICATION

ISSUE

-PROVIDE FOR SEISMIC AND DYNAMIC QUALIFICATION OF SAFETY RELATED EQUIPMENT

-PROVIDE FOR ENVIRONMENTAL QUALIFICATION OF SAFETY RELATED ELECTRICAL AND MECHANICAL EQUIPMENT

-PROVIDE A PUMP AND VALVE OPERABILITY PROGRAM

SER SECTION 3.10.1
3.10.2
3.11

RESOLUTION EXPECTED - NOVEMBER, 1984

ITEM - 6) PRESERVICE INSPECTION PROGRAM

ISSUE -PROVIDE A PRESERVICE INSPECTION PROGRAM FOR SYSTEMS AND COMPONENTS COMPRISING THE REACTOR COOLANT PRESSURE BOUNDARY IDENTIFYING AREAS WHERE ASME CODE SECTION XI CANNOT BE MET

SER SECTION 5.2.4.3, 6.6

RESOLUTION EXPECTED - OCTOBER, 1984

ITEM - 7) CONTAINMENT LOADS

ISSUE -
- ASSESS THE RESPONSE OF DRYWELL COMPONENTS AND STRUCTURES TO DYNAMIC LOADS RESULTING FROM REVERSE VENT CLEARING.
- PROVIDE MODIFIED GESSAR-II LOAD SPECIFICATIONS FOR LOCA-RELATED POOL DYNAMIC AND SRV HYDRO-DYNAMIC LOADS
- ASSESS SUPPRESSION POOL STRAINERS FOR HYDRODYNAMIC LOADS.

SER SECTION - 6.2.1.5
6.2.1.8.3
6.2.2

RESOLUTION EXPECTED - FEBRUARY, 1985

ITEM - 8) ECCS LOCA ANALYSIS

ISSUE -PROVIDE PLANT SPECIFIC LOCA ANALYSIS TO ENSURE ECCS MEETS ACCEPTANCE CRITERIA (10 CFR 50.46).

- MAXIMUM FUEL PCT SHALL NOT EXCEED 2200°F
- MAXIMUM CLADDING OXIDATION SHALL NOT EXCEED 0.17 TIMES TOTAL CLAD THICKNESS BEFORE OXIDATION
- MAXIMUM GENERATED HYDROGEN SHALL NOT EXCEED 0.01 TIMES TOTAL HYPOTHETICAL AMOUNT CAPABLE OF BEING GENERATED BY ALL CLAD METAL
- MAINTAIN COOLABLE GEOMETRY
- MAINTAIN CORE TEMPERATURE AT AN ACCEPTABLY LOW VALUE FOR AN EXTENDED PERIOD OF TIME

SER SECTION 6.3.3.3, 15.9.4

RESOLUTION EXPECTED - OCTOBER, 1984

ITEM - 9) BYPASSED AND INOPERABLE STATUS

ISSUE -PROVIDE INOPERABLE AND BYPASSED STATUS INDICATION FOR SAFETY SYSTEMS WHEN ESSENTIAL AUXILIARY OR SUPPORTING SYSTEMS ARE RENDERED INOPERABLE

SER SECTION 7.5.2.2

RESOLUTION EXPECTED - AUGUST, 1984

ITEM - 10) EMERGENCY DIESEL GENERATORS

ISSUE

- PERFORM QUALIFICATION TESTS ON EDGs IN ACCORDANCE WITH IEEE 387-1977 (MODIFIED BY REG GUIDE 1.9) AND PROVIDE SYNOPSIS OF RESULTS.
- PROVIDE INFORMATION ON HOW THE EDGs MEET NUREG/CR-0660
- PROVIDE INFORMATION ON MISCELLANEOUS EDG SUPPORT SYSTEMS

SER SECTION 8.3.1, 9.5.4.1, 9.5.5, 9.5.6, 9.5.7, 9.5.8

RESOLUTION EXPECTED - JANUARY, 1985

ITEM - 11) SUBMERGENCE OF ELECTRICAL EQUIPMENT

ISSUE -FOR ELECTRICAL EQUIPMENT (SAFETY AND NON-SAFETY) THAT MAY BECOME SUBMERGED AS A RESULT OF A LOCA, PROVIDE:

- THE SAFETY SIGNIFICANCE OF THE FAILURE OF THE EQUIPMENT FROM FLOODING
- THE EFFECTS ON CLASS 1E ELECTRIC POWER SOURCES
- PROPOSED DESIGN CHANGES RESULTING FROM THIS ANALYSIS

SER SECTION 8.4.7

RESOLUTION EXPECTED - NOVEMBER, 1984

ITEM - 12) HEAVY LOAD HANDLING SYSTEM

ISSUE -PROVIDE FOR REVIEW THE EVALUATION RESULTS AND ANY REQUIRED CHANGES OR MODIFICATIONS FOR NUREG-0612 "CONTROL OF HEAVY LOADS AT NUCLEAR POWER PLANTS" PHASES I AND II

SER SECTION 9.1.5

RESOLUTION EXPECTED - OCTOBER, 1984

ITEM - 13) SAFE/ALTERNATE SHUTDOWN

ISSUE -PROVIDE FOR THE CAPABILITY TO REACH AND MAINTAIN COLD SHUTDOWN FOLLOWING A FIRE WHICH COMPLETELY DESTROYS THE CONTROL ROOM. THIS REQUIRES ELECTRICAL ISOLATION FROM THE CONTROL ROOM FOR ALL SYSTEMS REQUIRED FOR SHUTDOWN.

SER SECTION 9.5.1.4

RESOLUTION EXPECTED - JULY, 1984

ITEM - 14) COMMUNICATIONS SYSTEMS

ISSUE -ENSURE THAT ADEQUATE COMMUNICATIONS WILL BE MAINTAINED FOLLOWING A SEISMIC EVENT AND/OR LOSS OF OFFSITE POWER (LONGER THAN 4 HOURS)

SER SECTION 9.5.2.1

RESOLUTION EXPECTED - JULY, 1984

ITEM - 15) LIGHTING SYSTEMS

ISSUE -PROVIDE INFORMATION TO SHOW THAT ADEQUATE LIGHTING WILL BE AVAILABLE IN SAFETY-RELATED AREAS FOLLOWING A DESIGN BASIS SEISMIC EVENT.

SER SECTION 9.5.3

RESOLUTION EXPECTED - JULY, 1984

ITEM - 16) HPCS DIESEL GENERATOR

ISSUE -PROVIDE INFORMATION ON HOW THE HPCS DIESEL GENERATOR MEETS NUREG/CR-0660
-PROVIDE INFORMATION ON MISCELLANEOUS HPCS DIESEL GENERATOR SUPPORT SYSTEMS

SER SECTION 9.5.4.1, 9.5.5, 9.5.6.3, 9.5.7

RESOLUTION EXPECTED - JULY, 1984

ITEM - 17) FUEL OIL STORAGE

ISSUE

- PROVIDE INFORMATION CONCERNING FUEL OIL STORAGE TANK INTERNAL CORROSION PROTECTION
- PROVIDE INFORMATION ON HOW HPCS AND EMERGENCY DGs WILL BE PROTECTED FROM CORROSION PRODUCTS FORMED IN THE STORAGE TANK EITHER CLOGGING FILTERS OR DAMAGING THE DIESEL DURING AND FOLLOWING FUEL OIL STORAGE TANK REFILLING.

SER SECTION 9.5.4.2

RESOLUTION EXPECTED - JULY 1984

ITEM - 18) EMERGENCY PREPAREDNESS

ISSUE -PROVIDE MISCELLANEOUS INFORMATION TO CONFIRM ACCEPTABILITY OF ONSITE AND OFFSITE EMERGENCY PREPAREDNESS.

SER SECTION 13.3

RESOULTION EXPECTED - DECEMBER, 1984

Table 1.4 Listing of confirmatory items

Issue	SER Section
(1) West Creek sediment removal	2.4.3.3
(2) Ultimate heat sink	2.4.11.2
(3) Slope stability	2.5.5.2
(4) Pipe failure modes and check valve stress analysis	3.6.2
(5) Annulus pressurization	3.9.2.4
(6) Minimum wall thickness	3.9.3.1
(7) Thermal and anchor displacement loads	3.9.3.3
(8) Fuel rod mechanical fracturing	4.2.3.2
(9) Fuel assembly structural damage	4.2.3.3
(10) Post-irradiation surveillance	4.2.4.3
(11) LOCTVS/CONTEMPT-LT 28 computer codes	6.2.1.3, 6.2.1.4
(12) Reactor vessel cooldown rate	6.2.1.7
(13) SRV discharge testing	6.2.1.8.3
(14) Mark III-related issues	6.2.1.9, 3.9.3.1
(15) Containment repressurization	6.2.3, 6.7.3
(16) Inleakage limit	6.2.3
(17) ECCS test return line design	6.2.4.2
(18) Containment purge valves	6.2.4.3
(19) Hydrogen control	6.2.5
(20) PVLCS leakage	6.2.6.3
(21) Electrical and instrumentation and control diagrams	7.1.6
(22) Routing of circuits and sensors	7.2.2.1
(23) Instrumentation setpoints	7.2.2.2
(24) RPS power supply protection	7.2.2.3

Table 1.4 (continued)

Issue	SER Section
(25) RPS and ESF channel separation	7.2.2.4
(26) Isolation devices	7.2.2.6
(27) Reactor mode switch	7.2.2.7
(28) ADS actuation	7.3.2.3
(29) ESF reset controls	7.3.2.4
(30) Initiation of ESF support systems	7.3.2.7
(31) Instrumentation and control power bus loss	7.4.2.1
(32) RCIC system	7.4.2.2
(33) SLCS	7.4.2.3
(34) Post-accident monitoring instrumentation	7.5.2.4
(35) Temperature effects on level measurements	7.5.2.5
(36) High/low pressure interlocks	7.6.2.2
(37) EOC-RPT	7.6.2.4
(38) NMS and RCIS isolation	7.6.2.5
(39) Rod pattern control system microprocessors	7.6.2.6
(40) DRMS	7.6.2.7
(41) High-energy line break control system failures	7.7.2.1
(42) Multiple control system failures	7.7.2.2
(43) ERIS	7.7.2.3
(44) LPCS/RHRA pump procedures	8.3.1
(45) EPA/RPS motor generator set interconnection	8.3.1
(46) Second level undervoltage protection relay setpoint	8.4.1
(47) Verification of test results for station electric distribution system voltages	8.4.1

Table 1.4 (continued)

Issue	SER Section
(48) Safety cable identification	8.4.5
(49) Lighting overcurrent device coordination	8.4.6
(50) Post-accident sampling system	9.3.2, 10.4.6
(51) Diesel generators	9.5.4.1, 9.5.5, 9.5.7
(52) TMI Item II.F.1 Attachment 2	11.5.4
(53) Spent fuel transfer canal	12.3.2
(54) TMI Item II.B.2	12.3.2
(55) Backup RPM designate	12.5.1
(56) Personnel resumes	13.1.7
(57) Licensed operator review	13.1.7
(58) Offsite fire department training	13.2.1
(59) Emergency planning	13.3.2.1, 13.3.2.2, 13.3.2.5, 13.3.2.6, 13.3.2.8, 13.3.2.9, 13.3.2.10
(60) TMI Item I.C.1	13.5.2.3
(61) Initial test program revisions	14
(62) Proper ESF Function	15.9.3
(63) Safety system operability status	15.9.3
(64) QA organization	17.4

LICENSE CONDITIONS

1) OIL AND GAS EXPLORATION - INFORM NRC OF ANY NEW WELLS (OIL OR GAS) OR PIPELINES THAT MAY BE LOCATED NEAR OR WITHIN EXCLUSION AREA BOUNDARY (2.2)

2) TURBINE SYSTEM MAINTENANCE - SUBMIT TURBINE MAINTENANCE PROGRAM OR VOLUMETRICALLY INSPECT ALL LP TURBINE ROTORS
   - CONDUCT TURBINE STEAM VALVE MAINTENANCE IN ACCORDANCE WITH NRC GUIDANCE UNTIL TURBINE SYSTEM MAINTENANCE PROGRAM APPROVED (3.5.1.3.3)

3) FUEL ROD INTERNAL PRESSURE - RESOLVE FUEL ROD INTERNAL PRESSURE EXCEEDING SYSTEM PRESSURE ISSUE PRIOR TO SECOND CYCLE (4.2.1.1)

4) INADEQUATE CORE COOLING - IMPLEMENT ADDITIONAL INSTRUMENTATION TO DETECT ICC BASED ON STAFF REVIEW AND GSU PLANT-SPECIFIC EVALUATION REPORT (4.4.7)

5) ESF RESET CONTROL - DEMONSTRATE THAT ALL EQUIPMENT REMAINS IN ITS EMERGENCY MODE UPON REMOVAL OF THE ACTUATING SIGNAL AND/OR RESET. (7.3.2.4)

6) POST ACCIDENT SAMPLING SYSTEM - PROVIDE AN OPERABLE PASS PRIOR TO EXCEEDING 5% POWER (10.4.6)

7) SOLID WASTE PROCESS CONTROL PROGRAM - PROVIDE AND HAVE APPROVED A PCP PRIOR TO PROCESSING SOLID WASTE (11.4.2)

8) PARTIAL FEEDWATER HEATING-OPERATION WITH PARTIAL FEEDWATER IS PROHIBITED UNLESS ANALYSES ARE PROVIDED AND APPROVED SHOWING THAT A MORE LIMITING MCPR IS NOT OBTAINED (15.1)

<u>HEARING ISSUES</u>

<u>CONTENTION 1</u> APPLICANTS HAVE FAILED TO PROVIDE ADEQUATE ASSURANCE THAT THE RIVER BEND STATION COMPONENTS AND SYSTEMS RELYING ON MISSISSIPPI RIVER WATER FOR THEIR OPERATION WILL BE ADEQUATELY PROTECTED AGAINST INFESTATION OF THE ASIATIC CLAM (CORBICULA LEANA). SEE I&E BULLETION 81-03, "FLOW BLOCKAGE OF COOLING WATER TO SAFETY SYSTEM COMPONENTS BY <u>CORBICULA</u> SP. (ASIATIC CLAM) AND <u>MYTILUS</u> SP. (MUSSEL).

<u>CONTENTION 2</u> THE PROBABILITY OF FAILURE OF THE OLD RIVER CONTROL STRUCTURE IS SUFFICIENTLY HIGH THAT THE CONSEQUENCES OF OPERATING THE RIVER BEND STATION FOLLOWING SUCH FAILURE MUST BE CONSIDERED. APPLICANTS HAVE NOT CONSIDERED THE PUBLIC HEALTH, SAFETY, AND ENVIRONMENTAL IMPACTS OF FURTHER FACILITY OPERATION UNDER ALTERED RIVER FLOW AND SALINITY CONDITIONS IN THE EVENT OF FAILURE.