MISSISSIPPI POWER & LIGHT COMPANY
Helping Build Mississippi
P. O. BOX 1640, JACKSON, MISSISSIPPI 39205

NUCLEAR PRODUCTION DEPARTMENT

June 8, 1982

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Attention: Mr. Harold R. Denton, Director

Dear Mr. Denton:

SUBJECT: Grand Gulf Nuclear Station
Units 1 and 2
Docket Nos. 50-416 and 50-417
File: 0260/L860.0
Justification for Fuel Load and Low Power Testing Pending Resolution of John Humphrey's Concerns
Ref: AECM-82/237
AECM-82/250

As a result of concerns raised by Mr. John Humphrey regarding the design of the Grand Gulf Nuclear Station (GGNS) Mark III containment, representatives of Mississippi Power & Light Company (MP&L), General Electric Company (GE) and Bechtel Power Corporation met with members of your staff and Mr. Humphrey on May 27, 1982 to discuss the concerns. On May 28, 1982, MP&L submitted letter AECM-82/237 which provided a substantial discussion of those concerns and their applicability to the Grand Gulf design. As a result of the May 27, 1982 meeting and the information submitted via the above referenced letter, the concerns have been categorized as "resolved" or "open" to the satisfaction of your staff and Mr. Humphrey. The status of each item is listed in Attachment One. A full list of the concerns is provided in Attachment Two to this letter.

Of the remaining concerns, MP&L has determined that none have the potential to impact the safe operation of the plant at power levels up to 5% of full power. Concern numbers 3.1 through 3.5 relate to use of the Residual Heat Removal System (RHR) for the Steam Condensing Mode. This mode of RHR will not be used until after receipt of a Full Power Operating License. The justification for all other open items is presented below.

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On February 12, 1982, MP&L submitted letter AECM-82/55 which described the GGNS phased startup program. Phase I of the program, which would be conducted following fuel load and prior to exceeding 5% of full power, includes low power testing (conducted without the reactor vessel head in place) and non-nuclear heatup which includes tests done at rated temperature and pressure using pump heat as an energy source. During non-nuclear heatup, the reactor will be maintained subcritical at all times with control rod motion allowed for single rod stroke and scram tests only.

Under these circumstances, there is no possibility of a design basis LOCA which would require the GGNS containment to fulfill its safety function in protecting public health and safety. Any events which could be postulated under these conditions are substantially less severe than DBA events. Under these circumstances, there would be minimal risk to the health and safety of the general public and plant personnel for the following reasons:

1) Low power physics testing is conducted at low power levels with the vessel head removed and at temperatures less than 212°F.

2) The radiological source term which could contribute to a radiological health hazard is extremely small since the fuel will have been irradiated to only the very limited degree required for physics testing.

3) Due to the low degree of fuel irradiation, there is an insignificant amount of decay heat which could lead to fuel damage or require containment features to mitigate the effects of a large energy release in the containment.

Although it is our conclusion that all of the technical questions raised have been adequately addressed, MP&L will submit a description of a program to demonstrate the margins and conservatism in the GGNS containment design.

The proposed program will consist of a combination of additional analyses, technical specification and procedure reviews, in-plant testing, and design modifications, as appropriate, to completely resolve each open item. The program description will be submitted by July 16, 1982, and will identify each outstanding issue, the proposed method to resolve the issue, and the schedule for completion. Prior to receipt of the Full Power Operating License, a report will be submitted which includes the results of all analyses completed, test descriptions for any testing which may be required after 5% of full power, and a status of any ongoing analyses and evaluations. The report will be submitted by August 19, 1982 and will justify power operation above 5% of full power for any items which are expected to be open upon the receipt of the Full Power Operating License.

MP&L is confident that the Grand Gulf Nuclear Station is designed and constructed in full compliance with all applicable regulatory requirements and criteria and that the above described program, in combination with the ongoing Independent Design Review being conducted by CYGNA Energy Services, will provide additional proof to support this confidence. We also conclude that the remaining open issues discussed in Attachment Two may be resolved after issuance of a Low Power Operating License for GGNS Unit 1 authorizing fuel loading, testing and operation of the GGNS Unit 1 up to 5% of full power. During this phase of plant operation, none of these concerns has the potential to create an adverse impact to the safe operation of the plant or to pose a hazard to the health and safety of the general public or plant personnel.

Therefore, we request that you proceed with the issuance of the Low Power Operating License for the Grand Gulf Nuclear Station Unit 1.

Yours truly,

J.P. McGaughy
Assistant Vice President

JPM:rg

cc: Mr. N. L. Stampley
Mr. R. B. McGehee
Mr. T. B. Conner
Mr. G. B. Taylor

Mr. Richard C. DeYoung, Director
Office of Inspection & Enforcement
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Mr. J. P. O'Reilly, Regional Administrator
Office of Inspection and Enforcement
U. S. Nuclear Regulatory Commission
Region II
101 Marietta St., N.W. Suite 3100
Atlanta, Georgia 30303

ATTACHMENT ONE
AECM-82/250

STATUS OF HUMPHREY CONTAINMENT CONCERNS
June 7,1982

NOTE: CONCERN IS OPEN UNLESS STATUS SHOWS 'RESOLVED'

CONCERN NO.	STATUS	CONCERN NO.	STATUS
1.1		5.7	RESOLVED
1.2		5.8	
1.3		6.1	RESOLVED
1.4		6.2	RESOLVED
1.5		6.3	
1.6		6.4	RESOLVED
1.7	RESOLVED	6.5	
2.1		7.1	
2.2		7.2	
2.3		7.3	RESOLVED
3.1		8.1	
3.2		8.2	
3.3		8.3	
3.4		8.4	
3.5		9.1	
3.6		9.2	
3.7		9.3	
4.1		10.1	
4.2		10.2	
4.3		11	
4.4		12	RESOLVED
4.5		13	RESOLVED
4.6		14	
4.7		15	RESOLVED
4.8		16	
4.9		17	RESOLVED
4.10		18.1	RESOLVED
5.1		18.2	RESOLVED
5.2	RESOLVED	19.1	
5.3		19.2	
5.4		20	
5.5		21	RESOLVED
5.6		22	

ATTACHMENT TWO
AECM-82/250

HUMPHREY CONTAINMENT CONCERNS

1. Effects of Local Encroachments on Pool Swell Loads

1.1 Presence of local encroachments such as the TIP platform, the drywell personnel airlock and the equipment and floor drain sumps may increase the pool swell velocity by as much as 20 per cent.

1.2 Local encroachments in the pool may cause the bubble breakthrough height to be higher than expected.

1.3 Additional submerged structure loads may be applied to submerged structures near local encroachments.

1.4 Piping impact loads may be revised as a result of the higher pool swell velocity.

1.5 Impact loads on the HCU floor may be imparted and the HCU modules may fail which could prevent successful scram if the bubble breakthrough height is raised appreciably by local encroachments.

1.6 Local encroachments or the steam tunnel may cause the pool swell and froth to move horizontally and apply lateral loads to the gratings around the HCU floor.

1.7 GE suggests that at least 1500 square feet of open area should be maintained in the HCU floor. In order to avoid excessive pressure differentials, at least 1500 $ft.^2$ of opening should be maintained at each containment elevation.

2. Safety Relief Valve Discharge Line Sleeves

2.1 The annular regions between the safety relief valve lines and the drywell wall penetration sleeves may produce condensation oscillation (c.o.) frequencies near the drywell and containment wall structural resonance frequencies.

2.2 The potential condensation oscillation and chugging loads produced through the annular area between the SRVDL and sleeve may apply unaccounted for loads to the SRVDL. Since the SRVDL is unsupported from the quencher to the inside of the drywell wall, this may result in failure of the line.

2.3 The potential condensation oscillation and chugging loads produced through the annular area between the SRVDL and sleeve may apply unaccounted for loads to the penetration sleeve. The loads may also be at or near the natural frequency of the sleeve.

3. ECCS Relief Valve Discharge Lines Below the Suppression Pool Level

3.1 The design of the STRIDE plant did not consider vent clearing, condensation oscillation and chugging loads which might be produced by the actuation of these relief valves.

3.2 The STRIDE design provided only nine inches of submergence above the RHR relief valve discharge lines at low suppression pool levels.

3.3. Discharge from the RHR relief valves may produce bubble discharge or other submerged structure loads on equipment in the suppression pool.

3.4 The RHR heat exchanger relief valve discharge lines are provided with vacuum breakers to prevent negative pressure in the lines when discharging steam is condensed in the pool. If the valves experience repeated actuation, the vacuum breaker sizing may not be adequate to prevent drawing slugs of water back through the discharge piping. These slugs of water may apply impact loads to the relief valve or be discharged back into the pool at the next relief valve actuation and apply impact loads to submerged structures.

3.5 The RHR relief valves must be capable of correctly functioning following an upper pool dump which may increase the suppression pool level as much as five feet creating higher back pressures on the relief valves.

3.6 If the RHR heat exchanger relief valves discharge steam to the upper levels of the suppression pool following a design basis accident, they will significantly aggravate suppression pool temperature stratification.

3.7 The concerns related to the RHR heat exchanger relief valve discharge lines should also be addressed for all other relief lines that exhaust into pool. (p. 132 of 5/27/82 transcript)

4. Suppression Pool Temperature Stratification

4.1 The present containment response analyses for drywell break accidents assume that the ECCS systems transfer a significant quantity of water from the suppression pool to the lower regions of the drywell through the break. This results in a pool in the drywell which is essentially isolated from the suppression pool at a temperature of approximately 135°F. The containment response analysis assumes that the drywell pool is thoroughly mixed with the suppression pool. If the inventory in the drywell is assumed to be isolated and the remainder of the heat is discharged to the suppression pool, an increase in bulk pool temperature of 10°F may occur.

4.2 The existence of the drywell pool is predicated upon continuous operation of the ECCS. The current emergency procedure guidelines require the operators to throttle ECCS operation to maintain vessel level below level 8. Consequently, the drywell pool may never be formed.

4.3 All Mark III analyses presently assume a perfectly mixed uniform suppression pool. These analyses assume that the temperature of the suction to the RHR heat exchangers is the same as the bulk pool temperature. In actuality, the temperature in the lower part of the pool

where the suction is located will be as much as $7\frac{1}{2}$°F cooler than the bulk pool temperature. Thus, the heat transfer through the RHR heat exchanger will be less than expected.

4.4 The long term analysis of containment pressure/temperature response assumes that the wetwell airspace is in thermal equilibrium with the suppression pool water at all times. The calculated bulk pool temperature is used to determine the airspace temperature. If pool thermal stratification were considered, the surface temperature, which is in direct contact with the airspace, would be higher. Therefore the airspace temperature (and pressure) would be higher.

4.5 A number of factors may aggravate suppression pool thermal stratification. The chugging produced through the first row of horizontal vents will not produce any mixing from the suppression pool layers below the vent row. An upper pool dump may contribute to additional suppression pool temperature stratification. The large volume of water from the upper pool further submerges RHR heat exchanger effluent discharge which will decrease mixing of the hotter, upper regions of the pool. Finally, operation of the containment spray eliminates the heat exchanger effluent discharge jet which contributes to mixing.

4.6 The initial suppression pool temperature is assumed to be 95°F while the maximum expected service water temperature is 90°F for all GGNS accident analyses as noted in FSAR table 6.2-50. If the service water temperature is consistently higher than expected, as occurred at Kuosheng. the RHR system may be required to operate nearly continuously in order to maintain suppression pool temperature at or below the maximum permissible value.

4.7 All analyses completed for the Mark III are generic in nature and do not consider plant specific interactions of the RHR suppression pool suction and discharge.

4.8 Operation of the RHR system in the containment spray mode will decrease the heat transfer coefficient through the RHR heat exchangers due to decreased system flow. The FSAR analysis assumes a constant heat transfer rate from the suppression pool even with operation of the containment spray.

4.9 The effect on the long term containment response and the operability of the spray system due to cycling the containment sprays on and off to maximize pool cooling needs to be addressed. Also provide and justify the criteria used by the operator for switching from the containment spray mode to pool cooling mode, and back again. (pp. 147-148 of 5/27/82 transcript)

4.10 Justify that the current arrangement of the discharge and suction points of the pool cooling system maximizes pool mixing. (pp. 150-155 of 5/27/82 transcript)

5. Drywell to Containment Bypass Leakage

5.1 The worst case of drywell to containment bypass leakage has been established as a small break accident. An intermediate break accident will actually produce the most significant drywell to containment leakage prior to initiation of containment sprays.

5.2 Under Technical Specification limits, bypass leakage corresponding to $A/\sqrt{K} = 0.1$ ft.^{2} constitute acceptable operating conditions. Smaller-than-IBA-sized breaks can maintain break flow into the drywell for long time periods, however, because the RPV would be depressurized over a 6 hour period. Given, for example, an SBA with $A/\sqrt{K} = 0.1$, projected time period for containment pressure to reach 15 psig is 2 hours. In the latter 4 hours of the depressurization the containment would presumably experience ever-increasing overpressurization.

5.3 Leakage from the drywell to containment will increase the temperature and pressure in the containment. The operators will have to use the containments spray in order to maintain containment temperature and pressure control. Given the decreased effectiveness of the RHR system in accomplishing this objective in the containment spray mode, the bypass leakage may increase the cyclical duty of the containment sprays.

5.4 Direct leakage from the drywell to the containment may dissipate hydrogen outside the region where the hydrogen recombiners take suction. The anticipated leakage exceeds the capacity of the drywell purge compressors. This could lead to pocketing of hydrogen which exceeds the concentration limit of 4% by volume.

5.5 Equipment may be exposed to local conditions which exceed the environmental qualification envelope as a result of direct drywell to containment bypass leakage.

5.6 The test pressure of 3 psig specified for the periodic operational drywell leakage rate tests does not reflect additional pressurization in the drywell which will result from upper pool dump. This pressure also does not reflect additional drywell pressurization resulting from throttling of the ECCS to maintain vessel level which is required by the current EPGs.

5.7 After upper pool dump, the level of the pool will be 6 feet higher, and drywell-to-containment differential pressure will be greater than 3 psi. The drywell H_2 purge compressor head is nominally 6 psid. The concern is that after an upper pool dump, the purge compressor head may not be sufficient to depress the weir annulus enough to clear the upper vents. In such a case, H_2 mixing would not be achieved.

5.8 The possibility of high temperatures in the drywell without reaching the 2 psig high pressure scram level because of bypass leakage through the drywell wall should be addressed. (pp. 168-174 of 5/27/82 transcript)

6. RHR Permissive on Containment Spray

6.1 General Electric had recommended that the drywell purge compressors and the hydrogen recombiners be activated if the reactor vessel water level drops to within one foot of the top of active fuel. This requirement was not incorporated in the emergency procedure guidelines.

6.2 General Electric has recommended that an interlock be provided to require containment spray prior to starting the recombiners because of the large quantities of heat input to the containment. Incorrect implementation of this interlock could result in inability to operate the recombiners without containment spray.

6.3 The recombiners may produce "hot spots" near the recombiner exhausts which might exceed the environmental qualification envelope or the containment design temperature.

6.4 For the containment air monitoring system furnished by General Electric, the analyzers are not capable of measuring hydrogen concentration at volumetric steam concentrations above 60%. Effective measurement is precluded by condensation of steam in the equipment.

6.5 Discuss the possibility of local temperatures due to recombiner operation being higher than the temperature qualification profiles for equipment in the region around and above the recombiners. State what instructions, if any, are available to the operator to actuate containment sprays to keep this temperature below design values. (pp. 183-185 of 5/27/82 transcript)

7. Containment Pressure Response

7.1 The containment is assumed to be in thermal equilibrium with a perfectly mixed, uniform temperature suppression pool. As noted under topic 4, the surface temperature of the pool will be higher than the bulk pool temperature. This may produce higher than expected containment temperatures and pressures.

7.2 The computer code used by General Electric to calculate environmental qualification parameters considers heat transfer from the suppression pool surface to the containment atmosphere. This is not in accordance with the existing licensing basis for Mark III environmental qualification. Additionally, the bulk suppression pool temperature was used in the analysis instead of the suppression pool surface temperature.

7.3 The analysis assumes that the containment airspace is in thermal equilibrium with the suppression pool. In the short term this is non-conservative for Mark III due to adiabatic compression effects and finite time required for heat and mass to be transferred between the pool and containment volumes.

8. Containment Air Mass Effects

8.1 This issue is based on consideration that some Tech Specs allow operation at parameter values that differ from the values used in assumptions for FSAR transient analyses. Normally analyses are done assuming a nominal

containment pressure equal to ambient (0 psig) a temperature near maximum operating (90°F) and do not limit the drywell pressure equal to the containment pressure. The Tech Specs operation under conditions such as a positive containment pressure (1.5 psig), temperatures less than maximum (60 or 70°F) and drywell pressure can be negative with respect to the containment (-0.5 psid). All of these differences would result in transient response different than the FSAR descriptions.

8.2 The draft GGNS technical specifications permit operation of the plant with containment pressure ranging between 0 and -2 psig. Initiation of containment spray at a pressure of -2 psig may reduce the containment pressure by an additional 2 psig which could lead to buckling and failures in the containment liner plate.

8.3 If the containment is maintained at -2 psig, the top row of vents could admit blowdown to the suppression pool during an SBA without a LOCA signal being developed.

8.4 Describe all of the possible methods both before and after an accident of creating a condition of low air mass inside the containment. Discuss the effects on the containment design external pressure of actuating the containment sprays. (pp. 190-195 of 5/27/82 transcript)

9. Final Drywell Air Mass

9.1 The current FSAR analysis is based upon continuous injection of relatively cool ECCS water into the drywell through a broken pipe following a design basis accident. The EPG's direct the operator to throttle ECCS operation to maintain reactor vessel level at about level 8. Thus, instead of releasing relatively cool ECCS water, the break will be releasing saturated steam which might produce higher containment pressurizations than currently anticipated. Therefore, the drywell air which would have been drawn back into the drywell will remain in the containment and higher pressures will result in both the containment and the drywell.

9.2 The continuous steaming produced by throttling the ECCS flow will cause increased direct leakage from the drywell to the containment. This could result in increased containment pressures.

9.3 It appears that some confusion exists as to whether SBA's and stuck open SRV accidents are treated as transients or design basis accidents. Clarify how they are treated and indicate whether the initial conditions were set at nominal or licensing values. (pp. 202-205 of 5/27/82 transcript)

10. Drywell Flooding Caused by Upper Pool Dump

10.1 The suppression pool may overflow from the weir wall when the upper pool is dumped into the suppression pool. Alternately, negative pressure between the drywell and the containment which occurs as a result of normal operation or sudden containment pressurization could produce similar overflow. Any cold water spilling into the drywell and striking hot equipment may produce thermal failures.

10.2 Describe the interface requirement (A-42) that specifies that no flooding of the drywell shall occur. Describe your intended methods to follow this interface or justify ignoring this requirement. (pp. 209-226 of 5/27/82 transcript)

11. Operational Control of Drywell to Containment Differential Pressures

Mark III load definitions are based upon the levels in the suppression pool and the drywell weir annulus being the same. The GGNS technical specifications permit elevation differences between these pools. This may effect load definition for vent clearing.

12. Suppression Pool Makeup LOCA Seal In

The upper pool dumps into the suppression pool automatically following a LOCA signal with a thirty minute delay timer. If the signal which starts the timer disappears on the solid state logic plants, the timer resets to zero preventing upper pool dump.

13. Ninety Second Spray Delay

The "B" loop of the containment sprays includes a 90 second timer to prevent simultaneous initiation of the redundant containment sprays. Because of instrument drift in the sensing instrumentation and the timers, GE estimates that there is a 1 in 8 chance that the sprays will actuate simultaneously. Simultaneous actuation could produce negative pressure transients in the containment and aggravate temperature stratification in the suppression pool.

14. RHR Backflow Through Containment Spray

A failure in the check valve in the LPCI line to the reactor vessel could result in direct leakage from the pressure vessel to the containment atmosphere. This leakage might occur as the LPCI motor operated isolation valve is closing and the motor operated isolation valve in the containment spray line is opening. This could produce unanticipated increases in the containment spray.

15. Secondary Containment Vacuum Breaker Plenum Response

The STRIDE plants had vacuum breakers between the containment and the secondary containment. With sufficiently high flows through the vacuum breakers to containment, vacuum could be created in the secondary containment.

16. Effect of Suppression Pool Level on Temperature Measurement

Some of the suppression pool temperature sensors are located (by GE recommendation) 3" to 12" below the pool surface to provide early warning of high pool temperature. However, if the suppression pool is drawn down below the level of the temperature sensors, the operator could be misled by erroneous readings and required safety action could be delayed.

17. Emergency Procedure Guidelines

The EPGs contain a curve which specifies limitations on suppression pool level and reactor pressure vessel pressure. The curve presently does not adequately account for upper pool dump. At present, the operator would be required to initiate automatic depressurization when the only action required is the opening of one additional SRV.

18. Effects of Insulation Debris

18.1 Failures of reflective insulation in the drywell may lead to blockage of the gratings above the weir annulus. This may increase the pressure required in the drywell to clear the first row of drywell vents and perturb the existing load definitions.

18.2 Insulation debris may be transported through the vents in the drywell wall into the suppression pool. This debris could then cause blockage of the suction strainers.

19. Submergence Effects on Chugging Loads

19.1 The chugging loads were originally defined on the basis of 7.5 feet of submergence over the drywell to suppression pool vents. Following an upper pool dump, the submergence will actually be 12 feet which may effect chugging loads.

19.2 The effect of local encroachments on chugging loads needs to be addressed. (pp. 251-252 of 5/27/82 transcript)

20. Loads on Structures Piping and Equipment in the Drywell During Reflood

During the latter stages of a LOCA, ECCS overflow from the primary system, can cause drywell depressurization and vent backflow. The GESSAR defines vent backflow vertical impingement and drag loads, to be applied to drywell structures, piping, and equipment, but no horizontal loading is specified.

21. Containment Makeup Air For Backup Purge

Regulatory Guide 1.7 requires a backup purge H_2 removal capability. This backup purge for Mark III is via the drywell purge line which discharges to the shield annulus which in turn is exhausted through the standby gas treatment system (SGTS). The containment air is blown into the drywell via the drywell purge compressor to provide a positive purge. The compressors draw from the containment, however, without hydrogen lean air makeup to the containment, no reduction in containment hydrogen concentration occurs. It is necessary to assure that the shield annulus volume contains a hydrogen lean mixture of air to be admitted to the containment via containment vacuum breakers.

22. Miscellaneous Emergency Procedure Guideline Concerns

The EPGs currently in existence have been prepared with the intent of coping with degraded core accidents. They may contain requirements conflicting with design basis accident conditions. Someone needs to carefully review the EPG's to assure that they do not conflict with the expected course of the design basis accident.