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Docket Nos. 50-416/417

Mississippi Power and Light Company
ATTN: Mr. [illegible] Stampley
Vice President - Production
P. O. Box 1640
Jackson, Mississippi 39205

Gentlemen:

In order that we may continue our review of your application for permits to construct the Grand Gulf Nuclear Station, Units 1 & 2, additional information on those matters set forth in the enclosure is needed. In the course of our review, we have identified the following as being significant review items:

1. The analytical model used to calculate the containment response to loss-of-coolant accidents must be presented in sufficient detail with suitable justification so that an independent review of the model can be made, and so that the adequacy of the containment design margins can be assured.

2. The blowdown mass and energy rates must be shown to be conservative for containment design purposes. The short-term blowdown is especially significant for the Grand Gulf containment as the peak drywell differential pressure occurs at approximately one second post-LOCA.

3. The objectives and design of the General Electric large scale test program must be described in detail and shown to be sufficient to establish and/or confirm the Grand Gulf containment design parameters.

4. The operation of the hydrogen recirculation system must be more clearly defined to assure proper coordination with the containment spray system.

You will find that our interest in the above matters is reflected by the enclosed request for additional information. Your response to the information requested in the enclosure should reflect your careful consideration of these matters.

B/29

To maintain our licensing review schedule, we will need a completely adequate response to the matters identified in the enclosure by June 22, 1973. Please inform us within 7 days after receipt of this letter of your confirmation of the above schedule or the date you will be able to meet. If you cannot meet our specified date or if your reply is not fully responsive to our requests, it is highly likely that the overall schedule for completing the licensing review for this project will have to be extended. Since reassignment of the staff's efforts will require completion of the new assignment prior to returning to this project, the amount of extension will most likely be greater than the extent of delay in your response.

The questions in the enclosure have been grouped by sections that correspond to the relevant sections of the Grand Gulf Preliminary Safety Analysis Report. Please contact us if you desire additional discussion or clarification of the mater l requested.

Sincerely,

Original signed by
Walter Butler

Walter R. Butler, Chief
Boiling Water Reactors Branch 1
Directorate of Licensing

Enclosure:
Request for Additional Information

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DATE ▶	5/11/73	5/12/73	5/1 /73			

REQUEST FOR ADDITIONAL INFORMATION
GRAND GULF NUCLEAR STATION, UNITS 1 & 2

6.2.0 Containment Systems

6.2.2 In Section 6.2.1.3.5 of the PSAR, it is stated that GE Topical Reports NEDO-10320 and NEDO-10320, Supplement 1, describe the analytical model used to evaluate the Grand Gulf containment response to loss-of-coolant accidents. The matters identified in items (a) through (e) below relate to this analytical model.

(a) Since this model was originally developed for other BWR pressure suppression vent configurations, clarify which sections of the referenced reports are still applicable and are being used to evaluate the Mark III containment configuration proposed for the Grand Gulf Nuclear Station.

(b) Provide a detailed description of the new analytical model which has been developed to represent the response of the Grand Gulf containment design, including the basis for this model. This description should include a discussion of the assumptions implicit in the analytical model and should provide the equations of the model. Provide the parametric values of the variables which were used to make this model represent the various features of the Grand Gulf containment design.

(c) Indicate the specific parts of the analytical model and parametric values which you believe require experimental substantiation or confirmation by the large scale test program planned by the General Electric Company.

(d) Describe the procedures which will be used to either establish or confirm the analysis and parametric values in (c) above.

(e) Discuss the bases of the proportionality constants which were used to scale the individual components of the test facility which are representative of the Grand Gulf containment system. Justify your conclusion that the test facility may be considered a valid simulation of the Mark III containment system as it is proposed for Grand Gulf.

6.2.3 In Table 6.2.1 and Section 6.2.1.2.2 of the PSAR, the maximum calculated values of containment design parameters and their design values are compared. However, technical bases on which the design margins were established have not been presented. Further, there probably will not be any significant Mark III test data until late 1973 to evaluate these margins. Therefore, provide a complete discussion justifying the design margins established for the containment and perform a sensitivity analysis so that we may make a preliminary assessment of the conservatism in your containment design.

Specifically, provide curves which illustrate the sensitivity of containment response to each of the following parameters:

(a) vent resistance factors;
(b) drywell net free volume;
(c) containment net free volume;
(d) vent areas;
(e) vent submergencies;
(f) drywell air carryover rates to the containment;
(g) blowdown flow and energy rates;
(h) suppression pool temperatures;
(i) steam bypass leakages between the drywell and containment; and
(j) core heat due to delay in control rod insertion.

Each curve should show containment and drywell pressure responses as a function of time for a range of values of the parameter under consideration. Aside from the parameter under consideration all other initial conditions and variables should be as assumed in the PSAR analysis of containment response to the DBA-LOCA. Each of the (a) through (j) parameters cited above should be specified as to the nominal value used in the PSAR analysis, the manner by which it was determined (e.g., calculated or experimental) and an estimate of the accuracy to which the value of the parameter is known.

6.2.4 Discuss the assumptions used in calculating the blowdown energy and mass rates provided on page 6.2-26 of the PSAR and provide justification that these assumptions maximize the energy input to the containment. As the peak drywell differential pressure occurs at less than 1 second post-LOCA, special consideration should be given to those assumptions (i.e., water entrainment) which could have a significant effect on the short term blowdown rate.

6.2.5 In the discussion of the main steam line break accident (PSAR Section 6.2.1.3.2) it was stated that after 4.2 seconds the isolation valves in the broken line will have closed sufficiently so that the valve flow area will be equal to the flow restrictor area and after 5.5 seconds the closure of the valves will terminate flow from one side of the break. These parameters establish the effective break area profile for the accident. It appears that the above assumptions are a departure from previous BWR containment design analyses and therefore should be substantiated as follows:

(a) Since the isolation valves are designed for closing times that range from 3 to 10 seconds, discuss and reference any testing that has correlated valve closing times to the valve closing speed control setting. Specify the sensitivity of the valve closing speed control.

(b) In Section 5.5.3 of the PSAR, the statement is made that the isolation valves are designed and installed such that performance of the valves is enhanced for forward steam flow conditions. Since the valves located in the broken steam line will experience reverse flow conditions (for MSL breaks inside the drywell), discuss the capability of the valves to close in 5.5 seconds or less. Provide or reference appropriate experimental data which supports your position.

6.2.6 Discuss your assumptions used in calculating the mass and energy blowdown rates for the rupture of a recirculation line (PSAR page 6.2-12c) and justify them as being conservative for containment design purposes. Specifically, consider:

(a) your assumptions regarding the inventory of subcooled reactor coolant in the recirculation loops and reactor vessel downcomer regions which could yield higher, short term (less than 1 second) blowdown rates; and

(b) the potential availability of uninterrupted feedwater flow which would increase the energy addition to the containment over the long term.

6.2.7 In PSAR Section 6.2.1.3.7 a description is given of the analytical model used to compute the long term containment response to a loss-of-coolant accident. Our review in this area indicates that the following modifications should be considered to provide a more accurate model and to account for design changes:

(a) One of the initial conditions assumed in this analysis (p. 6.2-17) is that containment and drywell pressures were equalized due to the operation of vacuum breakers. Since vacuum breakers have been eliminated from the containment design, your analysis should be revised to (1) return non-condensibles from the containment to the drywell by reverse flow through the vent system and/or (2) establish specific criteria to determine the conditions for opening the combustible gas control system recirculation inlet lines to equalize pressures.

(b) The statement of initial conditions should also include a specification of the time after the accident beyond which the long term analysis becomes valid.

(c) Your modeling of long term performance by use of equation (1) on page 6.2-21, indicates that the flow out of the reactor vessel, the flow out of the suppression pool, and the ECCS flow are all identical. However, information presented in other sections of the PSAR does not appear to support this position, e.g., pages 6.2-18 and 6.2-33 indicate that for Case B either 2 LPCI and 1 HPCS or 1 LPCI, 1 HPCS, and 1 LPCS pumps will be operating and only the LPCI flow is directed to the RHR heat exchangers. Also, on pages 6.2-18 and 6.2-32 you state that the

LPCI flow, after being cooled, can be returned to the suppression pool or injected into the reactor vessel as ECCS water. Clearly, the above considerations would indicate that the system cannot be modeled as a single loop of constant and equal flow rates as shown on Figure 6.2-16. Accordingly, your model should be revised to account for the various possible flow paths under Case B and to account for minimum safeguards. Use the revised model to determine the most conservative case for containment design purposes.

(d) Include in equation (5) on page 6.2-23 a term for the energy removed in condensing the drywell steam atmosphere and account for any heat addition due to operation of the recombiners.

(e) Page 6.2-25 of the PSAR indicates that equations 6, 7, 8, & 9 can be solved for M_{AS}, M_{AD}, and P_s/P_D. However, on page 6.2-24, it was assumed that $P_s = P_D$. Clarify this apparent anomaly.

(f) The term H, submergence of the top row of vents, appears in several equations on page 6.2-25. Discuss how values of this parameter are determined, as it is not a constant and it does not appear to be calculated for each time step.

(g) Your long term model assumes a single volume suppression pool with a uniform temperature throughout the pool. This assumption does not account for the separate volumes of water which would occupy the drywell and the smaller volume left in the suppression pool, and it does not consider the temperature gradients which may exist within these volumes. Revise your model to more accurately describe the phenomena, or provide justification for your present model by demonstrating that it is a conservative approach.

(h) Account for operation of the containment sprays in the long-term model.

6.2.8 In Section 6.2.1.3.9 of the PSAR, a table is provided with information on the core decay heat rates used in the containment response analysis. Discuss the bases used to calculate these values and confirm that the bases are at least as conservative as the methods set forth in the October 1971 draft of Proposed ANS Standard Decay Energy Release Rates Following Shutdown of Uranium-Fueled Thermal Reactors assuming an equilibrium fuel cycle and increasing the calculated heat inputs as follows:

(a) For the time interval 0 to 10^3 seconds, add 20 percent to the heat released by the fission products to cover the uncertainty in their nuclear properties.

(b) For the time interval 10^3 to 10^7 seconds, add 10 percent to the heat released by the fission products to cover the uncertainty in their nuclear properties.

(c) For the time interval 0 to 10^7 seconds, calculate and include the heat released by the heavy elements (using the best estimate of the production rate for Grand Gulf 1 & 2) and add 10 percent to cover the uncertainties in their nuclear properties.

6.2.9 The design value and bases for the drywell negative differential pressure is not clear (page 6.2-3 of the PSAR). Provide the following:

(a) The design negative differential pressure for the drywell.

(b) An evaluation of this design value with respect to the peak calculated negative differential pressure of 21 psi, with consideration of the available margin and the basis for the margin.

(c) The applicable experimental data and/or analytical models, assumptions, and values of the parameters used to calculate the condensation rate. The PSAR states (p. 6.2-8) that following reactor vessel reflood, ECCS flow out the break will condense drywell steam and cause a rapid depressurization. Discuss the significance of a less rapid or incomplete depressurization of the drywell.

6.2.10 In Section 6.2.1.3.7 of the PSAR, you state that during the long term post-LOCA period, ECCS water will spill out the pipe break and flood the drywell up to the top of the weir wall. Provide the following additional information regarding the above statement:

(a) A discussion of the potential for water leakage from the drywell and depletion of suppression pool inventory, since the drywell floor does not have a liner. Specify all sumps, drains, or piping which could provide leakage paths from the drywell floor to the areas outside of containment.

(b) A discussion of the design features which are provided to monitor suppression pool inventory during the post-accident period.

6.2.11 The discussion of vent areas on page 6.2-4 of the PSAR requires clarification. Demonstrate clearly with the aid of drawings if necessary, how the net free vent area (552 ft^2) and the net free vent annulus area (528 ft^2) are calculated. Provide drawings which detail the weir wall, vent, and suppression pool geometry and which indicate the safety/relief valve discharge line routing and its support.

6.2.12 Provide the following additional information concerning the containment spray system:

(a) Complete details on the analysis performed to size the containment sprays.

(b) A discussion of the restrictions on use of the containment sprays due to its interlocking with other functions of the Residual Heat Removal System for the spectrum of potential energy releases to the drywell.

(c) In Section 6.2.5.5 of the PSAR, you state that there is a time delay which ensures that the hydrogen mixing system will not be initiated until the resulting bypass energy is within the capability of the containment spray system. Specify the delay time and demonstrate that this will be an allowable time for starting recirculation, for the spectrum of potential energy releases to the drywell.

6.2.13 Clarification of Section 6.2.1.3.3 of the PSAR, describing intermediate size primary system breaks, is required as follows:

(a) The value of vent submergence used in the analysis, 9'10", does not appear to agree with information given on page 6.2-4, which indicates that the submergence is 8'10".

(b) The statement is made that pressurization of the containment will be terminated after about 250 seconds and the pressure will stabilize at about 7 psig. However, Figure 6.2-12 shows the containment pressure to stabilize at about 3 psig.

6.2.14 Specify the range of primary system break sizes which you consider to be "small breaks" as discussed in Section 6.2.1.3.4 of the PSAR.

6.2.15 Clarify the statement made on page 6.2-16 of the PSAR that "for <u>drywell</u> design purposes...the combination of primary system pressure and <u>containment</u> pressure which produces the maximum superheat" condition is used.

6.2.16 Explain why sensible heat energy inputs to the suppression pool, as shown on Figure 6.2-17, are not considered for temperatures below 212°F.

6.2.17 Provide details of the calculations for the net positive suction head for the three RHR pumps as tabulated in Table 6.3.4. Include your assumptions for suppression pool water level.

6.2.18 Figure 6.2-14 of the PSAR shows a peak suppression pool temperature of 182°F while the design basis of the containment includes a peak temperature to 185°F. Discuss the basis for selection of the design temperature of 185°F. Justify the adequacy of a 3°F margin; and since containment pressure is a function of suppression pool temperature, relate the significance of pool design conditions to containment design parameters.

6.2.19 Discuss the various responsibilities and interactions between the General Electric Company, Bechtel Corporation, and Mississippi Power & Light Company for the Grand Gulf containment design. Discuss the extent of participation and independent assessment which will be performed by Bechtel and Mississippi Power & Light for the large scale Mark III testing program.

6.2.20 Specify the source of the air that is needed for all pneumatic systems located in the containment or drywell and specify any separate containment control air systems, if provided. Show that your calculations of containment pressure response to a design basis loss-of-coolant accident are conservative, assuming that all Category II air lines located within primary containment fail at the time of the design basis loss-of-coolant accident.

6.2.21 Describe the suppression pool liner coating materials that will be used for your plant. Include a discussion of the qualification testing of the coating materials that has been performed and of the applicable test results; the experience, with supporting data, on the use of the coating materials on other plants, if applicable; and the proposed surveillance programs which will monitor the condition of the coatings and liner metal during the lifetime of the plant. Also, indicate if inhibitors or chemical additives will be used in the suppression pool water.

6.2.22 The following items which require correction have been noted in our review of Section 6 of the PSAR:

(a) The parameters listed on p. 6.2-21 and on Figure 6.2-16, e.g., m_{do}, q_{Hx}, q_d, q_e, do not have consistent definitions or units.

(b) On p. 6.2-11, reference is made to the drywell and containment pressures stabilizing at 12 and 7 psia, respectively. These pressures should be in units of psig. A similar correction is necessary on pages 6.2-14 and 6.2-15 of the PSAR.

(c) On p. 6.2-12, reference is made to vacuum breakers equalizing pressures. Since vacuum breakers are not included in the design, this statement should be corrected.

(d) Table 6.2.3, Case B, Long Term indicates one LPCS and no LPCI pumps as being operative while page 6.2-18 indicates that either 2 LPCI or 1 LPCI and 1 LPCS would be operative.

(e) In Table 6.2.5, Event No. 5, Maximum Positive Differential Pressure Occurs, and Event No. 14, Containment Reaches Peak Pressure, are not consistent with Figures 6.2-9 and 6.2-15, respectively.

6.2.23 Discuss the proposed surveillance systems and administrative procedures by which the leak-tightness of the containment can be continuously monitored.

6.2.24 With respect to the reliability of the containment isolation valves, describe the basis upon which the valves and valve operators will be selected.

6.2.25 For those containment isolation valves, including those valves connecting the drywell to the containment, which have seats fabricated from a rubber-like material, specify:

(a) the number and type of valves;

(b) the long term life and service characteristics of the material; and

(c) any service experience with the material in other nuclear plants which would justify its use in the containment environment.

6.2.26 Provide the following additional information concerning possible requirements for additional guard pipes on lines passing through the containment:

(a) For the reactor water cleanup system lines (PSAR, page 6.2-9), specify what amount of blowdown fluid is an acceptable value for the containment and describe how the break detection and isolation systems limit the possible amount of blowdown fluid to this value.

(b) Substantiate your statement (PSAR, page 6.2-9) that an instrument line rupture would release more fluid to the containment than TIP or CRD line ruptures. Include TIP line isolation arrangements in Table 6.2-7 and on Figure 6.2-19a.

(c) Discuss your bases for not providing guard pipes on the standby liquid control line (Item No. 27, Table 6.2.7) and the reactor water sample line (Item No. 4, Table 6.2.7).

(d) Discuss more fully your justification for not providing guard pipes on the LPCI, LPCS, and HPCS lines, since it appears that there are other lines with similar isolation capability (e.g., RHR Shutdown Cooling Return lines) which are equipped with guard pipes.

(e) Specify the design temperature and pressure of the guard pipes.

6.2.27 Provide plan and section view drawings which detail the arrangement of the RHR system suction and return lines to the suppression pool. Demonstrate that the arrangement selected facilitates mixing of the return water with the total pool inventory before the return water becomes available to the suction lines. Discuss the design provisions which have been taken to preclude blockage or plugging of the RHR system suction lines.

6.2.28 Provide the following additional information concerning the hydrogen mixing and control system:

(a) Specification of the accuracy of the hydrogen concentration analyzers;

(b) Discussion of the uncertainty involved in determining the hydrogen concentration (1) in the drywell prior to the start of recirculation, and (2) in the drywell and containment during the mixing period; and

(c) Specification of the hydrogen concentrations at which the recirculation and control systems will be started.

6.2.29 Since the hydrogen mixing system will also serve a vacuum relief function for the drywell, provide the following information:

(a) A specification of all plant conditions which could require operation of the recirculation lines for vacuum relief purposes. Also estimate the frequency for these conditions to exist.

(b) A description in detail of how the mixing system will be used to relieve drywell vacuum. Include the number of valves opened, the differential pressure at which the valves will be opened, the capability of the operator to effectively respond to the conditions outlined in item (a) above, and plant conditions for which the operator will not be allowed to open valves.

(c) A discussion of the potential for a recirculation line(s) to be open prior to a loss-of-coolant accident and a discussion of the consequences of such an event.

(d) A specification of the closing time for the mixing system valves.

(e) A statement of whether the break area referred to in Figure 6.2-26, showing the relationship of allowable bypass area to primary system break area, corresponds to a liquid or a steam system break.

(f) A discussion of the amount of suppression pool water which could flow into the drywell, assuming that the valves were not opened to relieve drywell vacuum, and the consequences of such a loss in pool inventory on containment response to a loss-of-coolant accident.

6.2.30 In Section 6.2.5.2.1 of the PSAR, the statement is made that the relatively high discharge velocity of the recirculating fans and the effects of diffusion and convection will maintain uniform concentrations of hydrogen in the containment following a loss-of-coolant accident. Support this statement by providing the following information:

(a) A description of the types of analyses that were performed to demonstrate adequate mixing throughout the drywell, containment, and all subcompartments;

(b) A discussion of the bases used to establish the flow rate of the recirculation fans;

(c) A discussion of additional means of ensuring mixing, such as periodic actuation of the containment sprays; and

(d) A discussion of any limitations on the initiation of the mixing system due to pressure differentials between the drywell and the containment.

6.2.31 Flow paths connecting various parts of the drywell may be restricted due to the arrangement of piping, gratings and equipment. Discuss the manner by which this effect was considered in calculating the drywell response to the loss-of-coolant accident.

6.2.32 Describe how the following containment design parameters were established:

(a) the distance between the drywell wall and containment wall;

(b) the distance between the weir wall and drywell wall;

(c) the vertical distance between rows of vents and the horizontal distance between columns of vents; and

(d) the submergence of each row of vents.

6.2.33 The containment pressure response profile, as shown in Figure 6.2-9, indicates that choked vent flow may be experienced for a time period following vent clearing. Specify whether the vent flow at this time is choked or unchoked and discuss in detail the analytical techniques used to determine the condition of the flow. Provide a curve of vent flow versus time corresponding to the pressure response presented in Figure 6.2-9.

6.2.34 Provide curves of suppression pool water level as a function of time (0 to 10^6 seconds) for the design basis loss-of-coolant accident. These curves should illustrate the level of water in the containment, the weir wall annulus, and the drywell. Clearly state all relevant assumptions.

6.2.35 Assuming that both recombiners are unavailable and that purging is the only means for post-accident combustible gas control, specify the required times and rates of purging, and demonstrate that the combined accident radiological dose due to containment leakage and purging does not exceed the guidelines of 10 CFR Part 100.

6.2.36 Describe and discuss the possible plant conditions under which the containment and drywell ventilation, purge and cooling systems may be essential, following an accident, to prevent or mitigate the consequences of the accident. Include in your response a discussion of the range of failures or malfunctions considered as well as the specific design criteria that will be followed to assure that no failure or malfunction in the system will result in offsite radiological doses comparable to the guidelines in 10 CFR Part 100.

6.2.37 Provide a detailed evaluation of through-line leakage or direct leakage which could bypass the boundary region of the Standby Gas Treatment System (SGTS). In your evaluation, include:

(a) The fraction of the total containment leakage which is assumed to enter the boundary region of the SGTS;

(b) The fraction of through-line leakage assumed to terminate within the boundary region of the SGTS;

(c) The fraction of through-line leakage assumed to terminate in the auxiliary building;

(d) The fraction of through-line leakage assumed to be discharged directly to the atmosphere; and

(e) Identification of the specific leakage paths from the containment for the above.

Discuss the tests and frequency of tests proposed to detect and limit the above leakage.

6.2.38 Provide the information specified in the attached table either by reference or by listing the appropriate numerical values.

I. <u>General Information</u>

A. Drywell

1. Internal design differential pressure, psi
2. External design differential pressure, psi
3. Design temperature, °F
4. Free Volume, ft^3

5. Design leak rate, %/day @ psig
6. Design ambient temperature range (min.-max.), °F
7. Volume of water necessary to flood drywell to top of weir wall, ft^3

B. Containment

1. Internal design pressure, psig
2. External design differential pressure, psi
3. Design temperature, °F
4. Air volume, minimum, ft^3, maximum, ft^3
5. Suppression pool water volume, minimum ft^3; maximum, ft^3
6. Suppression pool surface area, ft^2
7. Suppression pool depth, ft
8. Design leak rate, %/day @ psig
9. Design service water temperature range (min.-max.), °F

C. Vent System

1. Number of vent holes
2. Diameter of vent holes, ft
3. Drywell wall - weir wall distance, ft.
4. Net free vent area, ft^2
5. Net free vent annulus area, ft^2
6. Drywell wall thickness, ft
7. Vent submergences, minimum, ft, maximum, ft
8. Vent system resistance factors

D. Containment Spray System

1. Number of pumps for spray system
2. Capacity per pump, gpm
3. Spray flow rate for drywell, lb/hr
4. Spray flow rate for containment, lb/hr
5. Spray inlet temperature, °F
6. Spray thermal efficiency, %

E. Containment Cooling System

1. Number of pumps
2. Capacity per pump, gpm
3. Number and type of heat exchangers for containment cooling system
4. Heat transfer area per heat exchanger, ft^2

5. Overall heat transfer coefficient, $Btu/hr\text{-}ft^2\text{-}°F$
6. Secondary coolant flow rate per heat exchanger, lb/hr
7. Secondary coolant inlet temperature, °F

II. Combustible Gas Control System

A. Design Parameters

1. Mass of zirconium in fuel cladding, lb
2. Mass of aluminum in containment and drywell, lb
3. Aluminum surface area in containment and drywell, ft^2
4. Mass of zinc in containment and drywell, lb
5. Zinc surface area in containment and drywell, ft^2
6. Hydrogen dissolved in reactor coolant, equivalent scf

B. Recombiner System

1. Number and type of recombiners
2. Design flow rate per unit, cfm
3. Hydrogen removal efficiency, %
4. Hydrogen concentration when recombiners start, % volume
5. Time when recombiners start, days
6. Location (inside or outside containment)

C. Purge System

1. Hydrogen (or oxygen) concentration when purge is initiated, volume %
2. Time when purge is initiated, days
3. Purge rate, scfm

D. Recirculation System

1. Time when recirculation starts, hours
2. Number of recirculation fans
3. Capacity per fan, cfm
4. Pressure differential at which inlet lines open for vacuum relief, psi

III. Assumptions for Accident Analyses

A. Reactor Coolant System

1. Reactor power level, MWt
2. Average coolant pressure, psig
3. Average coolant temperature, °F
4. Mass of reactor coolant (liquid), lb

5. Mass of reactor coolant (steam), lb
6. Volume of water in reactor vessel, ft^3
7. Volume of steam in reactor vessel, ft^3
8. Volume of water in recirculation loops, ft^3

B. Initial Energy (in Btu)

1. Reactor coolant
2. Fuel and cladding
3. Core internals
4. Reactor vessel metal
5. Reactor coolant piping, pumps & valves
6. Drywell structures
7. Drywell air
8. Drywell steam
9. Containment air
10. Containment steam
11. Containment water

C. Drywell

1. Pressure, psig
2. Temperature, °F
3. Relative humidity, %

D. Containment

1. Pressure, psig
2. Air temperature, °F
3. Water temperature, °F
4. Relative humidity, %
5. Air volume, ft^3
6. Water volume, ft^3
7. Vent submergences, ft

E. Recirculation Loop Break

1. Recirculation pipe ID, inches
2. Effective total break area, ft^2
3. Blowdown data: time (sec), flow (lb/sec), enthalpy (Btu/lb)
4. Name of blowdown code

F. Main Steam Line Break

1. Main steam pipe ID, inches
2. Effective total break area, ft^2
3. Blowdown data: time (sec), flow (lb/sec), enthalpy (Btu/lb)
4. Name of blowdown code

G. Energy Sources (Provide data in tabular form)

1. decay heat rate (Btu/sec) as a function of time
2. primary system sensible heat rate (Btu/sec) to the containment as a function of time
3. metal-water reaction heat rate (Btu/sec) as a function of time
4. heat rate from other sources (Btu/sec) as a function of time

H. Subcompartment Pressure

1. Name of subcompartment
2. ID of ruptured pipe, inch
3. Effective total break area, ft^2
4. Volume of subcompartment, ft^3
5. Vent area of subcompartment, ft^2
6. Vent area flow coefficient
7. Vent area resistance factor
8. Blowdown data: time (sec), flow (lb/sec), enthalphy (Btu/lb)
9. Name of blowdown code

I. Structural Heat Sinks

1. Number of heat sinks
2. Heat sink data:
   heat sink
   material
   area (ft^2)
   thickness (ft)
   thermal conductivity (Btu/hr-ft-°F)
   specific heat (Btu/°F-lb)
   density (lb/ft^3)

IV. <u>Results of Accident Analysis</u>

A. Plot as a function of time (0 to 10^6 seconds) the results of the analysis for each accident case:

1. drywell pressure, psig
2. drywell temperature, °F
3. drywell differential pressure, psi
4. containment pressure, psig
5. containment air temperature, °F
6. suppression pool temperature, °F
7. vent flow, lb/sec
8. specific volume of vent flow, ft^3/lb