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October 22, 1985

NUCLEAR LICENSING & SAFETY DEPARTMENT

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

Attention: Mr. Harold R. Denton, Director

Dear Mr. Denton:

SUBJECT: Grand Gulf Nuclear Station
Unit 1
Docket No. 50-416
License No. NPF-29
File: 0260/0840/L-860.0
Response to Request for Additional Information on PCOL-85/11
AECM-85/0341

NRC staff reviewers have recently requested additional information on Mississippi Power and Light's (MP&L's) request for amendment of the GGNS Unit 1 Operating License NPF-29 submitted on August 12, 1985 by letter from Mr. O. D. Kingsley, Jr. to Mr. Harold R. Denton, MP&L correspondence number AECM-85/0228. NRC staff reviewers requested more information on the ECCS performance analysis performed in support of MP&L's proposed change to the technical specifications resulting from a design change to add high/low pressure interlocks to the injection valves on the low pressure ECCS systems.

Attached to this letter is a description of the ECCS performance analysis which supports an increase in peak cladding temperature of 51°F compared to the current FSAR analysis. Provided the design change is implemented, the necessary FSAR changes will be incorporated into the appropriate annual update.

Yours truly,

S H Hobbs
for L. F. Dale
Director

WJH/SHH:vog
Attachment

cc: (See Next Page)

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PDR ADOCK 05000416
P PDR

 Member Middle South Utilities System

A001
1/1

cc: Mr. J. B. Richard (w/a)
Mr. O. D. Kingsley, Jr. (w/a)
Mr. R. B. McGehee (w/a)
Mr. N. S. Reynolds (w/a)
Mr. H. L. Thomas (w/o)
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LOW PRESSURE INTERLOCK ECCS PERFORMANCE ANALYSIS

An ECCS performance analysis was performed for Grand Gulf to determine the effect of adding a pressure permissive to the LPCI and LPCS injection valve opening logic. This additional logic delays the low pressure ECCS injection for large breaks which rapidly depressurize the vessel. The results of this study show that for a valve opening time of 30 seconds, the delay in ECCS injection causes a delay of approximately 15 seconds in core reflooding and an increase in peak cladding temperature of 51°F compared to the current FSAR analysis. However, there is sufficient margin in the Grand Gulf FSAR analysis to absorb this increase and remain within the 2200°F PCT limit.

The design basis accident (DBA) recirculation suction line break with failure of the LPCI diesel generator was analyzed to determine the effect of the logic change. This break and failure combination was identified in the FSAR as the limiting LOCA event and is also the most sensitive to this change. Smaller breaks depressurize more slowly and are less affected by the pressure permissive. The analysis was identical to that in the FSAR with the exception of the low pressure ECCS injection. For the previous case presented in the FSAR, the LPCI and LPCS were assumed to inject at 45.9 seconds* after the break occurs (i.e., 40 seconds after the water level fell below Level 1 at 5.9 seconds*). For the case with the pressure interlock, the injection valves were assumed to begin opening only after the reactor pressure dropped below 450 psia at 27.8 seconds. Low pressure ECCS injection was then assumed only after the valves were fully open at 57.8 seconds (i.e., assuming a 30 second valve opening time).

The valve logic change results in a delay in both injection and core reflooding, and an increase in the calculated peak cladding temperature. Since the PCT for the FSAR case in 2098°F, there is sufficient margin to the 2200°F limit to absorb the increase for the case with the pressure interlock, and therefore it is acceptable from an ECCS viewpoint.

To document the effect on the LOCA analysis of adding the low pressure ECCS pressure permissive, attached are some recommended changes for FSAR Tables 6.3-1, 6.3-2, 6.3-3 and 6.3-6. Revised copies of FSAR Figures 6.3-14, 6.3-15 and 6.3-16 are also attached which show the water level, pressure and peak cladding temperature response with the addition of the injection valve pressure permissive. These recommended changes to the FSAR will be incorporated, if applicable, at the appropriate annual update.

* Table 6.3-1 in FSAR amendment 57 gives actual expected response as opposed to response assumed in the analysis. Level 1 indication at 7 seconds was a typographical error. Revised Table 6.3-1 attached to this letter depicts response assumed in current analysis.

GRAND GULF FSAR RECOMMENDED CHANGES TO INCORPORATE A PRESSURE PERMISSIVE ON THE LOW PRESSURE ECCS INJECTION VALVES

1. Table 6.3-1 would be updated and modified as shown on the next page.

2. In Table 6.3-2, insert the following information immediately following the "maximum allowable time delay" entry, and modify the "injection valve fully opened" entry as below for both LPCI and LPCS systems.

   o Injection valve fully open - seconds after pressure permissive $\leq$ 30.0.

   o Pressure at which injection valve may open - psia $\leq$ 450.

3. In Table 6.3-3, add footnote "(3)" after "3.1 ft^2 (DBA)" and add to the bottom of the page "(3)". The impact of the LPCI and LPCS injection valve pressure interlock is estimated to be a 51°F increase in PCT and a 0.004 increase in oxidation fraction. Consistent with the estimated increase in PCT, the CWMWR% would be 0.16."

4. In Table 6.3-6, under "high enrichment IC fuel" exposure 200.0, add "*" after (PCT) 2098 and (OXID FRAC) 0.0201, and the footnote to the bottom of the page "*" the impact of the LPCI and LPCS injection valve pressure interlock is estimated to be a 51°F increase in PCT and a 0.004 increase in oxidation fraction."

GGNS FSAR TABLE 6.3-1

OPERATIONAL SEQUENCE OF EMERGENCY CORE COOLING SYSTEMS FOR DESIGN BASIS ACCIDENT

Time (sec)	Events
0	Design basis loss-of-coolant accident assumed to start; normal auxiliary power assumed to be lost.
~ 0	High drywell pressure and reactor low water level (level 3) are reached. All diesel generators, HPCS, LPCS, LPCI signaled to start on high drywell pressure*. Scram initiated on level 3.
~ 3	Reactor low-low water level (level 2) reached. HPCS receives second signal to start.
~ 6	Reactor low-low-low water level (level 1) reached. Second signal to start LPCI and LPCS; main steam isolation valves close. Auto-depressurization sequence begins.
~13	All diesel generators ready to load; energize HPCS pump motor; open HPCS injection valve: begin energizing LPCI and LPCS pump motors.
~28	Pressure permissive for LPCI and LPCS injection valve reached.
~30	HPCS injection valve open and pump at design flow, which completes HPCS startup.
~ 33	LPCI and LPCS pumps at rated speed.
~ 58	LPCI and LPCS pumps at rated flow, LPCI and LPCS injection valves open, which completes the LPCI and LPCS startups.
See Figure 6.3-14	Core effectively reflooded assuming worst single failure; heatup terminated.
> 10 min	Operator shifts to containment cooling.
NOTE:	For the purpose of all but the next to last entry on this table all ECCS equipment is assumed to function as designed. Performance analysis calculations consider the effects of single equipment failures (see subsections 6.3.2.5 and 6.3.3.3).

* No credit taken in LOCA analyses for ECC System start on high drywell pressure signal.

GGNS FSAR TABLE 6.3-2

SIGNIFICANT INPUT PARAMETERS TO THE LOSS-OF-COOLANT ACCIDENT ANALYSIS

Plant Parameters

o	Core Thermal Power	MWt	3993
o	Vessel Steam Output	LB_m/hr	17.3×10^6
o	Corresponding percent of rated steam flow	percent	105
o	Vessel Steam Dome Pressure	psia	1060
o	Maximum Recirculation Line Break Area	ft^2	3.1

Emergency Core Cooling System Parameters

Low-Pressure Coolant Injection System

o	Vessel Pressure at which flow may commence	psid (vessel to drywell)	225
o	Minimum Rated Flow at Vessel Pressure	GPM psid (vessel to drywell	22000 20
o	Initiating signals low-low-low water level or high drywell pressure	 ft above top of action fuel psig	 ≥ 1.0 ≤ 2.0
o	Maximum allowable time delay from initiating signal to pumps at rated speed	sec	27.0
o	Injection valve fully open	sec after pressure permissive	30.00
o	Pressure at which injection valve may open	psia	≤ 450

GGNS FSAR TABLE 6.3-2 (Cont.)

Low-Pressure Core Spray System

o	Vessel pressure at which flow may commence	psid (vessel to drywell)	289
o	Minimum rated flow at Vessel Pressure	GPM psid (vessel to drywell)	7000 122
o	Initiating signals low-low-low water level or high drywell pressure	ft. above top of action fuel psig	≥ 1.0 ≤ 2.0
o	Maximum allowed (runout) flow	GPM	9100
o	Maximum allowed delay time from initiating signal to pump at rated speed	sec	27.0
o	Injection valve fully open	sec after pressure permissive	30.00
o	Pressure of which Injection valve may open	psia	≤ 450

High-Pressure Core Spray

o	Vessel pressure at which flow may commence	psid	1177
o	Minimum flow available at vessel to pump suction head		See Figure 6.3-3
o	Initiating signals low-low water level or high drywell pressure	ft. above top of active fuel psig	≥ 10.5 ≤ 2.0
o	Maximum allowed (runout) flow	GPM	9100
o	Maximum allowed delay time from initiating signal to rated flow available and injection valve wide open	sec	27.0

GGNS FSAR TABLE 6.3-2 (Cont.)

Automatic Depressurization System

o	Total number of valves installed		8
o	Number of valves used in analysis analysis		8[(1)]
o	Minimum Flow Capacity of 8 valves at vessel pressure	lb/hr psid (vessel to suppression pool)	6.4×10^6 1125

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(1) Additional LOCA analyses in Section 6.3.3.7.8 with seven ADS valves justify one ADS valve out of service for an extended period of time.

GGNS FSAR TABLE 6.3-3

SUMMARY OF RESULTS OF LOCA ANALYSIS

Break Spectrum Analysis		PCT (F)	Peak Local Oxidation % of Initial Cladding Thickness
Break Size Location Single Failure			
3.1 ft^2 (DBA) (3) Recirc. Suction LPCI D/G		2098 (1)	2.01
2.5 Ft^2 (80% DBA) Recirc. Suction LPCI D/G		1973 (1)	1.23
1.9 ft^2 (60% DBA) Recirc. Suction LPCI D/G		1791 (1)	< 1.0
1.0 ft^2 Recirc. Suction LPCI D/G	Large Break Method	1990 (1)	1.71
	Small Break Methods	1718 (2)	< 1.0
.09 ft^2 Recirc. Suction HPCS		1404 (2)	< 1.0

The corewide metal-water reaction for the subject plant has been calculated using method 1 described in Reference 2. The value is as follows:

Corewide Metal-Water Reaction % = .13

NOTES:

(1) CHASTE - Large break method
(2) Non-DBA reflood
(3) The impact of the LPCI and LPCS injection valve pressure interlock is estimated to be a 51°F increase in PCT and a 0.004 increase in oxidation fraction. Consistent with the estimated increase in PCT, the CWMWR would be 0.16.

GGNS FSAR TABLE 6.3-6

MAPLHGR, MAXIMUM LOCAL OXIDATION, AND PEAK CLAD TEMPERATURE VERSUS EXPOSURE

High Enrichment Fuel

Exposure MWD/T	MAPLHGR KW/FT	P.C.T. DEG = F	OXID FRAC
200.0	12.0	2098*	0.0201*
1,000.0	12.0	2087	0.0193
5,000.0	12.4	2069	0.0178
10,000.0	12.6	2071	0.0177
15,000.0	12.6	2083	0.0184
20,000.0	12.6	2085	0.0186
25,000.0	12.1	2014	0.0147
30,000.0	11.1	1885	0.0093
35,000.0	10.2	1764	0.0060
40,000.0	9.6	1692	0.0045

Medium Enrichment Fuel

Exposure MWD/T	MAPLHGR KW/FT	P.C.T. DEG = F	OXID FRAC
200.0	11.7	2016	0.0152
1,000.0	11.8	2019	0.0152
5,000.0	12.4	2027	0.0154
10,000.0	12.4	2018	0.0150
15,000.0	12.4	2026	0.0154
20,000.0	12.1	1986	0.0135
25,000.0	11.2	1869	0.0090
30,000.0	10.4	1760	0.0060
35,000.0	9.6	1672	0.0042
40,000.0	9.0	1609	0.0031

Low Enrichment Fuel

Exposure MWD/T	MAPLHGR KW/FT	P.C.T. DEG = F	OXID FRAC
200.0	11.5	1960	0.0125
1,000.0	11.4	1929	0.0112
5,000.0	11.3	1886	0.0095
10,000.0	11.5	1881	0.0092
15,000.0	11.5	1878	0.0091
20,000.0	11.0	1818	0.0073
25,000.0	10.4	1743	0.0055
30,000.0	9.7	1666	0.0040
35,000.0	9.0	1596	0.0029

* The impact of the LPCI and LPCS injection valve pressure interlock is estimated to be a 51°F increase in PCT and a 0.004 increase in oxidation fraction.

FIGURE 6.3-14

WATER LEVEL INSIDE THE SHROUD VERSUS TIME AFTER BREAK

GRAND GULF

DESIGN BASIS ACCIDENT, RECIRCULATION SUCTION BREAK, LPCI DIESEL GENERATOR FAILURE

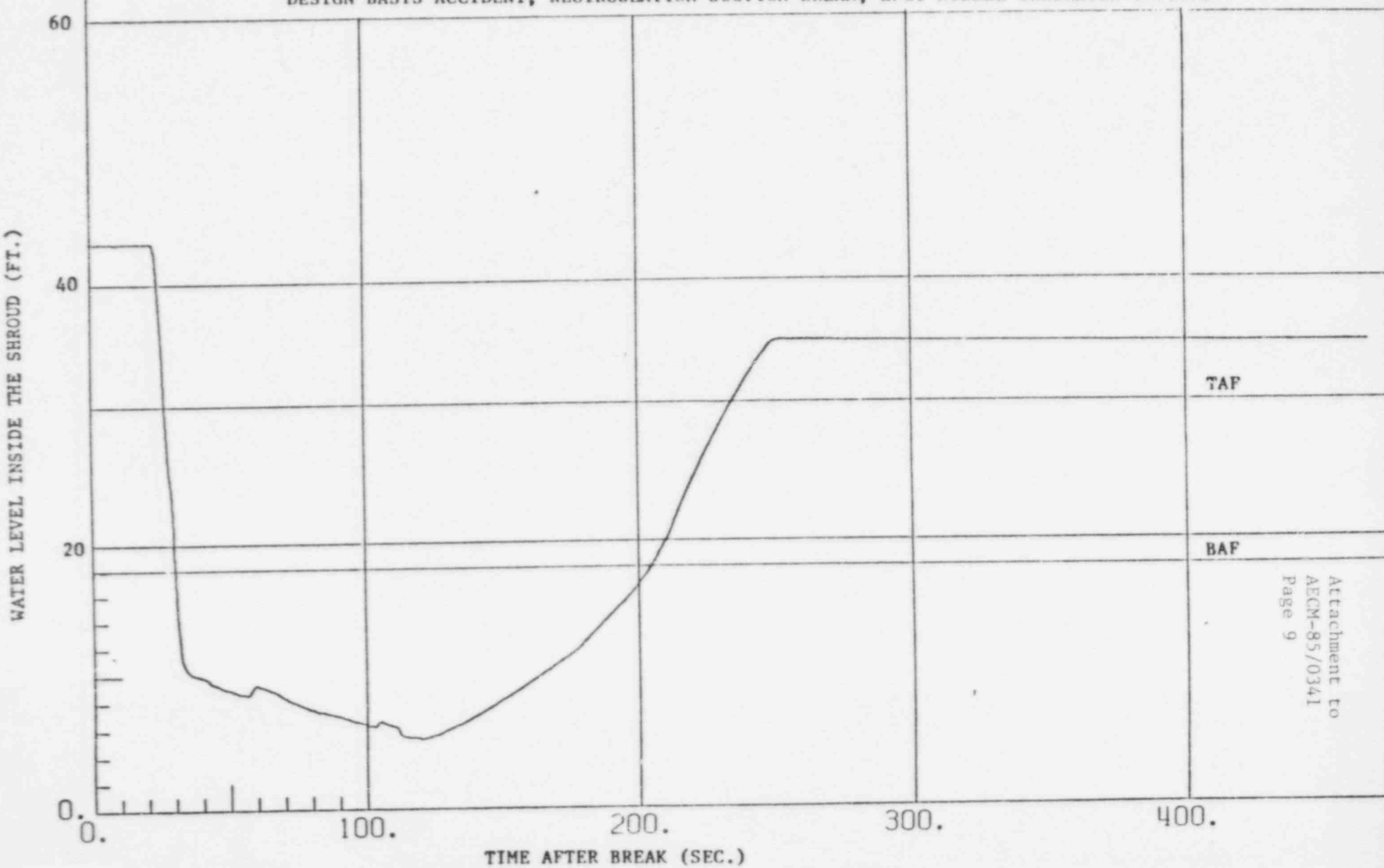
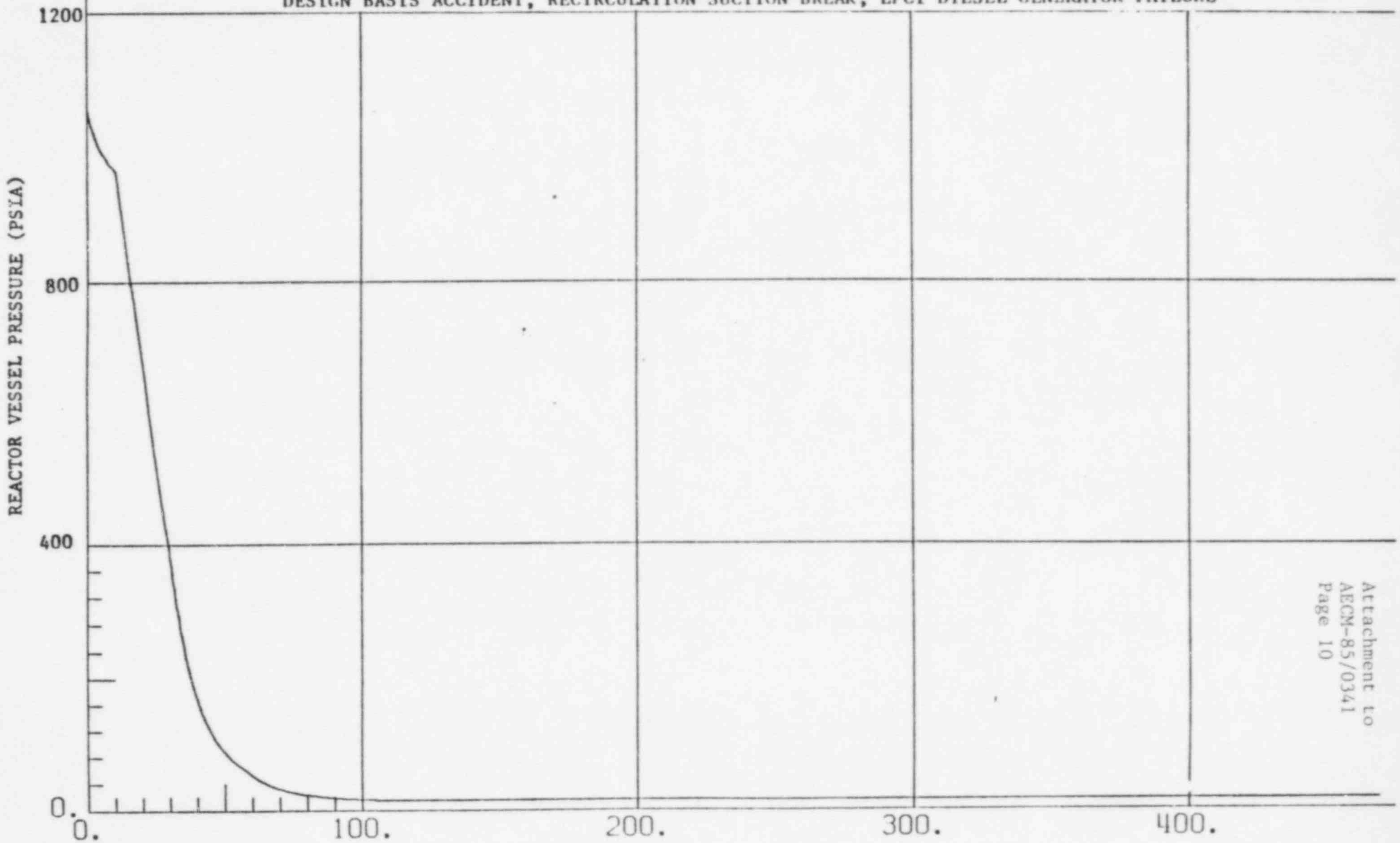


FIGURE 6.3-15

REACTOR VESSEL PRESSURE VERSUS TIME AFTER BREAK

GRAND GULF

DESIGN BASIS ACCIDENT, RECIRCULATION SUCTION BREAK, LPCI DIESEL GENERATOR FAILURE



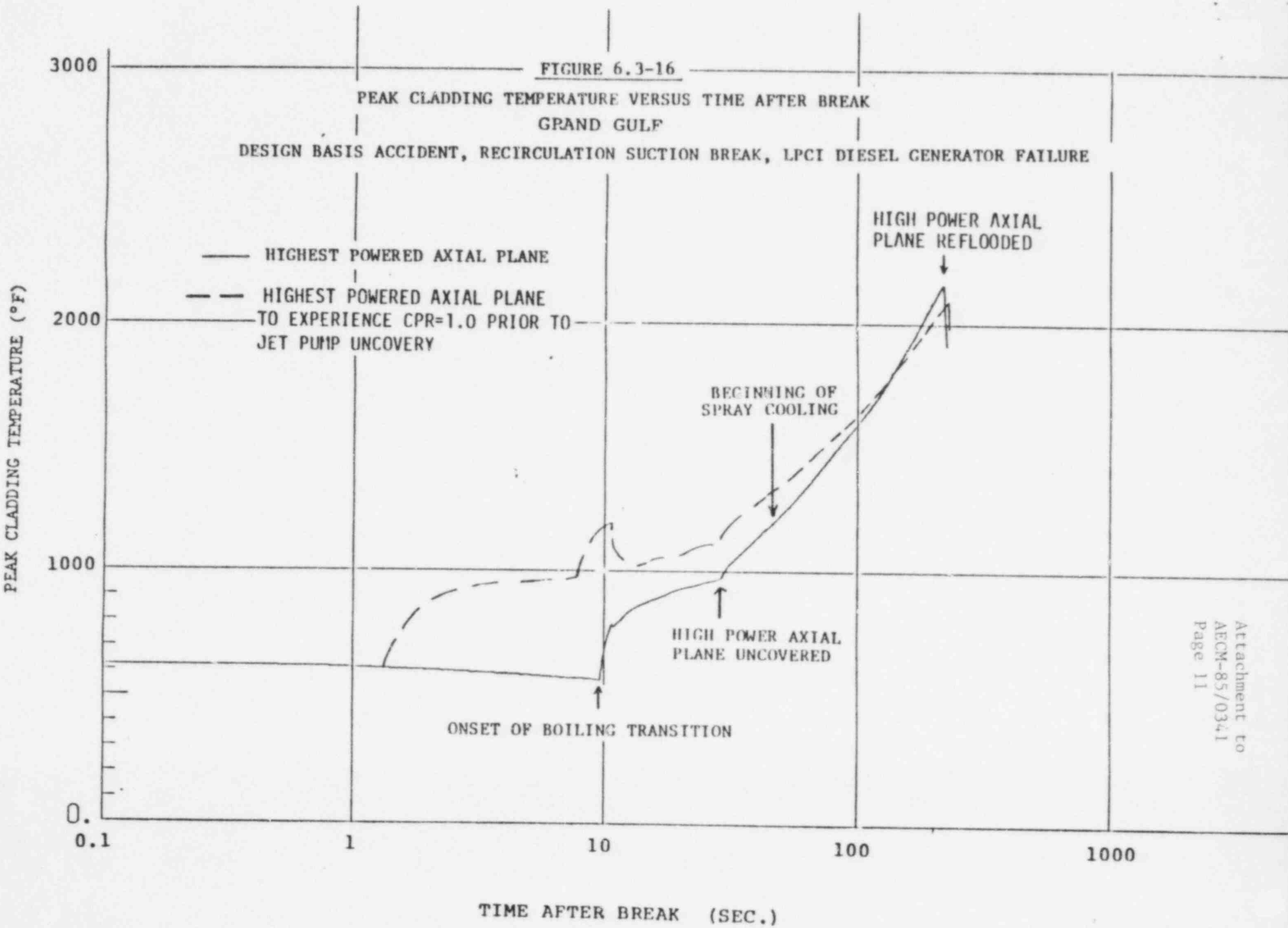


FIGURE 6.3-16
PEAK CLADDING TEMPERATURE VERSUS TIME AFTER BREAK
GRAND GULF
DESIGN BASIS ACCIDENT, RECIRCULATION SUCTION BREAK, LPCI DIESEL GENERATOR FAILURE
HIGHEST POWERED AXIAL PLANE
HIGHEST POWERED AXIAL PLANE TO EXPERIENCE CPR=1.0 PRIOR TO JET PUMP UNCOVERY
HIGH POWER AXIAL PLANE REFLOODED
BEGINNING OF SPRAY COOLING
HIGH POWER AXIAL PLANE UNCOVERED
ONSET OF BOILING TRANSITION
PEAK CLADDING TEMPERATURE (°F)
3000
2000
1000
0.
0.1
1
10
100
1000
TIME AFTER BREAK (SEC.)