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RECIP.NAME RECIPIENT AFFILIATION
EISENHUT,D.G. Division of Licensing

SUBJECT: Provides info requested re seized rotor event,per 831107 telcon.Graphs encl.Info suppls analysis contained in 820831 submittal.

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FLORIDA POWER & LIGHT COMPANY

December 22, 1983
L-83-600

Office of Nuclear Reactor Regulation
Attention: Mr. Darrell G. Eisenhut, Director
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Eisenhut:

Re: St. Lucie Unit No. 1
Docket No. 50-335
Seized Rotor Event
Additional Information Request

Reference: Telecon D. Langford and D. Sells (NRC) to C. G. O'Farrill, R. J. Stevens, and W. Webster (FPL) of November 7, 1983.

This letter provides the clarifying information requested by the referenced telecon of November 7, 1983, and in accordance with your letter of December 13, 1983.

The information supplements the Seized Rotor analysis contained in our submittal of August 31, 1982 (L-82-381).

Very truly yours,

for J. W. Williams, Jr.
Vice President
Nuclear Energy

JWW/RJS/cab

Enclosure

cc: J. P. O'Reilly, Region II
Harold F. Reis, Esquire

A001
1/1

ATTACHMENT I

Question: Why was the Seized Rotor analyzed rather than the Sheared Shaft ?

Answer: The Seized Rotor was analyzed rather than the sheared shaft for the following reasons:

1) The design bases of PSL-1 as documented in the FSAR has always analyzed the Seized Rotor as the most limiting. No plant modifications which would indicate any change in the limiting transient have been made.

2) The Seized Rotor event will always be more limiting for SL1 since:

   a) For the case of the sheared shaft, pump inertia will cause flow to continue at higher levels (1 pump coastdown-3 pumps running) during the critical first few seconds of the transient when the damage, if any, occurs. The higher flow to power ratio for the sheard shaft case will prevent or mitigate fuel damage levels.

   b) Degraded flows due to backflow thru the affected pumps would not occur until coastdown was completed, and, in the case of SL1 is prevented by an anti-reverse rotation device integral to the pump.

3) The December 1981 commitment by FPL for confirmatory analysis requested by the NRC was for the Seized Rotor.

Question :

Discuss the wording changes in the second paragraph of text between the Reference [7] (Stretch Power) and the Reference [8] (Current Submittal).

ie

Stretch Power: Reference [7]

The single reactor coolant pump shaft seizure is postulated to occur as a consequence of a mechanical failure. The single reactor coolant pump shaft seizure results in a rapid reduction in the reactor coolant flow to the three-pump value. A reactor trip for the seized rotor event is initiated by a low coolant flow rate as determined by a reduction in the [1] sum of the steam generator hot or cold leg pressure drops. [2] This signal is compared with a setpoint which is a function of the initial number of operating reactor coolant pumps. For this event a trip will be initiated when, or before, the flow rate drops to 93 percent of initial flow.

Current Submittal: Reference [8]

The single reactor coolant pump shaft seizure is postulated to occur as a consequence of a mechanical failure. Following this, the reactor coolant flow starts to decrease. A reactor trip is initiated by a low coolant flow rate, as determined by a reduction in the [1] sum of the individual loop coolant flow signals. This occurs when the flow rate decreases to 93 percent of the initial flow.

Answer:

Change 1 regarding the "sum of . .." has been changed to more correctly reflect the way flow is measured. This was strictly an editorial change for clarity. It does not indicate any plant hardware or setpoint change between submittals.

Change 2 which deletes reference to the initial number of operating coolant pumps is correct. Operation with less than all four RCP's running is prohibited by SL1 Technical Specifications (T/S 3/4.4). For four pump flow a setpoint of 95% with -2% uncertainty is correct.

Question : The stretch power submittal assumes that system flow drops immediately (step change) to the 3 pump value. The new submittal states that flow decreases rapidly approaching the 3 pump value by 1.5 seconds. Why the change?

Answer: The modelling of flow decay is a much more realistic assumption than that of a step change, and more accurately reflects what happens in the plant. This approach is acceptable since:

a) The system flows were calculated by the vendor using CESEC, an NRC approved code,

b) the current submittal corresponds to actual plant performance,

c) SRP 15.3.3 does not explicitly require an assumption of step change in reactor flow, and,

d) a similar treatment of flow was used in analysis of the Seized Rotor for SL2 and accepted by the NRC.

Question : Why is the ADV Failure the Worst Single Failure?

Answer: For the Seized Rotor, fuel damage occurs in the first few seconds of the transient. A review of plant systems which would be expected to function did not identify any system whose failure or malfunction could occur early enough to affect the fuel damage levels experienced.

The second criteria against which the Seized Rotor event is reviewed is the offsite dose. Failure of the ADV in the open position maximizes the steam release and therefore the offsite dose.

Question : Why is an AFW delay of 120 seconds used? Is this conservative?

Answer: The 120 second delay is a consequence of the AFW system model used. The system which was modeled was the so-called "smart" AFW system which had been scheduled for installation prior to Cycle 6 but is now anticipated for installation in Cycle 7.

The delay time used is inconsequential to the results of the analysis. Since the "SMART" AFW system was assummed, the steam generator on the side of the failed ADV will be sensed as a "faulted" steam generator, and AFW will be shut off to that side. Dryout will occur and thereafter, all primary to secondary leakage will be assummed to go directly to atmosphere, (in accordance with current vendor methods), i.e. the iodine partition factor goes to 1.0 (from 0.1). This effect causes large offsite doses to be predicted, which is the dominant effect of this transient.

A detailed description of the "SMART" AFW system was included in Reference [13].

Question : How is a stuck open ADV recognized by the operators?

Answer: Valve position indication systems with indications in the control room are available for all major plant valves, including ADVs.

Additionally a stuck open ADV:

a) would produce rapidly a decreasing steam generator level on the affected side (since Main Feedwater would have ceased on the LOOP)

b) would produce greater than anticipated cooldown rate

c) would be easily observed by plant personnel outside the control room from the excessively loud noise and the very visible plume of steam escaping from the ADV outlet to the atmosphere.

This analysis has assumed that the operators block shut the affected ADV thirty minutes into the transient. It is considered that with all the above indications of such a malfunction available, that recognition of such a problem would certainly occur and corrective action would be taken within the assumed period.

Question : Why are nominal values used for the seized rotor parameters when the LOOP analysis from the same submittal used nominal plus uncertainty.

e.g. 2700 MWT versus 2754

Answer: The current seized rotor submittal parallels the seized rotor submittal from the stretch package. In both, the vendor's Statistical Combination of Uncertainties (SCU) methods were used. Nominal input parameters are used and uncertainties are convoluted into the DNB correlation.

The current LOOP power submittal also parallels the stretch power submittal. In these cases, SCU methods were not used.

The two transients (SR and LOOP) should not be compared with each other for consistency of input assumptions since two different methodolgies are employed.

Question : The current submittals for Seized Rotor and LOOP show different lag times between the time of reactor trip and the time the "Rods Dropped"

i.e.	Seized Rotor	Loss of Offsite Power
Reactor Trip	0.82 sec.	0.88 sec.
Rods Dropped	1.32 sec.	2.5 sec.
Difference	0.5 sec.	1.62 sec.

Why the difference?

Answer:

The time reported for the Seized Rotor Event includes the following delays:

Low Flow Setpoint Reached	0.17 sec
(Signal Processing delay time	0.65 sec)
Reactor Trip Signal Generated	0.82 sec (.17 + .65 sec)
(Holding Coil delay time	0.50 sec)
Rods Drop	1.32 sec. (.82 + .50 sec)

The sequence of events table for the LOOP Event were erroreously entered and should be corrected to the following values:

Low Flow Setpoint Reached	0.88 sec
(Signal Processing delay time	0.65 sec)
Reactor Trip Signal Generated	1.53 sec (.88 + .65 sec)
(Holding Coil decay time	0.50 sec)
Rods Drop	2.03 sec (1.53 + .50 sec)

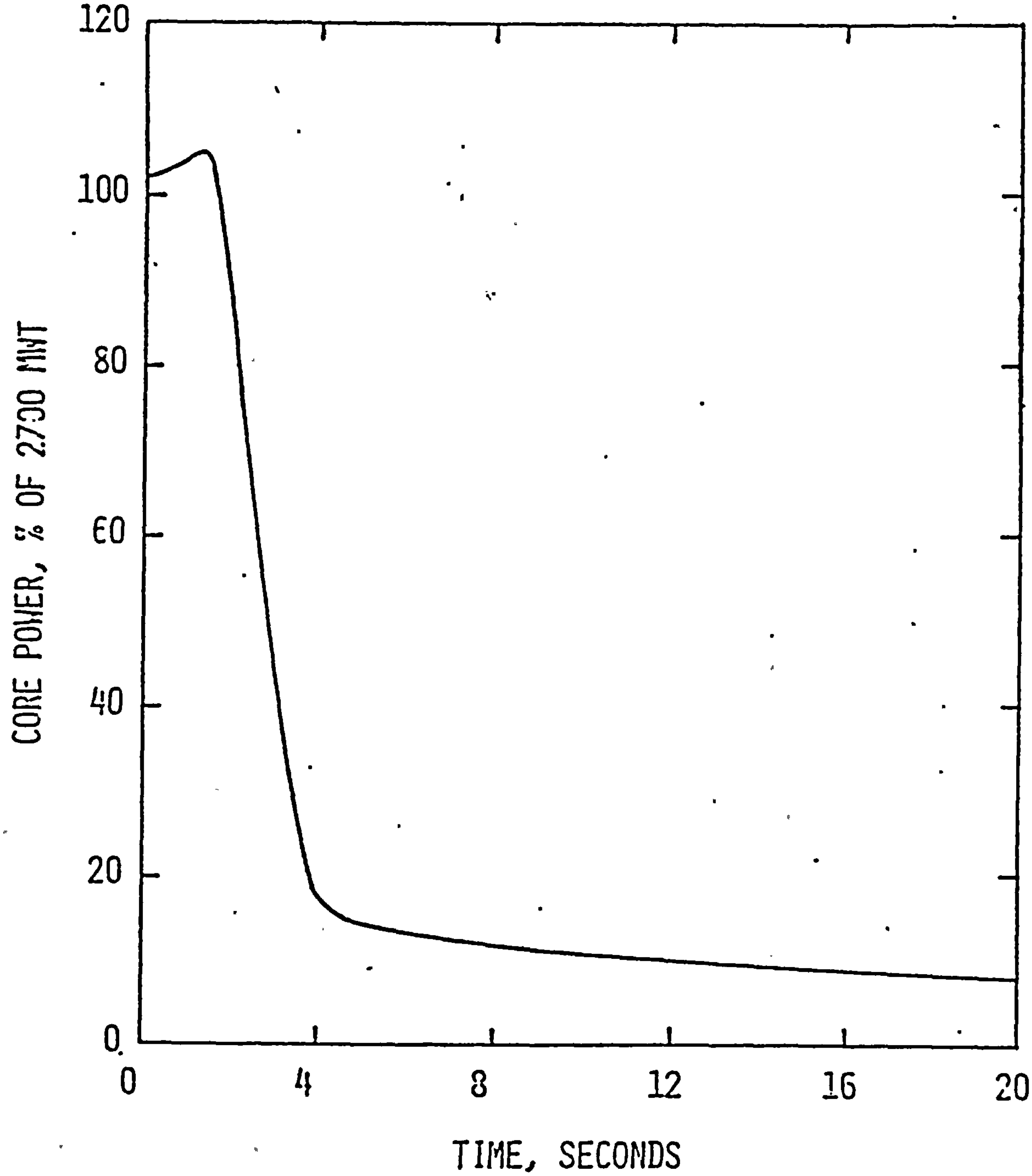
Question : What is the justification for the 3 second time delay between the turbine trip and the loss of offsite power?

Answer:

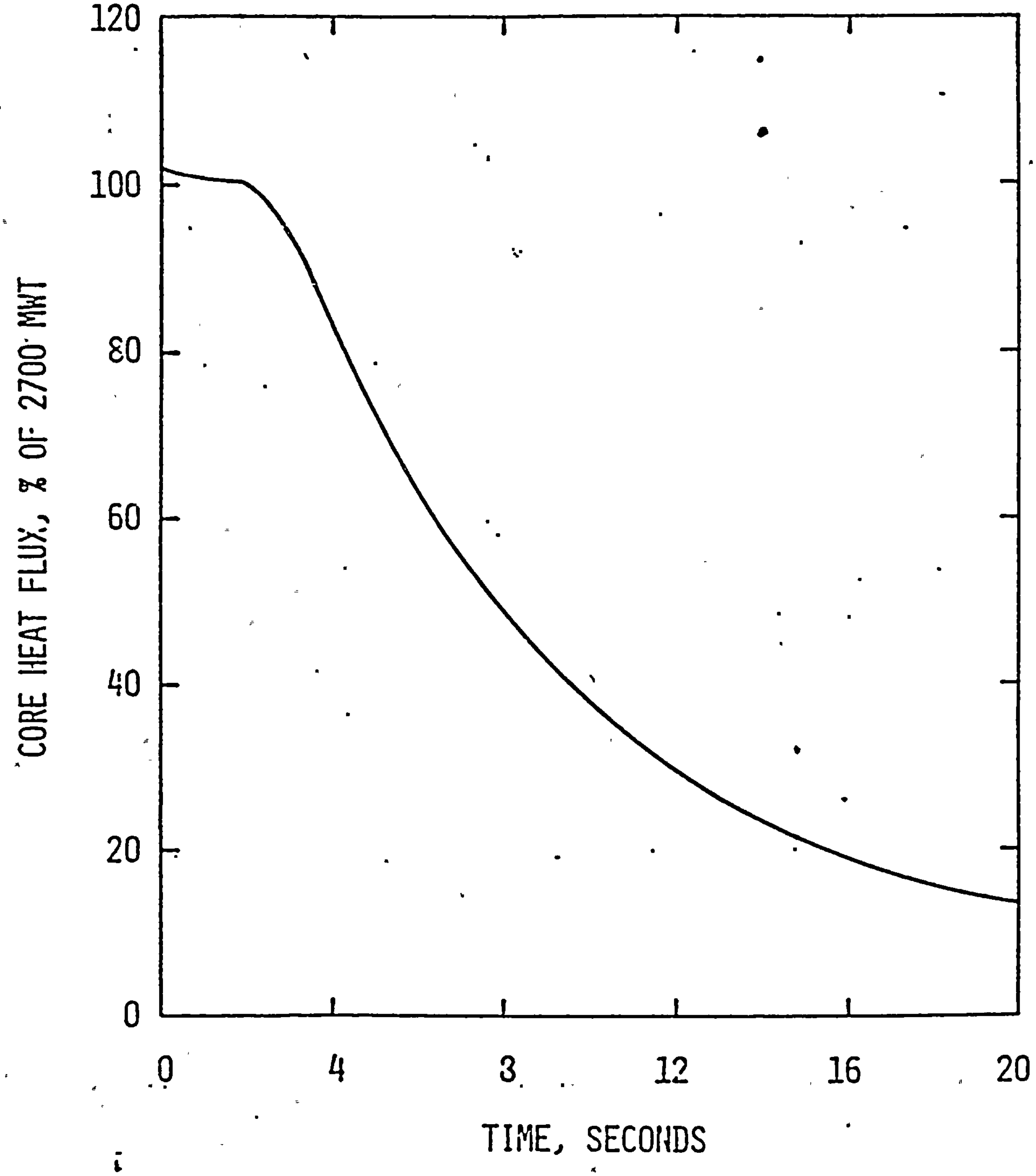
Justification for the 3 second time delay is provided in the Reference (14). The methodology employed in the reference has been approved by the NRC for CESSAR Chapter 15 analysis. The analysis provided by the reference assumes grid characteristics based on the actual Florida grid, and does not credit load shedding in the determination of the time to loss of offsite power. The analysis also conservatively assumes the highest underfrequency setpoint (of any United States grid) of 57.6 hertz. Using the above conservative assumptions, the reference arrived at a time delay of 3.1 seconds from turbine trip to loss of offsite power. A best estimate analysis would find this time delay to be well in excess of 3.1 seconds. Based on the conservatism mentioned above the 3.0 seconds time delay employed in the Seized Rotor analysis is justified.

NRC Request : Can additional graphs of the important parameters be supplied with a finer time scale to show details in the early seconds ?

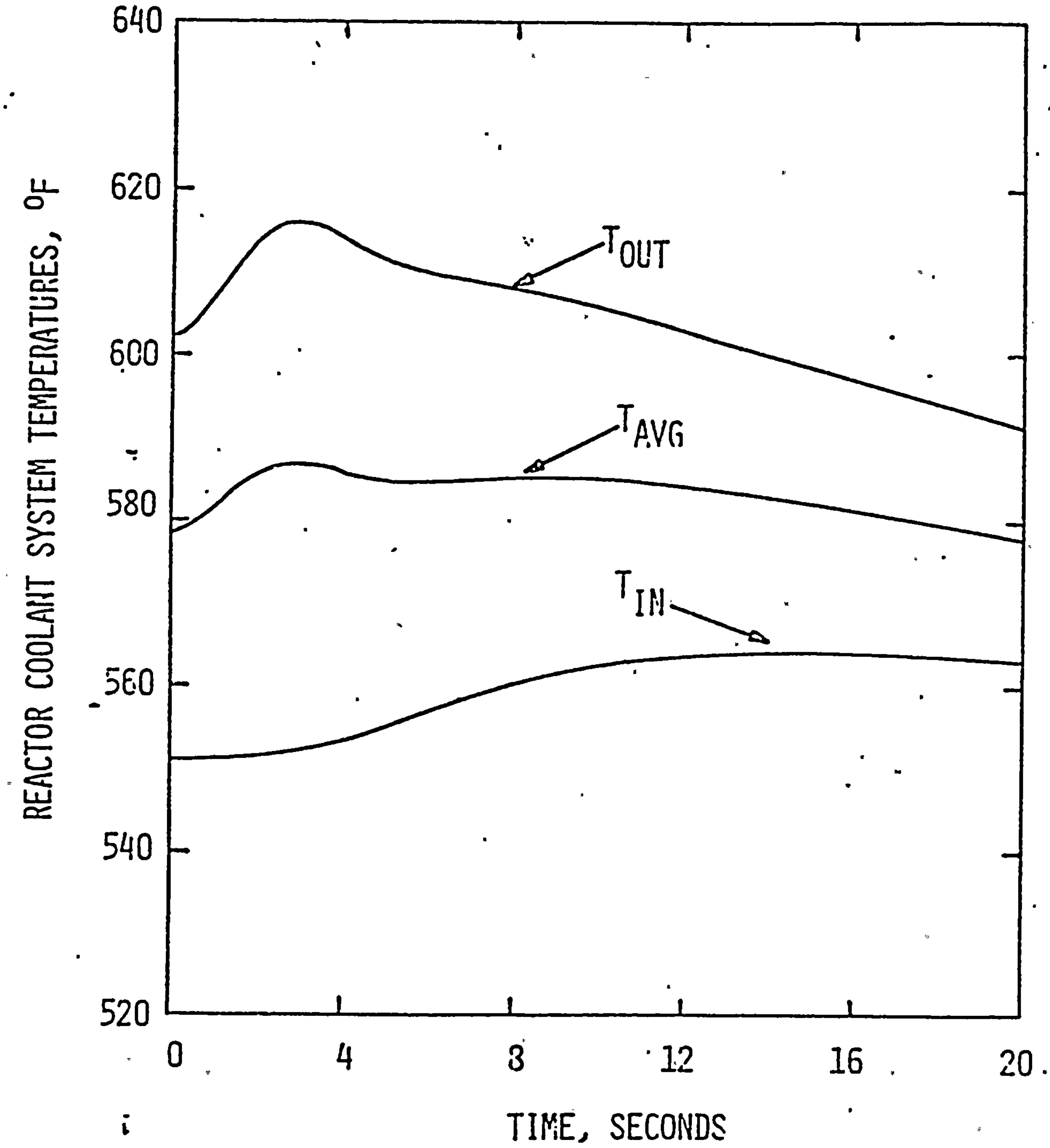
Answer : Additional graphs are attached.



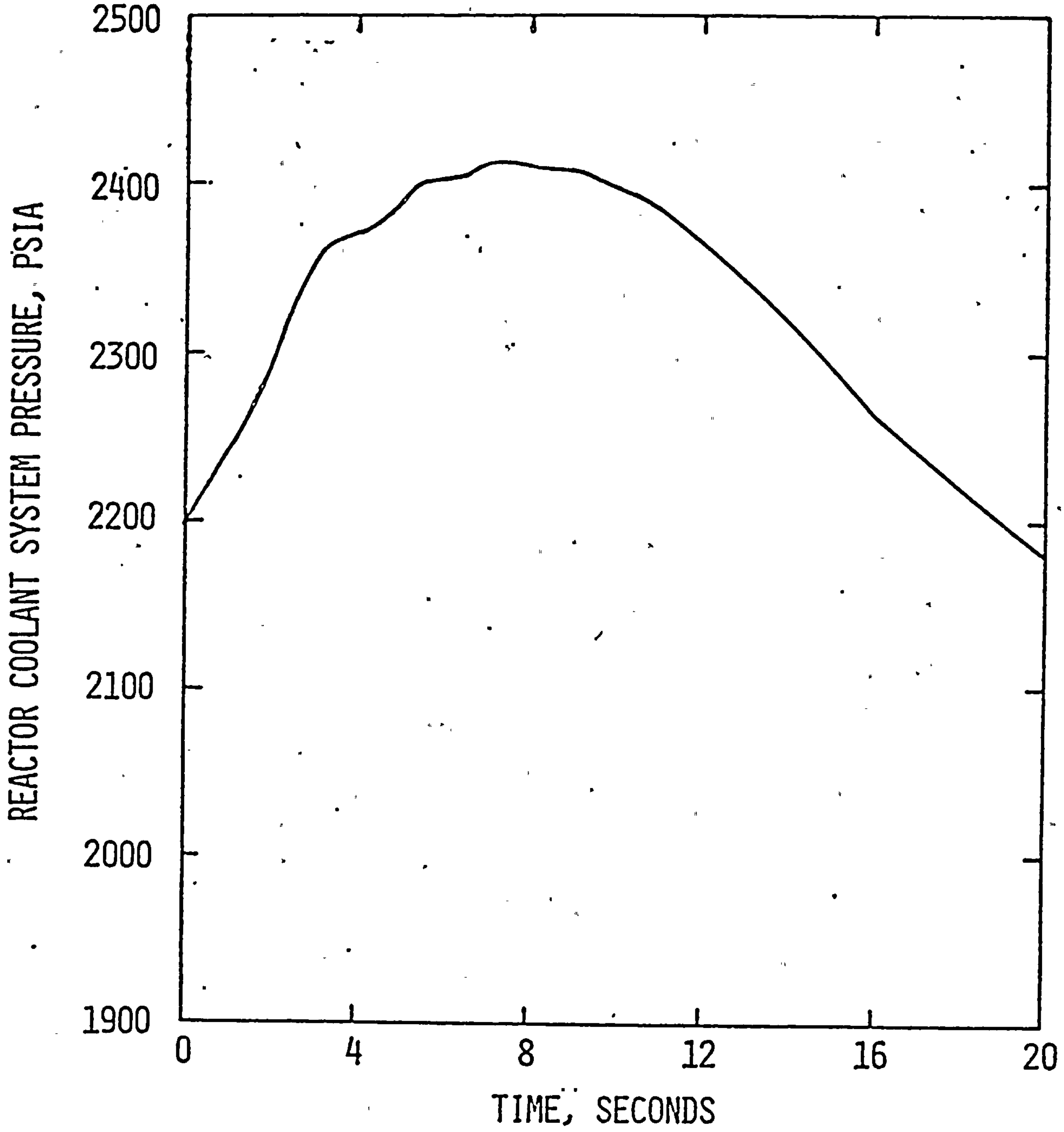
FLORDIA OWER & LIGHT CO. St. Lucie uclear Power Plant	SEIZED ROTOR WITH LOSS OF AC AND STUCK OPEN ADV CORE POWER VS TIME	FIGURE 1



FLORIDA R & LIGHT CO. St. Lucie ïear Power Plant	SEIZED ROTOR WITH LOSS OF AC AND STUCK OPEN ADV CORE HEAT FLUX VS TIME	FIGURE 2



FLORIDA R & LIGHT CO. St. Lucie ear Power Plant	SEIZED ROTOR WITH LOSS OF AC AND STUCK OPEN ADV REACTOR COOLANT SYSTEM TEMPERATURES VS TIME	FIGURE 3



FLORIDA ER & LIGHT CO. St. Lucie clear Power Plant	SEIZED ROTOR WITH LOSS OF AC AND STUCK OPEN ADV REACTOR COOLANT SYSTEM PRESSURE VS TIME	FIGURE 4

Figure 5

RCS Flow vs. Time

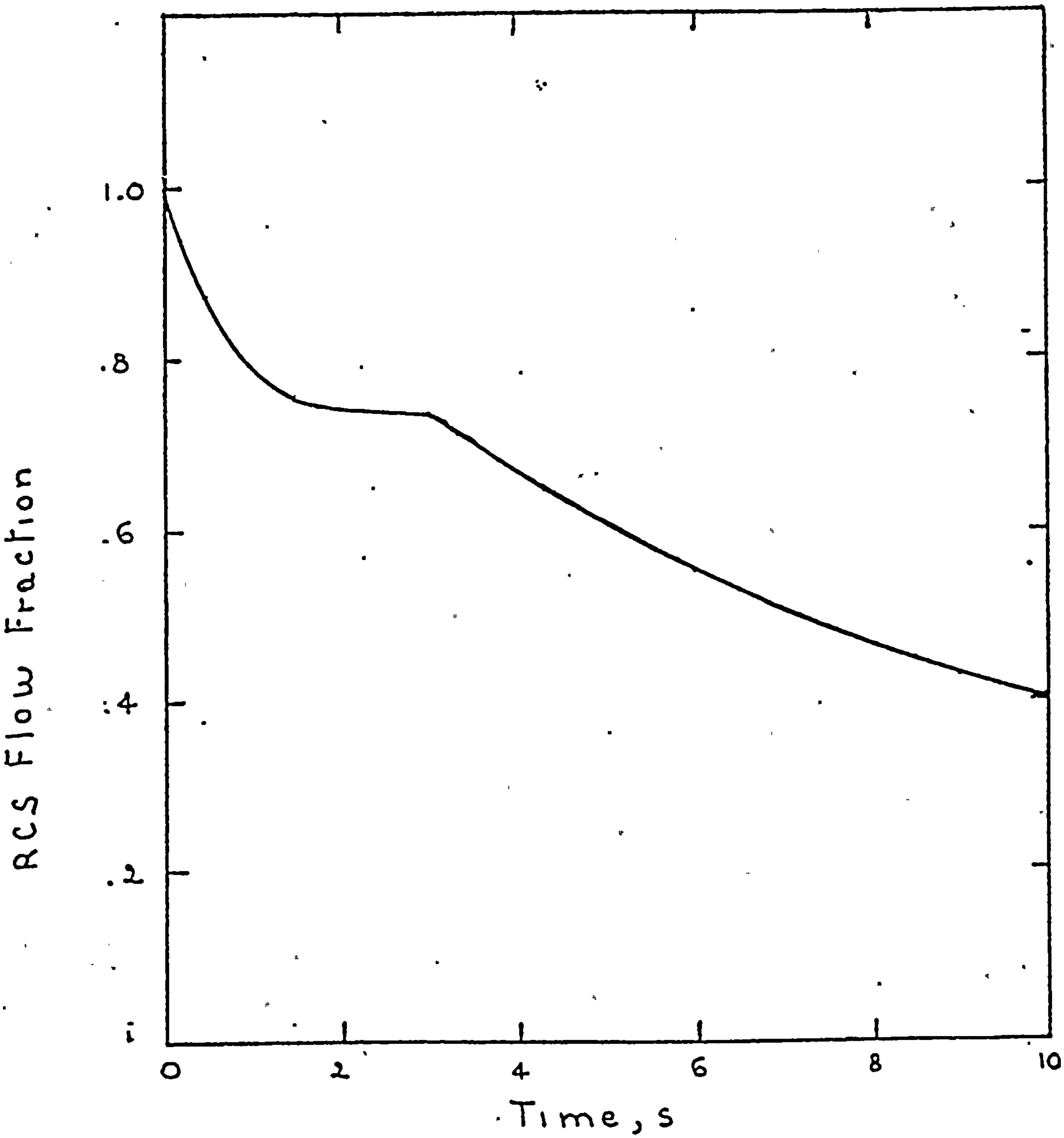
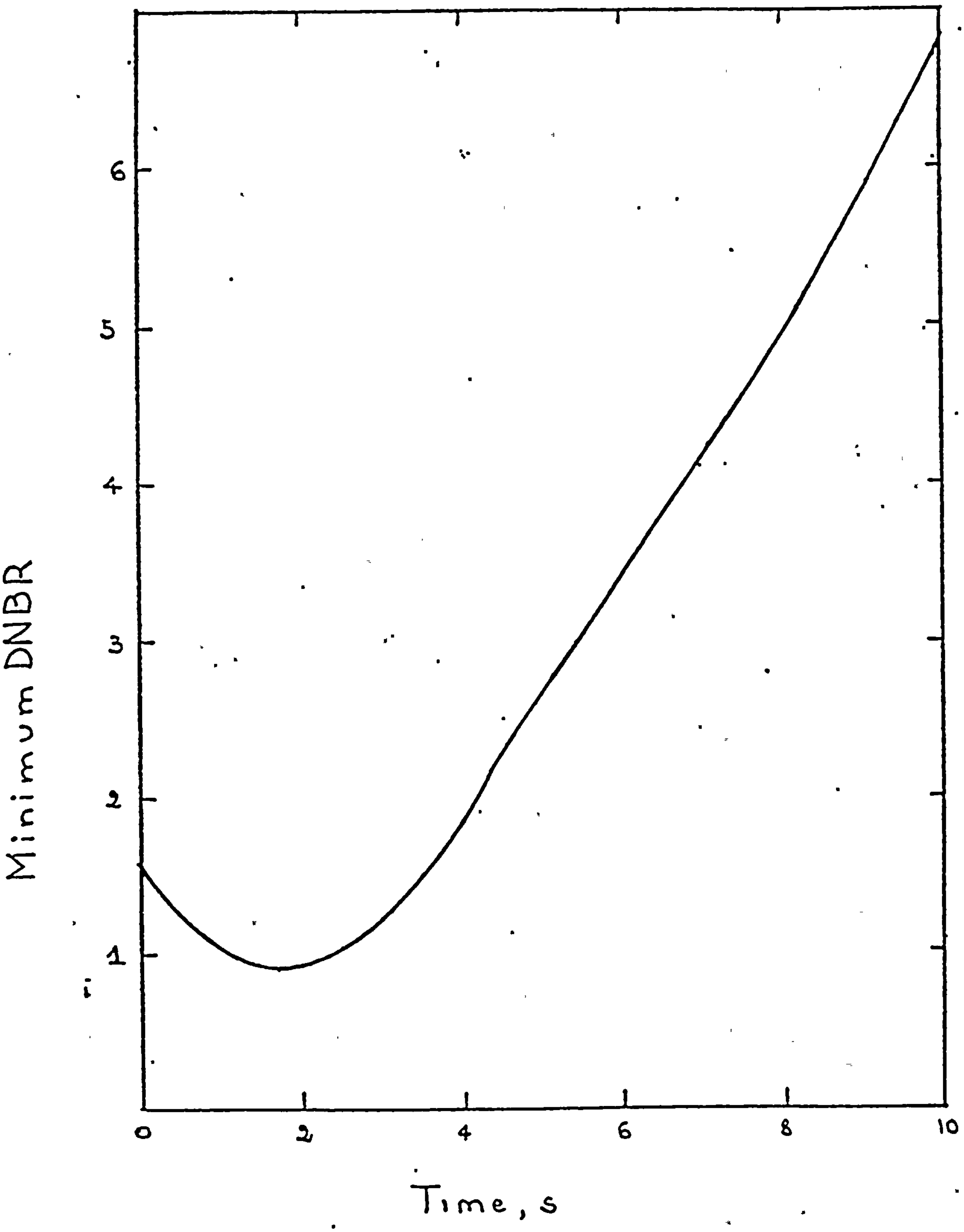


Figure 6

Minimum DNBR vs Time



Question : What are the references for the current submittal ?

Answer : The references page was inadvertently omitted from our original submittal. It was forwarded to you by our Reference [13] (answering your questions on Loss of Offsite Power) and is once again repeated here. For clarity, we have retained the same numbering convention for the original, Reference [13], and this submittal.

See the Reference list for this correspondence.

REFERENCES

References *

1. Letter R. R. Mills (CE) to C. G . O'Farrill (FPL), 10/1/81, F-CE-7567

2. CENPD-107, "CESEC - Digital Simulation of a C-E Nuclear Steam Supply System", April 1974

3. CENPD-135-P, "STRIKIN II - A Cylindrical Geometry Fuel Rod Heat Transfer Program", August 1974

4. CEN-123(F)-P, "Statistical Combination of Uncertainties Methodology", February 1980

5. CENPD-183, "C-E Methods for Loss of Flow Analysis", July 1975

6. St. Lucie Unit 2 - Final Safety Analysis Report, Section 10.4.9 ("SMART" AFW system description)

7. Letter R. E. Uhrig to D. G. Eisenhut, 11/14/80, L-80-381 (Original stretch power submittal)

8. Letter R. E. Uhrig to D. G. Eisenhut, 8/31/82, L-82-381 (Current submittal under review)

9. Letter R. E. Uhrig to D. G. Eisenhut, 7/23/81, L-81-306 (Post-TMI MSLB analysis)

10. Letter R. E. Uhrig to R. A. Clark, 9/4/81, L-81-388 (Post-TMI Excess Load and SGTR)

11. Letter R. E. Uhrig to R. A. Clark, 10/7/81, L-81-439 (Applicability of prior analyses to Cycle 5)

12. Letter J. R. Miller to R. E. Uhrig, 10/12/83

13. Letter J. W. Williams to D. G. Eisenhut, 11/21/83, L-83-567, (Answers for questions on Loss of Offsite Power)

14. Letter A. E. Scherer to D. G. Eisenhut, "Turbine Trip Time Delay", LD-82-040, 3/31/82, Docket #STN-50-470F

*References (1) through (5) are also the missing references for Reference (8).