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FACIL:50-335 St. Lucie Plant, Unit 1, Florida Power & Light Co. 05000335
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MILLER,J.R. Operating Reactors Branch 3

SUBJECT: Forwards clarifying info re postulated reactor coolant pump seized rotor & loss of all non-emergency AC events,per 840213 request.

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FLORIDA POWER & LIGHT COMPANY

September 11, 1984
L-84-246

Office of Nuclear Reactor Regulation
Attention: Mr. James R. Miller, Chief
Operating Reactors Branch #3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Miller:

Re: St. Lucie Unit 1
Docket No. 50-335
Reactor Coolant Pump Seized Rotor and
Loss of all Non-Emergency AC Power

In response to your letter of February 13, 1984, concerning the postulated reactor coolant pump seized rotor and loss of all non-emergency AC events, attached please find the clarifying information requested.

Very truly yours,

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

JWW/PLP/js

Attachment

cc: J. P. O'Reilly, Region II
Harold F. Reis, Esquire
PNS-LI-84-215

A001
1/1

ATTACHMENT

Question 1: Reference 1, Question 9 (two pages before graph): Claims 3-second time delay between turbine trip and LOOP is justified by C-E analysis. But this is justified only if St. Lucie output is less than 5% of subregional "grid power per your Ref. 14" p. 13, last two lines. Is this the case?

Answer:

The above question indicates a misunderstanding that the power "output" provided by St. Lucie 1 comprises less than 5% of the "grid power." The document referred to as Reference 14 in the question specifies that the plant power generation is about 8% of subregional grid generation during minimum load conditions.

The 8% generation loss to the grid upon turbine trip was calculated by assuming that St. Lucie 1 was operating at 100% capacity at the time minimum load conditions exist on the grid. Therefore, the percent generation loss to the grid can be defined as the plant generating capacity (802 MWe) divided by the minimum yearly load. The minimum yearly load was estimated using typical daily, weekly and annual load patterns presented in Reference Q1-1. The minimum yearly load was determined to be approximately 50% of the summer peak load. The summer peak load for the Florida subregion in 1983 was estimated to be 20,046 MWe based on data presented in Reference Q1-2. These values lead to the estimated 8% subregional grid generation loss.

i.e. 802 MWe (Unit Capacity) ÷ 50% of 20,046 MWe (estimated minimum early load ~ 8% generation.

If the generation loss to the grid were greater than 8%, the time to LOOP would decrease as shown in the attached figure. However, the loss of St. Lucie 1 is believed to be conservatively bounded by an 8% generation loss to the grid upon turbine trip. Even if the loss of St. Lucie 1 constituted a 9% generation loss to the grid, the time delay to LOOP would still be greater than three seconds. It should be noted that the methodology used to generate the attached figure incorporated several other conservatisms:

- No credit was taken for load shedding programs designed to arrest frequency decline. (i.e., initial rate of frequency decline is assumed.)
- No credit was taken for spinning reserve.
- The Florida model assumed "island" conditions (no support from neighboring grid systems, i.e., lower rotating inertia).
- Loss of offsite power occurs instantly at a grid frequency of 58.0 Hertz for SL1.
- All grid systems are standardly operated and specifically designed against unstable frequency oscillations resulting from loss of the largest generating unit on that grid.

Reference Q1-1: C. R. Musick, R. W. Knapp, "C-E Meets Utility Load Change Capability Needs with System 80 NSSS," TIS-6215, April 1979.

Reference Q1-2: Electric Power Supply and Demand 1981-1990, National Electric Reliability Council, July 1981.

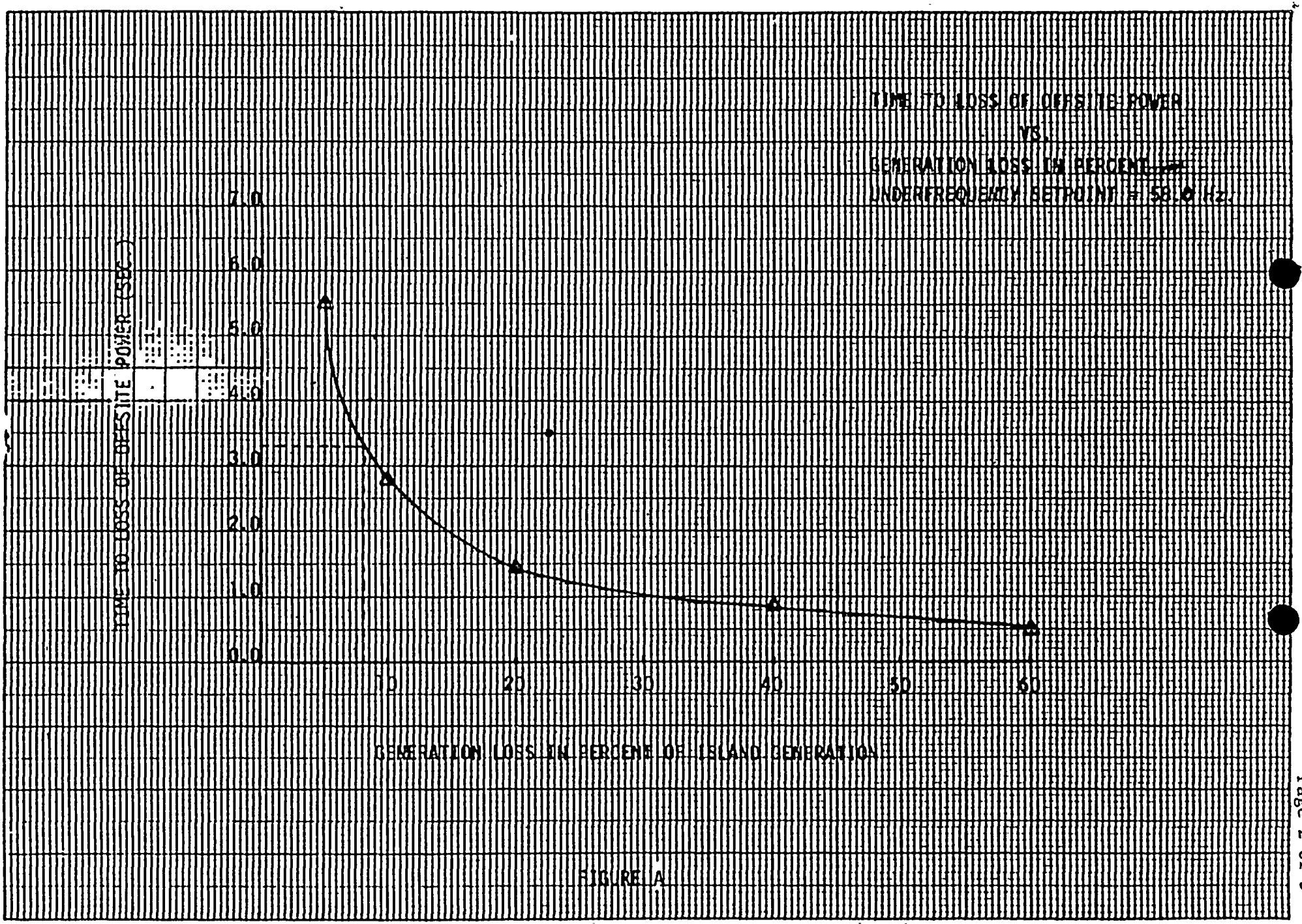
TIME TO LOSS OF OFFSITE POWER
VS.
GENERATION LOSS IN PERCENT
UNDERFREQUENCY SETPOINT = 58.0 Hz.
TIME TO LOSS OF OFFSITE POWER (SEC.)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
10
20
30
40
50
60
GENERATION LOSS IN PERCENT OF ISLAND GENERATION

FIGURE A

Question 2

Ref. 2, Q#4 says AFW has 3 minute delay for INTERIM system. Ref. 3, Q#5 says AFW has 2 minute delay for SMART system. Are these the numbers that were used in analyzing system performance?

Answer

The system performance following the LOOP and Seized Rotor Events analyzed in Reference 1 assumed a 2 minute delay time for the AFW SMART system.

Question 3

A. Ref. 3, Q#5 says delay time is inconsequential to the results because AFW will be shut off to SG side having a faulted ADV.

B. Ref. 2, Q#4 says the SMART AFW system is assumed (par. 1), and it also says that (par. 3), for both LOOP and SR, the AFW is shut off to the SG having a faulted ADV.

C. Statements A&B appear to conflict with statements in ref. 1 which say that AFW enters the affected SG. Specifically:

- Ref. 1, Att. 1, Table 4, 1056.7 sec for Seized Rotor for AFW entry.
- Ref. 1, Att. 2, Table 3, 1186.1 sec for LOOP for AFW entry.

Note: Both of the cited Tables show the operator closing the affected ADV's block valve at 1800 seconds.

D. Question: Was "interim" AFW system used to calculate system performance and SMART AFW system used to calculate dose, or what? For SR? For LOOP?

Answer to 3C

The reanalysis for the LOOP and Seized Rotor Events presented in Reference 1 assumed, as a single failure, a stuck opened ADV in the affected steam generator. The ADV is located on the main steam line, upstream of the main steam line isolation valve (MSIV). Results of the calculations presented in Reference 1 indicate that the affected steam generator's pressure never decreases below the MSIS setpoint pressure during the first 30 minutes of the transient. As such, the affected MSIV remains open during that period. Since pressure differentials in the steam lines are low following turbine trip, the check valve located by the affected MSIV remains open, allowing steam leakage from the unaffected steam generator. Therefore, both steam generators release stem through the stuck opened ADV. As a result, both steam generators depressurize virtually at the same rate, showing no apparent asymmetry. However, since the affected steam generator discharges more steam through the stuck opened ADV than the unaffected steam generator due to its proximity to that valve, its level reaches the AFW actuation setpoint, initiating the delivery of the AFW following a 2 minute delay time.

Answer to 3D

The analysis performed in Reference 1 used the SMART system to calculate system response and off-site doses for both the Seized Rotor and LOOP events.

The interim system was never used for any part of the analysis.

For the purposes of conservatively bounding the off-site dose calculating a partition factor of 1.0 was assumed. This factor maximizes off-site dose magnitude.

Such a partition factor could only arise if a large differential pressure developed between the two steam generators reaching the AFAS cutoff setpoint and resulting in subsequent dry-out of the affected side steam generator. This differential was not predicted to develop during these analyses and hence the sequence of events table shows AFW reaching both sides. However, by assuming a 1.0 partition factor, we have conservatively bounded the dose calculation.

As pointed out in prior correspondence, the upgraded or "SMART" AFW system was anticipated to be installed within less than a year of the Reference 1 submittal. It was felt to be prudent to include its effects in the analyses. Subsequent correspondence has remained consistent with the initial submittal.

It should be realized, however, that final implementation of the system has been delayed. The currently functional "interim" system, which has received NRC review is also conservatively bounded by this analysis.

Question 4

Ref. 3, last pages, repeats Reference list from Ref. 2 and says it is the same as the one missing from Reference 1. I question this specifically, referring to Reference 1, Attachment 1: that document has two citations to a "reference 1" which don't appear to match the "reference 1" included in Ref. 2 and Ref. 3. The two Citations in Reference 1, attachment 1 are (1) first page, Discussion, lines 1 and 2, and (2) second page, second paragraph, last sentence. Do these both refer to the same "reference 1" as in Ref. 3? If so, can you provide it?

Answer

The two citations in Reference 1 refer to the same "Reference 1" as in Reference 3. However, in that reference, the Seized Rotor Event was re-evaluated and the discussion was based on a previous analysis, which is presented as Reference 5 herein.

Question 5

Ref. 1, Att. 2 Table 3 says AFW begins to enter the affected SG at 1186.1 sec.; Ref. 2, Q#4 indicates that such AFW flow could occur with the existing "interim" system but not with "SMART" system that was claimed to be used in the analysis. Please describe what is being assumed in the analysis, and what is not being assumed about AFW system performance. Please summarize results, including corrected time data per Ref. 3, Q#B, bottom. And, if available, provide graphs covering 0 to 20 seconds.

Answer

As discussed in the answer to question 3C, even when assuming the SMART AFW system, the AFW begins to enter the affected steam generator at 1186.1 seconds since the LOOP reanalysis in Reference 1 does not show a calculated differential in the two steam header pressures great enough to reach the AFW shutoff setpoint.

References:

1. Reanalysis of 8-31-82 for LOOP and/or Seized Rotor: Letter, R. E. Uhrig (FP&L) to D. E. Eisenhut (NRC), "St. Lucie Unit 1 Docket 50-335 Stretch Power - Additional Analysis", L-82-381, August 31, 1982.

2. LOOP Clarification of 11-21-83: Letter, J. W. Williams (FP&L) to J. R. Miller (NRC), "St. Lucie Unit 1 Docket No. 50-335 Loss of Offsite Power - Additional Information Request," L-83-567, November 21, 1983.

3. Seized Rotor Clarification of 12-22-83: Letter, J. W. Williams (FP&L) to D. G. Eisenhut (NRC), "St. Lucie Unit No. 1 Docket No. 50-335, Seized Rotor Event Additional Information Request," L-83-60, December 22, 1983.

4. Letter, J. R. Miller (NRC) to J. W. Williams (FP&L), "Reanalysis of Reactor Coolant Pump Seized Rotor and Loss of All Non-Emergency AC Power," Docket No. 50-335, February 13, 1984.

5. Letter, A. S. Jameson to R. W. Winner, "Cycle 4 Design and Safety Report for Stretch Power," F-CE-7126, March 19, 1980.