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SAGER,D.A. Florida Power & Light Co.
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SUBJECT: Responds to questions on proposed license amend re increased max allowable RTD delay time.

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OCTOBER 1 9 1989

L-89-376
10 CFR 50.90

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Re: St. Lucie Unit No. 2
Docket No. 50-389
Response to Questions on Proposed License Amendment-
Increased Maximum Allowable RTD Delay Time

On August 17, 1989, a conference call was held between Florida Power and Light Company (FPL) and the NRC to discuss questions which the NRC Staff reviewer had pertaining to the St. Lucie Unit 2 proposed license amendment entitled, "Increased Maximum Allowable RTD Delay Time." Attached are the FPL responses to the questions which were raised during the conference call.

Should you have additional questions, please contact us.

Very truly yours,

D. A. Sager

D. A. Sager
Vice President
St. Lucie Plant

DAS/MSD/gmp

Attachment

cc: Stewart D. Ebneter, Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant

A001
1/1

Responses to NRC Questions on
<u>RTD Delay Time Increase Submittal</u>

NRC Question 1: What Control Element Assembly (CEA) Withdrawal event methodology was used in the re-analysis of the basis for the TM/LP trip setpoint?

FPL Response:

The CEA Withdrawal (CEAW) event methodology used to establish the basis for the TM/LP trip setpoint for the 16.0 second RTD response time limit is the same as that used in support of the current 8.0 second Technical Specification limit on RTD response time (Reference Q1). The only changes made between the two analyses were in the input assumptions regarding CEAW reactivity addition rates and the time interval required for CEAs to be fully withdrawn from their initially inserted positions, as allowed by the Technical Specification Power Dependent Insertion Limits (PDIL).

The C-E analytical methods described in Reference Q1 are based on performing a parametric analysis of the class of CEAW events to determine the reactivity addition rate for a particular CEAW transient which results in the maximum DNBR margin degradation between the time of trip and the time of minimum DNBR. The analysis supporting the current 8.0 second Technical Specification RTD response time limit considered all positive reactivity addition rates up to and including the maximum possible reactivity addition rate of $+1.6 \times 10^{-4}\ \Delta\rho$ /second. This parametric analysis showed that a reactivity addition rate of $+0.051 \times 10^{-4}\ \Delta\rho$/second resulted in the greatest post-trip DNBR degradation. Hence, this is the reactivity withdrawal rate that was used to conservatively establish the TM/LP trip setpoints and LSSS limits.

A review of the limiting CEAW event simulation revealed that, in the analysis, reactivity was still being added even after the CEAs were fully withdrawn. Further, by virtue of the way the limiting reactivity addition rate was selected, it was not clear whether it corresponded to physically meaningful reactivity addition rates based on calculated rod bank worths, allowable rod bank insertions, and known rod bank withdrawal rates. Accordingly, to support the RTD response time increase from 8 to 16 seconds, additional neutronics analyses were performed to determine the range of reactivity withdrawal rates which are possible based on realistic initial CEA bank insertions, rod bank worths, rod bank withdrawal rates, and initial axial distributions. This new data on minimum differential rod worth is shown in Figure 1 (see also the response to Question 2 below). Differential worth data (such as shown in Figure 1) was used in combination with the allowed PDIL and the known rod group withdrawal speeds, to establish that the most limiting, yet physically realistic, reactivity addition rate is $+0.245 \times 10^{-4}\ \Delta\rho$/seconds, rather than the $+0.051 \times 10^{-4}\ \Delta\rho$/second assumed in previous analyses.

This new limiting reactivity addition rate, combined with termination of the CEA motion when CEAs reach their fully withdrawn position, resulted in less DNBR margin degradation than that previously calculated. Hence, no changes to the TM/LP LSSS limits or setpoints *were required to accommodate the 8.0 second RTD* response time increase to 16.0 seconds.

In summary, the CEAW methodology used in support of the RTD response time increase submittal of Reference Q2 is the same as the methodology used in the previous analysis for St. Lucie Unit 2. The only difference between the most recent analysis and the previous analysis were in the two pieces of input data described above.

<u>NRC Question 2:</u> What initial physics data input was used for the RTD response time of 8.0 seconds versus the RTD response time of 16.0 seconds?

<u>FPL Response:</u>

In addition to the two parameters discussed in the response to Question 1, the physics data input to the CEAW transient analysis includes moderator temperature and Doppler coefficients, axial power distributions, CEA scram insertion characteristics, CEA scram worth and neutron β fractions. With the exception of the parameters discussed in Question 1, and in more detail below, the physics input data used in the CEAW analysis, for both 8.0 and 16.0 second RTD response times, are the same.

For an RTD response time of 8.0 seconds, the CEAW analysis assumed a maximum differential reactivity worth of 3.2×10^{-4} $\Delta\rho$ /inch. Since the maximum CEA group rod withdrawal speed is 30 inches/minute, this corresponds to a maximum reactivity addition rate of 1.6×10^{-4} $\Delta\rho$/second. Parametric analyses then considered all positive reactivity addition rates less than or equal to this maximum value.

For the 16.0 second RTD analysis, a maximum reactivity addition rate of 1.6×10^{-4} $\Delta\rho$ /second was again used as the upper bound. However, in addition to this maximum differential reactivity worth, a neutronics analysis, such as shown on Figure 1, was performed to generate the minimum possible differential reactivity worths. These new lower bound limits were used in conjunction with the upper bound limits, and the time intervals required for CEAs initially inserted to PDIL limits to be fully withdrawn, to determine a new limiting reactivity insertion rate. This more realistic reactivity insertion rate was less restrictive than the one previously assumed, and led to a CEAW transient which is also less limiting. Thus, it was possible to show that the 16.0 second RTD response time could be accommodated without having to change the TM/LP LSSS limits or trip setpoints.

NRC Question 3: In the RTD Response Time Testing Summary (Attachment One to FPL Letter L-89-197 dated June 1, 1989) a change of close to 3 seconds is observed in the response time for RTD number 1122HC from 1987 to 1989. Please explain this change in response time.

FPL Response:

During Cycle 5, it was determined that several RTD instrument nozzles installed on Unit 2 were manufactured using a material which was found to be susceptible to intergranular stress corrosion cracking. One of the suspect instrument nozzles was that holding the thermowell/RTD assembly for TE 1122HC. During the 1989 outage, the nozzle, thermowell and RTD were changed out. Therefore, the testing results shown in our response to the NRC's request for additional information for TE 1122HC are the results from two different RTD/thermowell assemblies in 1987 and in 1989.

NRC Question 4: For what RTD response time would the ΔT-power signal provide the limiting or primary reactor trip in the Control Element Assembly Withdrawal event?

FPL Response:

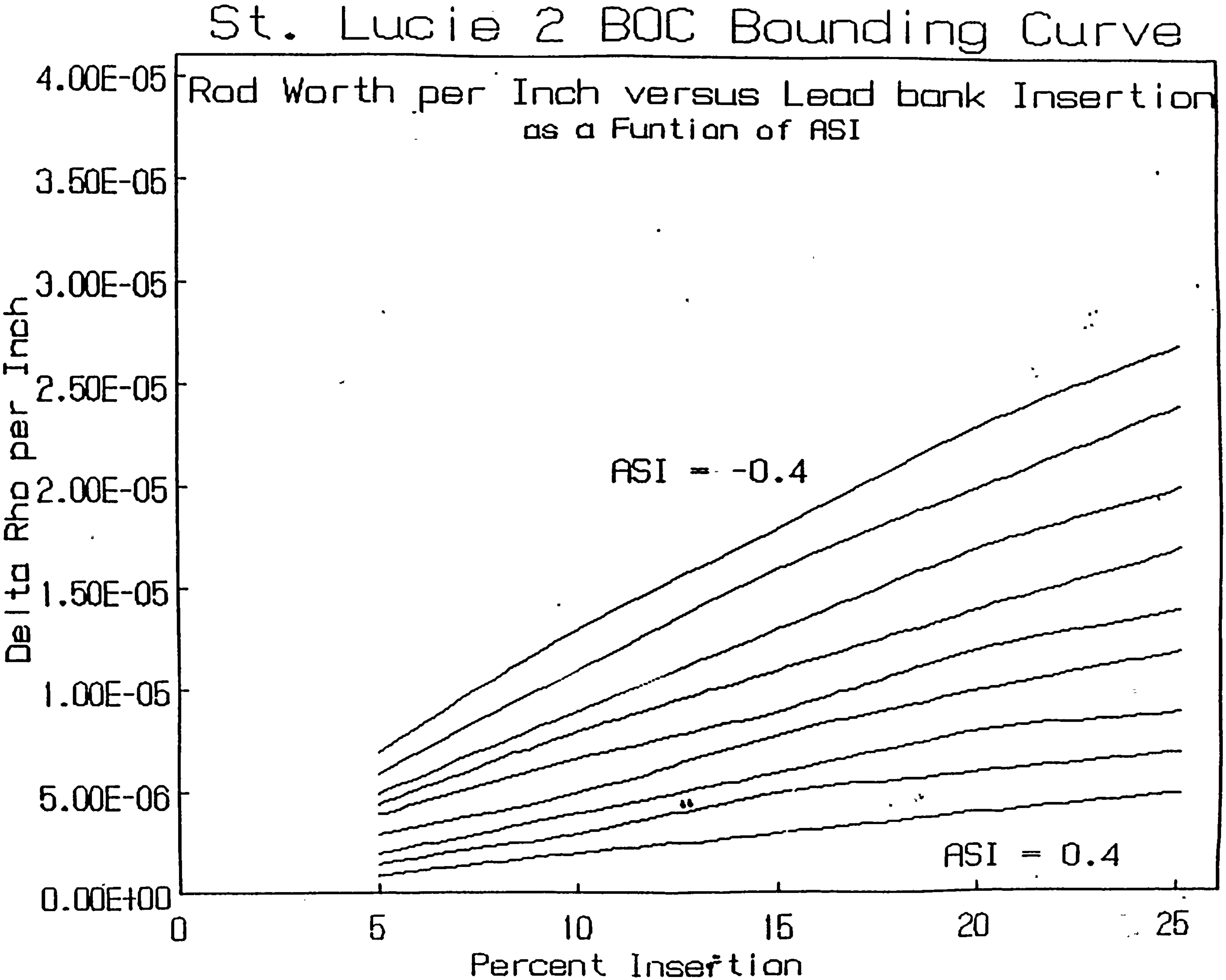
In general, the smaller the RTD time constant (i.e., the quicker the RTD response), the more likely the ΔT-power signal will be the limiting (i.e., primary) power signal input to trips during a CEAW event. The exact value of the RTD response time for which the ΔT-power signal becomes the primary input signal to the trip is a function of several variables, including the relative response times of the cold leg and hot leg RTDs. There is no a priori reason why the hot and cold leg RTD responses should always be equal. Further, whether or not the ΔT-power signal is the primary input signal to trips is a strong function of the value of ex-core decalibration due to rod and/or temperature shadowing. Since the TM/LP trip uses the auctioneered higher of the ΔT-power or the ex-core flux power signals, there is no unique RTD response time which would always make the ΔT-power signal the primary trip input.

Reference:

Q1. C-E Power Systems, "C-E Setpoint Methodology, C-E Local Power Density and DNB LSSS and LCO Setpoint Methodology for Analog Protection Systems," CENPD-199-P, Rev. 1-P, March 1982.

Q2. W. F. Conway (FP&L) to USNRC, "St. Lucie Unit 2 Docket No. 50-389 Proposed License Amendment-Increased Maximum Allowable RTD Delay Time," L-88-463, 10/24/88.

FIGURE 1


St. Lucie 2 BOC Bounding Curve
Rod Worth per Inch versus Lead bank Insertion
as a Funtion of ASI
ASI = -0.4
ASI = 0.4
Delta Rho per Inch
4.00E-05
3.50E-05
3.00E-05
2.50E-05
2.00E-05
1.50E-05
1.00E-05
5.00E-06
0.00E+00
0
5
10
15
20
25
Percent Insertion