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November 6, 1989
Fort St. Vrain
Unit No. 1
P-89427

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

Attn: Mr. Seymour H. Weiss, Director
Non-Power Reactor, Decommissioning
and Environmental Project Directorate

Docket No. 50-267

SUBJECT: Defueling SAR Request for Additional Information

REFERENCES: 1) PSC letter, Crawford to Weiss, Dated August 16, 1989 (P-89287)

2) NRC letter, Weiss to Crawford, Dated October 17, 1989 (G-89356)

Dear Mr. Weiss:

Public Service Company of Colorado (PSC) submitted in Reference 1, the Defueling Safety Analysis Report (SAR) for the Fort St. Vrain Nuclear Generating Station (FSV). By letter dated October 17, 1989 (Reference 2), the NRC in their preliminary safety evaluation requested additional information on the Defueling SAR and requested Technical Specification changes to support the defueling as described in the SAR.

Subsequent to receipt of Reference 2, a PSC/NRC meeting was held on October 25, 1989 to discuss, among other items, the NRC requests concerning the Defueling SAR, obtain clarification, and define PSC's response approach. Based on the results of that meeting, PSC hereby submits in Attachment 1, the NRC's requested information, and in Attachment 2, the Engineering Evaluation on the startup channel detectors response during defueling.

As indicated in the October 25, 1989 meeting, PSC is proceeding with all activities necessary to support the start of incore defueling on November 27, 1989. On this basis, PSC reiterates its request for NRC approval of the Technical Specifications (submitted in prior correspondence) in a time frame that would enable PSC to proceed with defueling on November 27, 1989.

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Should you have any questions regarding this information, please contact Mr. M. H. Holmes at (303) 480-6960.

Very truly yours,

A. Clegg Crawford

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Vice President
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ACC/JCS:drg

Attachments

cc: Regional Administrator, Region IV
ATTN: Mr. T. F. Westerman, Chief
Projects Section B

Mr. Robert Farrell
Senior Resident Inspector
Fort St. Vrain

The NRC preliminary safety evaluation covered the areas of Reactivity Evaluation, Reactivity Monitoring, Accident Analysis, Redundancy of Reactivity Control and Technical Specifications. The NRC requests for additional information are identified for each of the evaluated areas followed by PSC's response.

2.1 Reactivity Evaluation

NRC Requests:

The licensee should provide the actual calculated results with the boronation model for 0 ppm boron for defueling the first 10 regions. These calculations should demonstrate consistency with the 12 pin boron results presented in the Defueling SAR.

The licensee should provide a brief explanation of the calculation model differences in the shutdown margin defined in the cycle 4 SAR and in the Defueling SAR for the same conditions.

PSC Responses:

Two reactivity cases were calculated using the boronation model for 0 ppm boron and 12 pin boron (12 lumped poison pins in each defueling element). Figure 1 shows the calculated data points for reactivity as a function of the number of regions defueled with the shutdown margin verification rods withdrawn consistent with Table 3-2 of the Defueling SAR. Figure 2 shows a similar calculation except that all the rods are all inserted in the active core. Because the effects of control rod withdrawal from regions of varying reactivity worth are not superimposed, Figure 2 provides a better representation of the decrease in reactivity that occurs, with the use of boronated defueling elements, as fuel is removed and the active core shrinks in size. The models show a consistent reactivity value for zero regions defueled.

The Cycle 4 SAR shutdown margins were obtained using the 4 group GAUGE code, as was done with previous reload cycle SARs. The Defueling SAR shutdown margins were obtained using the 7 group GAUGE code. These codes differ in the number of energy groups used to represent the thermal neutron spectrum. The 7 group model was used because it provides a better representation of control rod worth, which was felt to be of particular importance for these analyses.

In addition, there is some difference due to the fact that the Cycle 4 SAR assumed that the reactor would run continuously at 100% power operation. The 7 group calculations for the Defueling SAR were done using "as-burnt" depletion calculations for the 155 EFPD case.

FSV Defueling with 3 Rods Cocked

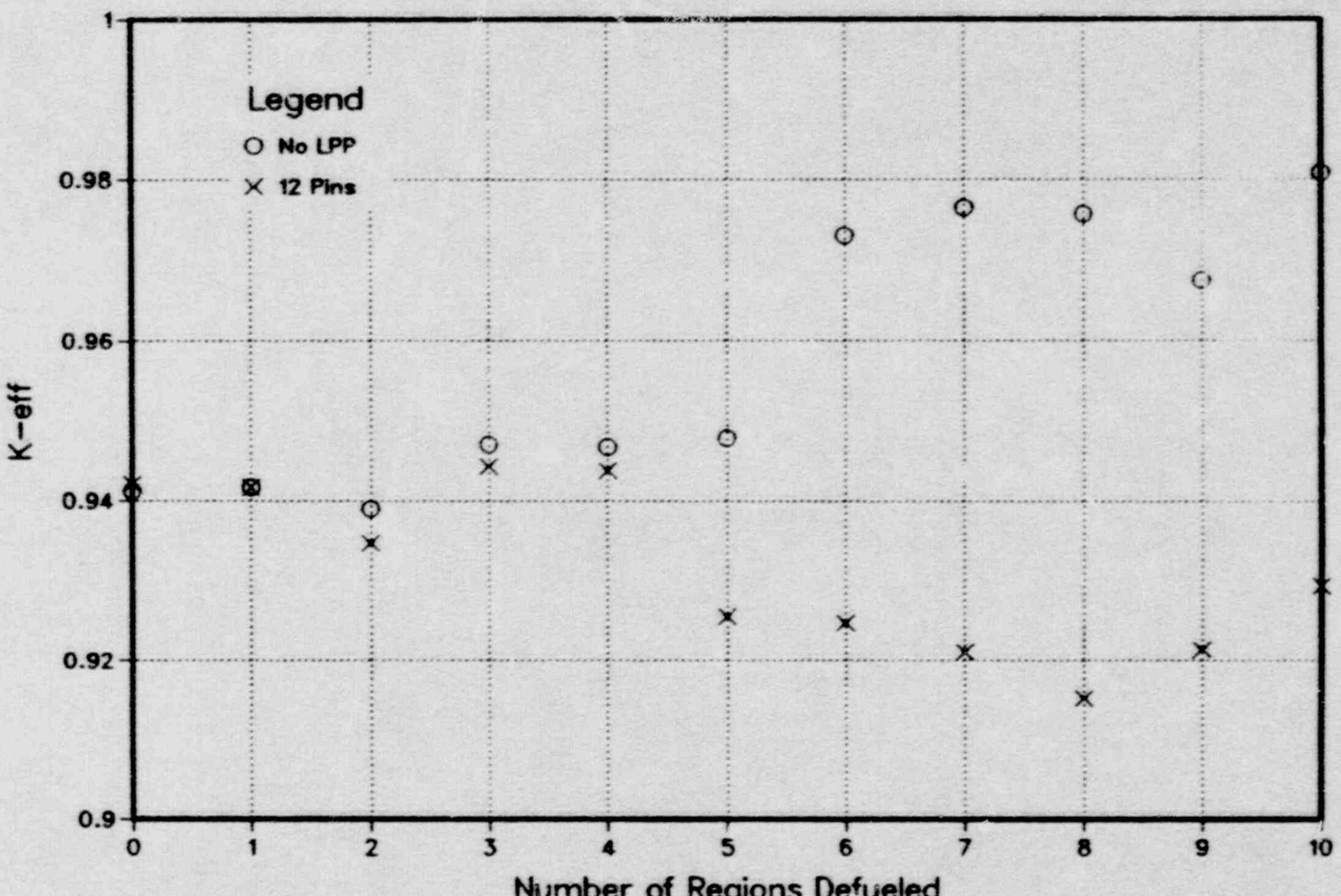

Figure I

FSV Defueling with All Rods In

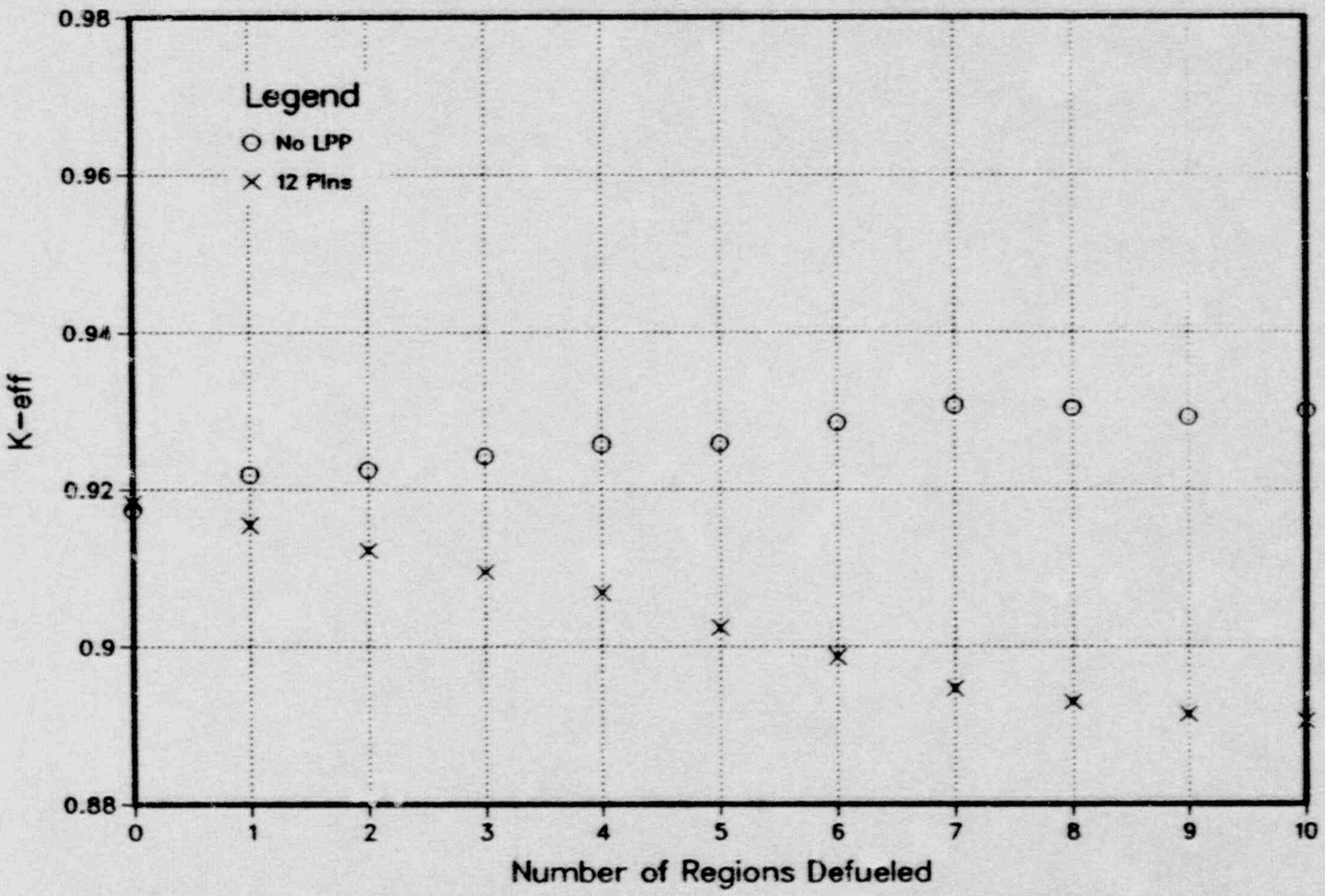

Figure 2

2.2 Reactivity Monitoring

NRC Request: "The licensee should provide a best estimate projection of the startup detectors count rate vs regions defueled. The effect of modifications proposed in the defueling SAR including modifications of boronated plenum elements should also be quantitatively evaluated.

Alternatively, the licensee should provide a specific proposal for a different reactivity monitoring scheme. (This could include the use of temporary incore monitors as appropriate)."

PSC Response: An Engineering Evaluation (EE), EE-DEC-0022, Rev. B, was prepared to evaluate the response of the startup channel detectors during defueling. Attachment 2 is a copy of the Engineering Evaluation which takes into account the proposed modifications addressed in the Defueling SAR.

The adequacy of the startup channels to detect local criticalities has been demonstrated in the past such that the startup channels can detect local criticality any place in the core.

The NRC request also made reference to the source range trip currently set at 10E+5 cps. A 10E+5 cps detection is equivalent to a maximum reactor power level of 10E-3%. Based on a 100% power level for an 842 Mw(t) output, the 10E+5 cps would equal a maximum power level of 8.42Kw.

Based on the above information and the EE conclusions, adequate neutron count rate can be maintained on the startup channels during the defueling process to the point where the all-rods-out demonstration test is performed. Therefore, there is no need for any alternate incore monitoring.

2.3 Accident Ana' is

NRC Request: "The licensee's defueling SAR, Section 5.2.2 argues that 'A Rod Pair Withdrawal Accident During Startup Operations at Source Levels or at Very Low Power' is not credible because the core will be shutdown at defueling conditions. However, the licensee's own calculations in the defueling SAR, Table 3-2 show the reactor is critical with only four or five control rods withdrawn.

The licensee states that certain control rod drives will be deenergized to prevent an accidental criticality. However, the possibility of such accidents is not precluded, especially during shutdown margin testing. This accident would be similar to that described in FSAR Section 14.2.2.7.

The licensee should present a more complete discussion of this issue. The goal of the discussion should demonstrate that appropriate safety limits are not exceeded or are bounded by the existing FSAR analysis."

PSC Response: The Defueling SAR, in Sections 3.3 and 5.2.2, discusses the credibility of experiencing a Rod Withdrawal Accident (RWA) during the defueling. PSC remains convinced that a RWA is not credible during defueling for the following reasons:

- o During defueling, the control rods are normally deenergized and incapable of being withdrawn.
- o During a shutdown margin verification test, only those rods to be tested are energized and capable of being withdrawn. During the test, the intent is to fully withdraw all of the energized rods. Analyses performed prior to the test by Technical Specifications require that the shutdown margin exceed .01 delta K with the test rods fully withdrawn. Therefore,criticality should not occur even when a test rod is withdrawn.
- o If the wrong rod pair is withdrawn during a shutdown margin verification test, the shutdown margin requirements are still met with the exception of Region 33. Table 3.2 (assuming 155 EFPD) in the Defueling SAR identified 3 regions (22, 28, and 33) with the potential for causing inadvertent criticality. Table 3.3 (assuming 200 EFPD) identified only Region 33 as not meeting the required shutdown margin. The core has accumulated 232 EFPD and, therefore, Region 33 is the only rod pair of concern in the defueling sequence. Administrative controls will be in place to assure that Region 33, as specified in the Defueling SAR sequence, can not be inadvertently withdrawn.
- o Deenergizing each control rod drive pair consists of "Racking Out" each circuit breaker drawer in the CRD Motor Control Centers (MCC) under the equipment clearance process. When the drawer is racked out, the connection between the circuit

breaker and the MCC bus is separated electrically and physically. The latching mechanism lever for the circuit breaker drawer for the CRD in Region 33 will be locked in place such that inadvertent "Racking In" of the circuit breaker will be prevented. The key(s) to the lock will be maintained under control by the Shift Supervisor. Energizing the circuit breakers (racking in of the circuit breaker) will be controlled by procedure during the shutdown margin verification tests and in the defueling sequence.

o With the administrative controls in place, the adequacy of the startup channels for detecting an inadvertent criticality, the existence of the 10E+5 cps Plant Protective System scram, and the availability of the reserve shutdown system per Technical Specifications, a realistic RWA which has any consequences is not credible.

2.4 Redundancy of Reactivity Control

NRC Request: "The staff has reviewed the licensee's response submitted August 24, 1989 concerning redundancy of reactivity control. The licensee has demonstrated in the defueling SAR that a combination of the control rods and boronated dummy blocks will maintain the reactor subcritical throughout the defueling sequence. However, no comparable calculations have been performed for the reserve shutdown system (RSS). The RSS is the independent means of reactivity control needed to satisfy FSAR Design Criteria 27. FSAR Section 3.5.3.3 provides an acceptable method of demonstrating the capability of the RSS to independently shutdown the reactor. The licensee should provide an equivalent analysis for the proposed defueling sequence."

PSC Response: Taken from the Defueling SAR:

"Table 3-2 presents the results of shutdown margin analyses throughout the defueling sequence... The purpose of these analyses was to determine whether withdrawal of a control rod of high worth could result in inadvertent criticality during shutdown margin verification testing. In none of the cases evaluated was reactor criticality predicted. However, in a few instance, a k-effective larger the 0.99 was calculated. Since the uncertainty of such analyses is plus or minus 0.01 delta k, it must be considered possible that reactor criticality could be achieved if control rods were withdrawn from these regions to confirm shutdown margin. The cases of interest are highlighted via an asterisk in Table 3-2."

Analyses have been performed to demonstrate that the RSS provides an independent means to shut the reactor down. For these analyses, the RSS was inserted in the shutdown margin verification region and into the next region in the defueling sequence. The results of calculations are presented in Table 1 and show that insertion of RSS material in these two regions produces a large subcritical margin. This demonstrates that FSAR Design Criterion 27 is met.

TABLE 1

FSV Defueling

155 EFPD Burnup Cycle 4

Regions Defueled	Rods Withdrawn	SDM Verif. Region	RSS Regions	No RSS K-eff	RSS Inserted K-eff
None	1,23,32	22	22,32	0.9882	0.9423
None	1,23,32	33	33,32	0.9988	0.9360
23	1,32,26	33	33,26	0.9988	0.9541
23,32,26	1,35,29	28	28,29	0.9910	0.9345
23,32,26, 35	1,29,20	28	28,20	0.9910	0.9545

3.0 Technical Specifications

While the NRC's preliminary safety evaluation discussed the need for suitable Technical Specifications in the area of design features and reactivity control, it also acknowledged receipt of PSC's proposed Technical Specifications for these areas.

PSC has submitted proposed Technical Specifications to support defueling in the following letters:

Design Features:	PSC Letter, Crawford to Weiss, Dated September 14, 1989 (P-89350)
	PSC Letter, Crawford to Weiss, Dated October 13, 1989 (P-89395). This letter supercedes the September 14, 1989 letter.
Reactivity Control:	PSC Letter, Crawford to Weiss, Dated September 14, 1989 (P-89341)
	PSC Letter, Crawford to Weiss, Dated October 13, 1989 (P-89394). This letter supercedes the September 14, 1989 letter.
	PSC Letter, Crawford to Weiss, Dated October 30, 1989 (P-89428). This letter provides additional information pertaining to the Reactivity Control Amendment Request.
Fuel Handling and Fuel Storage:	PSC Letter, Crawford to Weiss, Dated September 14, 1989 (P-89344)

PSC considers that the above license amendment submittals adequately address the NRC's request.

Engineering Evaluation
EE-DEC-0022
Rev. B