Public Service Company of Colorado
12015 East 46th Avenue, Suite 440; Denver, CO 80239

January 21, 1981
Fort St. Vrain
Unit No. 1
P-81021

Mr. James R. Miller, Chief
Special Projects Branch
Division of Project Management
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTENTION: Dr. Michael Tokar

Docket #50-267

Subject: Supplementary Information for Proposed Change to Technical Specification Table 6.1-1

Reference: (1) PSC Letter O.R. Lee to J.R. Miller, P-80203, Dated October 3, 1980

Dear Mr. Miller:

As requested in discussions between Dr. Michael Tokar of the NRC and Mr. Michael Holmes of PSC, enclosed is supplementary information for our requested change to Table 6.1-1 of the FSV Technical Specifications. The information relates to PSC's request in Reference (1) for extension of the fuel test elements core residence time to be compatible with the present Fort St. Vrain reactor core refueling intervals.

The following attachments are included with this submittal:

Attachment 1 -- New Table 6.1-1. This new Table 6.1-1, which is the proposed Technical Specification modification, differs from the previous Table 6.1-1 of Reference (1) only in the units of residence time; these have been changed from equivalent full power years to equivalent full power days. These new units directly correspond to the units used in the safety evaluations which have been performed.

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Attachment 2 -- Revised Reason for Technical Specification Revision. These revised reasons for the proposed change to Table 6.1-1 more clearly describe the reasons for the FTE core residence times as they are currently specified in Table 6.1-1, and the reasons for changing the existing residence times.

Attachment 3 -- P-78165, dated October 9, 1978
P-79025, dated January 25, 1979
These letters, previously submitted to the NRC, are being enclosed for reference purposes.

In addition, your attention is directed toward Section 3.6 of the Fort St. Vrain FSAR for a discussion of the reactor core refueling schedule. In Amendment No. 24 to the FSAR, PSC and General Atomic reduced the length of the first two refueling cycles from annual intervals to semi-annual intervals. The original basis for this reduction has been found to be without merit considering actual plant operating experience (see P-78165 and P-79025). Therefore, PSC has evaluated and authorized the extention of the first two refueling cycles from 150 equivalent full power days to 200 equivalent full power days. However, NRC approval of the proposed change to Technical Specification Table 6.1-1 is also required.

Please let us know if any further supplementary information may be required to support the proposed Fort St. Vrain Technical Specification change.

Very truly yours,

Frederic E. Swart

Frederic E. Swart
Nuclear Project Manager

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Attachments

TABLE 6.1-1

DESCRIPTION OF FORT ST. VRAIN FUEL ELEMENTS FTE-1 THROUGH FTE-8

	FTE-1	FTE-2	FTE-3	FTE-4	FTE-5	FTE-6	FTE-7	FTE-8
Segment	2	3	4	5	6	7	7	7
Graphite Type	H-451	H-451	H-451	H-451	H-451	H-451	H-451	H-451
Fissile Fuel Type	UC_2 TRISO	UC_2 TRISO plus test fuel (a)	UC_2 TRISO	UC_2 TRISO plus test fuel (a)	UC_2 TRISO	UC_2 TRISO plus test fuel (a)	$(Th,U)C_2$ TRISO	$(Th,U)C_2$ TRISO
Fertile Fuel Type	ThO_2 TRISO	ThO_2 TRISO plus BISO	ThO_2 TRISO	ThO_2 TRISO plus BISO	ThO_2 TRISO	ThO_2 TRISO plus BISO	ThC_2 TRISO	ThC_2 TRISO
Method of Fuel Rod Curing[b]	CIP	CIP	CIP	CIP	CIP	CIP	CIB	CIB
Residence Time, Equivalent Full Power Days	200	500	800	1100	1400	1700	1700	1700

(a) Test fuel includes:

$(Th,U)C_2$ TRISO,	88 rods per element CIB	HEU
UC_xO_y* TRISO/ThO_2 BISO,	350 rods per element CIP	
UC_2 TRISO/ThO_2 TRISO,	176 rods per element CIP	
$(Th,U)O_2$ TRISO/ThO_2 TRISO	88 rods per element CIT	MEU

(b) CIP = cure-in-place fuel rod carbonization; CIB = cure in alumina bed - reference FSV process; CIT = cure-in-tube, graphite crucibles, simulating conditions as experienced in cure-in-place.

*x and y represent the mean quantitites of carbon and oxygen and do not signify a specific compound. These values will be explicit in the final fuel specification. All kernels of this type are derived from WAR beads.

Attachment No. 2
to P-81021

REASON FOR TECHNICAL SPECIFICATION REVISION

Technical Specification Table 6.1-1 describes the design features of the eight Fuel Test Elements (FTE's) that were inserted into the Fort St. Vrain reactor core during the first refueling. Table 6.1-1 also includes a list of residence times for the FTE's that indicates the amount of time the FTE's are expected to reside in the core. The phased removal of the FTE's provided for in Table 6.1-1 would allow for the early examination of the FTE irradiated H-451 graphite, prior to H-451 graphite being irradiated in production fuel to comparable levels.

The FTE resident times in Table 6.1-1 correspond to the original expected Fort St. Vrain reactor core operating and refueling schedule as described in Section 3.5 of the Fort St. Vrain FSAR. Under the graded fuel cycle used for the Fort St. Vrain core, about one-sixth of the core will be replaced at each refueling. With the plant operating at rated full power conditions, the first segment was to be replaced after 6 months (150 equivalent full power days) and the second segment was to be replaced after the second six months (an additional 150 equivalent full power days). Subsequent refuelings were to be performed annually (after 300 equivalent full power day operating intervals).

Under this refueling schedule the maximum residence time of fuel in the core would be six years (1800 equivalent full power days-EFPD). This maximum fuel residence time in the reactor core is controlled by Technical Specification LCO 4.1.1.

With the FTE's being inserted after the end of the first cycle, the first FTE was expected to be removed after 0.5 years (150 EFPD), the second FTE would be removed after 1.5 years (450 EFPD), and so forth, with the last FTE's being removed after 5.5 years (1650 EFPD).

Actual Fort St. Vrain operations have not taken place at rated full power conditions. Consequently, measuring FTE residence times in terms of calendar years is not appropriate, and changing the measure of residence times to "equivalent full power days" is proposed.

Further, based on the actual performance of the Fort St. Vrain fuel to date, PSC has evaluated and found that extended operation of the first two reactor core operating cycles from 150 EFPD to 200 EFPD, to obtain additional life from these two cycles, is justified, and this extended operation has no adverse safety impacts on the plant or the public. The phased FTE removal has been retained in the revised residence times to allow for the continued early examination of the H-451 graphite (with 50 EFPD of additional exposure to each FTE).

The length of the first two reactor core operating cycles was reduced via Amendment No. 24 to the Fort St. Vrain FSAR from 300 EFPD for each cycle, to 150 EFPD for each cycle by PSC and the reactor supplier based on a potential concern regarding fuel particle coating integrity. Certain initial core fuel particles did not fully meet the specification requirements. Based on actual fuel performance during Cycle 1, and on

actual fuel performance to date during Cycle 2, the initial concern about this out-of-specification fuel was not warranted. (The last of the out-of-specification fuel will be removed from the reactor core during the next refueling). The Fort St. Vrain primary coolant fission product inventory continues to be well below both the Technical Specification limit and the original expected level (using fuel within specification limits).

Extending the length of Cycle 2 from 150 EFPD to 200 EFPD requires an extension of each FTE residence time shown in Technical Specification Table 6.1-1 by 50 EFPD. The safety significance of these extended FTE residence times has been evaluated in Amendment 3 to General Atomic Document GLP-5494. Per the evaluation in GLP-5494, as amended, the extended core residence times of the eight FTE's do not significantly affect any accident analysis presented in the FSAR, and do not involve any increased hazard to the health and safety of either plant personnel or the public.

Attachment 3
to P-81021

PUBLIC SERVICE COMPANY OF COLORADO
P. O. BOX 840 · DENVER, COLORADO 80201

J. K. FULLER
VICE PRESIDENT

October 9, 1978
Fort St. Vrain
Unit No. 1
P-78166

Mr. William Gammill
Assistant Director for Advanced Reactors
Division of Project Management
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Docket No. 50-267

Subject: Extension of Cycle 1 Operation

Dear Mr. Gammill:

The Fort St. Vrain reactor core is designed to operate on a graded fuel cycle and to have about one-sixth of the core removed and replaced at planned annual refueling outages. The fuel is designed to reside in the core for six years at full power.

During the manufacture of the fuel particles for the initial core, some particles were produced which were clearly not capable of residence in the core for a full six years. Accordingly, the initial reactor core was loaded in such a manner so as to assure that those particles would be removed after less than six years exposure. In addition, the first refueling was arbitrarily and conservatively scheduled to take place after six months of equivalent full power operation, (150 EFPD), so that refueling outages could be kept on an annual or semi-annual basis.

Experience to date has indicated that fuel particle performance has been much better than originally expected, as indicated by the fission product release to the primary coolant. At the present time, the primary coolant circulating fission product inventory is at least a factor of thirty less than the design inventory given in the FSAR and the limit given in Technical Specification LCO 4.2.8.

On the basis of the observed fuel particle performance, operation of Cycle 1 beyond 150 EFPD was considered and found to be acceptable. It was also determined that extension of Cycle 1 operation would not require a Technical Specification change nor did it involve an unreviewed safety question per the guidelines of 10 CFR 50.59.

A recommendation to extend Cycle 1 operation from 150 to 200 EFPD was submitted to the Nuclear Facility Safety Committee (NFSC) for consideration

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and was accordingly approved on August 3, 1978.

In accordance with the requirements of Technical Specification LCO 4.1.8, we have attached an approved revised Base Reactivity Curve for your information. It should be noted that the only change to the curve has been to extend it from $3.0X10^6$ MWHr to $4.2X10^6$ MWHr to account for the extended operation of Cycle 1 ($4.05X10^6$ MWHr is the equivalent of 200 EFPD).

If there are any questions, please let us know.

Very truly yours,

J. K. Fuller

J. K. Fuller, Vice President
Engineering and Planning

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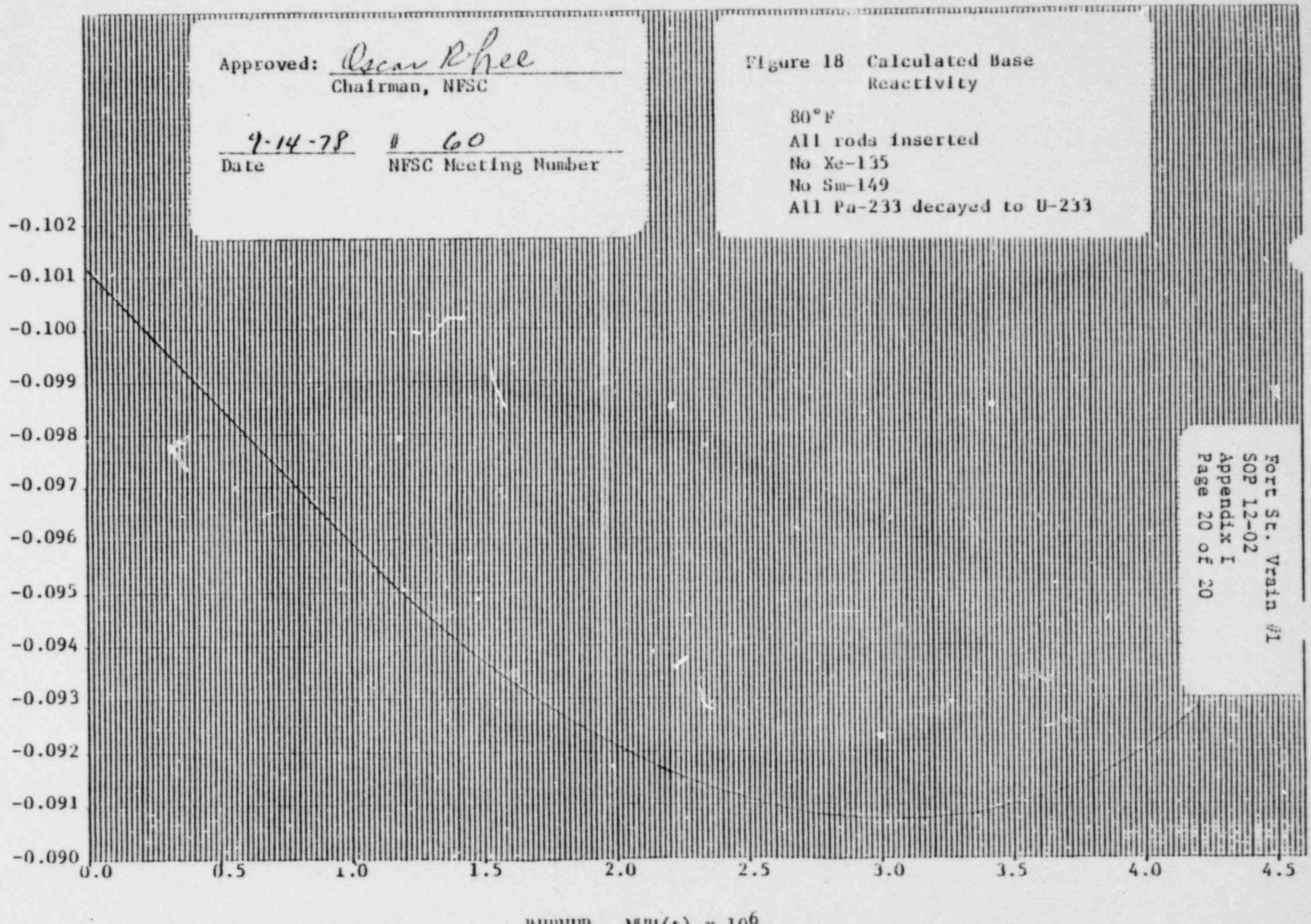
Approved: Oscar Rhee
Chairman, NFSC

9-14-78 # 60
Date NFSC Meeting Number

Figure 18 Calculated Base Reactivity

80°F
All rods inserted
No Xe-135
No Sm-149
All Pa-233 decayed to U-233



Attachment 3
to P-81021

Public Service Company of Colorado
P.O. BOX 840 · DENVER, COLORADO 80201

January 25, 1979
Fort St. Vrain
Unit No. 1
P-79025

Mr. William P. Gammill
Assistant Director for Standardization
and Advanced Reactors
Division of Project Management
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Docket No. #50-267

Subject: Extension of Cycle 2 (Reload 1) Operation

Gentlemen:

In the month of March, 1979, six of the thirty-seven fuel regions in the Fort St. Vrain (FSV) core will be replaced with fresh fuel elements. With the exception of eight fuel test elements, the replacement fuel elements are identical to the fuel elements existing in the core, having changes made only in the fuel and burnable poison loadings to satisfy the reactivity and power distribution requirements of Cycle 2.

An analysis of the Cycle 2 core was performed to determine if operation of the core could be extended from 150 effective full-power days (EFPD) to 200 EFPD. Results of the analysis indicate that operation of the FSV core for up to 200 EFPD is acceptable, would not involve an unreviewed safety question per the guidelines of 10CFR 50.59, and would not require a change to the FSV Technical Specifications.

A recommendation to extend the Cycle 2 operation from 150 to 200 EFPD was subsequently submitted to the FSV Nuclear Facility Safety Committee for consideration and received approval on October 24, 1978.

As required by FSV Technical Specification LCO4.1.8, an approved, revised Base Reactivity Curve for the extended Cycle 2 will be forwarded to the Office of Nuclear Reactor Regulation shortly after the upcoming refueling.

Very truly yours,

J.K. Fuller, Vice President
Engineering and Planning

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