Proposed Change No. 145
Supplement No. 4

Telephone 617 366-9011
TWX
710-390-0739

WYR-77-68

YANKEE ATOMIC ELECTRIC COMPANY

YANKEE

20 Turnpike Road Westborough, Massachusetts 01581

July 15, 1977

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Office of Nuclear Reactor Regulation

References: (1) License No. DPR-3 (Docket No. 50-29)

(2) Proposed Change No. 145, Supplement No. 1, April 13, 1977.

Dear Sir:

Subject: Changes to the Core XIII Performance Analysis

Pursuant to Section 50.59 of the Commission's Rules and Regulations, Yankee Atomic Electric Company hereby proposes the following modification to Appendix A of the Operating License.

PROPOSED CHANGE: Reference is made to the Technical Specifications of License No. DPR-3 and Attachment B, "Yankee Nuclear Power Station Core XIII Performance Analysis", of Reference (2) above. It is proposed that:

(1) Specification 3/4.2 (attached) and its associated bases be modified to reflect power escalation from zero to maximum allowable power;

(2) The attached Table 5.1-2 replace the corresponding page in Reference (2), and;

(3) The attached Section 8.0 replace the corresponding Section in Reference (2).

REASON FOR CHANGE: The change to the Technical Specifications allows power escalation from zero power to maximum allowable power without an intermediate hold. A hold may be necessary in some cases during power operation to reduce xenon peaking; however, it is not required when xenon is allowed to decay for 48 hours or more.

The change to Table 5.1-2 of the Core XIII Core Performance Analysis is the inclusion of the Technical Specification value of shutdown margin.

The change to Section 8.0 of the Core XIII Core Performance Analysis reflects the addition of two more critical boron measurements, the

measurement of control rod Group B, a power distribution map at approximately zero power, a measurement of power coefficient and a report on the startup physics testing.

SAFETY CONSIDERATIONS: The above changes do not alter the Core Performance Analysis described in Reference (2). Therefore, it remains our conclusion that Core XIII operation within the proposed specifications will not endanger the health and safety of the public.

This proposed change has been reviewed by the Nuclear Safety Audit and Review Committee.

SCHEDULE OF CHANGE: The Core XII-XIII refueling schedule began June 10, 1977. We respectfully request review of this Proposed Change by the Commission as soon as practical.

Any further questions regarding this supplement should be directed to Mr. Richard J. Cacciapouti at our Engineering Office, 20 Turnpike Road, Westborough, Massachusetts, 01581, (617)[illegible], Extension 2807.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

D. E. Vandenburgh

D. E. Vandenburgh
Senior Vice President

COMMONWEALTH OF MASSACHUSETTS)
) ss.
COUNTY OF WORCESTER)

Then personally appeared before me, D. E. Vandenburgh, who being duly sworn, did state that he is Senior Vice President of Yankee Atomic Electric Company and that he is duly authorized to execute and file the foregoing request in the name and on the behalf of Yankee Atomic Electric Company, and that the statements therein are true to the best of his knowledge and belief.

Armand R Soucy

Armand R. Soucy Notary Public
My Commission Expires September 9, 1977

4.2.1.2 The below factors shall be included in the calculation of peak full power LHGR:

a. Heat flux power peaking factor, F_q^N, measured using incore instrumentation at a power ≥10%.

b. Effect of inserting the control group from its position at the time of measurement to its insertion limit, F_I as shown in Figure 3.2-2. The rod insertion limit is shown in Figure 3.1-1.

c. The multiplier for xenon redistribution as a function of core lifetime as given in Figure 3.2-3. In addition, if control rod Group C is inserted below 75 inches, allowable power may not be regained until power has been at a reduced level defined below for at least twenty four hours with control rod Group C between 75 and 90 inches.

Reduced power = allowable fraction of full power times multiplier given in Figure 3.2-4.

Exception: 1. If the rods are inserted below 75 inches and power does not go below the reduced power calculated above, hold at the lowest attained power level for at least twenty four hours with control rod Group C between 75 and 90 inches before returning to allowable power.

2. If the rods are inserted below 75 inches and zero power is held for more than 48 hours, no reduced power level need be held on the way to the allowable fraction of full power.

d. Shortened stack height factor, 1.009.

e. Measurement uncertainty, 1.05.

f. Power level uncertainty, 1.03.

g. Heat flux engineering factor, F_q^E, 1.04.

h. Core average linear heat generation rate at full power, 4.40 kw/ft.

4.2.1.3 At least once per 1000 EFPH, the following limits shall be determined by calculation not to be exceeded at RATED THERMAL POWER:

a. Hottest channel exit coolant temperature ≤602°F, and

b. Maximum clad surface temperature in hottest channel ≤637°F.

3/4.2 POWER DISTRIBUTION LIMITS

BASES

The specifications of this section provide assurance of fuel integrity during Condition I (Normal Operation) and II (Incidents of Moderate Frequency) events by: (a) maintaining the minimum DNBR in the core >1.30 during normal operation and in short term transients, and (b) limiting the fission gas release, fuel pellet temperature and cladding mechanical properties to within assumed design criteria.

3/4.2.1 PEAK LINEAR HEAT GENERATION RATE

Limiting the peak linear heat generation rate (LHGR) during Condition I events provides assurance that the initial conditions assumed for the LOCA analyses are met and the ECCS acceptance criteria limit of 2200°F is not exceeded.

When operating at constant power, all rods out, with equilibrium xenon, power peaking in the Yankee Rowe core decreases monotonically as a function of cycle burnup. This has been verified by both calculation and measurement on Yankee cores and is in accord with the expected behavoir in a core that does not contain burnable poison. The all-rods-out power peaking measured prior to exceeding 75% of RATED THERMAL POWER after each fuel loading thus provides an upper bound on all-rods-out power peaking for the remainder of that cycle. Thereafter the measured power peaking shall be checked every 1000 equivalent full power hours and the latest measured value shall be used in the computation. The only effects which can increase peaking beyond this value would be control rod insertion and xenon transients and these are accounted for in calculationg peak LHGR.

The core is stable with respect to xenon, and any xenon transients which may be excited are rapidly damped.

The xenon multiplier in Figure 3.2-3 was selected to conservatively account for transients which can result from control rod motion at full power.

The limits on power level and control rod position following control rod insertion were selected to prevent exceeding the maximum allowable linear heat generation rate limits in Figure 3.2-1 within the first few hours following return to power after the insertion. With Yankee's highly damped core, the 24 hour hold allows sufficient time for the initial xenon maldistribution to accommodate itself to the new power distribution. The restriction on control rod location during these 24 hours assures that the return to allowable fraction of full power will not cause additional redistribution due to rod motion.

After 48 hours at zero power, the average xenon concentration has decayed to about 20% of the full power concentration. Since the xenon concentrations are so low, an increase in power directly to maximum allowable power creates transient peaking well below the value imposed by the xenon redistribution multiplier. Thus, any increase in power peaking due to this operation is below the value accounted for in the calculation of LHGR.

Table 5.1-2

SHUTDOWN REQUIREMENTS, % Δρ

	Core XIII		Core XI	
	BOL	EOL	BOL	EOL
Total Control Rod Worth	10.52	10.64	10.71	10.89
Worth of Stuck Rod	2.62	2.76	2.79	2.90
Total Worth Less Stuck Rod	7.90	7.88	7.92	7.99
Total Worth Less 7.5% Uncertainty	7.31	7.29	7.33	7.39
Allowances				
Fuel Temperature Variation	.85	.85	1.75	2.04
Moderator Temperature Variation	.24	.52	0.21	0.46
Moderator Voids	.03	.06	0.03	0.06
Operational Maneuvering Band	.11	.18	0.80	0.80
Shutdown Margin	4.72	4.72*	1.00	1.00
Total Allowances	5.95	6.33	3.79	4.36
Excess Shutdown Margin (for shutdown from HFP to HZP)	1.36	0.96	3.54	3.03

*Changed to agree with the Technical Specification.

8.0 STARTUP PROGRAM

Following refueling and prior to vessel reassembly, fuel assembly position will be verified by underwater television.

Yankee-Rowe Core XIII Startup Program will include the following tests:

1. Control rod operability test will be performed by moving each rod group in turn from 0" to 90" to 0" and verifying control rod momvement by the rod position indicators.

2. Control rod drop time measurement will be conducted by withdrawing one rod group at a time to 90 inches, dropping it and measuring its drop time with a recording oscillograph.

3. Just critical boron concentration is determined by placing the reactor just critical, allowing for system equilibrium, taking a series of main coolant boron samples. This will be done as close as possible to the conditions of all rods out, Group C inserted and Groups A and C inserted.

4. Rod group worths of Group C, Group A and Group B will be determined. This is done by establishing a boron change, balancing the reactivity change with a control rod position change and measuring the worth of the rod steps with a reactivity computer.

5. Measurement of the ejected control rod worth is done by balancing a small boron concentration change with movement of the single rod and measuring the reactivity change with the reactivity computer. The most worthy ejected rod will be measured. In addition, the second most worthy ejected rod may be measured by a rod-swap or boron change method.

6. Measurement of the dropped control rod worth is completed by balancing a small boron concentration change with rod movement and measuring the reactivity change with the reactivity computer. The most worthy dropped rod will be measured. In addition, the second most worthy dropped rod may be measured by a rod swap or boron change method.

7. Moderator temperature coefficient measurement is completed by changing main coolant temperature and measuring the reactivity change with the reactivity computer. Several such measurements are completed for each of a number of equilibrium boron conditions.

8. Power and Xenon defects are measured using a reactivity balance before and after power ascension. The two defects are not separated.

9. Power distributions will be measured at approximately zero power and as soon as the reactor is at steady state power (50%≤Power Level≤75%). This is done with the incore instrumentation.

10. Power coefficient will be measured at a power level approximately 10% below maximum allowable power. This will be done by observing the change in boron from one power level to another and making appropriate corrections for control rods, moderator temperature, xenon and samarium.

11. A startup test report on the above will be submitted t NRC in the required period of time.

NRC FORM 195 (2-76)

U.S. NUCLEAR REGULATORY COMMISSION

NRC DISTRIBUTION FOR PART 50 DOCKET MATERIAL

DOCKET NUMBER: 50-29

FILE NUMBER:

TO: NRC

FROM: Yankee Atomic Elec Co
Westborough, Mass 01581
D.E. Vandenburgh

DATE OF DOCUMENT: 7-15-77

DATE RECEIVED: 7-20-77

LETTER / ORIGINAL / COPY — NOTORIZED / UNCLASSIFIED

PROP — INPUT FORM

NUMBER OF COPIES RECEIVED: 1 SIGNED

DESCRIPTION: Ltr notarized 7-15-77 furn suppl #4 to proposed change No. 145 & trans the following: 2P

ENCLOSURE: Suppl #4 to Proposed Change No. 145 consists of changes to the Core XIIIPerformance analysis.....

(1 cy encl rec'd) 4P

DO NOT REMOVE

PLANT NAME: YAEC ACKNOWLEDGED

DHL 7-21-77

FOR ACTION/INFORMATION

SAFETY		ENVIRONMENTAL	
ASSIGNED AD:		ASSIGNED AD:	V. MOORE (LTR)
BRANCH CHIEF:	Schwencer (7)	BRANCH CHIEF:	
PROJECT MANAGER:		PROJECT MANAGER:	
LICENSING ASSISTANT:		LICENSING ASSISTANT:	
		B. HARLESS	

INTERNAL DISTRIBUTION

REG FILES	SYSTEMS SAFETY	PLANT SYSTEMS	SITE SAFETY & ENVIRON ANALYSIS
NRC PDR	HEINEMAN	TEDESCO	
I & E (2)	SCHROEDER	BENAROYA	DENTON & MULLER
OELD		LAINAS	CRUTCHFIELD
GOSSICK & STAFF	ENGINEERING	IPPOLITO	
HANAUER	KNIGHT	F. ROSA	ENVIRO TECH.
MIPC	BOSNAK		ERNST
CASE	SIHWELL	OPERATING REACTORS	BALLARD
BOYD	PAWLICKI	STELLO	YOUNGBLOOD
		EISENHUT	
PROJECT MANAGEMENT	REACTOR SAFETY	SHAO	SITE TECH.
SKOVHOLT	ROSS	BAER	
P. COLLINS	NOVAK	BUTLER	GAMMILL (2)
HOUSTON	ROSZTOCZY	GRIMES	
MELTZ	CHECK		SITE ANALYSIS
HELTEMES			VOLLMER
SK	AT&I		BUNCH
	SALTZMAN		J. COLLINS
	RUTBERG		KREGER

EXTERNAL DISTRIBUTION

		CONTROL NUMBER
LPDR: Greenfield, Ma		772020028
TIC	NSIC	
NAT LAB		
REG IV (J. HANCHETT)		
16 CYS ACRS SENT CATEGORY B		

NRC FORM 195 (2-76)