STARTUP TEST REPORT

VERMONT YANKEE CYCLE 19

Introduction:

Vermont Yankee Cycle 19 initial startup commenced on October 30, 1996 following a 56 day outage for refueling and maintenance activities.

The core loading for Cycle 19 consists of:

96 BP8DWB335-10GZ reinserts from Cycle 17
32 BP8DWB335-11GZ reinserts from Cycle 17
88 BP8DWB335-10GZ reinserts from Cycle 18
32 BP8DWB335-11GZ reinserts from Cycle 18
120 BP8DWB354-12GZ non-irradiated assemblies

An as-loaded Cycle 19 core map is included as Figure I. Details of the Cycle 19 core loading are contained in the Yankee Atomic Electric Company document YAEC-1935, "Vermont Yankee Cycle 19 Core Performance Analysis Report", October, 1996.

The final as-loaded core loading was verified correct by Vermont Yankee personnel on October 7, 1996.

Control rod coupling verification was performed satisfactorily for all 89 control rods on October 7 and 8, 1996. Control rod scram testing was performed satisfactorily prior to reaching 30% power per Technical Specifications. The testing was performed for all 89 control rods on October 22, 1996.

An in-sequence critical was performed satisfactorily on October 30, 1996. The shutdown margin was verified to be satisfactory based upon the data collected from the in-sequence critical.

Startup commenced October 30, 1996 and steady state full power conditions were reached November 6, 1996.

Core Verification:

The final core loading was verified correct on October 7, 1996 in accordance with Vermont Yankee procedure OP1411. Three separate criteria were checked:

1. Proper bundle seating was verified.

2. Proper bundle orientation, channel fastener integrity and upper tie plate cleanliness were verified.

3. Proper core loading was verified by checking the serial number of each bundle through the use of a video camera. This verification was recorded on video tape and was later independently reviewed and reverified to agree with the licensed core loading of Figure I.

Process Computer Data Checks:

Process computer data shuffling checks were completed on November 2, 1996. These checks included various manual and computer checks of the new data constants. A check for consistency of the data was also performed by Yankee Atomic Electric Company (YAEC) and found to be satisfactory.

In-Sequence Critical:

The in-sequence critical test was performed on October 30, 1996 as part of the reactor startup. Control rod sequence 19-A-2(1) was used to perform the in-sequence critical test. Criticality was achieved on the 9th rod in group 2 (1831) at notch position 16. The moderator temperature was 150°F.

The actual critical rod pattern and the prediction agreed within +/- 1% ΔK/K. Figure II shows the actual, predicted and the +/- 1% ΔK/K critical rod patterns.

Cold Shutdown Margin Testing:

The cold shutdown margin calculation was performed using data collected during the in-sequence critical and information provided in the YAEC "Cycle 19 Core Management Report" (YAEC-1938). The minimum shutdown margin required was 0.45% ΔK/K. The actual shutdown margin was shown to be 1.33% ΔK/K.

Control Rod Scram Testing:

Single rod scram testing of all 89 control rods was completed on October 22, 1996. All insertion times were within the limits defined in the Vermont Yankee Technical Specifications. Results of the testing are presented in Table IA.

In accordance with Technical Specifications Section 4.3.C.2, scram time information available for scrams occurring since the transmittal of the previous startup test report is included in Table IB.

Thermal Hydraulic Limits and Power Distribution:

The core maximum fraction of limiting critical power ratio (MFLCPR), the core maximum fraction of limiting power density (CMFLPD), the maximum average planar linear heat generation rate ratio to its limit (MAPRAT) and the ratio of CMFLPD to the fraction of rated power (FRP) were all checked daily during the startup using the process computer. All checks of core thermal limits were within the limits specified in the Technical Specifications.

The process computer power distribution was updated November 4, 1996 using the traversing incore probe (TIP) system during the ascent to full power. The results of this update is presented in Table II.

The local power range monitors (LPRMs) were manually calibrated once in conjunction with the TIP system. The LPRM high and low trip alarm set points were verified correct prior to startup on 10/14/96. The TIPs and the LPRMs were both functionally tested and found to operate satisfactorily. A total of 19 APRM gain adjustments were done as required during the startup from 10/31/96 to 11/06/96.

The process computer power distribution update performed on November 8, 1996 was used as a basis for comparison with an off line calculation performed using the Yankee Atomic Electric Company nodal code SIMULATE-3. For that power distribution, the SIMULATE-3 core average axial power distribution was compared to that calculated by the plant process computer. Comparisons are shown in Table III. A comparison was also performed between SIMULATE-3 and process computer peak radial power. These values show reasonable agreement and are presented in Table IV.

At approximately 25, 50, 75 and 100 percent power levels the process computer heat balance was compared with an off-line computer calculation. The values of core thermal power from each method were found to be in excellent agreement (within 5 Megawatts thermal).

A core flow calibration was completed on January 14, 1997 to ensure that the core flow calculation by the process computer is accurate over the entire operating range.

TIP Reproducibility and TIP Symmetry:

TIP system reproducibility was checked in conjunction with the power distribution update performed on November 8, 1996. All three TIP system traces were reproducible to within 2.3%. A TIP intermachine calibration was successfully completed on November, 1996. A check of tip axial alignment was completed on November, 1996 and found to be acceptable.

The total TIP uncertainty was calculated using TIP set 1567. Since the rod pattern was symmetric, the actual plant TIP readings were used in the calculation. The resulting total TIP uncertainty for this case was 1.50%. The results of the TIP uncertainty test as shown in Figure III are well below the 8.7% acceptance criteria.

Figure I
VERMONT YANKEE
Cycle 19 Core Map

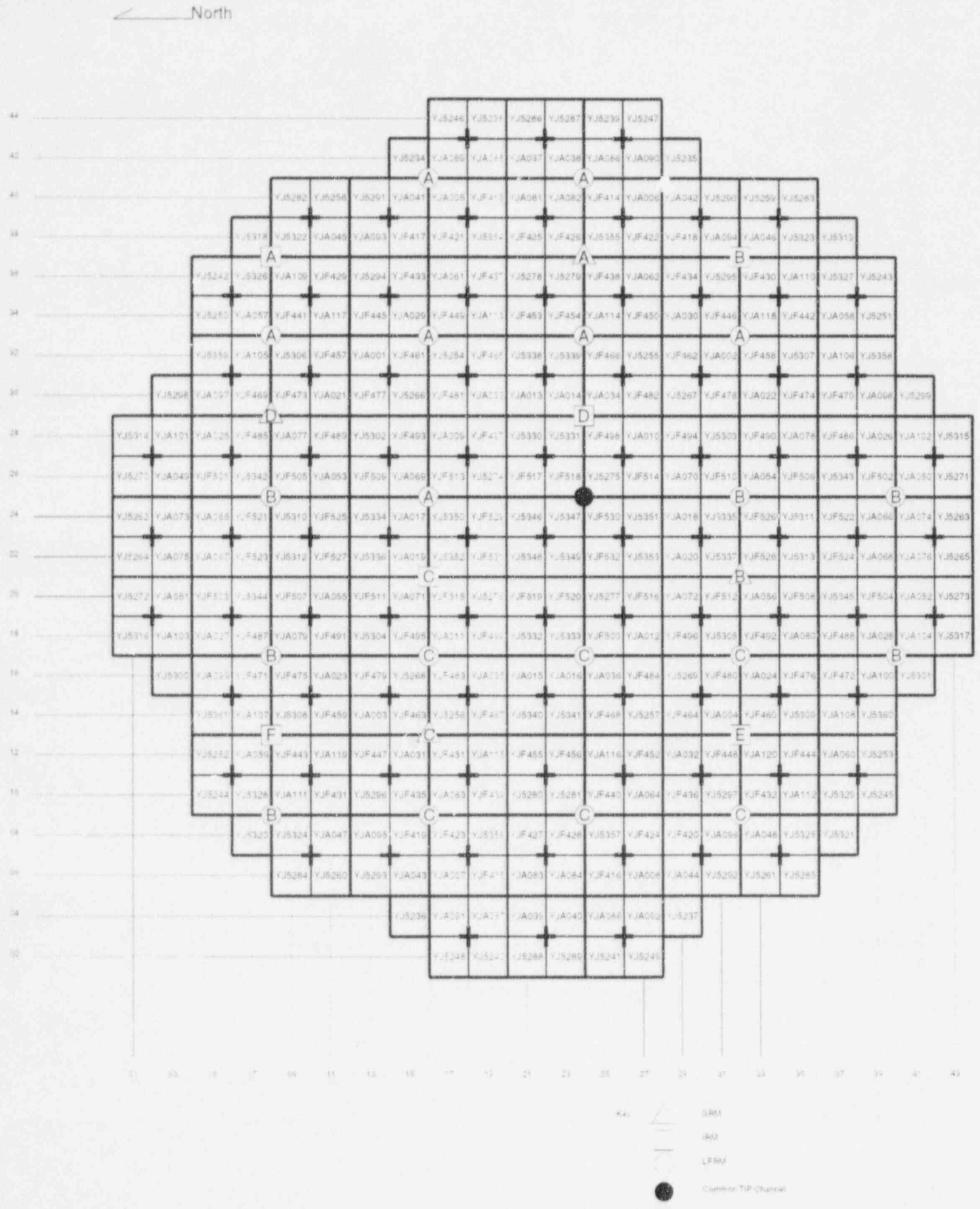
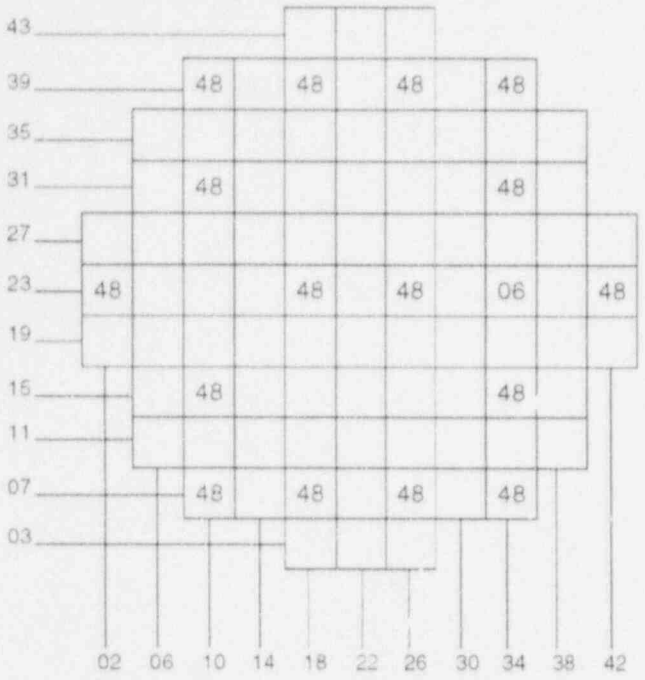
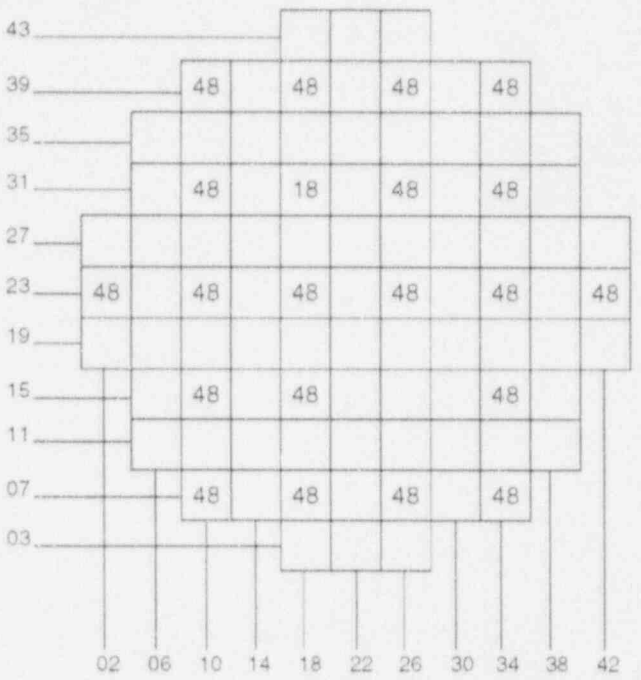


FIGURE II
VERMONT YANKEE BOC 19
CRITICAL ROD CONFIGURATION COMPARISON

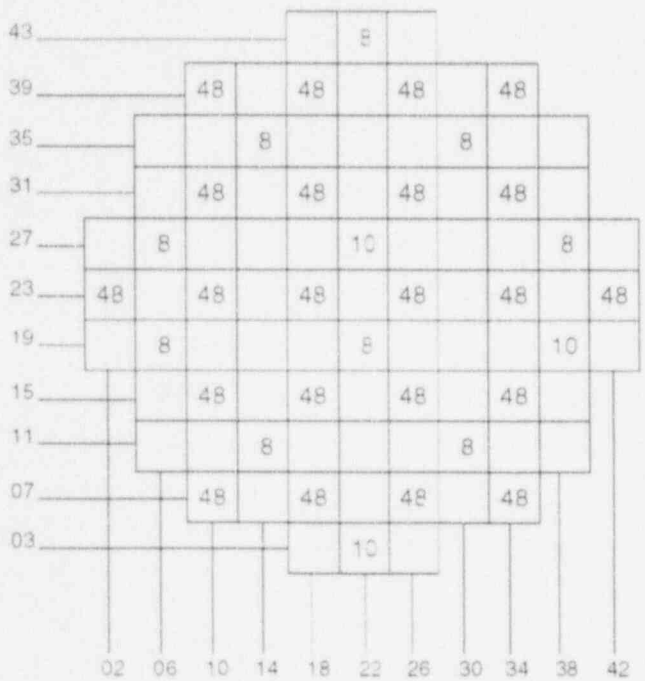
PREDICTED
CRITICAL -1% ΔK



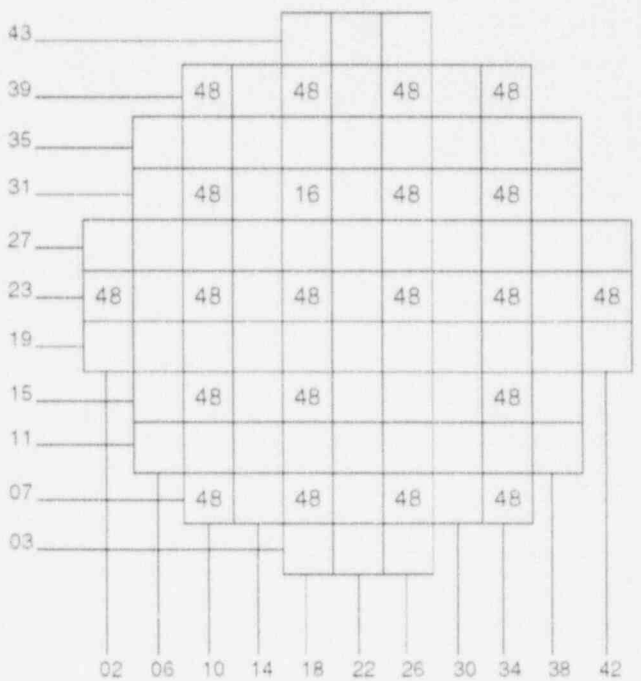
PREDICTED
CRITICAL PATTERN



PREDICTED
CRITICAL -1% ΔK



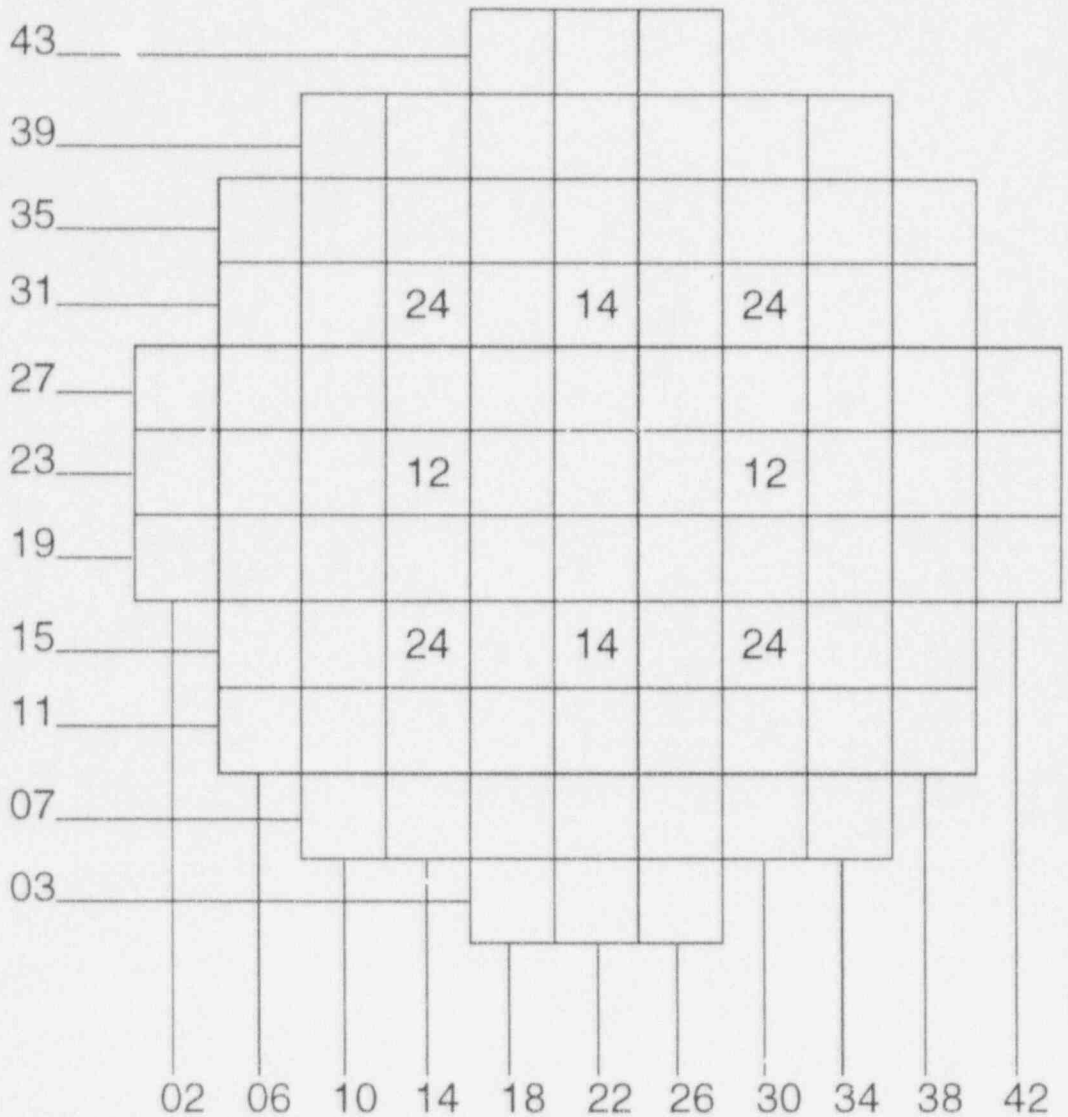
ACTUAL
CRITICAL PATTERN



Note: A Blank Box Denotes Rod Position 00

FIGURE III

Total TIP Uncertainty



TIP: 1567
Date: Nov. 11, 1996
CTP: 100.0%
Core Flow: 97.7%
Uncertainty: 1.5%

TABLE IA
CONTROL ROD SCRAM TESTING RESULTS
VERMONT YANKEE BEGINNING OF CYCLE 19

Single Rod Scrams - October 22, 1996

Maximum 92.01% insertion time (seconds) = 2.973
Tech. Spec. Limit for slowest 90% insertion time (seconds) = 7.000

Mean time for % insertion	4.51%	25.34%	46.18%	87.84%
Measured time (sec)	0.278	0.793	1.321	2.435
Tech. Spec. limit (sec)	0.358	0.912	1.468	2.686

Slowest 2x2 array for % insertion	4.51%	25.34%	46.18%	87.84%
Measured time (sec)	0.283	0.819	1.376	2.527
Tech. Spec. limit (sec)	0.379	0.967	1.556	2.848

TABLE IB

CYCLE 18 CONTROL ROD SCRAM TESTING RESULTS SUMMARY

			MEAN TIME					2 X 2 ARRAY MAXIMUM				
DATE	SCRAM #	DESCRIPTION	4.51%	25.34%	46.18%	87.84%	MAX 90%	4.51%	25.34%	46.18%	87.84%	
04/23/95	162	BOC XVIII SINGLE ROD SCRAMS	0.317	0.821	1.334	2.413	2.863	0.324	0.839	1.361	2.474	
05/03/95	163	SINGLE ROD SCRAM 10-35	0.317	0.821	1.334	2.413	2.863	0.324	0.839	1.361	2.474	
11/07/95	164	SINGLE ROD SCRAMS	0.333	0.837	1.347	2.425	2.673	0.362	0.886	1.400	2.495	
11/09/95	165	SINGLE ROD SCRAMS (5 RODS)	0.332	0.835	1.345	2.421	2.673	0.348	0.859	1.377	2.477	
11/15/95	166	SINGLE ROD SCRAM (1 ROD)	0.331	0.835	1.345	2.422	2.673	0.348	0.859	1.377	2.477	
11/21/95	167	SINGLE ROD SCRAM (2 RODS)	0.331	0.834	1.345	2.421	2.673	0.348	0.859	1.377	2.477	
		77 RODS	0.356	0.862	1.373	2.461						
12/08/95	168	ALL RODS	0.352	0.858	1.371	2.458	2.787	0.362	0.885	1.415	2.538	
12/09/95	169	SINGLE ROD SCRAMS	0.329	0.851	1.380	2.496	2.706	0.337	0.868	1.413	2.559	
01/09/96	170	15 SINGLE ROD SCRAMS	0.330	0.849	1.375	2.485	2.706	0.339	0.869	1.405	2.542	

TABLE IB

CYCLE 18 CONTROL ROD SCRAM TESTING RESULTS SUMMARY (Continued)

			MEAN TIME					2 X 2 ARRAY MAXIMUM				
DATE	SCRAM #	DESCRIPTION	4.51%	25.34%	46.18%	87.84%	MAX 90%	4.51%	25.34%	46.18%	87.84%	
02/27/96	171	15 SINGLE ROD SCRAMS	0.330	0.849	1.373	2.482	2.706	0.339	0.872	1.399	2.533	
04/23/96	172	15 SINGLE ROD SCRAMS	0.333	0.853	1.378	2.487	2.762	0.341	0.875	1.407	2.529	
		64 SINGLE ROD SCRAMS	0.310	0.812	1.320	2.397						
05/29/96	173	ALL RODS	0.317	0.824	1.336	2.415	2.611	0.341	0.867	1.407	2.501	
		25 SINGLE ROD SCRAMS	0.311	0.822	1.332	2.384						
06/11/96	174	ALL RODS	0.311	0.815	1.323	2.392	2.611	0.320	0.829	1.344	2.449	
10/22/96	175	BOC XIX SINGLE ROD SCRAMS	0.278	0.793	1.321	2.435	2.634	0.283	0.819	1.376	2.527	

TABLE II

Vermont Yankee
Power Distribution Measurements
Cycle 19 Start-Up

Date	Time	Core Power(%)	Flow(%)	CMFLPD	MFLCPR	MAPRAT
11/04/96	16:59	71.0	53.1	0.717	0.841	0.649
11/04/96	21:11	69.6	53.4	0.670	0.814	0.611

The Tech. Spec. limit for the three thermal limits above is less than or equal to 1.0.

TABLE III

Comparison of Process Computer and SIMULATE-3
Core Average Axial Relative Power Distributions
Vermont Yankee Beginning of Cycle 19

Node	SIMULATE-3	Process Computer
25	0.139	0.148
24	0.253	0.268
23	0.646	0.643
22	0.818	0.835
21	0.919	0.946
20	1.018	1.023
19	1.085	1.096
18	1.110	1.122
17	1.157	1.152
16	1.219	1.218
15	1.250	1.244
14	1.258	1.228
13	1.289	1.263
12	1.278	1.256
11	1.270	1.233
10	1.260	1.216
9	1.255	1.237
8	1.225	1.201
7	1.210	1.156
6	1.195	1.181
5	1.155	1.171
4	1.091	1.097
3	0.966	0.974
2	0.732	0.732
1	0.197	0.361

TABLE IV

Comparison of 10 Highest Relative Radial Powers
Vermont Yankee Beginning of Cycle 18

Location	Process Computer	SIMULATE-3
27-18	1.318	1.309
29-20	1.262	1.278
25-16	1.273	1.291
25-18	1.302	1.277
27-20	1.300	1.272
23-20	1.285	1.269
25-22	1.282	1.268
27-12	1.222	1.231
27-16	1.253	1.243
29-18	1.244	1.238