VERMONT YANKEE
NUCLEAR POWER CORPORATION

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February 16, 2000
BVY 00-22

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

Subject: **Vermont Yankee Nuclear Power Station**
License No. DPR-28 (Docket No. 50-271)
Vermont Yankee Cycle 21 Start-up Test Report

The purpose of this letter is to submit the Vermont Yankee (VY) Cycle 21 Start-up Test Report in accordance with the requirements of section 6.7.A.1 of the VY Technical Requirements Manual.

We trust that the information provided is adequate; however, should you have questions or require additional information, please contact Mr. Jim DeVincentis at (802) 258-4236.

Sincerely,

VERMONT YANKEE NUCLEAR POWER CORPORATION

Gautam Sen
Gautam Sen
Licensing Manager

Attachment

cc: USNRC Region 1 Administrator
USNRC Resident Inspector – VYNPS
USNRC Project Manager – VYNPS
Vermont Department of Public Service

IE26

SUMMARY OF VERMONT YANKEE COMMITMENTS

BVY NO.: 00-22

The following table identifies commitments made in this document by Vermont Yankee. Any other actions discussed in the submittal represent intended or planned actions by Vermont Yankee. They are described to the NRC for the NRC's information and are not regulatory commitments. Please notify the Licensing Manager of any questions regarding this document or any associated commitments.

COMMITMENT	COMMITTED DATE OR "OUTAGE"
None	N/A

STARTUP TEST REPORT
VERMONT YANKEE CYCLE 21

Introduction:

Vermont Yankee Cycle 21 initial startup commenced on December 1, 1999 following a 34 day outage for refueling and maintenance activities.

The core loading for Cycle 21 consists of:

20 GE9B-P8DWB335-10GZ-80M-150-T reinserts from Cycle 18
8 GE9B-P8DWB335-11GZ-80M-150-T reinserts from Cycle 18
120 GE9B-P8DWB354-12GZ-80M-150-T reinserts from Cycle 19
72 GE13-P9HTB380-12GZ-100T-146-T reinserts from Cycle 20
40 GE13-P9HTB379-13GZ-100T-146-T reinserts from Cycle 20
24 GE13-P9HTB388-13GZ1-100T-146-T non-irradiated assemblies
84 GE13-P9HTB388-13GZ-100T-146-T non-irradiated assemblies

An as-loaded Cycle 21 core map is included as Figure 1. Details of the Cycle 21 core loading are contained in the GE Nuclear document J11-03546CMR, "Cycle Management Report for Vermont Yankee Nuclear Power Station, Cycle 21", October 1999.

The final as-loaded core loading was verified correct by Vermont Yankee personnel on November 19, 1999 in accordance with 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 re-verified to agree with the licensed core loading of Figure 1.

After independent review of core verification was completed, a strongest worth control rod subcritical check was performed on November 19, 1999 in accordance with OP1411.

Control rod coupling and withdrawal speed verification was satisfactorily completed for all 89 control rods on November 29, 1999

Startup commenced December 1, 1999 and steady state full power conditions were reached December 5, 1999.

Process Computer Data Checks:

Process computer data shuffling checks were completed on November 24, 1999. These checks included various manual and computer checks of the new data constants.

In-Sequence Critical:

The in-sequence critical test was performed on December 1, 1999 as part of the reactor startup. Control rod sequence 21-A-2(1) was used to perform the in-sequence critical test. Criticality was achieved on the 7th rod in group 2 (26-31) at notch position 16. The moderator temperature was 141°F.

The actual critical rod pattern and the prediction agreed within +/- 1% $\Delta k/k$.

Cold Shutdown Margin Testing:

The cold shutdown margin calculation was performed using data collected during the in-sequence critical and information provided in GE Nuclear document J11-03546CMR, "Cycle Management Report for Vermont Yankee Nuclear Power Station, Cycle 21", October 1999. The minimum shutdown margin required was 0.38% $\Delta k/k$. The actual shutdown margin was shown to be 1.12% $\Delta k/k$, as determined in accordance with OP4426.

Control Rod Scram Testing:

Single rod scram testing of all 89 control rods was completed on November 29, 1999. All insertion times were within the limits defined in the Vermont Yankee Technical Specifications. Results of the testing are presented in Table 1.

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 2.

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 three times using the traversing incore probe (TIP) system as part of the ascent to full power. The results of these updates are presented in Table 3.

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 November 29, 1999. The TIPs and the LPRMs were both functionally tested and found to operate satisfactorily. A total of 7 APRM gain adjustments were done as required during the startup from December 1 through December 5, 1999.

The process computer power distribution update performed after reaching steady state conditions on December 7, 1999 was used as a basis for comparison with an off line calculation performed using Duke Engineering & Services 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 4. A comparison was also performed between SIMULATE-3 and process computer peak radial powers. These values show reasonable agreement and are presented in Table 5.

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 6 Megawatts thermal).

A core flow calibration was completed on December 28, 1999 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 January 25, 2000. All three TIP system traces were reproducible to within 1.6%. A TIP intermachine calibration was successfully completed on February 3, 2000. A check of tip axial alignment was completed on January 26, 2000 and found to be acceptable.

The total TIP uncertainty was calculated using TIP set 1651. 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 1.00%. The results of the TIP uncertainty test as shown in Figure 2 are well below the 8.7% acceptance criteria.

TABLE 1
CONTROL ROD SCRAM TESTING RESULTS
VERMONT YANKEE BEGINNING OF CYCLE 21

Single Rod Scrams – November 27, 1999 through November 29 1999

Maximum 92.01% insertion time of rods measured (seconds) = 3.053
Tech. Spec. Limit for slowest 90% insertion time (seconds) = 7.000

Average time for % insertion	4.51%	25.34%	46.18%	87.84%
Measured time (sec)	0.283	0.801	1.337	2.457
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)	0.289	0.828	1.372	2.520
Tech. Spec. limit (sec)	0.379	0.967	1.556	2.848

TABLE 2
CONTROL ROD SCRAM TESTING RESULTS
VERMONT YANKEE CYCLE 20

Full Scram – June 9, 1998
Scram #188 – 73 rods

Maximum 92.01% insertion time of rods measured (seconds) = 3.169
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) – 73 rods	0.282	0.796	1.318	2.443
Measured time (sec) – all rods	0.281	0.796	1.321	2.443
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)	0.288	0.813	1.345	2.502
Tech. Spec. limit (sec)	0.379	0.967	1.556	2.848

Single Rod Scrams - January 6, 1999
Scram #189 – 46 rods

Maximum 92.01% insertion time of rods measured (seconds) = 2.950
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) – 46 rods	0.285	0.806	1.338	2.470
Measured time (sec) – all rods	0.282	0.799	1.327	2.449
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)	0.289	0.813	1.349	2.492
Tech. Spec. limit (sec)	0.379	0.967	1.556	2.848

Single Rod Scram - March 16, 1999
Scram #190 – 1 rod

Maximum 92.01% insertion time of rods measured (seconds) = 2.821
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) – all rods	0.289	0.800	1.328	2.452
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)	0.289	0.813	1.349	2.492
Tech. Spec. limit (sec)	0.379	0.967	1.556	2.848

Single Rod Scrams - May 25, 1999
Scram #191 – 45 rods

Maximum 92.01% insertion time of rods measured (seconds) = 2.876
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) – 45 rods	0.287	0.818	1.358	2.492
Measured time (sec) – all rods	0.282	0.803	1.334	2.455
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)	0.290	0.820	1.363	2.530
Tech. Spec. limit (sec)	0.379	0.967	1.556	2.848

TABLE 3

Vermont Yankee
Power Distribution Measurements
Cycle 21 Start-Up

Date	Time	Power(%)	Core Flow(%)	CMFLPD	MFLCPR	MAPRAT
12/3/99	22:05	76.8	69.9	0.714	0.791	0.763
12/4/99	01:18	74.6	70.4	0.682	0.770	0.754
12/7/99	15:19	100.0	97.9	0.797	0.850	0.931

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

TABLE 4

Core Average Axial Power Distributions
Comparison of Process Computer and SIMULATE-3
Vermont Yankee Beginning of Cycle 21

Node	SIMULATE-3	Process Computer
25	0.086	0.078
24	0.226	0.224
23	0.602	0.575
22	0.745	0.752
21	0.865	0.892
20	0.934	0.974
19	1.004	1.031
18	1.067	1.088
17	1.059	1.072
16	1.083	1.081
15	1.084	1.080
14	1.075	1.063
13	1.112	1.091
12	1.134	1.113
11	1.147	1.121
10	1.176	1.137
9	1.207	1.181
8	1.242	1.225
7	1.274	1.252
6	1.332	1.347
5	1.365	1.413
4	1.337	1.406
3	1.229	1.317
2	0.956	1.016
1	0.260	0.471

TABLE 5

Comparison of 10 Highest Relative Radial Powers
Vermont Yankee Beginning of Cycle 21

Location	Process Computer	SIMULATE-3
23-22	1.305	1.286
25-22	1.463	1.420
23-20	1.467	1.417
25-20	1.253	1.234
27-20	1.249	1.235
35-20	1.253	1.199
25-18	1.260	1.234
35-18	1.254	1.268
35-14	1.245	1.215
27-10	1.246	1.263

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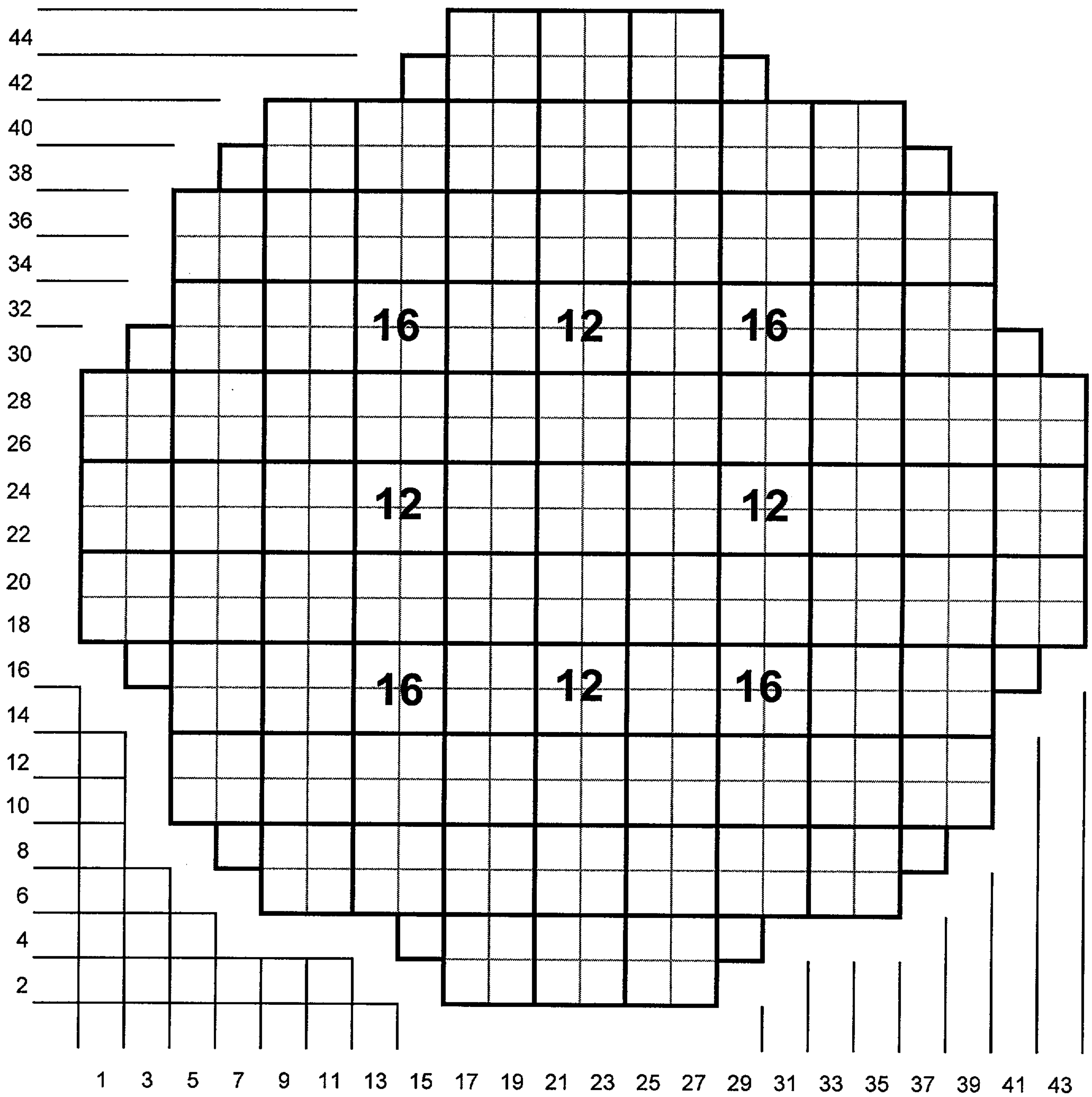
Cycle 21

Figure 1

	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43
44									YJA 039	YJA 017	YJF 529	YJF 517	YJA 013	YJA 040								
42								YJA 011	YJL 901	YJM 533	YJT 877	YJT 839	YJM 534	YJL 902	YJA 009							
40					YJF 458	YJA 088	YJF 450	YJL 921	YJM 529	YJT 889	YJM 517	YJM 518	YJT 851	YJM 530	YJL 922	YJF 477	YJA 046	YJF 446				
38				YJF 453	YJL 893	YJL 917	YJL 949	YJL 941	YJT 911	YJF 508	YJT 914	YJT 901	YJF 506	YJT 904	YJL 942	YJL 950	YJL 918	YJL 894	YJF 465			
36			YJF 499	YJL 937	YJT 856	YJF 489	YJM 513	YJT 820	YJM 509	YJT 823	YJF 420	YJF 471	YJT 853	YJM 510	YJT 860	YJM 514	YJF 478	YJT 824	YJL 938	YJF 496		
34			YJA 038	YJL 909	YJF 479	YJL 953	YJT 883	YJF 483	YJT 879	YJF 442	YJT 912	YJT 899	YJF 414	YJT 833	YJF 509	YJT 840	YJL 954	YJF 461	YJL 910	YJA 047		
32			YJF 498	YJL 957	YJM 525	YJT 817	YJF 440	YJT 810	YJF 473	YJL 889	YJF 416	YJF 432	YJL 890	YJF 475	YJT 891	YJF 486	YJT 857	YJM 526	YJL 958	YJF 497		
30		YJA 051	YJL 929	YJL 913	YJT 876	YJF 527	YJT 892	YJL 905	YJT 878	YJF 488	YJT 869	YJT 838	YJF 424	YJT 832	YJL 906	YJT 890	YJF 528	YJT 841	YJL 914	YJL 930	YJA 111	
28	YJF 494	YJL 925	YJM 505	YJT 896	YJM 537	YJT 809	YJF 484	YJT 816	YJF 502	YJT 815	YJF 516	YJF 493	YJT 858	YJF 501	YJT 852	YJF 520	YJT 854	YJM 538	YJT 907	YJM 506	YJL 926	YJF 481
26	YJA 036	YJM 501	YJT 884	YJF 460	YJT 870	YJF 429	YJL 897	YJF 521	YJT 875	YJF 455	YJL 945	YJL 946	YJF 435	YJT 831	YJF 522	YJL 898	YJF 430	YJT 829	YJF 425	YJT 834	YJM 502	YJA 070
24	YJF 437	YJT 818	YJM 521	YJT 893	YJF 469	YJT 895	YJF 427	YJT 819	YJF 463	YJL 933	YJF 531	YJF 500	YJL 934	YJF 447	YJT 859	YJF 485	YJT 908	YJF 418	YJT 906	YJM 522	YJT 861	YJF 474
22	YJF 448	YJT 836	YJM 523	YJT 902	YJF 417	YJT 903	YJF 436	YJT 835	YJF 451	YJL 935	YJF 532	YJF 467	YJL 936	YJF 480	YJT 871	YJF 421	YJT 916	YJF 470	YJT 913	YJM 524	YJT 861	YJF 438
20	YJA 033	YJM 503	YJT 849	YJF 426	YJT 868	YJF 413	YJL 899	YJF 523	YJT 864	YJF 439	YJL 947	YJL 948	YJF 456	YJT 826	YJF 524	YJL 900	YJF 431	YJT 811	YJF 476	YJT 822	YJM 504	YJA 082
18	YJF 512	YJL 927	YJM 507	YJT 900	YJM 539	YJT 848	YJF 519	YJT 837	YJF 503	YJT 846	YJF 515	YJF 495	YJT 882	YJF 504	YJT 880	YJF 468	YJT 873	YJM 540	YJT 915	YJM 508	YJL 928	YJF 482
16		YJA 086	YJL 931	YJL 915	YJT 862	YJF 526	YJT 850	YJL 907	YJT 867	YJF 428	YJT 866	YJT 828	YJF 423	YJT 812	YJL 908	YJT 814	YJF 525	YJT 827	YJL 916	YJL 932	YJA 116	
14			YJF 513	YJL 959	YJM 527	YJT 843	YJF 487	YJT 830	YJF 433	YJL 891	YJF 415	YJF 444	YJL 892	YJF 434	YJT 874	YJF 422	YJT 886	YJM 528	YJL 960	YJF 514		
12			YJA 112	YJL 911	YJF 457	YJL 955	YJT 863	YJF 511	YJT 855	YJF 441	YJT 905	YJT 894	YJF 443	YJT 813	YJF 510	YJT 825	YJL 956	YJF 492	YJL 912	YJA 037		
10			YJF 452	YJL 939	YJT 888	YJF 462	YJM 515	YJT 844	YJM 511	YJT 847	YJF 419	YJF 472	YJT 872	YJM 512	YJT 887	YJM 516	YJF 491	YJT 842	YJL 940	YJF 464		
8				YJF 466	YJL 895	YJL 919	YJL 951	YJL 943	YJT 910	YJF 507	YJT 909	YJT 898	YJF 505	YJT 897	YJL 944	YJL 952	YJL 920	YJL 896	YJF 454			
6					YJF 445	YJA 059	YJF 490	YJL 923	YJM 531	YJT 845	YJM 519	YJM 520	YJT 885	YJM 532	YJL 924	YJF 449	YJA 045	YJF 459				
4								YJA 010	YJL 903	YJM 535	YJT 865	YJT 821	YJM 536	YJL 904	YJA 004							
2									YJA 060	YJA 019	YJF 518	YJF 530	YJA 014	YJA 048								

Figure 2
Vermont Yankee
Cycle 21 Startup Total TIP Uncertainty



TIP #1651 Date: 7-Dec-1999
CTP = 99.0% WT = 97.9%
Uncertainty: 1.00%