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AUG 17 1992

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SUSQUEHANNA STEAM ELECTRIC STATION
UNIT 1 CYCLE 7 STARTUP REPORT
PLA-3833 FILE R41-2A **Docket No. 50-387**

Dear Mr. Martin:

Attached is a copy of the Susquehanna SES Unit 1 Cycle 7 Startup Report, which is being submitted to you in accordance with Technical Specifications 6.9.1.1 through 6.9.1.3. This report addresses those startup tests described in our reload application dated December 11, 1991.

Very truly yours,

H. W. Keiser

Attachment

cc: NRC Document Control Desk (original)
Mr. G. S. Barber - NRC Sr. Resident Inspector, SSES
Mr. J. J. Raleigh - NRC Project Manager, OWFN

IE26
11

SUSQUEHANNA SES UNIT 1 CYCLE 7

<u>STARTUP TEST SUMMARY</u>

Prepared by: Paul Moran

Approved by: J R Dorsey

Approved by: R G Paltucha
Manager Nuclear Operations

ABSTRACT

Susquehanna Unit 1
Cycle 7
Startup Test Summary

Susquehanna Unit 1 resumed commercial operation for Cycle 7 on May 17, 1992 following a 71 day refueling and maintenance outage. The Unit 1 Cycle 7 (hereafter referred to as S1C7) reload included:

88 ANF 9 x 9	thrice burned
228 ANF 9 x 9	twice burned
220 ANF 9 x 9	once burned
228 ANF 9 x 9	unirradiated fuel assemblies

The following startup tests, identified in the S1C7 Reload Licensing Submittal, are discussed in this report:

1. Core Loading Verification
2. POWERPLEX Input Deck Validation
3. Control Rod Functional (Insert and Withdrawal Checks)
4. Subcritical Shutdown Margin Demonstration
5. In-Sequence Critical and Shutdown Margin Demonstration
6. Control Rod Scram Time Testing
7. Tip Asymmetry

In addition, the startup program included core flow and LPRM calibrations, thermal limits monitoring and baseline recirculation data acquisition. A summary of these activities is also included in this report.

Susquehanna Unit 1
Cycle 7
Startup Test No. 1
Core Verification and Audit

Purpose

The purpose of this test is to visually verify that the core is loaded per the analyzed designs.

Criteria

Upon completion of core alterations during the refueling outage, the core must be verified to conform with the reference core design used in the various licensing analyses. The verifications to be performed include fuel bundle location, fuel bundle orientation, and proper seating of the fuel bundles within the core. The verifications will be performed by the Reactor Engineering Group utilizing an underwater television camera. The verification will be videotaped so that an independent verification may be performed. Any discrepancies discovered in the loading will be promptly corrected and the affected bundles shall be reverified prior to unit startup.

Results

Susquehanna took the following precautions to prevent a misloaded fuel bundle. During the total core offload, bundles to be used next cycle were placed in the pool in the order in which they were to be reloaded. This facilitated an orderly stripping of bundles during the reload. After the offload was complete, a serial number verification of these bundles was performed (4/2/92) prior to reload. The core reload was performed in three parts. First, the irradiated bundles were loaded and a partial core verification serial number, location, orientation and height check was performed on 4/18/92. Second, the first batch of new fuel, 72 bundles (3.40 wt % U-235, 10 GD5), was loaded and a location check was performed (4/19/92) before the remaining cells could have control rod functionals performed. Third, the remaining new fuel, 156 bundles (3.40 wt %, 9 GD4) was loaded.

The Cycle 7 final core verification consisted of two videotaped passes over the core. During the first pass, the fuel bundle serial numbers were recorded on the videotape to verify proper location. The second pass was performed to verify proper fuel assembly seating (assembly height check) and correct orientation.

The core tapes were independently verified to be correct by the Reactor Engineering Supervisor and a representative of Quality Control on 4/20/92. Therefore, the as-loaded core configuration is consistent with the core design Siemens Nuclear Power and PP&L used in the evaluation of the S1C7 Reload Licensing Analyses. The S1C7 core map is included as Figure 1.

FIGURE 1

SSES UNIT-1/CYCLE-7 FULL CORE LOADING PATTERN

APPROVED BY/DATE: [illegible] 3/11/92

PREPARED BY/DATE: [illegible] 3/16/92   REVIEWED BY/DATE: [illegible] 3/11/92   RECEIVED BY/DATE (SUPV REACT ENGRG): James [illegible] 3/25/92

CASE: 50   DATE STORED: 03/11/92   TITLE: SSES UNIT 1 CYCLE 7 FULL CORE LOADING PATTERN

GE-Y/GE-X:	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29
60									X13587	X13600	X13579	X13491	X13597	X13559	X13601
58								X13512	A15973	A15957	A15965	A15062	A15969	A15054	A15018
56						X13538	X13560	A15046	A16330	A14805	A16326	A14788	S16322	A14760	A16318
54						X13580	A15042	A16314	A15030	A16402	A15150	A16310	A15090	A16306	A14772
52					A14755	A15961	A16302	A15993	A15170	A14779	A16298	A14789	A16398	A14738	A16294
50			X13577	X13504	A15022	A15066	A14787	A16394	A14782	A16290	A14769	A15158	A14806	A16286	A14836
48			X13540	A15026	A16282	A14763	A15977	A14771	A16278	A15078	A16274	A14730	A16270	A15166	A16390
46		X13498	A15014	A16266	A15981	A16386	A14770	A15146	A14791	A16382	A14747	A16262	A15134	A14825	A14790
44	X13528	A15997	A16258	A15989	A15154	A14780	A16254	A14826	A15070	A14815	A16378	A15142	A16374	A15102	A16250
42	X13495	A15010	A14748	A16370	A14729	A16246	A15122	A16366	A14808	A16242	A14732	A16238	A14761	A16234	A14773
40	X13525	A15038	A16230	A15094	A16226	A14745	A16222	A14816	A16362	A14754	A15074	A14762	A15985	A14837	A15162
38	X13509	A15006	A14740	A16218	A14753	A15110	A14797	A16214	A15130	A16210	A14817	A16358	A15082	A16354	A14824
36	X13511	A15050	A16206	A15114	A16350	A14799	A16202	A15174	A16346	A14800	A15058	A15126	A14838	A14759	A15106
34	X13527	A15002	A14807	A16198	A14731	A16194	A15086	A14781	A15118	A16190	A14823	A16342	A14798	A16338	A14746
32	X13567	A15034	A16186	A14737	A16182	A14835	A16334	A14818	A16178	A14828	A15098	A14739	A15138	A14827	A14809
30	X13643	A15037	A16189	A14941	A16185	A14843	A16337	A14866	A16181	A14856	A15101	A14943	A15141	A14855	A14875
28	X13683	A15005	A14873	A16201	A14951	A16197	A15089	A14901	A15121	A16193	A14851	A16345	A14882	A16341	A14934
26	X13701	A15053	A16209	A15117	A16353	A14883	A16205	A15177	A16349	A14884	A15061	A15129	A14846	A14917	A15109
24	X13699	A15009	A14944	A16221	A14927	A15113	A14881	A16217	A15133	A16213	A14865	A16361	A15085	A16357	A14852
22	X13681	A15041	A16233	A15097	A16229	A14933	A16225	A14864	A16365	A14928	A15077	A14920	A15988	A14845	A15165
20	X13715	A15013	A14936	A16373	A14949	A16249	A15125	A16369	A14874	A16245	A14952	A16241	A14919	A16237	A14911
18	X13684	A15001	A16261	A15992	A15157	A14900	A16257	A14854	A15073	A14863	A16381	A15145	A16377	A15105	A16253
16		X13718	A15017	A16269	A15984	A16389	A14908	A15149	A14893	A16385	A14935	A16265	A15137	A14853	A14892
14			X13676	A15029	A16285	A14921	A15980	A14909	A16281	A15081	A16277	A14950	A16273	A15169	A16393
12			X13633	X13710	A15025	A15069	A14889	A16397	A14902	A16293	A14907	A15161	A14872	A16289	A14844
10					A14929	A15964	A16305	A15996	A15173	A14899	A16301	A14891	A16401	A14942	A16297
8						X13636	A15045	A16317	A15033	A16405	A15153	A16313	A15093	A16309	A14910
6						X13674	X13656	A15049	A16333	A14871	A16329	A14890	A16325	A14918	A16321
4								X13702	A15976	A15960	A15968	A15065	A15972	A15057	A15021
2									X13623	X13612	X13635	X13725	X13609	X13655	X13613

FIGURE 1 (continued)

** PENNSYLVANIA POWER & LIGHT - NUCLEAR FUELS & SYSTEMS ENGINEERING RUN #92-1664 PAGE 7. **
** CLASP - CORE LOADING AND SHUFFLE PROGRAM 03/11/92 **

SSES UNIT-1/CYCLE-7 FULL CORE LOADING PATTERN

APPROVED BY/DATE: [illegible] 3/19/92

PREPARED BY/DATE: [illegible] 3/16/92 REVIEWED BY/DATE: John P. [illegible] 3/19/92

RECEIVED BY/DATE (SUPV REACT ENGRG): [illegible] 3/25/92

CASE: 50 DATE STORED: 03/11/92 TITLE: SSES UNIT 1 CYCLE 7 FULL CORE LOADING PATTERN

GE-Y/GE-X:	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59
60	X13604	X13562	X13608	X13492	X13582	X13605	X13594								
58	A15019	A15055	A15970	A15063	A15966	A15958	A15974	X13515							
56	A16319	A14767	A16323	A14795	A16327	A14814	A16331	A15047	X13561	X13543					
54	A14775	A16307	A15091	A16311	A15151	A16403	A15031	A16315	A15043	X13581					
52	A16295	A14743	A16399	A14794	A16299	A14786	A15171	A15994	A16303	A15962	A14756				
50	A14841	A16287	A14813	A15159	A14778	A16291	A14783	A16395	A14796	A15067	A15023	X13507	X13584		
48	A16391	A15167	A16271	A14735	A16275	A15079	A16279	A14776	A15978	A14764	A16283	A15027	X13541		
46	A14793	A14832	A15135	A16263	A14750	A16383	A14792	A15147	A14777	A16387	A15982	A16267	A15015	X13499	
44	A16251	A15103	A16375	A15143	A16379	A14822	A15071	A14831	A16255	A14785	A15155	A15990	A16259	A15998	X13533
42	A14774	A16235	A14766	A16239	A14733	A16243	A14811	A16367	A15123	A16247	A14736	A16371	A14749	A15011	X13502
40	A15163	A14840	A15986	A14765	A15075	A14757	A16363	A14821	A16223	A14752	A16227	A15095	A16231	A15039	X13536
38	A14833	A16355	A15083	A16359	A14820	A16211	A15131	A16215	A14804	A15111	A14758	A16219	A14741	A15007	X13518
36	A15107	A14768	A14839	A15127	A15059	A14801	A16347	A15175	A16203	A14802	A16351	A15115	A16207	A15051	X13516
34	A14751	A16339	A14803	A16343	A14834	A16191	A15119	A14784	A15087	A16195	A14734	A16199	A14812	A15003	X13534
32	A14810	A14830	A15139	A14742	A15099	A14829	A16179	A14819	A16335	A14842	A16183	A14744	A16187	A15035	X13574
30	A14876	A14858	A15140	A14946	A15100	A14857	A16180	A14867	A16336	A14850	A16184	A14948	A16188	A15036	X13650
28	A14939	A16340	A14887	A16344	A14862	A16192	A15120	A14904	A15088	A16196	A14954	A16200	A14878	A15004	X13690
26	A15108	A14926	A14847	A15128	A15060	A14885	A16348	A15176	A16204	A14886	A16352	A15116	A16208	A15052	X13706
24	A14861	A16356	A15084	A16360	A14868	A16212	A15132	A16216	A14888	A15112	A14932	A16220	A14945	A15008	X13708
22	A15164	A14848	A15987	A14923	A15076	A14931	A16364	A14869	A16224	A14940	A16228	A15096	A16232	A15040	X13692
20	A14912	A16236	A14924	A16240	A14953	A16244	A14877	A16368	A15124	A16248	A14956	A16372	A14937	A15012	X13722
18	A16252	A15104	A16376	A15144	A16380	A14870	A15072	A14859	A16256	A14905	A15156	A15991	A16260	A15999	X13689
16	A14895	A14860	A15136	A16264	A14938	A16384	A14894	A15148	A14915	A16388	A15983	A16268	A15016	X13719	
14	A16392	A15168	A16272	A14955	A16276	A15080	A16280	A14914	A15979	A14922	A16284	A15028	X13677		
12	A14849	A16288	A14879	A15160	A14916	A16292	A14903	A16396	A14898	A15068	A15024	X13713	X13640		
10	A16296	A14947	A16400	A14896	A16300	A14906	A15172	A15995	A16304	A15963	A14930				
8	A14913	A16308	A15092	A16312	A15152	A16404	A15032	A16316	A15044	X13637					
6	A16320	A14925	A16324	A14897	A16328	A14880	A16332	A15048	X13657	X13679					
4	A15020	A15056	A15971	A15064	A15967	A15959	A15975	X13705							
2	X13616	X13658	X13620	X13726	X13638	X13617	X13630								

Susquehanna Unit 1
Cycle 7
Startup Test No. 2
POWERPLEX Input Deck Validation

Purpose

To ensure the POWERPLEX input deck is updated correctly before the start of every new fuel cycle.

Criteria

POWERPLEX is the Siemens (formerly ANF) software system designed to perform in-core monitoring of BWR cores. Core monitoring is performed by the module, XTGBWR, a three-dimensional reactor simulator code which calculates bundle nodal powers. The POWERPLEX input deck consists of all constants needed for the execution of this code and subsequent calculation of the margin to thermal limits. These constants must be updated prior to the start of every new fuel cycle in order to ensure satisfactory core monitoring of the new core configuration. The deck is updated and validated by members of the Reactor Engineering Group at Susquehanna.

Results

The POWERPLEX input deck was completely reviewed, all comments resolved, verified to be correct and successfully loaded into the POWERPLEX system prior to S1C7 startup.

Susquehanna Unit 1
Cycle 7
Startup Test No. 3
Control Rod Functional (Insert and Withdrawal Checks)

Purpose

The purpose of this startup test is to assure proper control rod function and demonstrate that criticality will not occur due to the withdrawal of a single rod.

Criteria

Control Rod Functionals include mobility, overtravel and subcritical checks. These may be performed as each control cell is loaded in its final configuration.

Each control rod will be cycled individually to ensure mobility. As each rod is fully withdrawn, it will be checked for overtravel by continually applying a withdrawal signal. Subcriticality will also be verified with the rod withdrawn.

Results

Due to Shutdown Margin considerations, no control rod functionals were allowed on fully loaded control cells until the partial core verification was completed. No control rods overtraveled and subcriticality was maintained as each rod was individually fully withdrawn and reinserted.

Susquehanna Unit 1
Cycle 7
Startup Test No. 4
Subcritical Shutdown Margin Demonstration

Purpose

The purpose of this startup test is to assure at least the minimum required shutdown margin exists with the strongest worth control rod fully withdrawn.

Criteria

The minimum required shutdown margin at BOC for Susquehanna Unit 1 Cycle 7 is 0.38% Δ K/K. This test will verify at least this amount by performance of a subcritical shutdown margin demonstration. The highest (strongest) worth control rod is fully withdrawn, then a diagonally adjacent rod is slowly notched out verifying subcriticality at each step until the analytically determined reactivity worth of the control rods at their respective notch position equals or slightly exceeds the required amount of SDM.

Results

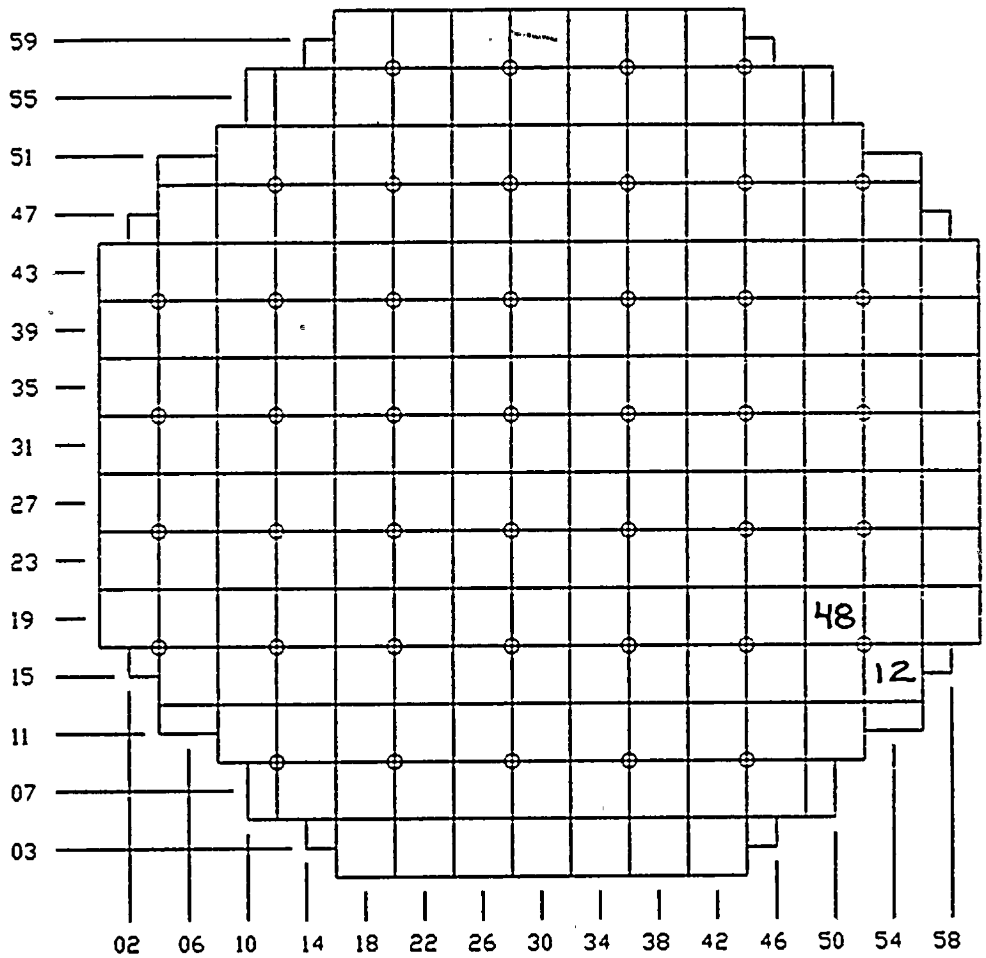
The reactor remained subcritical with the highest worth control rod fully withdrawn and an additional diagonally adjacent rod pulled to a notch position with a calculated worth of 1.293% Δ K/K. The required shutdown margin to be demonstrated was calculated to be 0.5312% Δ K/K. This is 0.38% Δ K/K plus a correction factor for the recirculation loop (moderator) temperature (104 degrees F) at the time of the test. Using data supplied by Nuclear Fuels Engineering it was determined that the following rods pulled to the indicated position would demonstrate a shutdown margin of 1.1418% Δ K/K.

ROD	POSITION	TOTAL WORTH % Δ K/K
50-19*	48	--
54-15	12	1.293

*analytically determined strongest rod.

As rods were pulled, subcritiality was verified after each notch. Subcriticality was also verified with the rods at the above indicated positions, thus satisfying the purpose of this startup test. Figure 2 is a core map showing the test rod positions.

FIGURE 2. CORE MAP SHOWING TEST ROD POSITIONS FOR SUBCRITICAL SHUTDOWN MARGIN DEMONSTRATION



BLANKS INDICATE RODS AT 00.

Susquehanna Unit 1
Cycle 7
Startup Test No. 5
In-Sequence Critical and SDM Determination

Purpose

The purpose of this startup test is to calculate the actual shutdown margin of the cycle 7 core and to demonstrate that no reactivity anomaly exists.

Criteria

1) Shutdown Margin

Technical Specification 3.1.1 requires an adequate shutdown margin to ensure the reactor can be made subcritical from all operating conditions. This value, .38% Δ K/K has been determined to be the minimum required SDM to bring a reactor subcritical under the worst case conditions - a cold, xenon-free core at the most reactive point in the cycle with the highest worth control rod unavailable for reactivity control. At beginning of cycle, the required SDM value must be increased by a factor, R, if it is determined that core shutdown margin is less at a point in the cycle other than the initial shutdown margin (for Cycle 7, R = 0% Δ K/K). The required beginning-of-cycle SDM for Susquehanna Unit 1 Cycle 7 is 0.38% Δ K/K; the actual SDM will be calculated from data obtained during the initial startup criticality.

2) Reactivity Anomaly

Core reactivity is monitored to prevent excessive reactivity additions due to unforeseen reactivity changes or reactivity anomalies. At BOC, a 1% Δ K/K difference between predicted and actual critical control rod positions might indicate improper core loading or a computer code that is unreliable. Data gathered during the in-sequence critical, specifically the Keff at the notch position of the control rod at which criticality occurs, is compared to predicted critical control rod position Keff and a % reactivity difference is calculated.

Results

The calculated SDM was 1.7455% Δ K/K and the difference between actual Keff and predicted Keff at criticality was 0.0937% Δ K/K.

Control rods were withdrawn in the B sequence until the reactor was on a stable, positive period. The notch position at which criticality occurred was rod 22-47, notch 20, step 36. A special log was initiated to record SRM count rates and recirculation loop temperatures. The average period was 152.2 seconds and the average loop temperature 134.7 degrees F which yield period and temperature corrections of $.393 \times 10^{-3}$ Δ K/K and 2.56×10^{-3} Δ K/K, respectively.

1) Shutdown Margin

The equation used to calculate SDM

$$SDM = \frac{Kcrit - Ksro}{Kcrit * Ksro} - \Delta p \text{ (period)} - \Delta p \text{ (temp)}$$

Kcrit is Keff at the actual critical control rod position (1.00390) and Ksro is Keff predicted with the strongest rod out (0.98375).

The minimum required SDM for Unit 1 Cycle 7 at beginning of cycle was 0.38% Δ K/K; the calculated shutdown margin based on this test was 1.7455% Δ K/K, thus satisfying the acceptance criteria.

2) Reactivity Anomaly

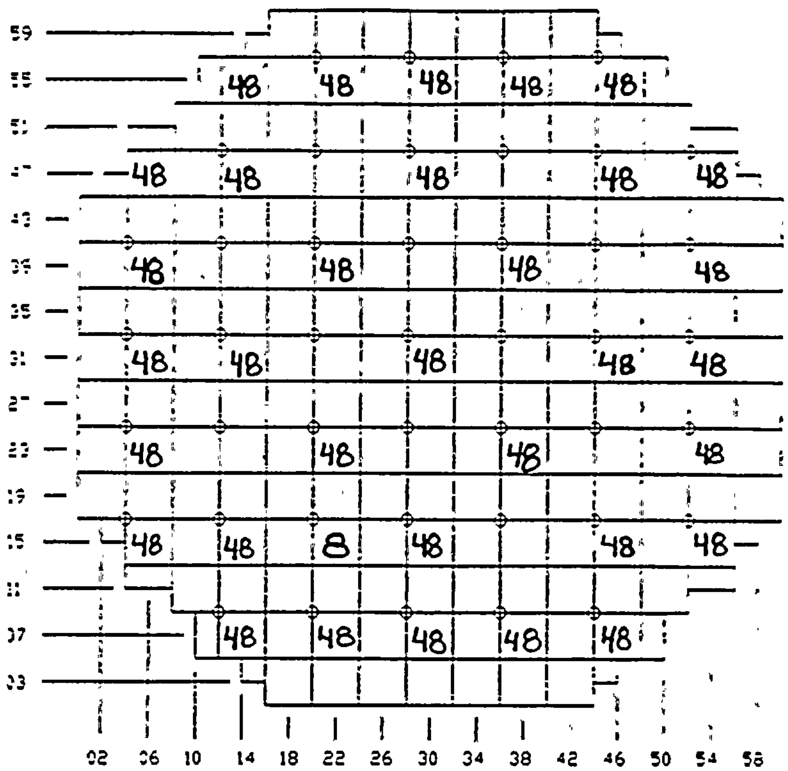
The reactor went critical at step 36 with Kcrit of 1.00390. The equation used to calculate reactivity difference was

$$\text{Reactivity difference} = \frac{Kcrit - 1}{Kcrit} - \Delta p \text{ (period)} - \Delta p \text{ (temp)}$$

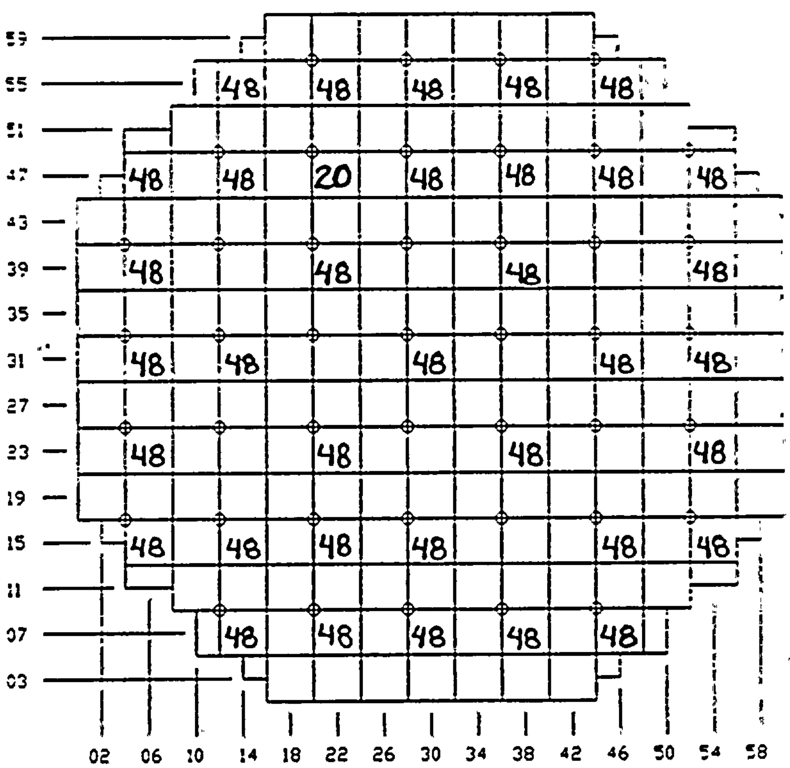
The calculated reactivity difference was 0.0937% Δ K/K. This satisfies ± 1% Δ K/K acceptance criteria.

A comparison of the predicted versus actual critical control rod patterns is included as Figure 3.

FIGURE 3. COMPARISON OF PREDICTED VS ACTUAL CRITICAL ROD PATTERNS



PREDICTED CRITICAL PATTERN



ACTUAL CRITICAL PATTERN

BLANKS INDICATE RODS AT 00

Susquehanna Unit 1
Cycle 7
Startup Test No. 6
Control Rod Scram Time Testing

Purpose

To demonstrate the maximum scram insertion times of all rods following core alterations.

Criteria

Susquehanna Technical Specification 4.1.3.2 states that scram insertion times of all control rods shall be demonstrated through measurement with reactor coolant pressure greater than 950 psig prior to exceeding 40% thermal power after core alterations. For Unit 1 cycle 7 approximately one-half of all control rod scram times were to be determined by performing a black-and-white scram from the B sequence and using GETARS scram data. The remaining rods were to be individually scram time tested.

Results

Control rod scram times for 96 rods were obtained through GETARS from the black-and-white scram performed 5/14/92 (B sequence). The remaining rods were individually scram timed on 5/18/92. All scram times were within the acceptance criteria, as shown in Table 1.

	ROD	ROD POSITION	TIME AS FOUND	T.S. LIMIT
MAXIMUM INDIVIDUAL ROD SCRAM INSERTION TIME T.S. 3.1.3.2	22-27	5	6.23	7.0
AVERAGE SCRAM INSERTION TIME OF OPERABLE RODS T.S. 3.1.3.3		45 39 25 05	0.30 0.60 1.32 2.41	0.43 0.86 1.93 3.49
AVERAGE SCRAM INSERTION TIME OF SLOWEST 2x2 ARRAY T.S. 3.1.3.4		45 39 25 05	0.31 0.65 1.42 2.61	0.45 0.92 2.05 3.70

TABLE 1: Results of Scram Time Testing of All Control Rods S1C7.

Susquehanna Unit 1
Cycle 7
Startup Test No. 7
TIP Asymmetry

Purpose

The purpose of this test is to check core symmetry by performing a statistical uncertainty analysis on the Traversing In-Core Probe (TIP) System. Also, by the performance of this test, the proper operation of the TIP system will be assured.

Criteria

The X^2 test of significance will be performed with the significance level fixed at 1%. The test will be performed utilizing an octant symmetric rod pattern at a power level greater than 75% of rated power. The startup test criteria for symmetric TIP differences is that the X^2 value calculated shall be less than the critical X^2 value. Since Susquehanna has 19 symmetric TIP pairs, the calculated X^2 value must be less than a critical X^2 value of 36.19 (as determined by Siemens). If the calculated X^2 value exceeds the critical value, the instrumentation and data processing system should be reviewed for any problems which may contribute to abnormal TIP asymmetries. A second determination of X^2 should be then made. If the new measured value of X^2 exceeds the critical value, the fuel vendor shall be consulted and appropriate action taken to assure that a larger than anticipated TIP asymmetry does not adversely affect the safe operation of the reactor.

Results

A complete set of TIP data was obtained at the completion of Susquehanna Unit 1 BOC7 Startup Testing Program at rated thermal power. The nodal TIP values (Nodes 3 through 22) were summed up for each symmetric TIP pair using equation 5.1 with the results summarized in Table 2. Using Equations 5.2 and 5.3, the variance and X^2 were calculated to be 4.15 and 2.19 respectively. The X^2 value of 2.19 is well within the 36.19 limit established by Siemens (Formerly ANF).

Table 1
Absolute Relative Difference

Symmetric TIP Pair	Absolute Relative Difference dm
1	.21
2	-1.90
3	-2.96
4	- .55
5	-3.72
6	-2.90
7	-2.37
8	- .98
9	3.69
10	-5.94
11	3.24
12	- .95
13	1.18
14	-1.04
15	4.50
16	4.95
17	.48
18	.38
19	2.87

Equation 5.1

$$dm = \frac{100\ (Tm1 - Tm2)}{\frac{Tm1 + Tm2}{2}}$$

Note: $Tm1 = \sum_{K=3}^{22} T(k)$ for TIP1 and $Tm2 = \sum_{K=3}^{22} t(k)$ for TIP2

where TIP1 and TIP2 are symmetric TIP pairs

Equation 5.2 (Variance)

$$S^2 TIPij = \frac{\sum_{M=1}^{19} dm^2}{38} = 4.15$$

Equation 5.3

$$X^2 = \frac{19\ S^2 TIPij}{36} = 2.19$$

Susquehanna Unit 1
Cycle 7
Startup Program Summary

The following is a short summary of additional Reactor Engineering activities performed during the Startup Testing Program.

Thermal Limit Monitoring

Thermal Limits were checked throughout the startup period through review of the POWERPLEX core monitoring program, MONITOR, output. At no time did thermal limits exceed Technical Specification limits.

TIP System - OD-1 Performance

A full set of TIPS was run at 38% power to update the core power distribution before the first core performance calculation, MONITOR, was initiated. Subsequent TIP sets were performed at 60% and 100% power in conjunction with two LPRM calibrations. The LPRM currents were updated and the LPRM GAFS found to be within the acceptable range.

Power Distribution Comparison with Offline Monitoring

Favorable results were obtained when actual core power distribution data was compared to SIMULATE-E/PPL core modelling code data. The SIMULATE-E/PPL code is used by the Nuclear Fuels core management engineer to predict power TIP response distributions throughout the cycle. This comparison is included as Figure 4.

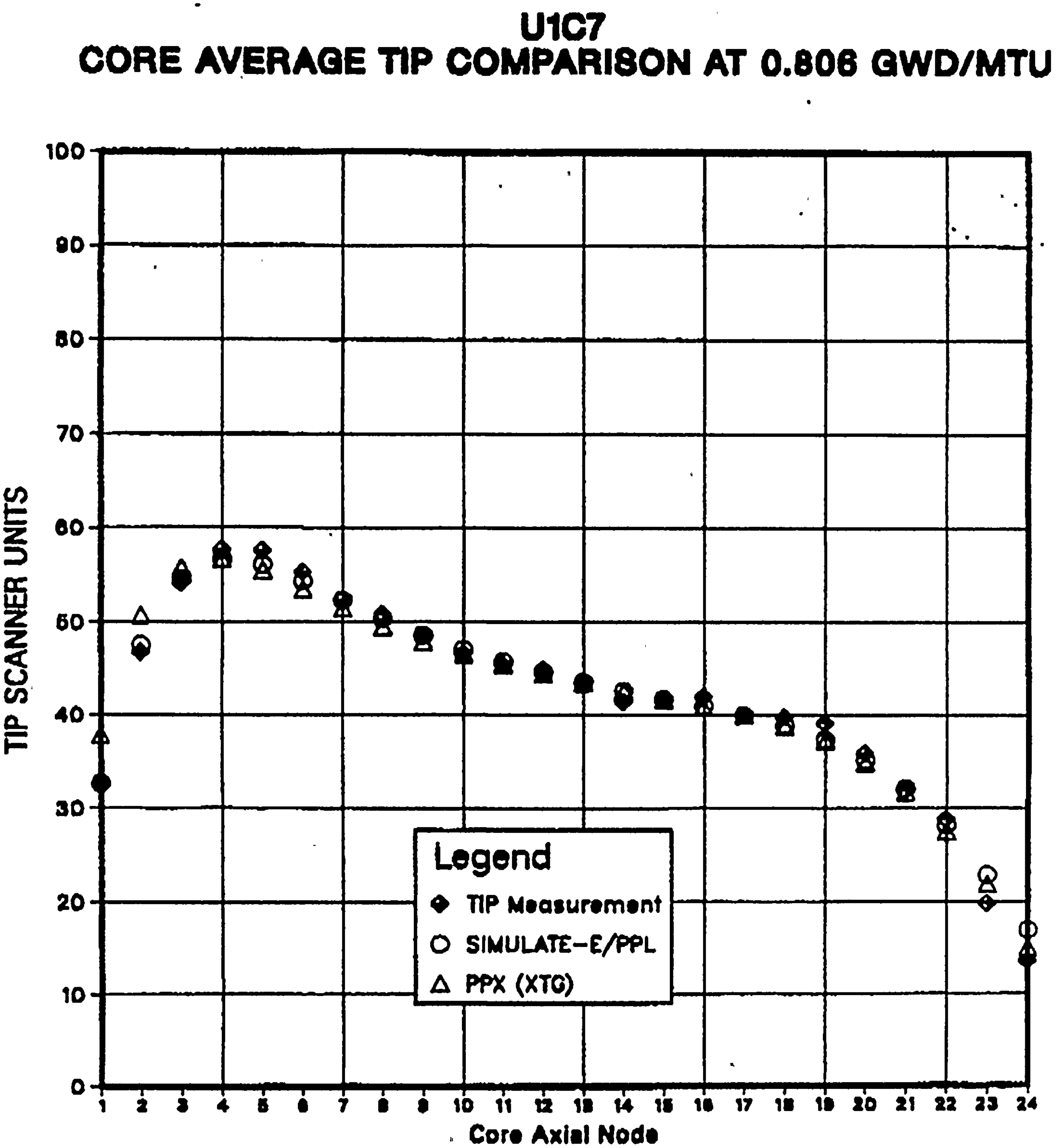
Core Flow Calibration

A core flow calibration was performed at 98.9% core flow. No adjustments to the jet pump and recirculation loop flow instrumentation were required.

Recirculation Loop Baseline Data Acquisition

Recirculation loop data was collected throughout the startup program to provide baseline data for plant performance monitoring in two loop and single loop operation. This data is used throughout the cycle during the performance of the Technical Specification Jet Pump Operability Surveillance.

FIGURE 4



U1C7
CORE AVERAGE TIP COMPARISON AT 0.806 GWD/MTU
TIP SCANNER UNITS
Core Axial Node
Legend
TIP Measurement
SIMULATE-E/PPL
PPX (XTG)
0
10
20
30
40
50
60
70
80
90
100
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24