The Light company
Houston Lighting & Power South Texas Project Electric Generating Station P. O. Box 289 Wadsworth, Texas 77483

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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498; STN 50-499
Response to NRC Bulletin 96-01 - Control Rod Insertion Problems

Attached is South Texas Project's response to the information requested by the Nuclear Regulatory Commission Bulletin 96-01 regarding control rod insertion problems. In addition, as requested in the bulletin, attached is a core map of rodded fuel assemblies with tables for both units indicating fuel type (materials, grids, spacers, guide tube inner diameter) and current and projected end of cycle burnup of each rodded assembly for the current cycle. (Attachment 3). The South Texas Project will submit similar core map information for Unit 1 for the next cycle once the core design has been finalized.

On March 2, 1996, the South Texas Project performed hot, full flow rod drop testing in Unit 1. In addition, hot, full flow rod drop testing was performed in Unit 2 on January 11, 1996. The results of the testing are provided in Attachments 4 and 5, respectively. The South Texas Project is currently supporting the ongoing root cause investigation, and taking remedial actions to limit rodded fuel assembly burnups in the next cycle's core design.

If you have any questions regarding this subject, please contact Mr. D. A. Leazar at (512) 972-7795 or me at (512) 972-8787.

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Vice President,
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JMP/nl

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Project Manager on Behalf of the Participants in the South Texas Project

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Attachments:
1. Affidavit
2. Response to Nuclear Regulatory Commission Bulletin 96-01
3. Core Map of Rodded Fuel Assemblies
4. Unit 1 March 2, 1996 Rod Drop Test Results
5. Unit 2 January 11, 1996 Rod Drop Test Results

c:

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AFFIDAVIT

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
Houston Lighting & Power	)	Docket Nos. 50-498
Company, et al.,	)	50-499
	)	
South Texas Project	)	
Units 1 and 2	)	

AFFIDAVIT

I, T. H. Cloninger, being duly sworn, hereby depose and say that I am Vice President, Nuclear Engineering, of Houston Lighting & Power Company; that I am duly authorized to sign and file with the Nuclear Regulatory Commission the attached response to Nuclear Regulatory Commission Bulletin 96-01; that I am familiar with the content thereof; and that the matters set forth therein are true and correct to the best of my knowledge and belief.

T. H. Cloninger
Vice President,
Nuclear Engineering

STATE OF TEXAS)
)
)

Subscribed and sworn to before me, a Notary Public in and for the State of Texas, this 4th day of April, 1996.

EUNICE I. SARGENT
Notary Public, State of Texas
My Commission Expires 10/13/98

Eunice I. Sargent
Notary Public in and for the
State of Texas

Response to Nuclear Regulatory Commission Bulletin 96-01

To ensure that the required shutdown margin is maintained during a reactor trip, all licensees of Westinghouse-designed plants were requested to take the following actions:

(1) Promptly inform operators of recent events (reactor trips and testing) in which control rods did not fully insert and subsequently provide necessary training, including simulator drills, utilizing the required procedures for responding to an event in which the control rods do not fully insert upon reactor trip (e.g., boration of a pre-specified amount).

(2) Promptly determine the continued operability of control rods based on current information. As new information becomes available from plant rod drop tests and trips, licensees should consider this new information together with data already available from Wolf Creek, South Texas, North Anna, and other industry experience, and make a prompt determination of control rod operability.

(3) Measure and evaluate at each outage of sufficient duration during calendar year 1996 (end of cycle, maintenance, etc.), the control rod drop times and rod recoil data for all control rods. If appropriate plant conditions exist where the vessel head is removed, measure and evaluate drag forces for all rodded fuel assemblies.

   a. Rods failing to meet the rod drop time in the technical specifications shall be deemed inoperable.

   b. Rods failing to bottom or exhibiting high drag forces shall require prompt corrective action in accordance with Appendix B to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR Part 50).

(4) For each reactor trip during calendar year 1996, verify that all control rods have promptly fully inserted (bottomed) and obtain other available information to assess the operability and any performance trend of the rods. In the event that all rods do not fully insert promptly, conduct tests to measure and evaluate rod drop times and rod recoil.

Pursuant to Section 182a, the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f), all licensees of Westinghouse-designed plants must submit the following written information:

(1) Within 30 days of the date of this bulletin, a report certifying that control rods are determined to be operable; actions taken for Requested Actions (1) and (2) above; and the plans for implementing Requested Action (3) and (4).

(2) Within 30 days of the date of this bulletin, a core map of rodded fuel assemblies indicating fuel type (materials, grids, spacers, guide tube inner diameter) and current and projected end of cycle burnup of each rodded assembly for the current cycle; when available, provide the same information for the next cycle.

(3) Within 30 days after completing Requested Action (3) for each outage, a report that summarizes the data and that documents the results obtained; this is also applicable to Requested Action (4) when any abnormal rod behavior is observed.

The South Texas Project provides the following response.

As stated in the bulletin, South Texas Project Unit 1 experienced incomplete control rod insertion during the December 18, 1995 reactor trip and subsequent rod drop time testing. A total of four control rods, located at core locations F10, C9, N7, and N9, stopped at 6 steps from rod bottom based on Digital Rod Position Indication. This event is documented in Unit 1 Licensee Event Report 95-013.

ITEM 1:

The following ensure that South Texas Project licensed operators have been made aware of the recent control rod insertion anomalies and appropriate training is provided:

- Training information regarding the lessons-learned from this event was issued to appropriate operations personnel.

- Guidance to licensed operators was issued to reinforce management's expectations regarding control rod insertion indication and Emergency Operating Procedure usage.

- Licensed Operator training will be provided by June, 1996 with a simulator drill scenario to emphasize the expected response to multiple incomplete rod insertions following a reactor trip (i.e., emergency boration).

ITEM 2:

Control rods exhibiting incomplete insertion in December, 1995 were all in high burnup fuel assemblies, approximately 44,000 MWD/MTU. Rod drop time testing did not indicate evidence of loose parts or any significant decrease in rod speed until dashpot entry. Rod drop times of the affected rods were consistent with startup testing performed in the spring of 1995 and well within Technical Specification requirements.

On March 2, 1996, South Texas Project Unit 1 was shut down to perform rod drop time testing on all 57 control rods. This was planned as part of the prior engineering assessment of the December 18, 1995 reactor trip. Approximately 2500 MWD/MTU cycle burnup had accumulated since the December trip. In addition to the original four affected control rods, three additional control rods did not fully insert; all seven control rods stopped at six steps from rod bottom. There was no significant degradation in any rod drop time to dashpot entry since the refueling outage in March, 1995 or from the December, 1995 testing. The maximum rod drop time was 1.62 seconds, and the average of all 57 rods was 1.58 seconds. Attachment 4 summarizes the test results.

In addition, on January 11, 1996, South Texas Project Unit 2 rod drop time testing was performed on all 57 control rods during a planned main generator repair outage. All rods fully inserted to rod bottom and dashpot entry times were consistent with Beginning of Cycle startup test results. Attachment 5 summarizes the test results.

A safety evaluation for this condition has determined that the affected rods are capable of performing their safety function for trip reactivity and shutdown margin through End of Cycle in Units 1 and 2. This safety evaluation conservatively assumes the following:

- All control rods could be stuck at 12 steps (Unit 1) and 9 steps (Unit 2) withdrawn , or sub-sets of these could be stuck at elevations corresponding to the tops of the first and second dashpots (38 and 20 steps withdrawn) as documented in South Texas Project Safety Evaluation #95-0103, Revision 1.

- The assumed sub-sets were selected based on control rods entering the highest burnup fuel assemblies.

- Rod drop testing showed that the rod drop time of 2.8 seconds required by Technical Specifications was met and had not degraded from Beginning of Cycle startup testing.

- The highest worth control rod is considered to be fully withdrawn.

Based on the above, the South Texas Project believes that the control rods for both units are capable of performing their intended safety functions and as such, are operable.

ITEM 3:

Currently, South Texas Project Unit 1 is scheduled to perform a refueling outage (1RE06) in May, 1996. The following are the planned actions regarding the control rod insertion anomalies:

- Unit 1 hot, full flow rod drop time testing of all 57 control rods at End of Cycle during the 1RE06 plant shutdown; rod recoil data will be taken as part of this testing.

- The Unit 1 fuel assemblies experiencing incomplete control rod insertion will be visually inspected during the 1RE06 outage.

- Testing of Unit 1 rodded fuel assemblies to support the South Texas Project and Westinghouse root cause investigation will be performed in the spent fuel pool as soon as practical following the 1RE06 outage. The test population will include those discharged rodded fuel assemblies experiencing incomplete control rod insertion and a representative number of non-affected assemblies. A test matrix will be developed to include drag force measurements of guide tubes, boroscopic examination of guide tubes, plug gauge measurements in guide tubes, and assembly axial growth measurements.

  The South Texas Project does not plan to test all currently rodded fuel assemblies since some of the currently rodded fuel assemblies will be reshuffled into the core for the next cycle. Thirty nine of the 57 rodded fuel assemblies are scheduled for discharge during 1RE06. These discharged assemblies will have a burnup range between approximately 31,000 to 50,000 MWD/MTU, and provide an adequate population for testing. The South Texas Project is planning to perform a rapid refueling operation during the upcoming 1RE06 outage. The design for South Texas Project rapid refueling operation requires that the control rods be locked in place, inside the reactor vessel head. Thus, when the reactor vessel head is removed, the control rods are also removed. This does not allow for in-vessel drag testing to be performed; however, similar drag testing using a reference control rod will be performed in the spent fuel pool as described above. These activities will support the root cause investigation. In addition, the Unit 1 Cycle 7 core loading pattern will limit rodded fuel assembly burnups to less than 40,000 MWD/MTU at End of Cycle which provides remedial action to support not testing the lower burnup rodded assemblies during 1RE06.

- Should an outage of sufficient duration occur in Unit 1 during the 1996 calendar year, or Unit 2 during the current fuel cycle, due to maintenance activities or similar activities, rod drop time testing and rod recoil data will be taken for all control rods when at least 1250 MWD/MTU cycle burnup has accumulated since the last rod drop time test performance.

- Any control rods failing to meet the rod drop times prescribed in the South Texas Project Technical Specifications shall be declared inoperable. Corrective action will be taken in response to rods failing to bottom or exhibiting high drag forces.

- Within 30 days after completing the evaluation of the results of the control rod insertion anomaly testing, a report that summarizes the data and documents the results will be submitted for each outage in which rod control testing is performed.

ITEM 4:

In response to Item 4, the South Texas Project will take the following actions:

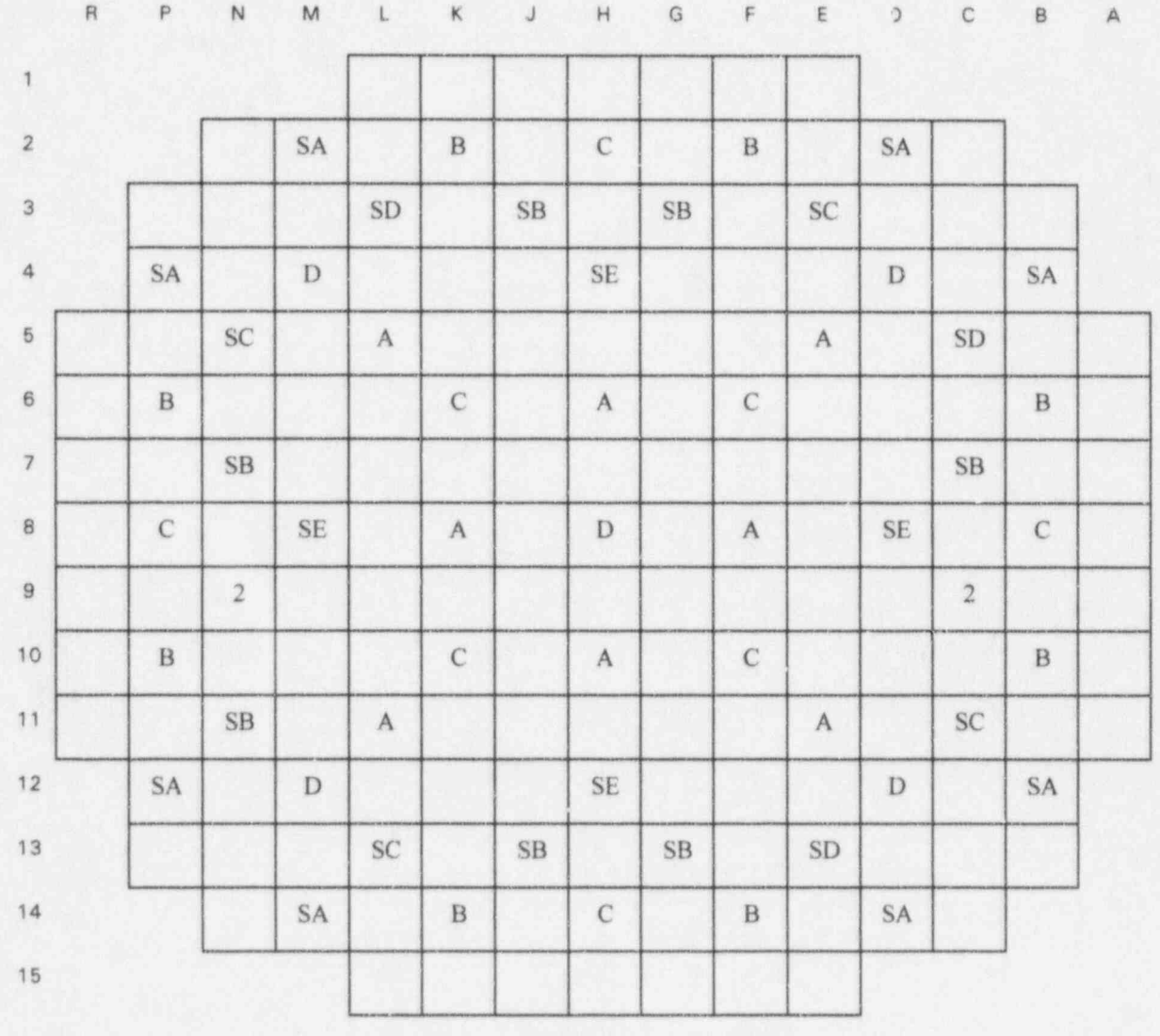
- For each reactor trip during calendar year 1996, the South Texas Project will verify that all control rods have promptly fully inserted (bottomed) and obtain other available information to assess the operability and any performance trend of the rods. In the event that all rods do not fully insert promptly, the South Texas Project will conduct tests to measure and evaluate rod drop times and rod recoil.

- Within 30 days after completing the evaluation of the test results, a report that summarizes the data and documents the results will be submitted for each reactor trip in the calendar year 1996 when abnormal rod behavior is observed.

SUMMARY:

The actions described above satisfy the requested actions documented in the Bulletin. The actions identified in this response ensure the proper dissemination of information regarding the control rod insertion problems, the operability of the control rods at the South Texas Project, and the appropriate testing is performed during upcoming 1996 outages and any 1996 reactor trips to ensure the identification and resolution of the control rod insertion problems experienced at the South Texas Project.

Core Map of Rodded Fuel Assemblies



SA - Shutdown Bank A
SB - Shutdown Bank B
SC - Shutdown Bank C
SD - Shutdown Bank D
SE - Shutdown Bank E

A - Control Bank A
B - Control Bank B
C - Control Bank C
D - Control Bank D

Unit 1 Cycle 6 Fuel Burnup Data (GWD/MTU)								
Core Loc	Fuel ID	B/U 4/1/96	B/U EOC		Core Loc	Fuel ID	B/U 4/1/96	B/U EOC
Cycle B/U →		12.4	14.0		Cycle B/U →		12.4	14.0
SA					A			
D-2	G21	25.0	26.3		E-5	E24	30.7	32.3
B-12	G04	25.0	26.3		E-11	E10	30.7	32.2
M-14	G13	25.3	26.6		L-11	E31	30.5	32.0
P-4	G11	25.0	26.3		L-5	C54	29.9	31.4
B-4	G03	25.3	26.6		H-6	F55	33.8	35.4
D-14	G09	24.5	25.8		F-8	F36	33.7	35.4
P-12	G34	25.0	26.3		H-10	F34	33.9	35.6
M-2	G28	24.7	26.1		K-8	F60	33.7	35.4
SB					B			
G-3	F32	47.2	48.6		F-2	H18	15.4	17.4
C-9	F59	47.4	48.8		B-10	H24	15.4	17.4
J-13	F62	47.1	48.6		K-14	H13	15.5	17.5
N-7	F64	47.1	48.5		P-6	H28	15.4	17.4
C-7	F47	47.1	48.6		B-6	H16	15.6	17.6
G-13	F21	46.9	48.4		F-14	H25	15.6	17.6
N-9	F25	46.9	48.4		P-10	H23	15.6	17.6
J-3	F43	47.3	48.7		K-2	H15	15.5	17.5
SC					C			
E-3	R30	41.9	43.4		H-2	G20	30.7	32.5
C-11	R32	42.2	43.7		B-8	G30	30.4	32.3
L-13	R28	41.7	43.2		H-14	G32	30.2	32.1
N-5	R34	41.8	43.3		P-8	G08	30.3	32.1
SD					F-6	F41	47.6	49.1
C-5	R27	41.7	43.2		F-10	F26	47.7	49.2
E-13	R26	42.2	43.7		K-10	F29	48.4	49.9
N-11	R35	42.1	43.6		K-6	F39	47.6	49.1
L-3	R31	41.6	43.1		D			
SE					D-4	F51	44.0	45.5
H-4	F37	45.1	46.6		M-12	F52	43.9	45.4
D-8	F53	44.4	45.9		D-12	F49	43.7	45.2
H-12	F42	44.1	45.5		M-4	F58	44.1	45.6
M-8	F50	43.6	45.1		H-8	C28	31.8	33.1

Unit 1 Cycle 6 Fuel Data (14 foot active fuel and 10 grids)	
"C", "R", "F", "G" Region Identifiers	"H" Region Identifier (V5H)
Inconel grids	Inconel top/bottom grids, zirconium mid grids
Zirconium guide tubes	Zirconium guide tubes
Stainless steel grid sleeves	Zirconium grid sleeves
Guide tube ID (above dashpot) = 0.450 inches	Guide tube ID (above dashpot) = 0.442 inches
Guide tube ID (dashpot) = 0.397 inches	Guide tube ID (dashpot) = 0.397 inches

Unit 2 Cycle 5 Fuel Burnup Data (GWD/MTU)								
Core Loc	Fuel ID	B/U 4/1/96	B/U EOC		Core Loc	Fuel ID	B/U 4/1/96	B/U EOC
Cycle B/U →		4.63	15.4		Cycle B/U →		4.63	15.4
SA					A			
D-2	S35	37.3	43.8		E-5	S19	28.6	39.8
B-12	S41	37.3	43.8		E-11	S12	28.6	39.8
M-14	S42	37.3	43.8		L-11	S05	28.6	39.8
P-4	S61	37.3	43.8		L-5	S06	28.6	39.8
B-4	S59	37.4	43.9		H-6	T53	27.3	39.3
D-14	S64	37.4	43.9		F-8	T55	27.3	39.3
P-12	S49	37.4	43.9		H-10	T56	27.3	39.3
M-2	S63	37.4	43.9		K-8	T54	27.3	39.3
SB					B			
G-3	T26	26.8	38.5		F-2	U40	5.6	18.7
C-9	T32	26.8	38.5		B-10	U37	5.6	18.7
J-13	T31	26.8	38.5		K-14	U44	5.6	18.7
N-7	T28	26.8	38.5		P-6	U41	5.6	18.7
C-7	T27	26.7	38.5		B-6	U42	5.6	18.7
G-13	T30	26.7	38.5		F-14	U39	5.6	18.7
N-9	T20	26.7	38.5		P-10	U43	5.6	18.7
J-3	T21	26.7	38.5		K-2	U38	5.6	18.7
SC					C			
E-3	U21	26.4	38.7		H-2	U17	19.2	31.3
C-11	U35	26.4	38.7		B-8	U19	19.2	31.3
L-13	U26	26.4	38.7		H-14	U16	19.2	31.3
N-5	U30	26.4	38.7		P-8	U15	19.2	31.3
SD					F-6	S21	28.5	39.2
C-5	U31	26.4	38.7		F-10	S15	28.5	39.2
E-13	U23	26.4	38.7		K-10	S23	28.5	39.2
N-11	U24	26.4	38.7		K-6	S22	28.5	39.2
L-3	U33	26.4	38.7		D			
SE					D-4	S70	38.2	49.3
H-4	S72	41.6	52.1		M-12	S54	38.2	49.3
D-8	S52	41.6	52.1		D-12	S30	38.2	49.3
H-12	S56	41.6	52.1		M-4	S34	38.2	49.3
M-8	S67	41.6	52.1		H-8	R37	38.1	46.7

Unit 2 Cycle 5 Fuel Data (14 foot active fuel and 10 grids)	
"R", "S" Region Identifiers	"T", "U" Region Identifiers (V5H)
Inconel grids	Inconel top/bottom grids, zirconium mid grids
Zirconium guide tubes	Zirconium guide tubes
Stainless steel grid sleeves	Zirconium grid sleeves
Guide tube ID (above dashpot) = 0.450 inches	Guide tube ID (above dashpot) = 0.442 inches
Guide tube ID (dashpot) = 0.397 inches	Guide tube ID (dashpot) = 0.397 inches

Unit 1 March 2, 1996 Rod Drop Test Results

Rod drop time testing was performed on all 57 control rods. The plant was in Mode 3 with RCS temperature greater than 561°F and four reactor coolant pumps running. Seven rods stopped at 6 steps from rod bottom based on Digital Rod Position Indication (C9, N7, N9, D8, F6, F10, K10), all other rods fully inserted. These results represent three new insertion anomalies since the December 1995 testing, a cycle burnup delta of approximately 2500 MWD/MTU. Rod drop times were comparable to Beginning of Cycle startup test results and the December 1995 testing with no significant degradation in rod drop (dashpot entry) time. Test results satisfied all Technical Specification and current safety evaluation limits.

Core Loc	Fuel ID	B/U 3/2/96 (GWD/MTU)	DE Time (sec)	Recoils		Core Loc	Fuel ID	B/U 3/2/96 (GWD/MTU)	DE Time (sec)	Recoils
Cycle B/U →		11.4				Cycle B/U →		11.4		
	SA						A			
D-2	G21	24.2	1.591	3		E-5	E24	29.8	1.555	2
B-12	G04	24.2	1.576	3		E-11	E10	29.7	1.564	0
M-14	G13	24.4	1.609	4		L-11	E31	29.5	1.551	1
P-4	G11	24.2	1.589	5		L-5	C54	29.0	1.551	2
B-4	G03	24.5	1.592	4		H-6	F55	32.7	1.602	2
D-14	G09	23.7	1.590	4		F-8	F36	32.7	1.567	0
P-12	G34	24.2	1.591	5		H-10	F34	32.8	1.569	0
M-2	G28	23.9	1.622	4		K-8	F60	32.7	1.585	0
	SB						B			
G-3	F32	46.2	1.573	1		F-2	H18	14.2	1.580	3
C-9	F59	46.5	1.540	0		B-10	H24	14.1	1.581	2
J-13	F62	46.2	1.572	1		K-14	H13	14.3	1.585	3
N-7	F64	46.1	1.558	0		P-6	H28	14.2	1.566	4
C-7	F47	46.2	1.608	0		B-6	H16	14.3	1.614	3
G-13	F21	46.0	1.571	1		F-14	H25	14.4	1.599	3
N-9	F25	46.0	1.530	0		P-10	H23	14.3	1.568	3
J-3	F43	46.3	1.559	1		K-2	H15	14.3	1.614	3
	SC						C			
E-3	R30	40.9	1.591	4		H-2	G20	29.5	1.589	4
C-11	R32	41.3	1.606	1		B-8	G30	29.3	1.571	1
L-13	R28	40.7	1.558	3		H-14	G32	29.1	1.602	4
N-5	R34	40.9	1.609	1		P-8	G08	29.1	1.570	2
	SD					F-6	F41	46.7	1.591	0
C-5	R27	40.7	1.591	0		F-10	F26	46.8	1.588	0
E-13	R26	41.2	1.562	1		K-10	F29	47.5	1.559	0
N-11	R35	41.2	1.575	1		K-6	F39	46.7	1.608	1
L-3	R31	40.6	1.593	4			D			
	SE					D-4	F51	43.1	1.558	1
H-4	F37	44.2	1.557	4		M-12	F52	43.0	1.560	1
D-8	F53	43.5	1.540	0		D-12	F49	42.8	1.570	0
H-12	F42	43.1	1.554	0		M-4	F58	43.1	1.544	3
M-8	F50	42.7	1.530	0		H-8	C28	31.0	1.575	1

Unit 2 January 11, 1996 Rod Drop Test Results

Rod drop time testing was performed on all 57 control rods. The plant was in Mode 3 with RCS temperature greater than 561°F and four reactor coolant pumps running. All rods inserted to rod bottom based on Digital Rod Position Indication, and rod drop times were comparable to Beginning of Cycle startup test results with no significant degradation in rod drop (dashpot entry) time. Rod F10 did not indicate any recoil which may suggest manifestation of the insertion anomaly. Test results satisfied all Technical Specification and current safety evaluation limits.

Core Loc	Fuel ID	B/U 1/11/96 (GWD/MTU)	DE Time (sec)	Recoils		Core Loc	Fuel ID	B/U 1/11/96 (GWD/MTU)	DE Time (sec)	Recoils
Cycle B/U →		2.3				Cycle B/U →		2.3		
SA						A				
D-2	S35	36.0	1.599	2		E-5	S19	26.2	1.552	2
B-12	S41	36.0	1.565	2		E-11	S12	26.2	1.542	1
M-14	S42	36.0	1.614	3		L-11	S05	26.2	1.556	3
P-4	S61	36.0	1.569	3		L-5	S06	26.2	1.560	3
B-4	S59	36.0	1.581	3		H-6	T53	24.6	1.672	2
D-14	S64	36.0	1.583	2		F-8	T55	24.6	1.610	2
P-12	S49	36.0	1.574	3		H-10	T56	24.6	1.582	2
M-2	S63	36.0	1.576	2		K-8	T54	24.6	1.563	4
SB						B				
G-3	T26	24.2	1.565	4		F-2	U40	2.7	1.600	3
C-9	T32	24.2	1.593	3		B-10	U37	2.7	1.585	5
J-13	T31	24.2	1.561	3		K-14	U44	2.7	1.575	5
N-7	T28	24.2	1.569	3		P-6	U41	2.7	1.617	5
C-7	T27	24.1	1.569	3		B-6	U42	2.7	1.561	5
G-13	T30	24.1	1.570	4		F-14	U39	2.7	1.582	5
N-9	T20	24.1	1.558	4		P-10	U43	2.7	1.563	5
J-3	T21	24.1	1.578	4		K-2	U38	2.7	1.562	5
SC						C				
E-3	U21	23.7	1.577	4		H-2	U17	16.6	1.595	4
C-11	U35	23.7	1.576	3		B-8	U19	16.6	1.582	4
L-13	U26	23.7	1.571	3		H-14	U16	16.6	1.569	4
N-5	U30	23.7	1.574	4		P-5	U15	16.6	1.560	4
SD						F-6	S21	26.1	1.560	1
C-5	U31	23.7	1.574	4		F-10	S15	26.1	1.540	0
E-13	U23	23.7	1.583	3		K-10	S23	26.1	1.529	2
N-11	U24	23.7	1.555	3		K-6	S22	26.1	1.553	2
L-3	U33	23.7	1.594	5		D				
SE						D-4	S70	35.8	1.595	2
H-4	S72	39.3	1.549	1		M-12	S54	35.8	1.585	2
D-8	S52	39.3	1.560	1		D-12	S30	35.8	1.569	2
H-12	S56	39.3	1.550	2		M-4	S34	35.8	1.581	3
M-8	S67	39.3	1.586	3		H-8	R37	36.3	1.605	2