VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

October 15, 1996

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555-0001

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Docket No. 50-339
License No. NPF-7

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNIT 2
CONTROL ROD DROP TIME AND DRAG TEST RESULTS
IN ACCORDANCE WITH NRC BULLETIN 96-01

NRC Bulletin 96-01, "Control Rod Insertion Problems," dated March 8, 1996, requested licensees to measure and evaluate control rod drop times and rod recoil data for all control rods during 1996 outages of sufficient duration. North Anna Unit 2 completed Cycle 11 on September 8, 1996. The commitments made in our response to NRC Bulletin 96-01 require control rod drop time testing to be performed at outages of sufficient duration and to evaluate control rod drag forces during outages when the vessel head is removed. Both of these tests were performed during the Cycle 11 to Cycle 12 refueling outage following the September 8 unit shutdown. Attached is an evaluation of the data obtained from the control rod drop time tests completed on September 8, 1996 and the control rod drag force measurements completed on September 16, 1996.

Should you have any questions or require additional information, please contact us.

Very truly yours,

James P. O'Hanlon

James P. O'Hanlon
Senior Vice President - Nuclear

Attachment

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cc: U. S. Nuclear Regulatory Commission
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Mr. R. D. McWhorter
NRC Senior Resident Inspector
North Anna Power Station

Evaluation of North Anna 2 End of Cycle 11
Control Rod Drop Time Tests and Control Rod Drag Tests

North Anna Unit 2 completed Cycle 11 on September 8, 1996. The commitments made in our response to NRC Bulletin 96-01 require control rod drop time testing to be performed at the end of a cycle and to evaluate control rod drag forces during outages when the vessel head is removed. Both of these tests were performed during the Cycle 11 to Cycle 12 refueling outage following the September 8 shutdown. The following is an evaluation of the data obtained from the control rod drop time tests and the control rod drag force measurements.

Control Rod Drop Time and Recoil Evaluation

Control rod drop time tests were performed on September 8 shortly after Unit 2 was shut down for refueling. The measured drop times were within the internal operational limit of 2.13 seconds which is less than the Technical Specification limit of 2.7 seconds. Figure 1 compares the drop time test results obtained from the end-of-cycle (EOC) tests to the drop time test results that were obtained at the beginning of Cycle (BOC) 11. As can be seen on Figure 1, there is very little variation in the drop times that were measured at EOC compared to the drop times measured at BOC. On average, the EOC drop times are approximately 0.02 seconds less per rod than the drop times measured at BOC. Therefore, by examination of these data, there was no significant change in the drop time behavior during the operation of North Anna 2 Cycle 11.

Recoil was observed for all rod drop tests. Recoil is the control rod bounce that occurs when the spring pack on the control rod impacts the top nozzle of the fuel assembly. The existence of recoil is positive indication that the control rod has fully inserted.

By examination of the control rod drop time data and the existence of recoil, it is concluded that all 48 control rods were capable to promptly, fully insert during operation of Cycle 11.

Control Rod Drag Measurement Evaluation

Control rod drag measurements were performed in the spent fuel pool on September 16 following the offload of the North Anna 2 Cycle 11 (N2C11) core using the actual rodded fuel assemblies from Cycle 11 with their respective control rods. The acceptance criteria for the drag tests are: (a) the maximum drag load of a control rod in a fuel assembly should not exceed 100 pounds in the dashpot region, and (b) the maximum drag load of a control rod in a fuel assembly should not exceed 40 pounds in the upper guide tube region (region above the dashpot). All 48 rodded fuel assemblies from N2C11 had less than 100 pounds of control rod drag force in the dashpot region. Two fuel assemblies slightly exceeded the criterion for drag force in the upper guide tube. The remaining 46 rodded fuel assemblies from Cycle 11 had less than 40 pounds of control rod drag force in the dashpot region. Assemblies 5M6 (46,264 MWD/MTU) and 5M0 (46,149 MWD/MTU) exceeded the drag force acceptance criterion of 40 pounds in the upper guide tube by 4 pounds and 1 pound, respectively.

The control rod drop times for assemblies 5M6 and 5M0 indicate that the ability of the control rods to perform as designed was not affected by their upper guide tube drag forces. The EOC control rod drop times in assemblies 5M6 and 5M0 were 1.69 seconds and 1.67 seconds, respectively. The EOC control rod drop time in 5M6 was 0.03 seconds greater than its BOC drop time. There was no difference between the EOC and BOC measured control rod drop times in assembly 5M0. Recoil was observed for both control rods during the drop tests. It is therefore concluded that the drag force of 44 pounds and 41 pounds in the upper guide tubes of these assemblies did not impede the ability of the control rods in assemblies 5M6 and 5M0 to perform as designed.

A Fuel Anomaly Form was issued documenting that the drag force in assemblies 5M6 and 5M0 exceeded the acceptance criterion for drag force in the upper guide tube region. These two fuel assemblies are not scheduled for reuse. However, these two assemblies are restricted from use in a core location that requires an insert component should they be selected for use in a future core design.

Table 1 is a list of the N2C11 rodded assemblies, corresponding EOC burnup, Cycle 11 core location, and drag test results. Figure 2 is a core map comparing the average assembly burnup at BOC and EOC for rodded fuel assemblies in N2C11. Figure 3 is a chart of measured control rod drag force versus fuel assembly burnup for the rodded assemblies in N2C11.

Conclusion

Based on the control rod drop time tests and control rod drag force measurements that were performed following the shutdown of N2C11, it is concluded that all 48 control rods were capable to promptly, fully insert as designed during operation of Cycle 11. The conclusion is supported by the following:

- The 48 control rods in the N2C11 core were within the internal operational limit of 2.13 seconds and the Technical Specification limit of 2.7 seconds for drop time to the dashpot.

- Control rod recoil was observed during the EOC control rod drop time tests for each of the 48 control rods in the core. The presence of recoil verifies that the control rod fully inserted when tripped into the core.

- The drag test results of the N2C11 rodded assemblies with the exception of 5M6 and 5M0 were within the acceptance criteria of 40 pounds in the upper guide tube and 100 pounds in the dashpot.

- Two assemblies (5M6 and 5M0) exceeded the drag force acceptance criterion of 40 pounds in the upper guide tube by 4 pounds and 1 pound, respectively. The EOC control rod drop times and the presence of recoil indicate that the drag force of 44 pounds and 41 pounds in the upper guide tubes of these assemblies did not impede the ability of the control rods in assemblies 5M6 and 5M0 to perform as designed. These two fuel assemblies are not scheduled for reuse. However, they are restricted from use in a core location that requires an insert component should they be selected for use in a future core design.

Table 1
North Anna 2 Cycle 11 Control Rod Drag Test Results

Assembly ID	N2C11 Core Location	Burnup (MWD/MTU)	Dashpot Drag Force (lbf)	Guide Tube Drag Force (lbf)
1M8	F 6	48055	46	19
2M4	K10	47904	42	27
2M5	F10	47415	64	28
1M1	K 6	47246	21	3
3M9	D 6	47162	16	4
3M4	M 6	46948	9	1
3M1	K 4	46903	21	4
5M7	F12	46826	43	34
3M0	F 8	46639	44	14
4M6	K12	46569	36	19
4M8	M10	46530	21	9
5M8	D10	46360	25	6
5M6	F 4	46264	57	44
5M0	H10	46149	48	41
3M7	H 6	46009	34	25
4M5	K 8	45877	30	16
3M2	E11	44496	20	13
6M3	C 9	44390	14	4
4M2	G 3	44316	19	10
6M1	N 7	44110	12	3
3M3	J 3	43883	22	9
5M3	L11	43742	12	5
3M6	C 7	43638	15	5
4M0	L 5	43508	30	10
5M2	G13	43391	31	18
4M7	E 5	43338	23	13
4M4	J13	43243	17	13
6M0	N 9	43174	17	11
5M5	J 7	41771	19	9
5M1	G 9	41676	49	29
2M3	D12	41634	30	9
5M4	J 9	41619	33	24
0M1	M12	41485	29	6
5M9	G 7	41370	31	20
1M4	D 4	40544	22	12
1M3	M 4	40176	19	6
6M2	P 8	37905	18	3
4M9	B 8	37886	8	1
0M7	F14	37824	17	6
2M0	K14	37743	22	6
1M7	B10	37735	7	2
4M3	H14	37385	12	4
6M4	H 2	37336	12	3
2M8	P 6	37158	7	0
2M7	B 6	37133	7	2
0M3	K 2	36807	18	5
0M5	P10	36721	29	10
2M6	F 2	36550	15	7

Figure 1
North Anna Unit 2 Cycle 11 BOC Control Rod Drop Time Measurements Compared to EOC Rod Drop Time Measurements
(Drop times are measured to the dashpot and are represented in seconds)

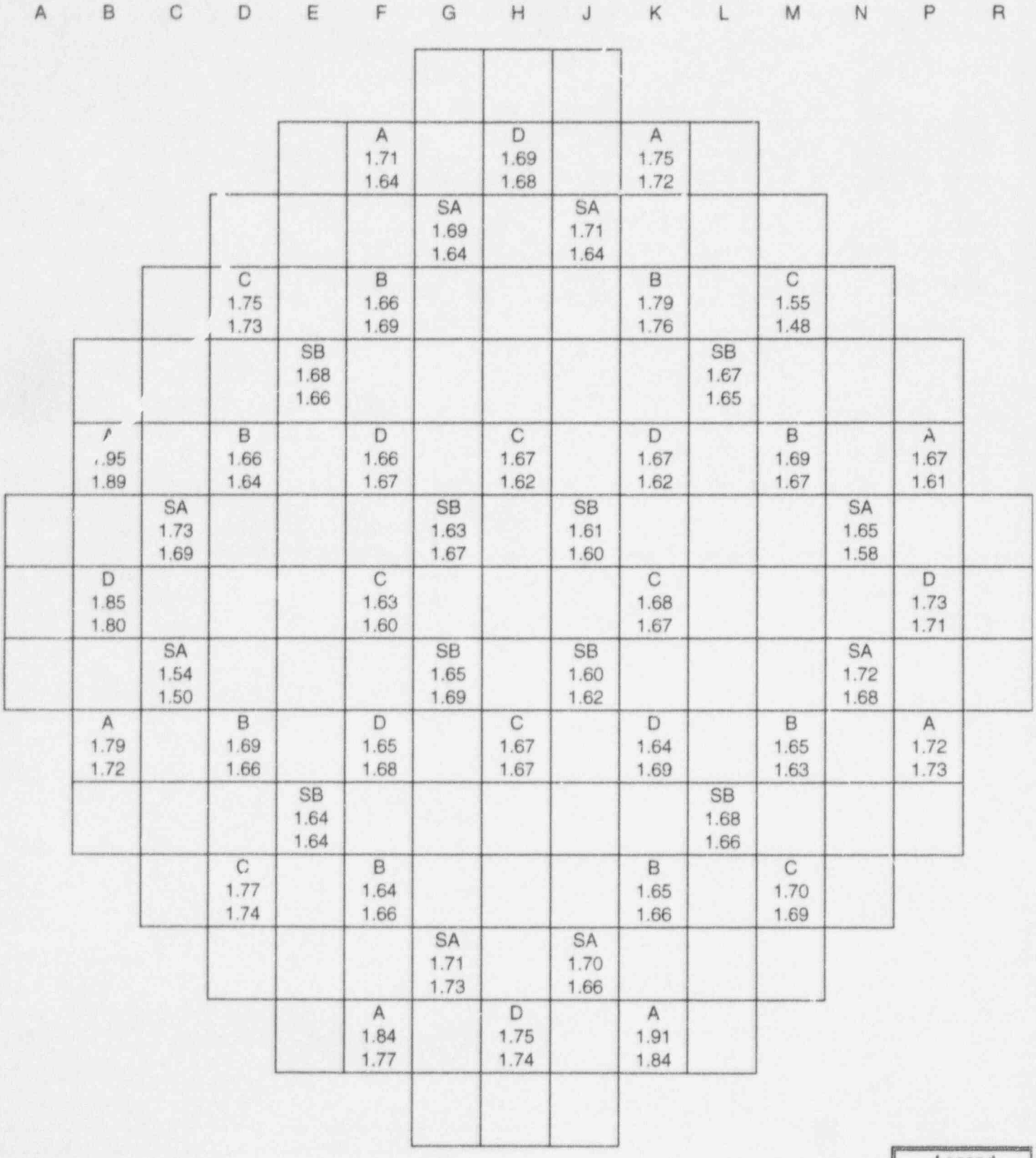


Figure 2
North Anna Unit 2 Cycle 11 Rodded Fuel Assembly Burnup Map
Average Assembly Burnup at BOC and EOC (Burnup is expressed in MWD/MTU)

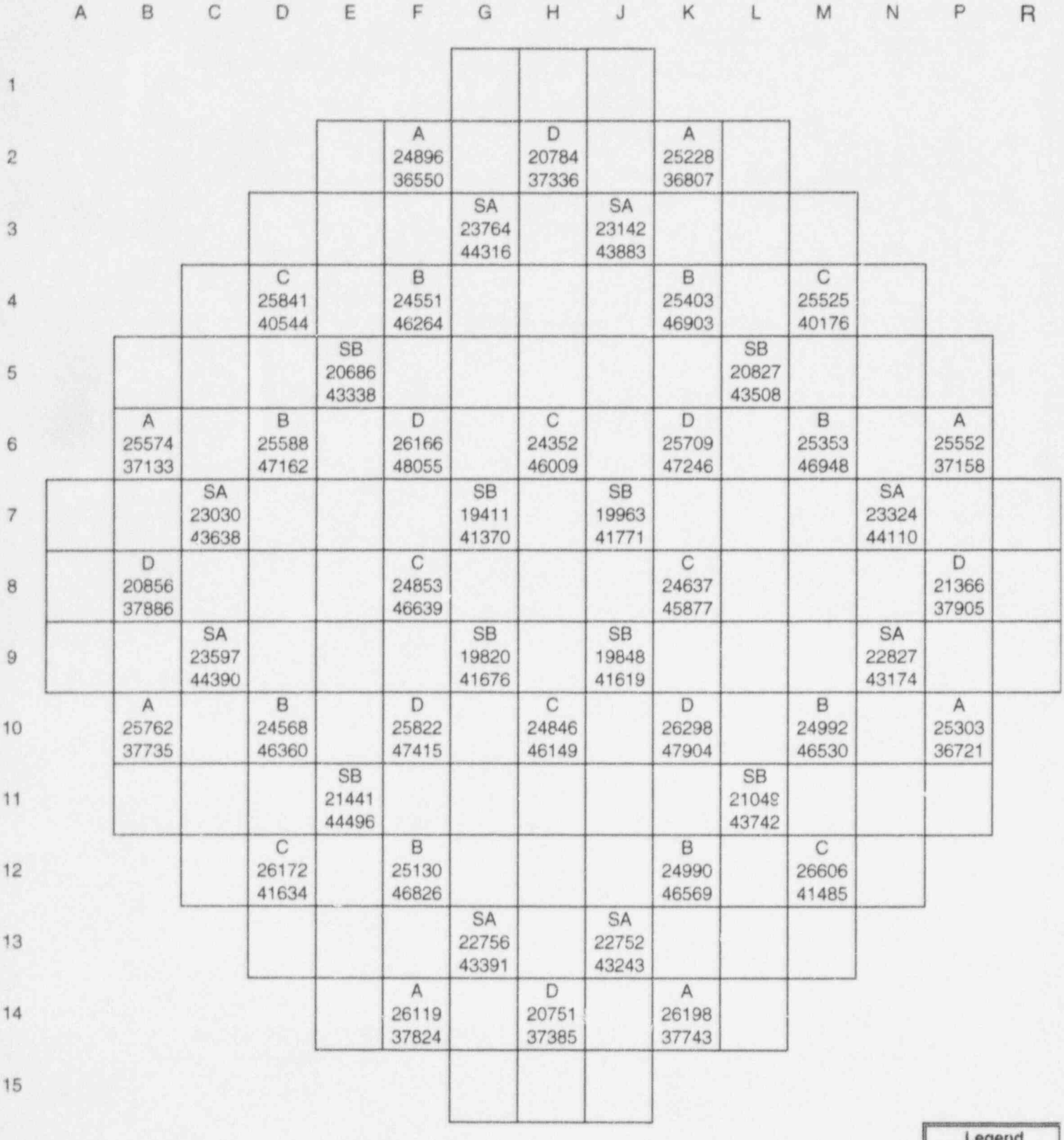
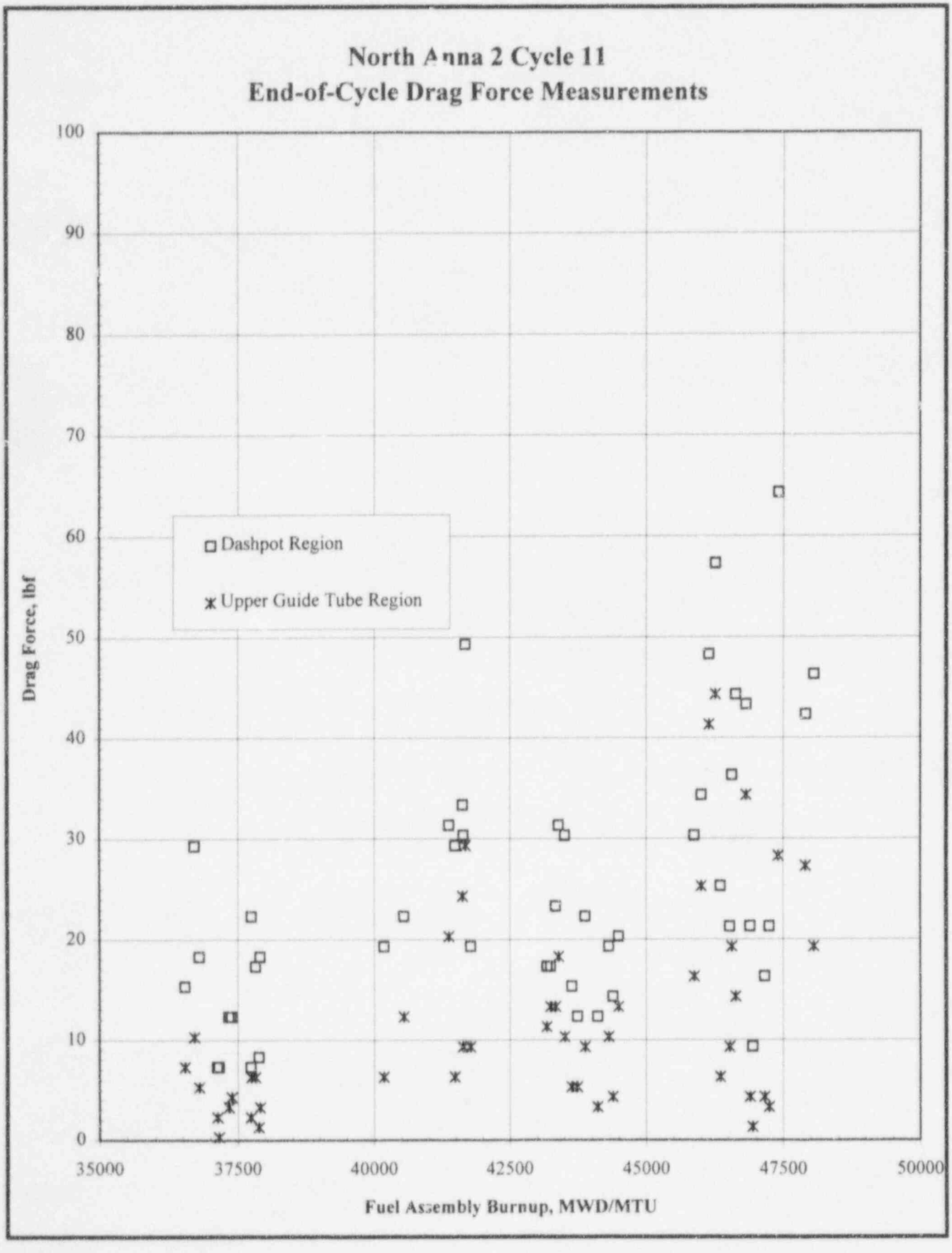


Figure 3


North Anna 2 Cycle 11
End-of-Cycle Drag Force Measurements
Drag Force, lbf
100
90
80
70
60
50
40
30
20
10
0
Dashpot Region
Upper Guide Tube Region
35000
37500
40000
42500
45000
47500
50000
Fuel Assembly Burnup, MWD/MTU