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SUBJECT: Forwards response to NRC Bulletin 96-001, "Control Rod Insertion Problems."

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**Carolina Power & Light Company**

Robinson Nuclear Plant
3581 West Entrance Road
Hartsville SC 29550

Robinson File No: 13510

Serial: RNP-RA/96-0208

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United States Nuclear Regulatory Commission
Attn: Document Control Desk
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H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261/LICENSE NO. DPR-23
REQUIRED RESPONSE 3 TO NRC BULLETIN 96-01,
"CONTROL ROD INSERTION PROBLEMS"

Gentlemen:

NRC Bulletin 96-01, "Control Rod Insertion Problems," required that licensees that completed Requested Action 3 for each outage submit a report that summarizes the data and the results obtained within 30 days after completing the Requested Action. Control rod testing during Refueling Outage 17 was completed on October 16, 1996; therefore, the enclosed report is due to be submitted by November 15, 1996.

Questions regarding this matter may be referred to me at (803) 857-1437.

Very truly yours,

H. K. Chernoff
Supervisor-Licensing/Regulatory Programs

JSK/klb

Enclosures

- c: Mr. S. D. Ebnetter, Regional Administrator, USNRC, Region II
Ms. B. L. Mozafari, USNRC Project Manager, HBRSEP
Mr. J. Zeiler, USNRC Resident Inspector, HBRSEP

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Affidavit

State of South Carolina

County of Darlington

C. S. Hinnant, having been first duly sworn, did depose and say that the information contained in letter 96-0208 is true and correct to the best of his information, knowledge and belief; and the sources of his information are officers, employees, contractors, and agents of Carolina Power & Light Company.

C S Hinnant

Sworn to and subscribed before me

this 14 day of November 1996

(Seal) David Cado

Notary Public for South Carolina

My commission expires: March 21, 2005

H. B. ROBINSON STEAM ELECTRIC PLANT UNIT NO. 2
REQUIRED RESPONSE 3 TO NRC BULLETIN 96-01,
"CONTROL ROD INSERTION PROBLEMS"

Required Response

NRC Bulletin 96-01, "Control Rod Insertion Problems," dated March 8, 1996, requested that licensees take specific actions and required certain responses regarding recent problems with control rod insertion. Our letter dated April 4, 1996, contained the information concerning the Bulletin's Required Response 1 and Required Response 2. Required Response 3 states the following.

"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."

Requested Action 3 consisted of the following.

"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 assemblies.

- a. Rods failing to meet the rod drop times in the technical specifications shall be deemed inoperable.
- b. Rods failing to bottom or exhibiting high drag forces shall require prompt corrective actions in accordance with Appendix B to Part 50 of Title 10 of the Code Of Federal Regulations (10 CFR Part 50)."

Response

Control Rod Drop Time/Rod Recoil Testing

On September 7, 1996, H. B. Robinson Steam Electric Plant (HBRSEP), Unit 2 was being shutdown for the commencement of Refueling Outage 17. Due to a problem with the High Pressure Turbine Electro-Hydraulic Control System, it was necessary to initiate a manual reactor scram from 28 percent of full power, as described in Licensee Event Report (LER) No. 96-004-00, dated October 7, 1996. The HBRSEP, Unit No. 2 Nuclear Steam Supply System was manufactured by the Westinghouse Electric Corporation; however, the fuel currently installed was manufactured by Siemens Power Corporation. The control rods were manufactured by Westinghouse.

Control rod drop time testing was performed on control rods on September 8 1996, at Hot Shutdown conditions. The testing involved 9 Standard Mixing Vane (SMV) fuel assemblies that had achieved burnups between 41,000 and 49,000 MWD/MTU, as well as 36 High Thermal Performance (HTP) fuel assemblies that had achieved burnups between 19,000 and 47,000 MWD/MTU. The SMV assemblies do not have Intermediate Flow Mixer (IFM) grids installed, while the HTP assemblies have 3 IFMs installed. Attachment 1 provides both the Beginning of Cycle (BOC) 17 drop time test results and End of Cycle (EOC) 17 drop time test results, and shows that there is no significant change in the measured drop times. Rod recoil was seen at the end of rod travel for the control rods tested.

Control Rod drop time testing was also performed on October 16, 1996, at Hot Shutdown conditions to fulfill the requirements of Technical Specification Section 4.1, "Operational Safety Review," prior to the commencement of Operating Cycle 18. This testing involved 1 SMV assembly that had achieved a burnup of 23,000 MWD/MTU, and 44 HTP assemblies that had achieved burnups ranging from 0 to 35,000 MWD/MTU. Attachment 2 provides the BOC 18 drop time test results. Rod recoil was seen at the end of travel for the control rods tested.

The Control Rod drop time testing performed during Refueling Outage 17 supports the conclusion in our initial response to NRC Bulletin 96-01 dated April 4, 1996, that there is no observed correlation at HBRSEP, Unit No. 2 between fuel assembly burnup and control rod drop times for either the SMV fuel assemblies, or for the HTP fuel assemblies.

Control Rod Drag Testing

Control rod drag testing was performed during Refueling Outage 17 in the Spent Fuel Pool for the Operating Cycle 17 rodded assemblies for which control rods were being relocated for Operating Cycle 18. Five Cycle 17 control rods were not drag tested, but other control rods in fuel assemblies with equivalent burnup levels were tested. The drag testing was performed using the portable Rod Control Cluster Assembly (RCCA) Change Tool fitted with a load cell. Attachment 3 provides the results of the control rod drag testing. The method used to perform the drag testing overestimates the drag forces from the fuel assembly above the dashpot region since it measures both the drag caused by the control rod passing through the RCCA Change Tool guide cards, as well as the drag caused by the control rod moving through the fuel assembly guide tubes. These data exhibit a large amount of scatter, and no correlation between the measured drag forces and the fuel assembly burnup is apparent. Although we do not have any historical data for comparison, the measured drag forces compare well with industry data provided by the Westinghouse Owners Group (WOG).

Control Rod Performance During Reactor Trips

During the shutdown for Refueling Outage 17, a manual reactor trip was required due to problems with the Turbine Electro-Hydraulic Control System. As reported in LER 96-004-00, the rod bottom lights for control rods B-10 and H-8 did not illuminate immediately. The rod bottom light for H-8 illuminated in approximately 30 seconds and the rod bottom light for B-10 illuminated in approximately 41 minutes. Our investigation into the cause of this failure to illuminate indicated that a zero shift was seen in the control rod position indication circuitry. Control rod drop testing performed on September 8, 1996, demonstrated that these two control rods would insert fully within the Technical Specifications requirement. Control rod B-10 had a drop time from the All Rods Out (ARO) position to the dashpot of 1.40 seconds, and a drop time from the dashpot to rod bottom of 0.60 seconds. Control rod H-8 had a drop time from the ARO position to the dashpot of 1.34 seconds, and a drop time from the dashpot to rod bottom of 0.71 seconds during the September 8, 1996, testing. Rod recoil was seen at the end of rod travel for both control rods.

During startup from Refueling Outage 17 on October 20, 1996, a reactor trip from approximately 20% power was received due to the failure of a feedwater manual/automatic controller. The control rods fully inserted upon reactor trip. No control rod testing was performed subsequent to this reactor trip since this shutdown did not meet the criteria for our plan to implement Requested Action (3) outlined in our April 4, 1996, letter.

Conclusion

The control rod drop time testing and drag testing performed during Refueling Outage 17 supports the conclusion in our April 4, 1996, submittal that our control rods are operable and capable of fully inserting upon a reactor trip.

Cycle 17 Drop Time Testing Results

Control Rod Bank	Core Location	Fuel Assembly Serial #	Fuel Assembly Type	Control Rod Serial #	BOC 17			EOC 17			Rod Recoil (# bounces)	Delta (EOC-BOC)		
					Burnup MWD/MTU	Time to Dashpot (seconds)	Dashpot to Rod Bottom (seconds)	Burnup MWD/MTU	Time to Dashpot (seconds)	Dashpot to Rod Bottom (seconds)		Burnup MWD/MTU	Time to Dashpot (seconds)	Dashpot to Rod Bottom (seconds)
Control A	E09	X33	HTP	CR28	15330	1.23	0.60	33840	1.30	0.60	1	18510	0.07	0.00
Control A	L07	X44	HTP	CR50	15330	1.25	0.55	33820	1.30	0.56	2	18490	0.05	0.01
Control A	J11	X41	HTP	CR502	15280	1.33	0.59	33840	1.40	0.60	1	18560	0.07	0.01
Control A	G05	X36	HTP	CR48	15280	1.24	0.52	33840	1.29	0.55	1	18560	0.05	0.03
Control A	E07	X38	HTP	CR29	15060	1.23	0.53	33640	1.28	0.56	1	18580	0.05	0.03
Control A	J05	X42	HTP	CR41	15040	1.32	0.52	33610	1.40	0.54	2	18570	0.08	0.02
Control A	G11	X35	HTP	CR26	15040	1.33	0.56	33640	1.45	0.56	2	18600	0.12	0.00
Control A	L09	X39	HTP	CR25	15060	1.28	0.62	33620	1.34	0.66	1	18560	0.06	0.04
Control B	F14	W37	HTP	CR46S	32050	1.35	0.58	40850	1.40	0.56	2	8800	0.05	-0.02
Control B	P06	W39	HTP	CR08	32270	1.27	0.57	41060	1.27	0.59	2	8790	0.00	0.02
Control B	F02	W34	HTP	CR03	32100	1.23	0.53	40910	1.28	0.55	2	8810	0.05	0.02
Control B	B10	W38	HTP	CR52	32260	1.38	0.57	41070	1.40	0.60	2	8810	0.02	0.03
Control B	P10	W35	HTP	CR06	32200	1.32	0.57	41010	1.32	0.57	2	8810	0.00	0.00
Control B	B06	W33	HTP	CR02	32200	1.28	0.60	41020	1.32	0.60	2	8820	0.04	0.00
Control B	K02	W40	HTP	CR34	32050	1.35	0.55	40860	1.38	0.56	2	8810	0.03	0.01
Control B	K14	W36	HTP	CR31	32100	1.32	0.55	40900	1.34	0.58	1	8800	0.02	0.03
Control C	F04	P27	SMV	CR39	34390	1.23	0.55	48620	1.26	0.56	2	14230	0.03	0.01
Control C	F12	P17	SMV	CR35	34970	1.32	0.51	49090	1.35	0.54	1	14120	0.03	0.03
Control C	M06	P12	SMV	CR45	35040	1.31	0.66	49040	1.38	0.67	2	14000	0.07	0.01
Control C	K12	P26	SMV	CR27	34390	1.22	0.56	48620	1.27	0.60	2	14230	0.05	0.04
Control C	M10	P15	SMV	CR42	35040	1.25	0.52	49060	1.26	0.53	2	14020	0.01	0.01
Control C	D06	P13	SMV	CR07	35040	1.22	0.62	49070	1.27	0.63	1	14030	0.05	0.01
Control C	D10	P14	SMV	CR47	35040	1.33	0.60	49060	1.38	0.62	1	14020	0.05	0.02
Control C	K04	P16	SMV	CR13	35040	1.22	0.57	49140	1.28	0.55	2	14100	0.06	-0.02
Control D	M08	W05	HTP	CR43	32570	1.35	0.53	47720	1.34	0.56	2	15150	-0.01	0.03
Control D	H12	W07	HTP	CR503	31920	1.28	0.57	47130	1.26	0.58	2	15210	-0.02	0.01
Control D	H08	J20	SMV	CR21	32590	1.33	0.65	41720	1.34	0.71	2	9130	0.01	0.06
Control D	D08	W08	HTP	CR51	32570	1.28	0.52	47740	1.26	0.54	2	15170	-0.02	0.02
Control D	H04	W06	HTP	CR01	31920	1.27	0.55	47130	1.26	0.58	1	15210	-0.01	0.03
Shutdown A	J03	W46	HTP	CR36	27100	1.30	0.57	43490	1.34	0.57	2	16390	0.04	0.00
Shutdown A	C07	W41	HTP	CR17	27050	1.32	0.79	43600	1.38	0.82	1	16550	0.06	0.03
Shutdown A	G13	W48	HTP	CR32	27100	1.22	0.54	43480	1.26	0.54	2	16380	0.04	0.00
Shutdown A	G03	W45	HTP	CR14	26940	1.27	0.68	43360	1.28	0.73	3	16420	0.01	0.05
Shutdown A	N09	W43	HTP	CR33	27050	1.25	0.57	43580	1.28	0.57	1	16530	0.03	0.00
Shutdown A	J13	W47	HTP	CR09	26940	1.22	0.58	43350	1.27	0.59	2	16410	0.05	0.01
Shutdown A	N07	W42	HTP	CR23	26900	1.24	0.59	43440	1.28	0.60	2	16540	0.04	0.01
Shutdown A	C09	W44	HTP	CR19	26900	1.31	0.56	43460	1.37	0.55	2	16560	0.06	-0.01
Shutdown B	K08	Y04	HTP	CR508	0	1.37	0.58	19850	1.38	0.60	1	19850	0.01	0.02
Shutdown B	H06	Y01	HTP	CR05	0	1.27	0.53	19870	1.26	0.56	2	19870	-0.01	0.03
Shutdown B	L05	X05	HTP	CR46	18180	1.35	0.58	36560	1.34	0.61	2	18380	-0.01	0.03
Shutdown B	L11	X10	HTP	CR49	18140	1.25	0.53	36570	1.25	0.56	2	18430	0.00	0.03
Shutdown B	E11	X07	HTP	CR505	18180	1.33	0.58	36610	1.33	0.59	2	18430	-0.00	0.01
Shutdown B	H10	Y03	HTP	CR501	0	1.35	0.58	19890	1.36	0.60	2	19890	0.01	0.02
Shutdown B	E05	X12	HTP	CR504	18140	1.32	0.58	36580	1.32	0.56	1	18440	0.00	-0.02
Shutdown B	F08	Y02	HTP	CR18	0	1.33	0.52	19860	1.34	0.57	2	19860	0.01	0.05

Beginning Of Cycle 18 Drop Time Test Results

BOC 18

Control Rod Bank	Core Location	Fuel Assembly Serial #	Fuel Assembly Type	Control Rod Serial #	Burnup MWD/MTU	Time to Dashpot (seconds)	Dashpot to Rod Bottom (seconds)	Rod Recoil (# bounces)
Control A	E09	X31	HTP	CR23	28750	1.26	0.59	2
Control A	L07	X28	HTP	CR34	28760	1.26	0.54	2
Control A	J11	X29	HTP	CR33	28900	1.38	0.58	2
Control A	G05	X26	HTP	CR42	28900	1.28	0.53	1
Control A	E07	X27	HTP	CR13	28720	1.26	0.59	2
Control A	J05	X30	HTP	CR35	28830	1.36	0.54	2
Control A	G11	X25	HTP	CR47	28850	1.41	0.57	2
Control A	L09	X32	HTP	CR508	28720	1.31	0.65	1
Control B	F14	X21	HTP	CR503	35750	1.38	0.58	2
Control B	P06	X17	HTP	CR29	35740	1.27	0.51	3
Control B	F02	X24	HTP	CR39	35770	1.27	0.57	1
Control B	B10	X19	HTP	CR46	35720	1.39	0.57	2
Control B	P10	X20	HTP	CR01	35820	1.32	0.56	1
Control B	B06	X18	HTP	CR501	35820	1.32	0.58	2
Control B	K02	X23	HTP	CR27	35790	1.35	0.55	2
Control B	K14	X22	HTP	CR51	35780	1.34	0.58	2
Control C	F04	Y10	HTP	CR32	21040	1.26	0.54	2
Control C	F12	Y11	HTP	CR08	20990	1.36	0.6	2
Control C	M06	Y14	HTP	CR06	21030	1.38	0.58	2
Control C	K12	Y12	HTP	CR02	21040	1.24	0.56	2
Control C	M10	Y13	HTP	CR03	21090	1.28	0.54	2
Control C	D06	Y15	HTP	CR31	21090	1.28	0.58	2
Control C	D10	Y16	HTP	CR46S	21050	1.38	0.56	1
Control C	K04	Y09	HTP	CR52	20990	1.28	0.58	1
Control D	M08	X01	HTP	CR18	35900	1.39	0.55	1
Control D	H12	X02	HTP	CR48	35900	1.28	0.5	2
Control D	H08	M24	SMV	CR05	23670	1.36	0.56	1
Control D	D08	X03	HTP	CR26	35900	1.29	0.55	1
Control D	H04	X04	HTP	CR28	35900	1.28	0.62	2
Shutdown A	J03	Y44	HTP	CR49	20240	1.36	0.58	2
Shutdown A	C07	Y42	HTP	CR41	20250	1.36	0.56	2
Shutdown A	G13	Y38	HTP	CR511	20250	1.26	0.62	2
Shutdown A	G03	Y41	HTP	CR50	20300	1.26	0.56	1
Shutdown A	N09	Y40	HTP	CR502	20250	1.26	0.58	1
Shutdown A	J13	Y39	HTP	CR507	20300	1.28	0.6	1
Shutdown A	N07	Y43	HTP	CR505	20230	1.28	0.58	2
Shutdown A	C09	Y37	HTP	CR19	20250	1.35	0.57	2
Shutdown B	K08	Z15	HTP	CR509	0	1.38	0.61	2
Shutdown B	H06	Z16	HTP	CR506	0	1.3	0.58	1
Shutdown B	L05	Y17	HTP	CR43	19630	1.4	0.58	2
Shutdown B	L11	Y20	HTP	CR504	19660	1.28	0.58	1
Shutdown B	E11	Y19	HTP	CR09	19650	1.36	0.59	2
Shutdown B	H10	Z14	HTP	CR510	0	1.36	0.6	1
Shutdown B	E05	Y18	HTP	CR36	19670	1.36	0.59	1
Shutdown B	F08	Z13	HTP	CR512	0	1.36	0.62	1

Control Rod Drag Test Results

Fuel Assembly Serial #	Fuel Assembly Type	Control Rod Serial #	Burnup MWD/MTU	Drag Force in Dashpot (lbs)	Drag Force Above Dashpot (lbs)
X33	HTP	CR28	33840	12.4	23.3
X44	HTP	CR50	33820	7.8	20.2
X41	HTP	CR502	33840	9.3	21.7
X36	HTP	CR48	33840	21.7	41.9
X38	HTP	CR29	33640	4.7	18.6
X42	HTP	CR41	33610	7.8	26.4
X35	HTP	CR26	33640	15.5	24.8
X39	HTP	CR25	33620	10.9	37.2
W37	HTP	CR46S	40850	9.3	10.9
W39	HTP	CR08	41060	10.9	7.8
W34	HTP	CR03	40910	12.4	69.8
W38	HTP	CR52	41070	7.8	10.9
W35	HTP	CR06	41010	10.9	10.9
W33	HTP	CR02	41020	15.5	34.1
W40	HTP	CR34	40860	18.6	18.6
W36	HTP	CR31	40900	15.5	17.1
P27	SMV	CR39	48620	10.9	29.5
P17	SMV	CR35	49090	3.1	10.9
P26	SMV	CR27	48620	15.5	24.8
P15	SMV	CR42	49060	27.9	51.2
P14	SMV	CR47	49060	23.3	43.3
P16	SMV	CR13	49140	38.8	60.5
W05	HTP	CR43	47720	7.8	21.7
W07	HTP	CR503	47130	7.8	23.3
W08	HTP	CR51	47740	17.1	51.2
W06	HTP	CR01	47130	6.2	18.6
W46	HTP	CR36	43490	24.8	32.6
W48	HTP	CR32	43480	9.3	20.2
W43	HTP	CR33	43580	9.3	20.2
W47	HTP	CR09	43350	7.8	18.6
W42	HTP	CR23	43440	46.5	46.5
W44	HTP	CR19	43460	3.1	7.8
Y04	HTP	CR508	19850	10.9	24.8
Y01	HTP	CR05	19870	17.1	46.5
X05	HTP	CR46	36560	10.9	26.4
X10	HTP	CR49	36570	7.8	15.5
X07	HTP	CR505	36610	7.8	9.3
Y03	HTP	CR501	19890	3.0	3.0
X12	HTP	CR504	36580	14.0	27.9
Y02	HTP	CR18	19860	3.1	10.9
Z44	HTP	CR511	0	21.7	21.7
Z26	HTP	CR507	0	6.2	17.1
S15H	SMV	CR511	64562	20.2	35.7