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SUBJECT: Responds to NRC 90-02 bulletin: loss of thermal margin caused by channel box bow.

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March 29, 1994
G02-94-074

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Docket No. 50-397

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
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Subject: WNP-2, OPERATING LICENSE NPF-21 -- RESPONSE TO NRC
BULLETIN 90-02: "LOSS OF THERMAL MARGIN CAUSED BY
CHANNEL BOX BOW", EFFECT ON CYCLE 10 OPERATION

- References:
1. NRC Bulletin No. 90-02, March 20, 1990, "Loss of Thermal Margin Caused by Channel Box Bow"
 2. Letter G02-90-162, dated September 28, 1990, GC Sorensen to USNRC, "Final Response to NRC Bulletin No. 90-02: Loss of Thermal Margin Caused by Channel Box Bow"
 3. Letter, dated April 22, 1991, PL Eng (NRC) to GC Sorensen, "Evaluation of Response to NRC Bulletin No. 90-02: Loss of Thermal Margin Caused by Channel Box Bow (TAC NO. 76354)"
 4. Letter G02-93-024, dated February 2, 1993, GC Sorensen to USNRC, "Response to NRC Bulletin No. 90-02: Loss of Thermal Margin Caused by Channel Box Bow, Effect on Cycle 9 Operation (TAC No. M82920)"
 5. ANF-524(P)(A), Rev. 2, Supplements 1 and 2, dated November 1990, "Advanced Nuclear Fuels Corporation Critical Power Methodology for Boiling Water Reactors"
 6. Letter G02-91-037, dated February 25, 1991; GC Sorensen to USNRC, "Request for Additional Information Regarding NRC Bulletin 90-02, Loss of Thermal Margin Caused by Channel Box Bow"

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Response to NRC Bulletin 90-02: "Loss of Thermal Margin
Caused by Channel Box Bow", Effect on Cycle 10 Operation

7. Letter G02-92-048, dated February 25, 1992, GC Sorensen to USNRC, "Response to NRC Bulletin No. 90-02: Loss of Thermal Margin Caused by Channel Box Bow, Effect on Cycle 8 Operation"
8. Letter, dated June 15, 1992, WM Dean (NRC) to GC Sorensen, "Evaluation of Response to NRC Bulletin No. 90-02: Loss of Thermal Margin Caused by Channel Box Bow (TAC No. M82920)"
9. Letter, dated May 11, 1993, JW Clifford (NRC) to GC Sorensen, "Reused Channel Boxes for Cycle 9 (TAC M85924)"

INTRODUCTION

NRC Bulletin (NRCB) 90-02 (Reference 1) requested that licensees reusing channel boxes verify that current Minimum Critical Power Ratio (MCPR) Technical Specification operating and safety limits are met. All affected licensees were also requested to advise the NRC of the number and location of reused channel boxes and to describe the methods and associated data base used to account for the effects of channel box bow during reuse of channel boxes to ensure conformance with the CPR limits. This letter updates the Supply System response to NRCB 90-02: "Loss of Thermal Margin Caused by Channel Box Bow," as requested.

The Supply System originally responded to NRCB 90-02 in Reference 2. The NRC Safety Evaluation Report (SER), "Evaluation of Response to NRC Bulletin No. 90-02: Loss of Thermal Margin Caused by Channel Box Bow (TAC NO. 76354)" (Reference 3), required that the reuse of channel boxes in future cycles be evaluated on a cycle specific basis. The Cycle 10 update for the Supply System's response to NRCB 90-02 is provided below along with a correction to the Cycle 9 update (Reference 4). The Cycle 10 update begins with a summary of reused channel management at WNP-2.

SUMMARY OF REUSED CHANNEL MANAGEMENT

The Supply System is aware of the potential problems associated with channel box bow. WNP-2, a C-lattice BWR, is less susceptible than a D-lattice BWR to the phenomena of and effects from channel box bow. The Supply System has had a channel management program in place since initial operation of WNP-2. The Supply System channel management program is described in the WNP-2 Final Safety Analysis Report (FSAR), Section 4.2.4.4, Amendment 43. The channel management program consists of data collection on channel operating history and actual measurement of channel distortion as a function of channel operation. The Supply System has in the past installed re-qualified irradiated channels on new fuel but has since begun a program to transition away from channel reuse.

As discussed in the FSAR, the current Supply System channel management goal is use of a channel box for a single assembly lifetime. To achieve this goal, the Supply System is installing only new channels on new fuel. Reuse of channels is needed to complete the transition to using channels for one assembly lifetime. During the transition, the Supply System will discharge channels predicted

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to achieve a target exposure of approximately 50 GWd/MTU in a cycle or perform an analysis to justify continued use. All reused channels have been measured prior to reuse and required to meet a predetermined acceptance criteria. Reference 2 discusses the basis for the selection of the exposure target and the analytical methodology used to establish the acceptance criteria for channel reuse. Having measured all of the channels intended for reuse at WNP-2, the Supply System has discontinued channel measurement. Data on channel operating history will continue to be collected until all reused channels have been discharged. These actions are consistent with the Supply System's channel management goal of transitioning away from channel reuse.

Beginning with Cycle 7, the effects of channel box bow have been addressed in the WNP-2 reload design using the NRC approved Siemens Power Corporation (SPC) methodology for determining the WNP-2 MCPR Safety and Operating Limits (Reference 5). The Safety Limit is established through statistical consideration of measurement and calculational uncertainties associated with the thermal hydraulic state of the reactor using design basis radial, axial and local power distributions and considering channel box bow. Reference 5 discusses SPC's Safety Limit methodology and describes in detail how channel bow effects are incorporated into the Safety Limit. SPC channel bow data (including WNP-2 measured data) have been included in the Safety Limit methodology and reviewed and approved by the NRC (Reference 5). The anticipated effect of maximum channel bow is accounted for in the MCPR operating limit through the Safety Limit, which is a part of the operating limit.

References 4 and 6 through 9 list the updates to References 2 and 3 through Cycle 9.

CYCLE 9 CORRECTION

Reference 4 reported that Cycle 9 contained 232 reused channels. During the preparation of the reused channels data for Cycle 10, it was discovered that Cycle 9 contained 233 reused channels. Reused channel HA5422 on assembly AN3113 was inadvertently excluded from the list of reused channels in Reference 4. Figure 1 (Attachment 1) shows that assembly AN3113 was located at position 29,8 (row and column coordinates from the upper left corner of the figure). Its projected End of Cycle (EOC) 9 exposure was 46,831 MWd/MTU. Channel HA5422 was not listed as reused in Reference 4 because of an error in the computer program which transcribed the data from the channel management database to Reference 4. The computer program has been modified to prevent recurrence of this problem. There was no risk of operating Cycle 9 with a reused channel whose exposure exceeded 50 GWd/MTU. The methods in place at the time would have detected an over exposed channel and flagged it for discharge, independent of the programming error that affected Reference 4. In summary, there was an error in preparing the information reported in Reference 4, but commitments relating to channel exposure or distortion were met.

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CYCLE 10 DISCUSSION

Thirty-nine channels will be replaced at the end of Cycle 9 because their exposures at the end of Cycle 10 would have exceeded 50 GWd/MTU. These channels will be replaced with less exposed channels which have been measured and meet the criteria established for allowable distortion. The Cycle 10 core will contain 104 reused channels. At the end of Cycle 10, the peak reused channel exposure is predicted to be 49.3 GWd/MTU. The exposure distribution for the reused channels is given in the following table:

Reused Channel Exposure Distribution at EOC 10

EXPOSURE RANGE GWd/MTU	QUANTITY
16 - 33	38
33 - 41	33
41 - 49.3	33

The typical irradiation path for channels at WNP-2 is five cycles in the core interior and one on the core edge. The Supply System evaluates atypical irradiation histories and justifies continued reuse of affected channels on a case specific basis. Four reused channels in Cycle 10 will experience a second cycle of irradiation on the core edge. These channels and their respective assemblies and core locations are given in the following table:

Channels with Two Cycles of Irradiation on the Core Edge

CHANNEL	ASSEMBLY	CORE LOCATION (Figure 2: row,column)
72014	AN3015	30,17
71985	AN3014	30,14
71758	AN3008	1,17
71965	XN2087	1,15

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The four listed channels have been evaluated and meet the applicable acceptance criteria for channel reuse as determined by the methodology discussed in Reference 2. Irradiating these channels on the edge of the Cycle 10 core is, therefore, deemed acceptable. The four channels are scheduled for discharge after Cycle 10.

The probability of a reused channel being face adjacent to a limiting bundle is recognized and taken into account in the calculation of the MCPR Safety Limit using the SPC methodology. As stated before, 104 reused channels will reside in the WNP-2 Cycle 10 core. The planned core location for each reused channel is given in Table 1 (Attachment 2). The location of each reused channel is also indicated in Figure 2 (Attachment 3) by assembly number. The appropriate channel number for each assembly number can be determined from Table 1. Fifty of the reused channels will be located face adjacent to new fuel assemblies. Experience has shown that, although limiting assemblies are typically once burned, fresh assemblies could potentially be limiting at the end of a long cycle. However, the precise location of limiting assemblies during the cycle depends upon the actual operating experience. A reused channel could, therefore, be adjacent to a limiting assembly at some time during Cycle 10 operation.

Channel distortion (bow + bulge), magnitude and direction, is directly dependent upon the location history of the channels. The channels that will have the largest estimated exposure at the end of Cycle 10 are channels 71848 and 61550. These channels will reside in core locations 8,3 and 15,14 respectively (row and column coordinates from the upper left corner as shown in Figure 2). The Supply System analytical channel bow model predicts the maximum, calculated total distortion for these and all other reused channels in the Cycle 10 core to be small enough to avoid interference with both control blades and in-core instrumentation.

CONCLUSION

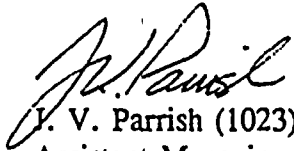
In accordance with NRCB 90-02 and Reference 3, the Supply System requests NRC approval of this plan for the reuse of channel boxes during Cycle 10. The Supply System will continue to conduct the channel management program as outlined in this letter and the references. Only measured channel boxes will be reused. The Supply System's channel bow methodology (Reference 2) will continue to be used to assure that reused channels will not interfere with control blades or in-core instrumentation. The Supply System will continue the transition to using channels for one assembly lifetime. NRC approved methods for accounting for channel bow effects in the MCPR Safety and Operating Limits will continue to be used.

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Caused by Channel Box Bow", Effect on Cycle 10 Operation

The reused channels are scheduled to be loaded into the core during the spring 1994 refueling outage, scheduled to end June 26, 1994. Therefore, NRC approval of this submittal prior to June 26, 1994 is requested. If you have any questions or desire additional information, please contact me or H. E. Kook at (509) 377-4278.

Sincerely,



J. V. Parrish (1023)

Assistant Managing Director for Operations

JDF/slc

- Attachments:
1. Figure 1; Cycle 9 Load Pattern Showing Assemblies with Reused Channels
 2. Table 1; Reused Channels, Assemblies And Projected Exposure
 3. Figure 2; Cycle 10 Load Pattern Showing Assemblies with Reused Channels

cc: JW Clifford - NRC
KE Perkins, Jr. - NRC RV
NRC Site Inspector - 927N
NS Reynolds - Winston & Strawn
DL Williams - BPA/399

STATE OF WASHINGTON)
)
COUNTY OF BENTON)

Subject: Response to IEB 90-02
Channel Box Bow

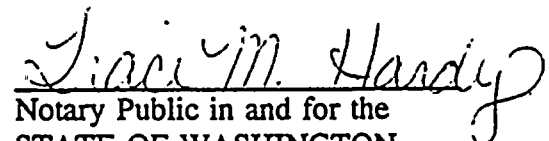
I, J. V. PARRISH, being duly sworn, subscribe to and say that I am the Assistant Managing Director, Operations for the WASHINGTON PUBLIC POWER SUPPLY SYSTEM, the applicant herein; that I have the full authority to execute this oath; that I have reviewed the foregoing; and that to the best of my knowledge, information, and belief the statements made in it are true.

DATE 29 March, 1993


J. V. Parrish, Assistant Managing Director
Operations

On this date personally appeared before me J. V. PARRISH, to me known to be the individual who executed the foregoing instrument, and acknowledged that he signed the same as his free act and deed for the uses and purposes herein mentioned.

GIVEN under my hand and seal this 29th day of March 199⁴3.


Notary Public in and for the
STATE OF WASHINGTON

Residing at Kennewick, Washington

My Commission Expires August 9, 1995

ATTACHMENT 1

Figure 1
Cycle 9 Load Pattern Showing Assemblies with Reused Channels

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1									AN3042*	AN3075*	AN3033*	AN3067*	AN3066*	AN3036*	XN2087*
2								AN3068*	UD6038	UD4018	UD5124	UD6069	UD6059	UD5093	UD6039
3						AN3040*	XN2091*	UD6113	UD4034*	WP8	UD6068	WP8	UD7030	WP8	XN2025
4						AN3099*	AN3064*	UD6075	WP8	UD4115*	UD7095	UD4114	WA6003	UD4032*	UD5128
5					AN3031*	UD4146	UD6054	WP8	UD7078	WP8	AN3074*	WP8	UD5066*	WP8	UD7075
6			AN3038*	AN3051*	AN3133*	AN3043*	UD6120	UD5071*	AN3092*	UD5064*	UD6087	UD6013	UD6028	UD5061	UD4082
7			XN2086*	AN3046	UD6056	UD6112	UD4112	UD5070*	UD7021	WP8	UD5058	AN3039*	UD7064	WP8	UD4051
8		AN3034*	UD6058	UD6053	WP8	UD5129	UD5135	UD5072*	UD6061	AN3070*	UD4025*	UD5063*	UD5125	UD4118	UD5122
9	AN3032*	UD6052	UD4122	WP8	UD7024	AN3104*	UD7089	UD6062	UD4128	WP8	UD4108	WP8	UD5062	WP8	UD5005
10	AN3076*	UD4111	WP8	UD4024*	WP8	LYV153	WP8	AN3079*	WP8	UD4045	WP8	UD4048	UD7087	UD4107	UD4103
11	AN3100*	UD5121	UD6041	UD7005	AN3053*	UD6037	UD5126	UD4121	UD4117	WP8	UD4100	UD5131	UD7093	WP8	UD5057
12	AN3052*	UD6057	WP8	UD4017	WP8	UD6060	AN3069*	UD5132	WP8	UD4047	UD5123	UD4043	UD6108	UD4099	AN3035*
13	AN3054*	UD6114	UD7068	UD5111	UD5127	UD6036	UD7090	UD5065*	UD5055	UD7020	UD7023	UD6103	UD4053	WP8	UD6026
14	AN3080*	UD5054	WP8	UD4054	WP8	UD5087	WP8	UD4052	WP8	UD4113	WP8	UD4104	WP8	UD7079	UD4044
15	XN2084*	UD6115	XN2024	UD5130	UD7019	UD4062	UD4088	UD5030*	UD5007	UD4061	UD5056	AN3041*	UD6094	UD4046	UD5069*
16	XN2066*	UD6002	XN2071	UD5040*	UD7011	UD4016*	UD4021*	UD5042	UD5019	UD4143*	UD5036*	AN3020*	UD6117	UD4102	UD5028*
17	AN3002*	UD5075	WP8	UD4097	WP8	UD5134	WP8	UD4091	WP8	UD4144*	WP8	UD4012*	WP8	UD7063	UD4098
18	AN3058*	UD6012	UD7053	UD5086	UD5080	UD6034	UD7072	UD5095	UD5039*	UD7062	UD7047	UD6022	UD4095	WP8	UD6102
19	AN3019*	UD6078	WP8	UD4077	WP8	UD6080	AN3010	UD5103	WP8	UD4005*	UD5010*	UD4101	UD6016	UD4039*	AN3056*
20	AN3086*	UD5085	UD6015	UD7031	AN3057*	UD6100	UD5094	UD4072	UD4033*	WP8	UD4041*	UD5004*	UD7001	WP8	UD5016*
21	AN3073*	UD4042*	WP8	UD4076	WP8	LYV156	WP8	AN3128*	WP8	UD4038*	WP8	UD4015*	UD7010	UD4027*	UD4040*
22	AN3123*	UD6079	UD4071	WP8	UD7065	AN3050*	UD7046	UD6021	UD4131	WP8	UD4026*	WP8	UD5014*	WP8	UD5003
23		AN3011*	UD6077	UD6110	WP8	UD5078	UD5102	UD5011*	UD6029	AN3131*	UD4087	UD5084	UD5079	UD4116*	UD5018*
24		XN2056*	AN3037*	UD6072	UD6001	UD4138*	UD5017*	UD7060	WP8	UD5009*	AN3055*	UD7083	WP8	UD4092	
25		AN3009	AN3013*	AN3102*	AN3012*	UD6017	UD5020*	AN3088*	UD5076	UD6105	UD6071	UD6035	UD5008*	UD4028*	
26				AN3044*	UD4145	UD6067	WP8	UD7080	WP8	AN3087*	WP8	UD5082	WP8	UD7004	
27					AN3101*	AN3018*	UD6111	WP8	UD4011*	UD7054	UD4137*	WA6001	UD4006*	UD5077	
28					AN3118	XN2081*	UD6073	UD4094	WP8	UD6055	WP8	UD7013	WP8	XN2073*	
29							AN3113*	UD6014	UD4078	UD5081	UD6070	UD6076	UD5120	UD6018	
30								AN3127*	AN3071*	AN3132*	AN3072*	AN3114*	AN3014*	XN2065*	
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	XN2095*	AN3008*	AN3095*	AN3098*	AN3021*	AN3107*	AN3025*								
2	UD6066	UD5083	UD6050	UD6063	UD5052	UD4058	UD6065	AN3096*							
3	XN2108*	WP8	UD7027	WP8	UD6019	WP8	UD4059	UD6119	XN2099*	AN3126*					
4	UD5068	UD4055	WA6004	UD4127	UD7067	UD4105	WP8	UD6096	AN3028*	AN3045*					
5	UD7103	WP8	UD5115	WP8	AN3090*	WP8	UD7082	WP8	UD6046	UD4147	AN3029*				
6	UD4093	UD5044	UD6049	UD6047	UD6010	UD5073	AN3089*	UD5043	UD6101	AN3083*	AN3134*	AN3119*	AN3130*		
7	UD4065	WP8	UD7077	AN3125*	UD5109	WP8	UD7043	UD5050	UD4109	UD6099	UD6040	AN3124*	XN2094*		
8	UD5116	UD4126	UD5108	UD5049	UD4073	AN3027*	UD6064	UD5091	UD5046	WP8	UD5048	WP8	UD6109	AN3022*	
9	UD5015	WP8	UD5045	WP8	UD4124	WP8	UD4130	UD6044	UD7025	AN3085*	UD7018	WP8	UD4096	UD6043	AN3030*
10	UD4119	UD4129	UD7091	UD4010	WP8	UD4020	WP8	AN3084*	WP8	LYV155	WP8	UD4022*	WP8	UD4110	AN3097*
11	UD5041	WP8	UD7105	UD5117	UD4001	WP8	UD4123	UD4031*	UD5118	UD6011	AN3103*	UD7040	UD6048	UD5047	AN3049*
12	AN3007*	UD4120	UD6042	UD4064	UD5051	UD4019	WP8	UD5119	AN3081*	UD6045	WP8	UD4066	WP8	UD6025	AN3120*
13	UD6020	WP8	UD4070	UD6107	UD7032	UD7099	UD5053	UD5067	UD7022	UD6104	UD5113	UD5133	UD7094	UD6106	AN3082*
14	UD4063	UD7033	WP8	UD4106	WP8	UD4050	WP8	UD4029*	WP8	UD5013*	WP8	UD4069	WP8	UD5110	AN3001*
15	UD5112	UD4057	UD6074	AN3026*	UD5074	UD4009	UD5012	UD5035*	UD4125	UD4056	UD7102	UD5114	XN1090	UD6098	XN2067*
16	UD5025*	UD4084	UD6081	AN3060*	UD5022*	UD4140*	UD5027	UD5060	UD4003*	UD4139*	UD7066	UD5101	XN1141	UD6030	XN2100*
17	UD4080	UD7088	WP8	UD4134*	WP8	UD4142*	WP8	UD4081	WP8	UD5136	WP8	UD4067	WP8	UD5026*	AN3122*
18	UD6116	WP8	UD4068	UD6027	UD7100	UD7056	UD5031*	UD5021*	UD7016	UD6006	UD5105	UD5092	UD7057	UD6008	AN3112*
19	AN3078*	UD4007*	UD6009	UD4079	UD5024*	UD4014*	WP8	UD5090	AN3023*	UD6093	WP8	UD4086	WP8	UD6088	AN3063*
20	UD5037*	WP8	UD7084	UD5106	UD4036*	WP8	UD4023*	UD4075	UD5033*	UD6118	AN3111*	UD7106	UD6085	UD5023*	AN3091*
21	UD4035*	UD4008*	UD7097	UD4013*	WP8	UD4083*	WP8	AN3016*	WP8	LYV154	WP8	UD4060	WP8	UD4135*	AN3116*
22	UD5006	WP8	UD5100	WP8	UD4037*	WP8	UD4133	UD6032	UD7096	AN3093*	UD7058	WP8	UD4089	UD6092	AN3048*
23	UD5002	UD4004*	UD5107	UD5001	UD4090	AN3121*	UD6023	UD5089	UD5088	UD5029*	WP8	UD6086	UD6089	AN3061*	
24	UD4030*	WP8	UD7050	AN3077*	UD5104	WP8	UD7055	UD5099	UD4136*	UD6003	UD6084	AN3129*	XN2068*		
25	UD4049	UD5096	UD6005	UD6024	UD6082	UD5097	AN3094*	UD5098	UD6007	AN3059*	AN3065*	AN3005*	AN3006*		
26	UD7081	WP8	UD5034*	WP8	AN3105*	WP8	UD7026	WP8	UD6083	UD4148	AN3047*				
27	UD5038*	UD4002	WA6002	UD4141*	UD7052	UD4132*	WP8	UD6051	AN3117	AN3108*					
28	XN2060*	WP8	UD7035	WP8	UD6090	UD4074	WP8	UD6095	XN2078*	AN3017*					
29	UD6031	UD5059	UD6091	UD6033	UD5032*	UD4085	UD6004	AN3109*							
30	XN2052*	AN3015*	AN3106*	AN3110*	AN3024*	AN3115*	AN3062*								

WP8 are fresh 9x9-9X assemblies loaded in Cycle 9
* Assemblies with Reused Channels

ATTACHMENT 2

Table 1

Reused Channels, Assemblies and Projected EOC 10 Exposures

Row ===	Column =====	Current Assembly =====	Channel ID =====	Proj EOC 10 Exposure =====
1	13	UD4032	62686	33603
1	14	AN3036	63602	47970
1	15	XN2087	71965	42174
1	16	XN2095	70104	42297
1	17	AN3008	71758	47894
2	15	UD5066	71780	49138
4	12	AN3133	71982	32252
4	19	AN3134	71827	32580
5	5	AN3031	71389	47043
5	7	UD4115	70190	36612
5	11	AN3064	72035	49039
5	20	AN3028	72474	48856
5	26	AN3029	72439	46495
6	10	UD5064	71806	29399
7	5	UD4024	73124	37075
7	13	UD5071	71938	46301
7	26	UD4022	73386	44105
8	3	UD5030	71848	49294
8	10	UD4025	71473	29800
8	28	UD5035	71983	48904
9	11	UD5063	71898	29041
9	29	UD5013	73228	29385
10	10	UD4034	73151	33700
10	23	UD4031	71754	29177
11	13	UD5070	71803	29334
11	26	AN3124	71376	48972
12	30	UD4029	73117	33262
13	13	UD5072	71902	28976
14	1	AN3080	5866D	39640
14	14	UD5069	73223	32571
14	30	AN3001	71790	48568
15	1	XN2084	71936	42199
15	14	UD5065	61550	49149
15	30	XN2067	73582	42779
16	1	XN2066	61972	35985
16	9	UD5036	71946	33123
16	17	UD5021	71459	32744
16	22	UD5022	71987	33118
16	30	XN2100	71959	36061
17	1	AN3002	62283	39724
17	4	UD5039	73362	32690

Table 1 (Cont.)

Row ===	Column =====	Current Assembly =====	Channel ID =====	Proj. EOC 10 Exposure =====
17	14	UD5028	73053	32696
17	17	UD5025	73378	30915
17	21	UD5033	73127	28456
17	27	UD5031	70202	32595
17	29	UD5026	61750	48451
17	30	AN3122	71928	45625
18	13	UD5011	73172	29164
18	24	UD5029	73138	33011
19	2	UD5010	73150	30791
19	10	UD5040	73149	33004
19	29	UD5024	73109	30824
20	5	AN3037	72037	48889
20	13	UD5017	71798	29357
20	26	AN3129	71442	48660
20	29	UD5023	73069	47613
21	1	UD4012	71950	35822
21	2	UD4042	71989	29894
21	14	UD5009	73439	16872
21	19	UD5038	71972	32701
21	29	UD4135	71975	47999
21	30	UD4134	70167	32930
22	1	UD4143	72042	34327
22	15	UD5016	71204	33064
22	16	UD5037	73170	33072
22	30	UD4140	71801	32218
23	2	UD4016	71904	36252
23	29	UD4139	73132	32660
24	3	UD4144	71434	33533
24	13	UD5020	71939	32992
24	28	UD4142	6028D	39523
25	4	UD4038	73403	34868
25	5	UD4021	73423	29727
25	26	UD4003	72030	30037
25	27	UD4083	71953	34929
26	5	AN3044	73422	47041
26	7	UD4011	71792	36921
26	11	AN3018	71431	48639
26	24	UD4132	63950	36620
26	25	UD4030	71854	29867
26	26	AN3047	73133	44402
27	6	UD4040	71786	37044
27	12	AN3102	71753	44114
27	14	UD5014	73369	32492
27	19	AN3065	71976	46869
28	7	UD4027	71393	33820

Table 1 (Cont.)

Row	Column	Current Assembly	Channel ID	Proj. EOC 10 Exposure
===	=====	=====	=====	=====
28	8	UD5018	73589	30428
28	24	UD4008	71907	33614
29	8	UD4028	73368	32736
29	9	UD5008	70209	29086
29	12	UD5004	70159	30662
29	16	UD5034	63510	30427
29	20	UD5032	70243	47597
30	10	UD4039	71835	34732
30	11	UD4116	71392	33546
30	12	UD4138	71334	32657
30	13	UD4006	71954	35439
30	14	AN3014	71985	48017
30	15	XN2065	71921	35791
30	16	XN2052	61526	35767
30	17	AN3015	72014	48117
30	19	UD4136	70103	32695
30	20	UD4004	73444	41246
30	21	UD4007	73426	34398

ATTACHMENT 3

Figure 2

Cycle 10 Load Pattern Showing Assemblies with Reused Channels

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1								UD4053	UD4099	UD4118	UD4112	UD4032*	AN3036*	XN2087*
2							UD4082	UD5061	UD4018	UD5124	UD5131	UD8004	UD5093	UD5066*
3					UD4044	UD4107	UD5122	UD7092	wp9	UD8001	wp9	UD8069	wp9	UD7030
4					UD4103	UD8096	UD8064	wp9	WA6003	UD7006	AN3133*	wp9	UD5062	UD6113
5				AN3031*	UD4051	UD4115*	wp9	UD8003	wp9	AN3064*	wp9	UD6054	wp9	UD7075
6		UD4046	UD4045	UD4088	wp9	wp9	UD8050	UD7095	UD5064*	UD7059	UD7078	UD8034	UD5005	UD6038
7		UD4113	UD8099	UD4024*	wp9	UD6057	UD6039	UD8036	wp9	UD7064	UD7021	UD5071*	wp9	UD6120
8	UD4062	UD5030*	UD8077	wp9	UD8067	UD6115	UD6069	UD4025*	UD7087	UD6068	UD8023	UD6061	UD7093	
9	UD4061	UD5087	UD7008	wp9	UD8002	UD7005	UD8017	UD6053	UD4122	wp9	UD5063*	wp9	UD6087	UD5057
10	UD4104	UD4111	wp9	UD5111	wp9	LYV153	wp9	UD4121	wp9	UD4034*	wp9	UD5128	UD7071	UD5058
11	UD4128	UD5121	UD8057	UD7044	AN3046	UD7042	UD7090	UD7020	UD5132	wp9	UD6013	UD6026	UD5070*	wp9
12	UD4052	UD5123	wp9	UD4146	wp9	UD7024	UD7089	UD6041	wp9	UD5130	UD6094	UD6060	wp9	UD6108
13	UD4054	UD8008	UD8055	wp9	UD6056	UD8043	UD5129	UD8016	UD6037	UD7086	UD5135	wp9	UD5072*	wp9
14	AN3080*	UD5054	wp9	UD5055	wp9	UD5007	wp9	UD6062	wp9	UD5126	wp9	UD6103	wp9	UD5069*
15	XN2084*	UD5127	UD7068	UD6058	UD7019	UD6052	UD6112	UD7023	UD5056	UD7085	UD6036	UD6114	UD8066	UD5065*
16	XN2066*	UD5080	UD7053	UD6077	UD7011	UD6079	UD6001	UD7047	UD5036*	UD7045	UD6034	UD6012	UD8071	UD5095
17	AN3002*	UD5075	wp9	UD5039*	wp9	UD5019	wp9	UD6021	wp9	UD5094	wp9	UD6022	wp9	UD5028*
18	UD4097	UD8047	UD8088	wp9	UD6072	UD8040	UD5078	UD8074	UD6100	UD7061	UD5102	wp9	UD5011*	wp9
19	UD4091	UD5010*	wp9	UD4145	wp9	UD7065	UD7046	UD6015	wp9	UD5040*	UD6117	UD6080	wp9	UD6016
20	UD4131	UD5085	UD8053	UD7076	AN3037*	UD7007	UD7072	UD7062	UD5103	wp9	UD6071	UD6102	UD5017*	wp9
21	UD4012*	UD4042*	wp9	UD5086	wp9	LYV156	wp9	UD4072	wp9	UD4094	wp9	UD5077	UD7069	UD5009*
22	UD4143*	UD5134	UD7029	wp9	UD8009	UD7031	UD8007	UD6110	UD4071	wp9	UD5084	wp9	UD6105	wp9
23		UD4016*	UD5042	UD8048	wp9	UD8070	UD6002	UD6070	UD6111	UD4087	UD7010	UD6055	UD8026	UD6029
24		UD4144*	UD8039	UD4076	wp9	UD6078	UD6018	UD8028	wp9	UD7083	UD7060	UD5020*	wp9	UD6017
25		UD4102	UD4038*	UD4021*	wp9	wp9	UD8090	UD7054	UD5076	UD7014	UD7080	UD8022	UD5003	UD6014
26				AN3044*	UD4092	UD4011*	wp9	UD8024	wp9	AN3018*	wp9	UD6067	wp9	UD7004
27					UD4040*	UD8015	UD8049	wp9	WA6001	UD7028	AN3102*	wp9	UD5014*	UD6073
28					UD4098	UD4027*	UD5018*	UD7101	wp9	UD8073	wp9	UD8081	wp9	UD7013
29							UD4028*	UD5008*	UD4078	UD5081	UD5004*	UD8005	UD5120	UD5082
30								UD4095	UD4039*	UD4116*	UD4138*	UD4006*	AN3014*	XN2065*
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	XN2095*	AN3008*	UD4055	UD4109	UD4126	UD4120	UD4070							
2	UD5115	UD5083	UD8014	UD5117	UD5052	UD4058	UD5044	UD4093						
3	UD7027	wp9	UD8044	wp9	UD8032	wp9	UD7049	UD5116	UD4129	UD4063				
4	UD6119	UD5045	wp9	AN3134*	UD7041	WA6004	wp9	UD8072	UD8019	UD4119				
5	UD7103	wp9	UD6046	wp9	AN3028*	wp9	UD8037	wp9	UD4105	UD4065	AN3029*			
6	UD6065	UD5015	UD8013	UD7082	UD7074	UD5073	UD7067	UD8033	wp9	wp9	UD4125	UD4020	UD4057	
7	UD6101	wp9	UD5043	UD7043	UD7077	wp9	UD8012	UD6066	UD6025	wp9	UD4022*	UD8091	UD4050	
8	UD7105	UD6064	UD8011	UD6019	UD7091	UD4073	UD6096	UD6063	UD6098	UD8061	wp9	UD8051	UD5035*	UD4056
9	UD5041	wp9	UD6010	wp9	UD5049	wp9	UD4096	UD6097	UD8006	UD7040	UD8030	wp9	UD7037	UD5013*
10	UD7107	UD5109	UD7051	UD5068	wp9	UD4059	wp9	UD4031*	wp9	LYV155	wp9	UD5133	wp9	UD4110
11	UD6049	wp9	UD5050	UD6020	UD6047	wp9	UD5119	UD7099	UD7022	UD7017	AN3124*	UD7015	UD8010	UD5047
12	UD6050	UD6042	wp9	UD6045	UD6074	UD5114	wp9	UD6048	UD7025	UD7018	wp9	UD4147	wp9	UD4130
13	UD8021	wp9	UD5091	wp9	UD5046	UD7048	UD6011	UD8054	UD5048	UD8029	UD6040	wp9	UD8035	UD4029*
14	UD5108	UD5112	wp9	UD6107	wp9	UD5118	wp9	UD6044	wp9	UD5012	wp9	UD5053	wp9	UD4069
15	UD7033	UD5067	UD8060	UD6106	UD6104	UD7070	UD5074	UD7032	UD6099	UD6043	UD7102	UD6109	UD7094	AN3001*
16	UD7088	UD5021*	UD8098	UD6008	UD6006	UD7036	UD5022*	UD7100	UD6003	UD6092	UD7066	UD6089	UD7057	UD5113
17	UD5107	UD5025*	wp9	UD6027	wp9	UD5033*	wp9	UD6032	wp9	UD5027	wp9	UD5031*	wp9	XN2067*
18	UD8093	wp9	UD5089	wp9	UD5088	UD7038	UD6118	UD8065	UD5029*	UD8038	UD6084	wp9	UD8025	UD5105
19	UD6091	UD6009	wp9	UD6093	UD6081	UD5101	wp9	UD6085	UD7096	UD7058	wp9	UD4148	wp9	UD8031
20	UD6005	wp9	UD5099	UD6116	UD6024	wp9	UD5090	UD7056	UD7016	UD7039	AN3129*	UD7012	UD8042	UD5024*
21	UD7098	UD5104	UD7104	UD5038*	wp9	UD4074	wp9	UD4075	wp9	LYV154	wp9	UD5092	wp9	UD4081
22	UD5037*	wp9	UD6082	wp9	UD5001	wp9	UD4089	UD6086	UD8027	UD7106	UD8046	wp9	UD7108	UD5023*
23	UD7084	UD6023	UD8018	UD6090	UD7097	UD4090	UD6051	UD6033	UD6030	UD8068	wp9	UD8052	UD5060	UD4133
24	UD6007	wp9	UD5098	UD7055	UD7050	wp9	UD8020	UD6031	UD6088	wp9	UD4060	UD8075	UD4142*	UD4134*
25	UD6004	UD5006	UD8062	UD7026	UD7034	UD5097	UD7052	UD8100	wp9	wp9	UD4003*	UD4083*	UD4084	UD4140*
26	UD7081	wp9	UD6083	wp9	AN3117	wp9	UD8076	wp9	UD4132*	UD4030*	AN3047*			
27	UD6095	UD5100	wp9	AN3065*	UD7003	WA6002	wp9	UD8056	UD8092	UD4086				
28	UD7035	wp9	UD8094	wp9	UD8045	wp9	UD7073	UD5002	UD4008*	UD4080				
29	UD5034*	UD5059	UD8063	UD5106	UD5032*	UD4085	UD5096	UD4049						
30	XN2052*	AN3015*	UD4002	UD4136*	UD4004*	UD4007*	UD4068							

wp9 are fresh 9x9-9X assemblies loaded in Cycle 10
 * Assemblies with Reused Channels