Commonwealth Edison
1400 Opus Place
Downers Grove, Illinois 60515

July 27, 1992

Dr. Thomas E. Murley
U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, D. C. 20555

Attn: Document Control Desk

Subject: LaSalle County Station Unit 1
Fuel Channel Evaluation for Unit 1 Cycle 6
NRC Docket No. 50-373

References:

1. M. Richter (CECo) Letter to U.S. NRC, dated April 26, 1990.
2. M. Richter (CECo) Letter to U.S. NRC, dated January 7, 1991.
3. J. B. Hickman (U.S. NRC) Letter to T. J. Kovach (CECo), dated February 28, 1991.
4. P. L. Piet (CECo) Letter to U.S. NRC, September 6, 1991.
5. B. L. Siegel (U.S. NRC) Letter to T. J. Kovach, January 21, 1992

Dr. Murley:

NRC Bulletin 90-02 (Bulletin) requested that all Boiling Water Reactor (BWR) Licensees address the effect of fuel channel bow on thermal margins in BWRs, particularly the bow of channels that are being reused on a second bundle. Reference 1 provided Commonwealth Edison Company's (CECo) response to the Bulletin for LaSalle County Station (LaSalle). The response indicated that, although CECo no longer places irradiated channels on new/fresh fuel assemblies, previous channel management practices included the reuse of channels. Consequently, LaSalle 1 Cycle 6 (currently scheduled to begin December 28, 1992) will use some fuel channels which had been previously installed on other fuel bundles from Cycle 1. These channels had a previous single cycle of operation.

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The attachment to this letter presents the evaluation performed by CECo to address the thermal margin impact of the residual reused channels during Cycle 6. This evaluation is based on the results of the LaSalle 1 Cycle 5 analysis, which was submitted to the NRC in Reference 2 and approved in Reference 3, and the LaSalle 2 Cycle 5 analysis, which was submitted to the NRC in Reference 4 and approved in Reference 5. In order to minimize their potential effects, the 156 residual reused channels will be loaded near the core periphery and are projected to have substantial margin to limits. As discussed in the attachment, CECo believes the large Cycle 6 margins coupled with the previous Cycle 5 analysis (which bounds this cycle) are responsive to the concerns expressed by your staff in the Bulletin.

Please direct any questions or comments on this letter to this office.

Respectively,

J. M. Shields
Nuclear Licensing Administrator

Attachment

Evaluation of the Effect of Residual Reused Channels on Thermal Margins for LaSalle 1 Cycle 6

cc: A. B. Davis - Regional Administrator, Region III
B. L. Siegel - Project Manager, NRR
L. E. Phillips - Reactor Systems Branch, NRR
A. C. Attard - Reactor Systems Branch, NRR
D. L. Hills - Senior Resident Inspector, LaSalle

Attachment

Evaluation of the Effect of Residual Reused Channels
on Thermal Margins for LaSalle 1 Cycle 6

Background:

Reference 1, which presented Commonwealth Edison's (Edison) response to NRC Bulletin 90-02 for its Boiling Water Reactor Stations, indicated that although Edison no longer places irradiated fuel channels on fresh fuel assemblies, previous channel management practices had included the reuse of channels. As a result, channels from the LaSalle County Station initial core discharge batch were placed on the fresh fuel assemblies that were loaded in LaSalle 1 Cycle 3, as discussed in Reference 1. These channels had received a single cycle of irradiation, yielding channel exposures from 2 to 14 GWD/MTU, prior to their placement on the LaSalle 1 Cycle 3 reload fuel. Assemblies from this reload continue to be resident in the projected LaSalle 1 Cycle 6 loading.

Channel bow is primarily caused by differential neutron flux across the lattice. C-lattice plants, such as LaSalle County Station, have uniform water gaps around the assemblies and hence experience less channel bow as a function of exposure relative to comparable D-lattice plants. This leads to a smaller impact on local peaking, and hence Minimum Critical Power Ratio (MCPR) and Linear Heat Generation (LHGR) margins, as a result of channel bow for C-lattice plants.

Projected LaSalle 1 Cycle 6 Channel Configuration:

The projected LaSalle 1 Cycle 6 core configuration is shown in Figure 1. This figure shows the location of the reused channels, the end of Cycle 6 projected channel exposure, and the end of Cycle 6 projected fuel assembly exposure. For reference purposes, the assemblies with reused channels are listed in Table 1 in order of decreasing end of Cycle 6 channel exposure. The projected end of Cycle 5 exposure is based on the latest projection. Actual bundle and hence channel exposures may increase up to 0.20 GWD/MTU because the unit is operating at a higher capacity factor than predicted. Therefore, the values in Figure 1 and Table 1 may increase by that amount.

It can be seen from Figure 1 that the fuel assemblies with reused channels are loaded within three rows of the core periphery as the result of a deliberate effort by Edison nuclear design engineers to minimize the number of residual reused channels in limiting, high-power locations while maintaining core symmetry. As a result, 156 assemblies which had received reused channels when they were originally loaded will remain in LaSalle 1 Cycle 6 but are all within three rows of the periphery.

As seen in Table 1, maximum channel exposure at the end of Cycle 6 is significantly below the maximum channel exposure 54 GWD/MTU which was used in the GE generic channel bow methodology, Reference 4. Assuming Cycle 5 and Cycle 6 run at 100% capacity, the end of Cycle 6 channel exposures are still below the maximum value used in the GE analysis.

Channel Bow Evaluation:

General Electric performed a cycle-specific analysis for the residual reused channels in LaSalle 1 Cycle 5. This was evaluated and submitted by Edison to the NRC in Reference 2 and approved by the NRC in Reference 3. The cycle-specific analysis was required due to the number of reused channels in central, limiting locations. This analysis determined the appropriate value of bow to be used to adjust the critical power correlation's R-factors for the various assemblies in the core by evaluating the past exposure history of the reused channels present in LaSalle 1 Cycle 5. R-factors are a location-weighted function of the local pin powers in a bundle.

The LaSalle 1 Cycle 5 evaluation was only performed for reused channels which were present on the interior, limiting assemblies. Cells which are located within four rows of the core periphery were not included due to the large degree of margin in these low power regions.

The bundles with the reused channels are projected to have at least 50% margin to the MCPR Operating Limit and at least 55% margin to the LHGR Limit at the most limiting point in LaSalle 1 Cycle 6. Therefore, consistent with the LaSalle 1 Cycle 5 analysis and evaluation, these assemblies will not be rechanneled or specifically analyzed due to their substantial margin to thermal limits.

R-Factor Adjustment:

Since there will be no reused channels in the interior, potentially limiting area of the core, and the maximum projected end of Cycle 6 channel exposure is less than the maximum value in the GE generic channel bow analysis (Reference 4) of 54 GWD/MTU, the application for the NRC-approved GE core average bow technique for single bundle channels, as described in Reference 4, is appropriate. Edison will apply an R-factor set consistent with this method. This approach was previously used for LaSalle 2 Cycle 5, submitted in Reference 5 and reviewed and approved by the NRC (Reference 6).

MCPR Safety Limit:

A potential impact of channel bow is an increase in the MCPR Safety Limit due to increased measurement uncertainties. GE evaluated this for the LaSalle 1 Cycle 5 loading in Reference 2 and concluded that there would be no impact on the MCPR Safety Limit since the spread in the channel bow data was within the tolerances used in the generic methodology, Reference 4. Since the LaSalle 1 Cycle 5 loading bounds the LaSalle 1 Cycle 6 loading in terms of number and location of reused channels, and the maximum end of Cycle 6 channel exposure is less than the maximum value in the GE generic methodology, no adjustment of the MCPR Safety Limit is required to ensure fuel cladding integrity. This approach was previously used for LaSalle 2 Cycle 5, submitted in Reference 5 and reviewed and approved by the NRC (Reference 6).

Conclusion:

To summarize, the single previous cycle of exposure (on different assemblies) of the remaining 156 residual reused channels in the LaSalle 1 Cycle 6 core does not present a challenge to the LHGR limit, the MCPR Operating Limit, or the MCPR Safety Limit. They will be loaded into non-limiting locations on or near the core periphery.

During cycle operation, all assemblies in the core will be modeled using an R-factor adjustment strategy consistent with the GE generic channel bow methodology. These steps will ensure that the MCPR Safety Limit and LHGR design limitas are protected throughout LaSalle 1 Cycle 6 even in the event of a limiting Abnormal Operating Occurrence.

As indicated in the Reference 1 response to NRC Bulletin 90-02, Edison has discontinued the previous practice of channeling fresh fuel with previously irradiated channels and anticipates that all residual reused channels will be completely discharged at the end of Cycle 6 on Unit 1 and the end of Cycle 6 on Unit 2. Until that time, Edison will continue to minimize the number of residual reused channels during the core loading development, and will load all reused channels only in locations which are clearly non-limiting.

References:

1. Letter, M. H. Richter to U. S. Nuclear Regulatory Commission, "Dresden Station Units 2 and 3, Quad Cities Station Units 1 and 2, LaSalle County Station Units 1 and 2 - Response to NRC bulletin 90-02, NRC Docket Nos. 50-237/249, 50-254/265, 50-373/374", April 26, 1990.
2. Letter, M. H. Richter to U. S. Nuclear Regulatory Commission, "LaSalle County Nuclear Power Station Unit 1 - Fuel Channel Evaluation for LaSalle 1 Cycle 5, NRC Docket No. 50-373", January 7, 1991.
3. Letter, J. B. Hickman (USNRC) to T. J. Kovach (Edison), "Safety Evaluation for LaSalle Unit 1 - Fuel Channel Evaluation for Cycle 5 (TAC No. 79439)", February 28, 1991.
4. Letter, P. W. Marriot (GE) to T. E. Murley (NRC), "Fuel Channel Bow", August 22, 1989.
5. Letter, P. L. Piet to U. S. Nuclear Regulatory Commission, "LaSalle County Nuclear Power Station Unit 2 - Fuel Channel Evaluation for LaSalle 2 Cycle 5, NRC Docket No. 50-374", September 6, 1991.
6. Letter, B. L. Siegel (USNRC) to T. J. Kovach (Edison), "Evaluation of Response to NRC Bulletin 90-02 For LaSalle County Station, Unit 2 (TAC No. M82038)", January 21, 1992.

Figure 1

LaSalle 1 Cycle 6 Core Configuration

The attached figure shows the location of the residual reused channels in LaSalle 1 Cycle 6. Control cell locations are identified for reference purposes.

The information included for each reused channel is as follows:

LYJ553 - Assembly Identification
42. - Channel Projected End of Cycle Exposure, GWD/MTU
29. - Fuel Assembly Projected End of Cycle Exposure, GWD/MTU.

Core locations which do not have a reused channel are marked "N/R" for Not Reused.

Figure 1, Continued
LaSalle 1 Cycle 6 Core Configuration

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1									LYJ60o 46 33	N/R	N/R	N/R	LYJ542 38 33	LYJ732 49 35	LYJ553 47 34
2								N/R	LYJ626 36 32	LYJ557 46 33	LYJ549 36 33	LYJ.35 39 34	LYJ653 4u 36	LYJ664 41 37	N/R
3						LYJ655 39 35	LYJ536 37 33	LYJ604 46 33	LYJ704 49 35	N/R	LYJ646 50 37	N/R	N/R	N/R	N/R
4						LYJ534 37 33	LYJ733 48 35	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
5					N/R	LYJ647 39 35	LYJ726 39 36	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
6			LYJ724 48 35	LYJ629 37 33	LYJ662 40 35	LYJ603 39 36	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
7			LYJ571 46 33	LYJ637 48 35	LYJ695 49 36	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
8		/R	LYJ602 47 33	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
9	LYJ540 46 33	LYJ612 36 32	LYJ65/ 39 35	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
10	N/R	LYJ601 46 33	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
11	N/R	LYJ564 38 33	LYJ648 50 37	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
12	N/R	LYJ584 37 34	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
13	LYJ531 36 33	LYJ671 40 36	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
14	LYJ745 48 35	LYJ670 41 37	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
15	LYJ579 47 33	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R

Figure 1, Continued
LaSalle 1 Cycle 6 Core Configuration

Figure 1, Continued
LaSalle 1 Cycle 6 Core Configuration

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	LYJ600 47 33	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
17	LYJ730 48 35	LYJ713 41 37	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
18	LYJ593 47 33	LYJ714 40 36	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
19	N/R	LYJ627 37 34	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
20	N/R	LYJ624 47 33	LYJ661 50 37	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
21	N/R	LYJ598 47 33	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
22	LYJ561 47 33	LYJ628 36 32	LYJ712 39 35	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
23		N/R	LYJ586 46 33	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
24			LYJ535 36 33	LYJ711 48 35	LYJ696 49 36	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
25			LYJ640 48 35	LYJ590 46 33	LYJ643 48 35	LYJ541 39 36	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
26					N/R	LYJ743 48 35	LYJ673 49 36	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
27						LYJ570 46 33	LYJ716 48 35	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
28						LYJ690 48 35	LYJ551 37 33	LYJ545 47 33	LYJ718 38 35	N/R	LYJ73. 50 37	N/R	N/R	N/R	N/R
29								N/R	LYJ630 37 32	LYJ621 46 33	LYJ592 47 33	LYJ632 39 34	LYJ715 40 36	LYJ719 40 37	N/R
30									LYJ572 47 33	N/R	N/R	N/R	LYJ594 47 33	LYJ709 49 35	LYJ555 47 34

Figure 1, Continued
LaSalle 1 Cycle 6 Core Configuration

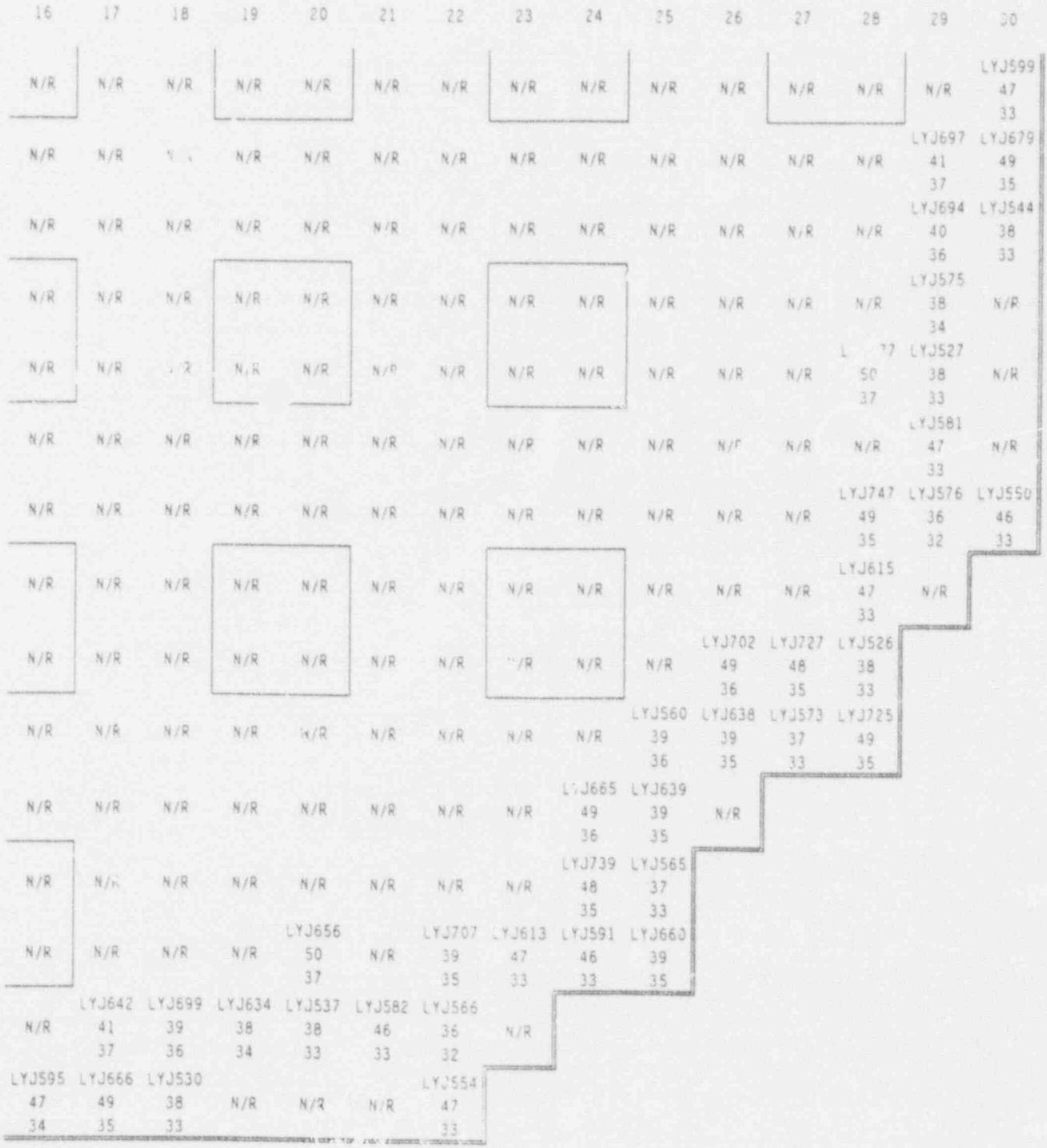

Table 1
Listing of Assemblies with Reused Channels

Assembly ID	Location I	Location J	Exp, GWD/MTU CHANNEL	Exp, GWD/MTU FUEL
LYJ646	11	3	50	37
LYJ737	11	28	50	37
LYJ701	28	11	50	37
LYJ677	28	20	50	37
LYJ669	20	3	50	37
LYJ661	3	20	50	37
LYJ656	20	28	50	37
LYJ648	3	11	50	37
LYJ723	29	14	50	37
LYJ650	17	2	50	37
LYJ644	29	13	50	36
LYJ654	18	2	49	36
LYJ726	7	5	49	36
LYJ702	26	24	49	36
LYJ696	5	24	49	36
LYJ685	26	7	49	36
LYJ673	7	26	49	36
LYJ665	24	26	49	36
LYJ649	24	5	49	36
LYJ587	25	6	49	36
LYJ695	5	7	49	36
LYJ709	14	30	49	35
LYJ747	28	22	49	35
LYJ738	22	6	49	35
LYJ736	17	1	49	35
LYJ7[illegible]	14	1	49	35
LYJ725	28	25	49	35
LYJ704	9	3	49	35
LYJ692	30	14	49	35
LYJ679	30	17	49	35
LYJ666	17	30	49	35
LYJ745	1	14	48	35
LYJ739	24	27	48	35
LYJ733	7	4	48	35
LYJ728	24	4	48	35
LYJ727	27	24	48	35

Table 1
Listing of Assemblies with Reused Channels

Assembly ID	Location I	Location J	Exp, GWD/MTU CHANNEL	Exp, GWD/MTU FUEL
LYJ724	3	6	48	35
LYJ720	26	6	48	35
LYJ716	7	27	48	35
LYJ711	4	24	48	35
LYJ675	27	7	48	35
LYJ645	25	5	48	35
LYJ643	5	25	48	35
LYJ640	3	25	48	35
LYJ637	4	7	48	35
LYJ743	6	26	48	35
LYJ690	6	28	48	35
LYJ730	1	17	48	35
LYJ631	19	2	47	34
LYJ623	29	12	47	34
LYJ596	16	1	47	34
LYJ595	16	30	47	34
LYJ555	15	30	47	34
LYJ553	15	1	47	34
LYJ600	1	16	47	33
LYJ599	30	16	47	33
LYJ579	1	15	47	33
LYJ545	8	28	47	33
LYJ529	30	15	47	33
LYJ561	1	22	47	33
LYJ624	2	20	47	33
LYJ615	28	23	47	33
LYJ613	23	28	47	33
LYJ602	3	8	47	33
LYJ594	13	30	47	33
LYJ593	1	18	47	33
LYJ592	11	29	47	33
LYJ598	2	21	47	33
LYJ589	30	9		33
LYJ581	29	21		33
LYJ572	9	30	47	33
LYJ554	22	30	47	33

Table 1
Listing of Assemblies with Reused Channels

Assembly ID	Location I	Location J	Exp, GWD/MTU CHANNEL	Exp, GWD/MTU FUEL
LYJ610	23	3	46	33
LYJ609	28	8	46	33
LYJ604	8	3	46	33
LYJ590	4	25	46	33
LYJ586	3	23	46	33
LYJ570	6	27	46	33
LYJ621	10	29	46	33
LYJ608	9	1	46	33
LYJ591	24	28	46	33
LYJ582	21	29	46	33
LYJ571	3	7	46	33
LYJ568	22	1	46	33
LYJ563	29	10	46	33
LYJ557	10	2	46	33
LYJ552	21	2	46	33
LYJ550	30	22	46	33
LYJ540	1	9	46	33
LYJ601	2	10	46	33
LYJ539	22	2	46	32
LYJ625	29	9	45	32
LYJ713	2	17	41	37
LYJ697	29	17	41	37
LYJ670	2	14	41	37
LYJ664	14	2	41	37
LYJ642	17	29	41	37
LYJ719	14	29	40	37
LYJ715	13	29	40	36
LYJ714	2	18	40	36
LYJ694	29	18	40	36
LYJ671	2	13	40	36
LYJ653	13	2	40	36
LYJ662	5	6	40	35
LYJ682	25	3	40	35
LYJ699	18	29	39	36
LYJ541	6	25	39	36
LYJ560	25	25	39	36

Table 1
Listing of Assemblies with Reused Channels

Assembly ID	Location I	Location J	Exp, GWD/MTU CHANNEL	Exp, GWD/MTU FUEL
LYJ603	6	6	39	36
LYJ712	3	22	39	35
LYJ707	22	28	39	35
LYJ652	3	9	39	35
LYJ647	6	5	39	35
LYJ639	25	26	39	35
LYJ729	28	9	39	35
LYJ638	26	25	39	35
LYJ655	6	3	39	35
LYJ659	22	3	39	35
LYJ660	25	28	39	35
LYJ635	12	2	39	34
LYJ632	12	29	39	34
LYJ718	9	28	38	35
LYJ634	19	29	38	34
LYJ575	29	19	38	34
LYJ605	30	13	38	33
LYJ544	30	18	38	33
LYJ542	13	1	38	33
LYJ537	20	29	38	33
LYJ530	18	30	38	33
LYJ527	29	20	38	33
LYJ585	18	1	38	33
LYJ564	2	11	38	33
LYJ525	29	11	38	33
LYJ526	28	24	38	33
LYJ627	2	19	37	34
LYJ584	2	12	37	34
LYJ629	4	6	37	33
LYJ574	27	6	37	33
LYJ573	27	25	37	33
LYJ565	25	27	37	33
LYJ546	20	2	37	33
LYJ534	6	4	37	33
LYJ536	7	3	37	33
LYJ524	28	7	37	33

Table 1
Listing of Assemblies with Reused Channels

Assembly ID	Location I	Location J	Exp, GWD/MTU CHANNEL	Exp, GWD/MTU FUEL
LYJ551	7	28	37	33
LYJ630	9	29	37	32
LYJ633	25	4	36	33
LYJ549	11	2	36	33
LYJ531	1	13	36	33
LYJ538	24	3	36	33
LYJ535	3	24	36	33
LYJ628	2	22	36	32
LYJ612	2	9	36	32
LYJ576	29	22	36	32
LYJ626	9	2	36	32
LYJ566	22	29	36	32