Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

www.exeloncorp.com

Exelon Nuclear

10 CFR 50.90

RS-09-037

March 5, 2009

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: Supplemental Information Concerning License Amendment to Allow Ganged Rod Drive Capability of the Rod Control Management System

References:
1. Letter from D. M. Benyak (Exelon Generation Company, LLC) to U. S. NRC, "Request for License Amendment to Allow Ganged Rod Drive Capability of the Rod Control Management System," dated August 14, 2007
2. Letter from P. R. Simpson (Exelon Generation Company, LLC) to U. S. NRC, "Supplemental Information Concerning License Amendment to Allow Ganged Rod Drive Capability of the Rod Control Management System," dated February 11, 2009

In Reference 1, Exelon Generation Company, LLC (EGC) requested an amendment to Facility Operating License Nos. NPF-11 and NPF-18 for LaSalle County Station (LSCS), Units 1 and 2. The proposed change revises the LSCS licensing basis to allow ganged rod drive capability of the Rod Control Management System.

In Reference 2, EGC provided supplemental information concerning the Reference 1 license amendment request (LAR). This supplemental information included a preliminary NRC-requested high power control rod gang withdrawal error (CRGWE) analysis that was conducted by AREVA NP Inc., (i.e., the LSCS fuel vendor). EGC also indicated that the final version of this analysis would be provided by March 11, 2009. This letter provides the final version of the high power CRGWE analysis. This analysis is provided in Attachments 1 through 3 to this letter.

The final version of the high power CRGWE analysis is essentially the same as the preliminary version provided in the Reference 2 letter. The only technical differences involved: 1) a revision of Table 3.2, "Summary of Allowable Control Rod Gangs (A-Sequence)" to correctly indicate the unacceptability of two gangs (i.e., the preliminary table incorrectly characterized two gangs as acceptable, even though the preliminary analytical results indicated unacceptability); and 2) a minor revision of seven analytical results in Tables 3.2, 3.4, 3.5, and 3.6 (i.e., the predicted gang withdrawal Delta-CPR values for the four analyzed reloads).

In addition, the supplemental information provided in Attachment 1 of Reference 2 remains unchanged by the finalization of the high power CRGWE analysis.

The information provided in this letter and attachments does not affect the No Significant Hazards Consideration, or the Environmental Consideration provided in Attachment 1 of the original Reference 1 LAR.

In accordance with 10 CFR 50.91(b), "State consultation," EGC is providing the State of Illinois with a copy of this letter and its attachment to the designated State Official.

Attachment 1 contains information considered proprietary to AREVA NP, Inc. Therefore, EGC requests that the information be withheld from public disclosure in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding," paragraph (a)(4), and 10 CFR 9.17, "Agency records exempt from public disclosure," paragraph (a)(4). An affidavit attesting to the proprietary nature of this information is included in Attachment 2, and a redacted version of the information is provided in Attachment 3.

There are no regulatory commitments contained in this letter.

If you have any questions concerning this letter, please contact Mr. John L. Schrage at (630) 657-2821.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 5th day of March 2009.

Respectfully,

Patrick R. Simpson
Manager - Licensing

Attachment 1: AREVA NP Inc., ANP-2801(P), Revision 0, "High Power CRWE Evaluation of Control Rod Gangs for LaSalle County Nuclear Power Station," February 2009

Attachment 2: AREVA NP Inc., Inc. Affidavit, dated February 24, 2009

Attachment 3: AREVA NP Inc., ANP-2801(NP), Revision 0, "High Power CRWE Evaluation of Control Rod Gangs for LaSalle County Nuclear Power Station," February 2009

Attachment 2
AREVA NP Inc., Affidavit

AFFIDAVIT

STATE OF WASHINGTON)
) ss.
COUNTY OF BENTON)

1. My name is Alan B. Meginnis. I am Manager, Product Licensing, for AREVA NP Inc. and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by AREVA NP to determine whether certain AREVA NP information is proprietary. I am familiar with the policies established by AREVA NP to ensure the proper application of these criteria.

3. I am familiar with the AREVA NP information contained in the report ANP-2801(P), Revision 0, entitled "High Power CRWE Evaluation of Control Rod Gangs for LaSalle County Nuclear Power Station," dated February 2009 and referred to herein as "Document." Information contained in this Document has been classified by AREVA NP as proprietary in accordance with the policies established by AREVA NP for the control and protection of proprietary and confidential information.

4. This Document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by AREVA NP and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in this Document as proprietary and confidential.

5. This Document has been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in this Document be withheld from public disclosure. The request for withholding of proprietary information is made in accordance with 10 CFR 2.390. The information for which withholding from disclosure is

requested qualifies under 10 CFR 2.390(a)(4) "Trade secrets and commercial or financial information."

6. The following criteria are customarily applied by AREVA NP to determine whether information should be classified as proprietary:

(a) The information reveals details of AREVA NP's research and development plans and programs or their results.

(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for AREVA NP.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for AREVA NP in product optimization or marketability.

(e) The information is vital to a competitive advantage held by AREVA NP, would be helpful to competitors to AREVA NP, and would likely cause substantial harm to the competitive position of AREVA NP.

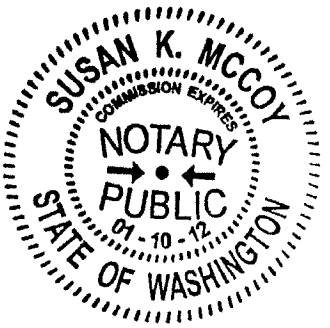
The information in these Documents is considered proprietary for the reasons set forth in paragraphs 6(b), 6(d) and 6(e) above.

7. In accordance with AREVA NP's policies governing the protection and control of information, proprietary information contained in this Document have been made available, on a limited basis, to others outside AREVA NP only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. AREVA NP policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

SUBSCRIBED before me this 24th day of February, 2009.



Susan K. McCoy
NOTARY PUBLIC, STATE OF WASHINGTON
MY COMMISSION EXPIRES: 1/10/12

Attachment 3
AREVA NP Inc., ANP-2801(NP), Revision 0, "High Power CRWE Evaluation of Control Rod Gangs for LaSalle County Nuclear Power Station,"
February 2009

REDACTED VERSION

An AREVA and Siemens company

ANP-2801(NP)
Revision 0

High Power CRWE
Evaluation of Control Rod Gangs for LaSalle County Nuclear Power Station

AREVA

February 2009

AREVA NP Inc.

ANP-2801(NP)
Revision 0

High Power CRWE
Evaluation of Control Rod Gangs for
LaSalle County Nuclear Power Station

sjp

AREVA NP Inc.

ANP-2801(NP)
Revision 0

Nature of Changes

Item	Page	Description and Justification
1.	All	This is the initial release.

Contents

Tables

Figures

Nomenclature

ATRIUM-10	a fuel assembly product line manufactured by AREVA
BOC	beginning of cycle
CPR	critical power ratio
CRGWE	control rod gang withdrawal error
GE14	a fuel assembly product line manufactured by GNF (formerly GE)
GXXA	control rod gang where XX is group and A is alphanumeric gang identifier
HEX	cycle energy with the maximum peak hot excess reactivity
LHGR	linear heat generation rate
NRC	Nuclear Regulatory Commission, U.S.
RBM	rod block monitor
RWE	rod withdrawal error
SRP	standard review plan
UFSAR	updated final safety analysis report
ΔCPR	delta CPR or change in CPR

1.0 Introduction and Summary

Replacement of the analog Reactor Manual Control System at LaSalle allows for the capability of ganged control rod pulls. Gang rod withdrawal is only anticipated to be used for low power rod withdrawals. However, it is postulated that a common mode software failure could allow an erroneous withdrawal of a control rod gang. This event is not identified in the current UFSAR (Reference 1) nor is there an existing approved methodology for evaluation of this event. Therefore, this evaluation of a Control Rod Gang Withdrawal Error (CRGWE) event has been completed to demonstrate a process that can be used to define rod gangs such that the CRGWE event is not a limiting event. This report documents the methodology used to evaluate the event and identifies assumptions and deviations from approved methodology used to complete the evaluation. The primary result of the evaluation is the definition of a process to determine which control rod gangs could be allowed at power conditions. The criteria used to determine if a gang would be allowed is that the ΔCPR from the CRGWE would be [ ] which is used to set the MCPR operating limit. In other words, the CRGWE event is not allowed to set an operating limit. Based on the demonstration of methods described within this document, this methodology defined within will be applied on a cycle specific basis for subsequent cycles which have Control Rod Gangs defined for the LaSalle Units.

This evaluation was performed using the CASMO4/MICROBURN-B2 approved methodology (Reference 2). The evaluation was performed in a manner consistent with AREVA RWE approved methodology (Reference 3) and with SRP 15.4.2 (Reference 4) to the extent possible. Analyses were completed for four LaSalle cycles comprised of ATRIUM-10, GE14, and ATRIUM 10XM fuel.

These analyses have shown for the high power conditions that:

- CRGWE results are acceptable for at least a subset of the possible A1 and A2 sequence group 7 through 10 control rod gangs. In this demonstration evaluation, the Gangs G07F, G07G, G08C, G08D, G09E, G09F and G10G were determined to be acceptable in all four cycles.
- The increase in ΔCPR is less for a sub-divided gang than for the whole gang.
- The gang definitions will be cycle specific.
- The cycle specific analyses will only need to be performed for full power.

The process used in this evaluation to define rod gangs has demonstrated that some rod gangs can be defined which would not challenge the MCPR safety limit for a postulated CRGWE event. This process is to be applied during the cycle licensing process to include the effect of the actual core loading as well as operating strategy and operation flexibility that is accounted for in the specific MCPR operating limits.

The process is based on using the least restrictive operating MCPR limit (smallest ΔCPR) for establishing acceptance criteria for allowable gang assignments. It is noted that at the time of licensing, the actual limiting ΔCPR may not be known at the time this evaluation is performed. Therefore, the maximum ΔCPR for each acceptable gang will be tabulated in the evaluation process.

When the final limits are established and the COLR is prepared, the ΔCPR for each allowed gang must be verified to be less than that used to establish the least restrictive MCPR operating limit.

The reload analysis process for determining the acceptable rod gangs based on the results of this demonstration evaluation is provided in Appendix A. The process identified in Appendix A also allows for the evaluation of asymmetric inserted control rods during cycle operation.

2.0 Methodology

The currently approved AREVA methodology for the control rod withdrawal error from Reference 4 is summarized below:

- Candidate rods for the error are determined based on the relative rod worth, and the high worth rods are then evaluated.
- The control rod pattern is adjusted to place an assembly close to the fully inserted error rod on its CPR limit.
- The single control rod is withdrawn and the Rod Block Monitor response is evaluated.
- The event is terminated by the RBM system which limits the ΔCPR.

For the evaluation of the CRGWE event, the following exceptions to the approved methodology are identified:

- All potential gangs in rod groups 7 and higher are evaluated regardless of the gang worth.
- Multiple rods are withdrawn as opposed to a single rod.
- The event is terminated when the control rods are fully withdrawn from the core. No credit is given for the RBM system to terminate the event.

The use of the approved steady state core simulator (Reference 2) provides an acceptable evaluation of the change in CPR and LHGR for slow events and is independent of the number of control rods withdrawn. The evaluation of multiple control rods does not reduce the impact of the event or adversely affect the ability to model the event.

The evaluation of the CRGWE is performed such that the MCPR safety limit would be protected by the applicable operating limit if the gang is fully withdrawn. This is the same as a single rod CRWE which does not produce an instrument response which initiates a rod block and is terminated when the rod is fully withdrawn from the core.

2.1 *Assumptions and Evaluation Process*

The analysis is based on assumptions which will become requirements for future cycle licensing and operation.

The LaSalle Units will only define A-Sequence gangs for operation above the low power set point. The evaluation of at power B sequence rod gangs is not needed since this is not a planned mode of operation for the LaSalle units.

The CRGWE will be performed with xenon free conditions.

The analyses are performed based on the nominal licensing depletion for each cycle [

]

Rod groups 1 through 6 are withdrawn at low power conditions. Only the gangs in groups 7 through 10 are evaluated.

The ΔCPR determined from a gang withdrawal will not be used to set the MCPR operating limit.

The initial rod pattern used for the gang withdrawal will be quarter or eighth core symmetric depending on the gang assignment.

All rods in groups 7 through 10 of the A-Sequence are candidates for a potential high-power CRGWE. As an initial condition for the analysis, a predefined gang of rods will be fully inserted, with surrounding rods adjusted to place the fuel at or near its thermal limits. Then the inserted rod gang will be withdrawn in steps of six or 12 inches, from full-in to full-out. At each step, the CPR of each assembly will be determined, and a ΔCPR will be calculated to determine the maximum ΔCPR obtained during gang withdrawal from the full in position.

If the analytical results indicate that the ΔCPR is acceptable [

] then the gang assignment will be allowed. Gangs that do not provide acceptable results will not be allowed in the sequence design.

A four rod gang can be subdivided into two gangs of two rods each. If a gang is subdivided into two sub gangs, the CRGWE results for both sub gangs must be acceptable for either gang to be allowed.

Gangs in Groups 9 and 10 (G09E, G09F, and G10G) that are located one cell in from the core edge were determined to be acceptable in all four cycles evaluated. Based on this it is concluded that if gangs within Groups 5 and 6 were not withdrawn prior to reaching the low power set point, these gangs would also be acceptable since they are only located in peripheral cells.

For a normal CRWE analysis, LHGR values would be calculated for the fuel in the core to verify that the transient LHGR limits for ATRIUM-10 fuel is not exceeded for the CRWE analysis. Similarly, MOP values would be calculated to verify that the transient thermal-mechanical licensing basis for the co-resident GE14 fuel is maintained. Since experience has shown that

the transient thermal-mechanical limits are not exceeded for a CRWE, these evaluations will not be performed as part of this demonstration calculation. These evaluations would be necessary for any cycle specific application of the CRGWE for licensing purposes.

3.0 Demonstration Cycle Evaluation

The CRGWE calculations have been performed as a series of steady state solutions using the MICROBURN-B2 reactor simulator code. The MICROBURN-B2 code is used to calculate the maximum delta-CPR of the core for each rod gang withdrawal. The rod gang withdrawals were performed by withdrawing rod gangs from the full in position to the full out position in increments of six to twelve inches. The CRGWE analyses have been performed for LaSalle Units 1 and 2. The analyses were performed for Cycles 12 and 13 of each Unit at [ ]. Only A1 and A2 sequence control rods in rod groups 7 through 10 were evaluated. Each rod gang in these groups was analyzed at full power conditions. Further analyses of selected gangs were performed at off-rated power conditions above the Low Power Setpoint.

Figure 3.1 identifies the A sequence gang assignments for the LaSalle Units. Table 3.1 provides a tabular listing of the gang assignments. Sub-gangs are identified with a lower case a or b.

Calculations were performed for each Unit/Cycle at [ ] Calculations were performed at 100%, 80%, and 60% of rated power. The off-rated calculations were only performed for selected control rod gangs or sub-gangs when needed to demonstrate acceptable results. The acceptable control rod gang assignments determined in this evaluation for the four cycles are summarized in Table 3.2. The following conclusions are drawn from the collective evaluation of the four cycles:

[

]

The MCPR operating and safety limits for each cycle are reported in References 5 through 8. Multiple sets of operating limits are defined within the given reload reports for various equipment out of service or operation conditions.

In the evaluation, [ ] is used to determine the limiting delta ΔCPR for comparison with the CRGWE ΔCPR. By using the [ ] operating limit for determining the acceptable rod gangs, operation with more [ ] the basis used to define the acceptable rod gangs.

3.1 *Unit 1 Cycle 12*

The Unit 1 Cycle 12 cycle design (Reference 5) includes 280 fresh feed ATRIUM-10 assemblies, 290 irradiated GE14 assemblies, and 194 irradiated ATRIUM-10 assemblies. The detailed evaluation results for Unit 1 Cycle 12 are given in Table 3.3.

All unacceptable gang configurations were identified with the BOC 100% power case for this cycle. Gang G07E was identified as not acceptable based on the BOC 100% power case. However additional cases were performed to characterize the power dependence. The non-rated power cases did not exceed the limiting ΔCPR more than the 100% power case did. Subdividing Gang G07E into two gangs did not produce acceptable results. Therefore, all rods in the Gang G07E, must be configured as single rod gangs.

Gangs G07F, G07G were demonstrated to have acceptable results compared to the limiting ΔCPR.

Gang G08A was determined to be unacceptable. Evaluation of the sub gangs G08A.a and G08A.b were completed at the conditions at which Gang G08A was found to be unacceptable. The results indicated that sub gangs were acceptable.

Gang G08B is a 1/8 core symmetric gang to G08A. The calculation results and conclusions are consistent between these two gangs.

Gang G09B was found to be unacceptable at BOC and acceptable at HEX. Subdividing the gang resulted in acceptable results at BOC. Therefore, sub-gangs G09B.a and G09B.b are acceptable.

Gang G09C was found to be unacceptable only for BOC 100% power. Subdividing the gang resulted in acceptable results at BOC 100% power. Therefore sub-gangs G09C.a and G09C.b are acceptable.

The remaining gangs were determined to be acceptable without subdividing for Unit 1 Cycle 12.

3.2 *Unit 1 Cycle 13*

The Unit 1 Cycle 13 cycle design (Reference 6) includes 324 fresh feed ATRIUM-10 assemblies, 279 irradiated ATRIUM-10 assemblies, and 161 irradiated GE14 assemblies. The

results for Unit 1 Cycle 13 are presented in Table 3.4. In general, the results and conclusions are similar to the discussion of those for Unit 1 Cycle 12. Both Gangs G08A and G08B were determined to be unacceptable. Gang G08A was sub-divided and the results were not acceptable. Therefore, sub-dividing Gang G08B was determined to be unacceptable based on the symmetry of Gangs G08A and G08B. Gang G09D was unacceptable at 100% power HEX. However, sub-dividing Gang G09D resulted in acceptable results.

3.3 *Unit 2 Cycle 12*

The Unit 2 Cycle 12 cycle design (Reference 7) includes 304 fresh feed ATRIUM-10, assemblies, 286 irradiated GE14 assemblies, and 174 irradiated ATRIUM-10 assemblies. The results for Unit 2 Cycle 12 are presented in Table 3.5. In this cycle only Gang G09B could be subdivided to achieve an acceptable ΔCPR. As with the prior cycles, the 100% power case bounded the lower power cases for determining acceptable control rod gangs.

3.4 *Unit 2 Cycle 13*

The Unit 2 Cycle 13 cycle design (Reference 8) includes 312 fresh feed ATRIUM-10 assemblies, 8 fresh ATRIUM 10XM lead test assemblies, 305 irradiated ATRIUM-10 assemblies, and 139 irradiated GE14 assemblies. The results for Unit 2 Cycle 13 are presented in Table 3.6. There is a significant change in these results compared to the prior cycles. The core loading consisted of more reactive assemblies near the outer edge of the core and the center of the core was less reactive than the other cycles at BOC.

This is the only cycle in which Gang G07E was found to be acceptable. This cycle demonstrates the impact that the core loading can have with respect to CRGWE. Sub-gangs G08A.a, G08A.b, G08B.a, and G08B.b were determined to be acceptable based on the 100% power case. It is noted that Gangs G08A and G08B had the same ΔCPR at HEX as the limiting ΔCPR. However, as demonstrated in the calculations, a sub-division of a gang results in a smaller ΔCPR. Therefore, the sub-gangs of G08A and G08B are determined to be acceptable at HEX as well as BOC.

Table 3.1 LaSalle Control Rod Gangs

A1 Sequence Control Rod Gangs			A2 Sequence Control Rod Gangs		
Gang	IR	JR	Gang	IR	JR
G07A	26	35	G09A	30	31
G07B	34	35			
G07C	34	27	G09B.a	22	39
G07D	26	27	G09B.b	38	39
			G09B.a	38	23
G07E.a	18	43	G09B.b	22	23
G07E.b	42	43			
G07E.a	42	19	G09C.a	30	47
G07E.b	18	19	G09C.b	46	31
			G09C.a	30	15
G07F	26	51	G09C.b	14	31
G07F	50	35			
G07F	34	11	G09D.a	14	47
G07F	10	27	G09D.b	46	47
			G09D.a	46	15
G07G	34	51	G09D.b	14	15
G07G	50	27			
G07G	26	11	G09E	22	55
G07G	10	35	G09E	54	39
			G09E	38	7
G08A.a	26	43	G09E	6	23
G08A.b	42	35			
G08A.a	34	19	G09F	6	39
G08A.b	18	27	G09F	38	55
			G09F	54	23
G08B.a	34	43	G09F	22	7
G08B.b	42	27			
G08B.a	26	19	G10A	22	31
G08B.b	18	35	G10B	30	39
			G10C	38	31
G08C	18	51	G10D	30	23
G08C	50	43			
G08C	42	11	G10E.a	22	47
G08C	10	19	G10E.b	46	39
			G10E.a	38	15
G08D	10	43	G10E.b	14	23
G08D	42	51			
G08D	50	19	G10F.a	14	39
G08D	18	11	G10F.b	38	47
			G10F.a	46	23
			G10F.b	22	15
			G10G	30	55
			G10G	54	31
			G10G	30	7
			G10G	6	31

Table 3.2 Summary of Allowable Control Rod Gangs (A-Sequence)

[

]

* These sub-gangs were determined to be unacceptable since the results for the symmetric gang G08A sub-grouping were not acceptable. Therefore, this is not an allowed sub grouping.

Table 3.3 LaSalle Unit 1 Cycle 12, Gang Withdrawal Delta-CPR Values

[

]

Table 3.4 LaSalle Unit 1 Cycle 13, Gang Withdrawal Delta-CPR Values

[

]

Table 3.5 LaSalle Unit 2 Cycle 12, Gang Withdrawal Delta-CPR Values

[

]

Table 3.6 LaSalle Unit 2 Cycle 13, Gang Withdrawal Delta-CPR Values

[

]

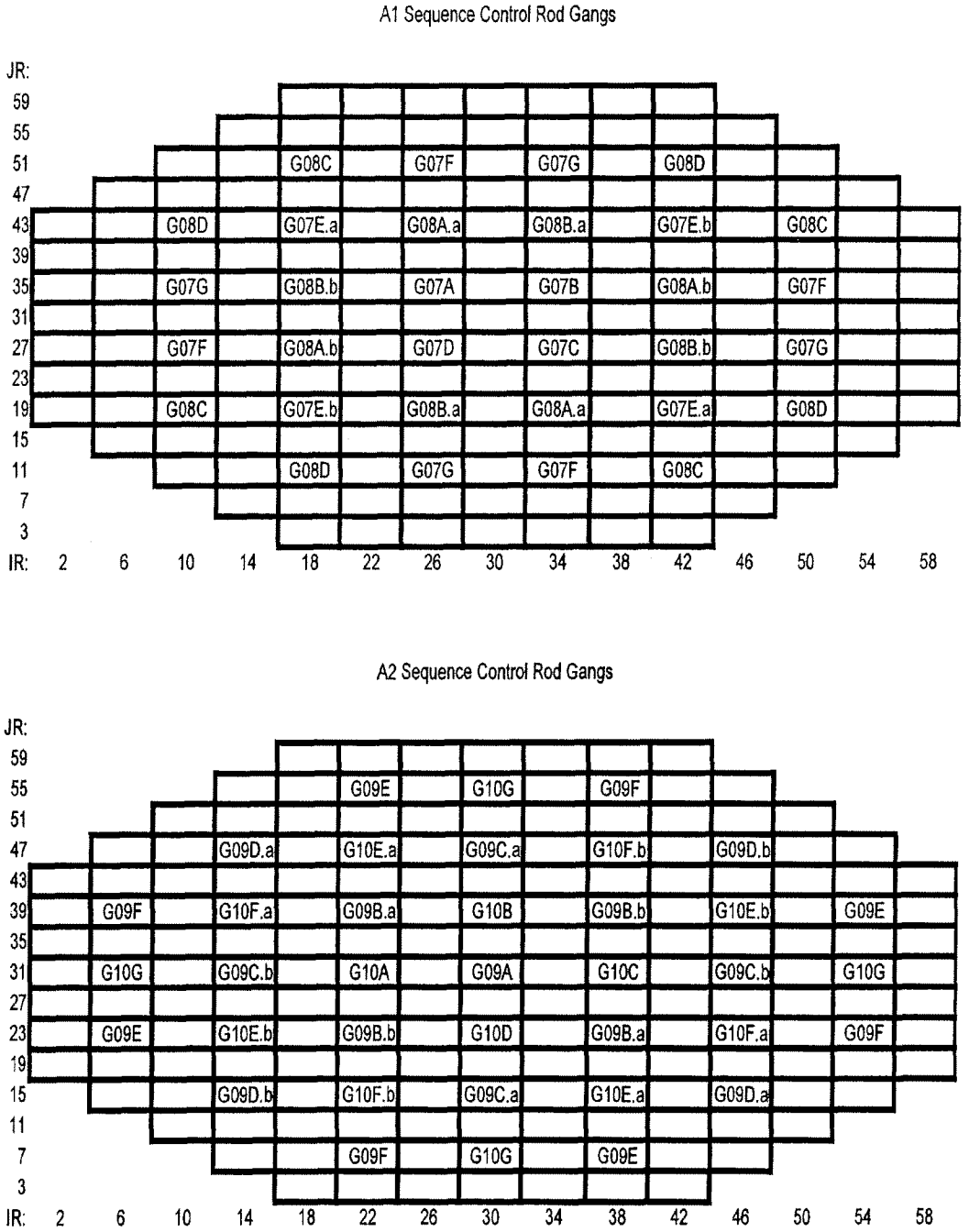


Figure 3.1 LaSalle A-Sequence Control Rod Gangs

4.0 References

1. LaSalle County Station UFSAR Revision 17, April 2008.

2. EMF-2158(P)(A) Revision 0, *Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-4/MICROBURN-B2,* October 1999.

3. XN-NF-80-19(P)(A), Volume 1 and Supplements 1 and 2, *Exxon Nuclear Methodology for Boiling Water Reactors – Neutronic Methods for Design and Analysis,* Exxon Nuclear Company, March 1983.

4. NUREG-0800 Revision 3, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,* SRP 15.4.2, "Uncontrolled Control Rod Assembly Withdrawal at Power," U.S. Nuclear Regulatory Commission, March 2007.

5. EMF-3260 Revision 0, *LaSalle Unit 1 Cycle 12 Reload Analysis,* Framatome ANP, January 2006.

6. ANP-2678 Revision 0, *LaSalle Unit 1 Cycle 13 Reload Analysis,* AREVA NP, December 2007.

7. ANP-2571 Revision 1, *LaSalle Unit 2 Cycle 12 Reload Analysis,* AREVA NP, January 2007.

8. ANP-2774 Revision 0, *LaSalle Unit 2 Cycle 13 Reload Analysis,* AREVA NP, December 2008.

Appendix A Reload Analysis Process for Defining Acceptable Rod Gangs for LaSalle Units

The following process is to be used to define the acceptable rod gangs within the A-Sequence rod groups 7 through 10 on a cycle specific basis for the LaSalle Units.

Single rod RWE shall be completed for A1, A2, B1, and B2 rod sequences with an approved methodology.

Obtain customer input with respect to the desired gangs to be supported. Only those gangs identified within the body of this report are allowed.

The analysis will be performed with an approved core simulator methodology.

The calculations will be performed with xenon free core conditions.

Identify the assumed ΔCPR of the limiting event.

An initial rod pattern is determined for each evaluation which places assemblies near the gang rods on limits.

- Since all of the A1 and A2 sequence gangs are quarter core symmetric, then the initial starting control rod pattern for the withdrawal is quarter core symmetric.
- If the control rod gang is a member of a one-eighth core grouping (for example gangs G08A and G08B) then the initial control rod pattern must be one-eighth core symmetric and both of the symmetric gangs must be fully inserted.

The gang withdrawal is completed in steps of 6 or 12 inch increments.

Starting Notch	Ending Notch	Allowed increment
00	22	6 or 12 in
22	40	6 in
40	48	6 or 12 in

Tabulate the maximum ΔCPR between the initial CPR and the CPR at all positions of the withdrawal.

Verify that the change in LHGR does not exceed transient LHGR limits.

Evaluate each potential gang at BOC at 100% power. For those gangs which are determined to be acceptable at BOC, repeat the evaluation at peak hot excess reactivity (HEX) including both CPR and LHGR evaluation.

If a gang of four rods produces unacceptable results, the gang may be subdivided into gangs of two rods and the calculations repeated to determine if acceptable results can be obtained.

Tabulate the acceptable gang assignment for the given cycle similar to Table A.1 and generate a figure of acceptable gang assignments similar to Figure A.1.

Upon completion of the cycle licensing calculations and establishment of the actual MCPR operating limits, verify that the smallest ΔCPR used to set the least restrictive operating limit bounds the ΔCPR for each rod gang.

This process is used to establish allowed gangs based on the intended cycle operation. The typical design accounts for operation scenarios with equipment out of service. A common operation scenario that may impact the CRGWE results is operation with out of sequence rods inserted.

In the event of prolonged operation with out of sequence inserted control rods, the allowed gangs should be re-evaluated. This evaluation would be performed in a consistent manner with the exception that the initial starting control rod pattern for the evaluation may not be symmetric.

Table A.1 Allowable Control Rod Gangs (A-Sequence) for Unit X Cycle Y

Gang		ΔCPR
G07E		0.35
G07E.a		0.32
G07E.b		0.31
G07F	OK	0.20
G07G	OK	0.20
G08A		0.34
G08A.a	OK	0.29
G08A.b	OK	0.29
G08B		0.34
G08B.a	OK	0.29
G08B.b	OK	0.29
G08C	OK	0.24
G08D	OK	0.25
G09B		0.34
G09B.a	OK	0.28
G09B.b	OK	0.29
G09C		0.32
G09C.a	OK	0.28
G09C.b	OK	0.29
G09D	OK	0.27
G09E	OK	0.15
G09F	OK	0.16
G10E	OK	0.27
G10F	OK	0.27
G10G	OK	0.24

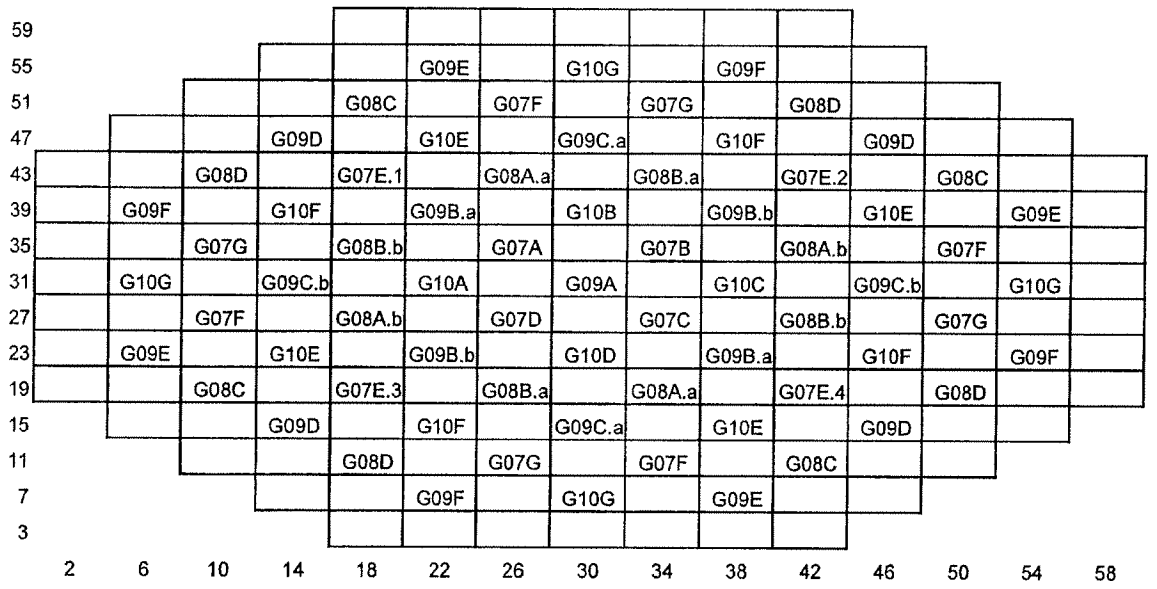


Figure A.1 Allowable Control Rod Gangs (A-Sequence) for Unit X Cycle Y*

---

* Gang G07E is not acceptable. Therefore each rod of G07E is uniquely identified as G07E.1, G07E.2, G07E.3, and G07E.4.

Distribution

Controlled Distribution

Richland

SW Jones

E-Mail Notification

RJ DeMartino
R Fundak
RG Grummer
DP Jordheim
AB Meginnis
PD Wimpy