



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

February 27, 2013

Mr. Michael J. Pacilio  
President and Chief Nuclear Officer  
Exelon Nuclear  
4300 Winfield Road  
Warrenville, IL 60555

SUBJECT: LASALLE COUNTY STATION, UNIT 2 - ISSUANCE OF AMENDMENT NO. 192  
REGARDING TECHNICAL SPECIFICATION CHANGE FOR SAFETY LIMIT  
MINIMUM CRITICAL POWER RATIO (TAC NO. ME9769)

Dear Mr. Pacilio:

The U.S. Nuclear Regulatory Commission (NRC) has issued the enclosed Amendment No. 192 to Facility Operating License No. NPF-18 for the LaSalle County Station, (LSCS), Unit 2. The amendment is in response to your application dated October 11, 2012, as supplemented by letters dated January 17, February 20, and February 26, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML12285A387, ML13018A228, ML130510727, and ML13058A446, respectively).

The amendment modifies the LSCS, Unit 2, Appendix A, Technical Specifications (TS), Section 2.1.1, "Reactor Core SLs [Safety Limits]" minimum critical power ratio from  $\geq 1.11$  to  $\geq 1.14$  for two-loop recirculation operation and from  $\geq 1.12$  to  $\geq 1.17$  for single-loop recirculation operation. This change in safety limit was requested to support a change in fuel type from AREVA ATRIUM-10 to Global Nuclear Fuel GNF2. However, the NRC staff did not review or approve any other aspect of this fuel change since the licensee concluded, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.59, "Changes, tests, and experiments," that the other aspects of the change in fuel type do not require a license amendment. The licensee conclusions under 10 CFR 50.59 are subject to inspection under the Reactor Oversight Process.

In support of this amendment, the licensee proposed to use a version of the critical heat flux (CHF) correlation for the SL minimum critical power ratio calculation not approved for generic use. The licensee adequately justified the use of the version of the CHF correlation, except for the expanded range of applicability. In order to find the licensee's approach acceptable, the NRC is imposing a license condition to limit the SL minimum critical power ratio calculation to the range of applicability for the CHF correlation to that which was previously approved by the NRC staff in a letter dated January 14, 2004 (ADAMS Accession No. ML040130278). The licensee accepted this license condition in its letter dated February 26, 2013.

A copy of the Safety Evaluation is enclosed.

M. Pacilio

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If you have any questions regarding his matter, please contact me at 301-415-1115.

Sincerely,

A handwritten signature in black ink, appearing to read "Nicholas DiFrancesco", with a long horizontal line extending to the right.

Nicholas DiFrancesco, Project Manager  
Plant Licensing Branch III-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-374

Enclosures:

1. Amendment No. 192 to NPF-18
2. Safety Evaluation

cc w/encls: ListServ



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

EXELON GENERATION COMPANY, LLC

DOCKET NO. 50-374

LASALLE COUNTY STATION, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 192  
License No. NPF-18

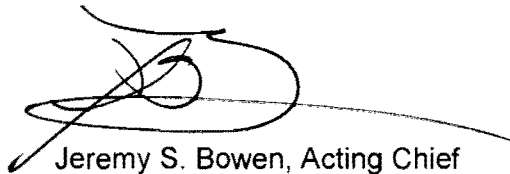
1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment filed by the Exelon Generation Company, LLC (the licensee), dated October 11, 2012, as supplemented by letters dated January 17, February 20, and February 26, 2013, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's regulations set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the regulations of the Commission;
  - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations set forth in 10 CFR Chapter I;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 2.C.(2) of the Facility Operating License No. NPF-18 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 192, and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of its date of issuance and shall be implemented after Cycle 14 is completed and prior to the operation of Cycle 15.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in black ink, appearing to read 'J. Bowen', is written over a horizontal line. The signature is stylized and somewhat cursive.

Jeremy S. Bowen, Acting Chief  
Plant Licensing Branch III-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications and Facility Operating License

Date of Issuance: February 27, 2013

ATTACHMENT TO LICENSE AMENDMENT NO. 192

FACILITY OPERATING LICENSE NO. NPF-18

DOCKET NO. 50-374

Replace the following pages of the Facility Operating Licenses and Appendix "A" Technical Specifications with the enclosed pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove

License NPF-18

Page 3

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TSs

Page 2.0-1

Insert

License NPF-18

Page 3

Page 8a

TSs

Page 2.0-1

- (5) Pursuant to the Act and 10 CFR Parts 30, 40, and 70 possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of LaSalle County Station, Units 1 and 2, and such Class B and Class C low-level radioactive waste as may be produced by the operation of Braidwood Station, Units 1 and 2, Byron Station, Units 1 and 2, and Clinton Power Station, Unit 1.

C. This license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

The licensee is authorized to operate the facility at reactor core power levels not in excess of full power (3546 megawatts thermal). Items in Attachment 1 shall be completed as specified. Attachment 1 is hereby incorporated into this license.

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 192, and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

Am. 181 (3) DELETED  
08/28/09

Am. 181 (4) DELETED  
08/28/09

Am. 181 (5) DELETED  
08/28/09

Am. 181 (6) DELETED  
08/28/09

Am. 181 (7) DELETED  
08/28/09

Am. 181 (8) DELETED  
08/28/09

Am. 181 (9) DELETED  
08/28/09

## 2.0 SAFETY LIMITS (SLs)

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### 2.1 SLs

#### 2.1.1 Reactor Core SLs

2.1.1.1 With the reactor steam dome pressure < 785 psig or core flow < 10% rated core flow:

THERMAL POWER shall be  $\leq$  25% RTP.

2.1.1.2 With the reactor steam dome pressure  $\geq$  785 psig and core flow  $\geq$  10% rated core flow:

For Unit 1, MCPR shall be  $\geq$  1.13 for two recirculation loop operation or  $\geq$  1.15 for single recirculation loop operation.

For Unit 2, MCPR shall be  $\geq$  1.14 for two recirculation loop operation or  $\geq$  1.17 for single recirculation loop operation.

2.1.1.3 Reactor vessel water level shall be greater than the top of active irradiated fuel.

#### 2.1.2 Reactor Coolant System Pressure SL

Reactor steam dome pressure shall be  $\leq$  1325 psig.

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### 2.2 SL Violations

With any SL violation, the following actions shall be completed within 2 hours:

2.2.1 Restore compliance with all SLs; and

2.2.2 Insert all insertable control rods.

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- Am. 192  
2/27/13
- (34) Use of Global Nuclear Fuel – Americas, LLC, Report, NEDC-33106P, "GEXL97 Correlation for Atrium-10 Fuel," Revision 4, August 2012, for LaSalle Unit 2 shall be limited to the same range of applicability for calculations of Safety Limit Minimum Critical Power Ratios as documented in NRC letter from W. A. Macon, Jr. (NRC) to J. L. Skolds, "LaSalle County Station, Units 1 and 2 – Correction to Issuance of Amendments (TAC Nos. MB9888 and MB9889)," dated January 14, 2004 (ADAMS Accession Number ML040130278).





UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

AMENDMENT NO. 192 TO FACILITY OPERATING LICENSE NO. NPF-18

EXELON GENERATION COMPANY, LLC

LASALLE COUNTY STATION, UNIT 2

DOCKET NO. 50-374

1.0 INTRODUCTION

By letter to the U.S. Nuclear Regulatory Commission (NRC, the Commission) dated October 11, 2012, as supplemented by letters dated January 17, February 20, and February 26, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML12285A387, ML13018A228, ML130510727, and ML13058A446, respectively), Exelon Generation Company, LLC (the licensee), requested changes to the technical specifications (TSs) for LaSalle County Station (LSCS), Unit 2. The January 17, February 20, and February 26, 2013, supplements contained clarifying information and did not expand the scope of the application as originally noticed, and did not change the NRC staff's initial proposed finding of no significant hazards consideration published in the *Federal Register* (77 FR 66489, dated November 5, 2012).

The NRC has issued the enclosed Amendment No. 192 to Facility Operating License No. NPF-18 for the LaSalle County Station, (LSCS) Unit 2. The submittal seeks to revise TS 2.1.1, "Reactor Core SLs [Safety Limits]" to reflect revised safety limit minimum critical power ratio (SLMCPR) values (limits) listed in TS 2.1.1.2 and calculated for operating Cycle 15. The analysis establishes SLMCPR values that will ensure that during normal operation and during abnormal operational transients, at least 99.9 percent of all fuel rods in the core do not experience transition boiling if the limit is not violated. The SLMCPRs are calculated to include cycle-specific parameters.

The NRC staff's review and approval is limited to the TS 2.1.1 cycle-specific SLMCPR change submitted with this amendment. The staff review did not include any other aspects of the fuel transition from AREVA ATRIUM-10 to Global Nuclear Fuel (GNF) GNF2. The licensee evaluated the fuel change pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.59, "Changes, tests, and experiments," concluding no prior review or approval was required for this change.

The NRC staff has completed its review and finds that the requested TS modifications are acceptable.

## 2.0 REGULATORY EVALUATION

Title 10 CFR, Section 50.36, "Technical specifications," Paragraph (c)(1), requires that power reactor facility TS include safety limits for process variables that protect the integrity of certain physical barriers that guard against the uncontrolled release of radioactivity. The fuel cladding is one of the physical barriers that separate the radioactive materials from the environment. The purpose of the SLMCPR is to ensure that specified acceptable fuel design limits (SAFDLs) are not exceeded during steady state operation and analyzed transients. The integrity of this cladding barrier is related to its relative freedom from perforations or cracking. Fuel cladding perforations can result from thermal stresses, which can occur from reactor operation significantly above design conditions. Since the parameters that result in fuel damage are not directly observable during reactor operation, the thermal and hydraulic conditions that result in the onset of transition boiling have been used to mark the beginning of the region in which fuel cladding damage could occur.

Criterion 10 (GDC 10), "Reactor Design," of 10 CFR Part 50, Appendix A, "General Design Criteria [GDC] for Nuclear for Nuclear Power Plants," states, in part, that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that SAFDLs are not exceeded.

Guidance on the acceptability of the reactivity control systems, the reactor core, and fuel system design is provided in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants." Specifically, Section 4.2, "Fuel System Design," specifies all fuel damage criteria for evaluation of whether fuel designs meet the SAFDLs. Section 4.4, "Thermal Hydraulic Design," provides guidance on the review of thermal-hydraulic design in meeting the requirement of GDC 10 and the fuel design criteria established in Section 4.2.

## 3.0 TECHNICAL EVALUATION

### 3.1 Proposed TS Changes

The proposed changes would revise LSCS, Unit 2, Appendix A, TS, Section 2.1.1, "Reactor Core SLs" minimum critical power ratio (MCPR) safety limit from  $\geq 1.11$  to  $\geq 1.14$  for two-loop recirculation operation (TLO) and from  $\geq 1.12$  to  $\geq 1.17$  for a single-loop recirculation operation (SLO) for LSCS, Unit 2, beginning with Cycle 15. These SLMCPR values apply when the reactor steam dome pressure is greater than or equal to 785 psig [pounds per square inch gauge] and core flow is greater than or equal to 10 percent of rated core flow.

### 3.2 NRC Staff Evaluation

The NRC staff has reviewed the licensee's regulatory and technical analyses in support of its proposed license amendment. The licensee described the methodology to calculate the new SLMCPR values for the TS in its submittal and supplements. The Cycle 15 SLMCPR analysis was performed by GNF using the plant- and cycle-specific fuel and core parameters and NRC-approved methodologies, including:

- NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel (GESTAR II)," Revision 19
- NEDC-32505P-A, "R-Factor Calculation Method for GE11, GE12 and GE13 Fuel," Revision 1, July 1999
- NEDC-32601P-A, "Methodology and Uncertainties for Safety Limit MCPR Evaluations," August 1999
- NEDC-32694P-A, "Power Distribution Uncertainties for Safety Limit MCPR Evaluations," August 1999
- NEDO-10958-A, "General Electric BWR Thermal Analysis Basis (GETAB): Data, Correlation, and Design Application," January 31, 1977

The LSCS, Unit 2, Cycle 15, core has 764 fuel assemblies, of which there are 304 fresh GNF2 bundles, 312 once burned ATRIUM-10 bundles, and 148 twice burned ATRIUM-10 bundles. The licensee addressed the applicability of the above approved methodologies to the LSCS, Unit 2, Cycle 15, SLMCPR calculation because there are 304 fresh GNF2 fuels, whose databases were not included in those approved methodologies. The NRC staff reviewed the licensee's justification for the applicability of the above approved methodologies to LSCS, Unit 2, Cycle 15, including a review of the NRC staff's report dated September 25, 2008, "Audit Report for Global Nuclear Fuels GNF2 Advanced Fuel Assembly Design GESTAR II Compliance Audit," (ADAMS Accession No. ML081630579). This report was based on the GESTAR II compliance report for GNF2 fuel<sup>1</sup> and concluded that the justification is acceptable because GNF2 fuel meets the requirements as specified in the limitations and conditions of the approved methodologies.

In addition, the licensee also addressed the mixed core issues and identified those related analyses in several GNF's design record files, which may be subject to an NRC staff audit in the future. The staff reviewed mixed core issues with respect to fuel rod power calculational uncertainty, R-factor uncertainty, the MCPR importance parameter criterion, and effective bundle power uncertainty, and found that the justification is acceptable for the LSCS, Unit 2, Cycle 15 operation.

The licensee qualitatively addressed the final core loading pattern selection for LSCS, Unit 2, Cycle 15 operation with respect to the combination of the input parameters such as cycle energy requirements, thermal limit margins, reactivity margins, discharge exposure limitations and other limits, desired control rod patterns, and channel distortion minimization. The licensee addressed the SLMCPR calculation process with respect to the uncertainties associated with R-Factor, core flow rate, and the local power range monitor update/calibration interval. The licensee also addressed the bundle groupings for both TLO and SLO SLMCPR calculations, along with the number of bundles in the group, their contribution to percent number of rods subject to boiling transition and group average fuel assembly exposure for

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1. "GNF2 Advantage Generic Compliance with NEDE-24011-P-A (GESTAR II), NEDC-33270P, March 2007, and GEXL17 Correlation for GNF2 Fuel, NEDC-33292P, March 2007," FLN-2007-011, dated March 14, 2007 (ADAMS Accession No. ML070780335).

Cycle 15. The licensee confirmed the applicability of the updated two-loop power/flow map for Cycle 15 operation, including stability Option III features of the scram region, and controlled entry region for backup stability protection using decay ratio criterion specified in GESTAR II.

The NRC staff reviewed the information presented in the submittal and supplemental information and concluded that the licensee provided sufficient data and methodology descriptions. The NRC staff determined that the proposed revisions to the TS SLMCPR values for LSCS, Unit 2, Cycle 15, operation from  $\geq 1.11$  to  $\geq 1.14$  for TLO and from  $\geq 1.12$  to  $\geq 1.17$  for SLO are acceptable because:

- (1) adjustments to the approved critical heat flux correlations were acceptably justified to account for uncertainties relating to R-Factor and traversing incore probe reading;
- (2) GNF2 data points along with ATRIUM-10 fuel are shown in the acceptable bound in the figure of relationship between the MCPR importance parameter and critical power ratio margin;
- (3) qualitative descriptions of the final core loading pattern and critical power analysis are provided;
- (4) core map was provided and dominant fuel bundle location were identified based on LSCS, Unit 2, Cycle 15, SLMCPR calculation in terms of percentage contribution to number of rods subject to boiling transition;
- (5) mechanisms to push the SLMCPR increase into the higher range of expectations are identified along with results that the GNF2 fuel would dominate the SLMCPR calculation; and
- (6) LSCS, Unit 2, Cycle 15, SLMCPR calculation does not use the expanded ranges stated in NEDC-33106P, "GEXL97 Correlation for ATRIUM-10 Fuel," Revision 4, August 2012, which is subject to further review by staff.

The licensee proposed to use a version<sup>2</sup> of the critical heat flux correlation for the SLMCPR calculation that had not been generically approved. The newer version accounts for uncertainties in the R-Factor and the traversing incore probe reading as well as expanded the range of applicability. In response to the staff's request for additional information (RAI), the licensee justified the R-Factor and traversing incore probe reading adjustments but did not provide an acceptable justification for the expanded applicability. In letter dated February 20, 2013, response to RAI-03, the licensee noted that they did not rely on the expanded applicability included in NEDC-33106P, Revision 4, of the code. Rather they used the applicability in NEDC-33106P, "GEXL97 Correlation for Atrium-10 Fuel," Revision 1, June 2003, as approved by the NRC by letter dated January 14, 2004 (ADAMS Accession No. ML040130278)<sup>3</sup>.

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2. Global Nuclear Fuel – Americas, LLC, Report, NEDC-33106P, "GEXL97 Correlation for Atrium-10 Fuel," Revision 4, August 2012

3. NEDC-33106P, Revision 1, as approved by the NRC in the January 14, 2004, is referenced, by the licensee, as NEDC-33106P-A, "GEXL97 Correlation for Atrium-10 Fuel," Revision 2, June 2004.

Based on the February 20, 2013, response to the NRC staff's RAI-03, the staff will impose a license condition that the range of applicability in the SLMCPR calculation for ATRIUM-10 fuel shall be limited to NEDC-33106P, Revision 1, as approved by the NRC. Because the license condition will limit the SLMCPR calculation to the approved applicability the staff finds the approach acceptable. The license condition reads as follows:

Use of Global Nuclear Fuel – Americas, LLC, Report, NEDC-33106P, "GEXL97 Correlation for Atrium-10 Fuel," Revision 4, August 2012, for LaSalle Unit 2 shall be limited to the same range of applicability for calculations of Safety Limit Minimum Critical Power Ratios as documented in NRC letter from W. A. Macon, Jr. (NRC) to J. L. Skolds, "LaSalle County Station, Units 1 and 2 – Correction to Issuance of Amendments (TAC Nos. MB9888 and MB9889)," dated January 14, 2004 (ADAMS Accession Number ML040130278).

The NRC staff has also reviewed the justification for the SLMCPR value of  $\geq 1.14$  for TLO and  $\geq 1.17$  for SLO using the approach stated in GESTAR-II, Revision 19. Based on the staff's review of the submittal and supplements, the staff has concluded that the SLMCPR analysis for LSCS, Unit 2, Cycle 15, operation using the plant- and cycle-specific calculation in conjunction with the approved method is acceptable. The Cycle 15 SLMCPR will ensure that 99.9 percent of the fuel rods in the core will not experience boiling transition which satisfies the requirements of GDC-10 regarding acceptable fuel design limits. Therefore, the NRC staff concludes that the justification for analyzing and determining the SLMCPR value of  $\geq 1.14$  for TLO and  $\geq 1.17$  for SLO for LSCS, Unit 2, Cycle 15, is acceptable since approved methodologies were used in conjunction with assumption of a higher R-Factor uncertainty, performance of a bounding calculation at rated core power and minimum core flow, and analysis of power shape for Cycle 15 operation resulting with no fuel axial power shape penalty.

Based on the review above, the NRC staff finds that the TS changes proposed in the application involving the SLMCPR values for both TLO and SLO are acceptable for LSCS Unit 2, Cycle 15, operation because the changes were analyzed based on NRC-approved methods using LSCS, Unit 2, Cycle 15, cycle-specific inputs for the Cycle 15 fuel bundles.

#### 4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Illinois State official was notified of the proposed issuance of the amendment. The State official had no comments.

#### 5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding recorded in the *Federal Register* (77 FR 66489; November 5, 2012). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR

51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

## 6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: Tai Huang, DSS/SRXB

Date of issuance: February 27, 2013

M. Pacilio

- 2 -

If you have any questions regarding his matter, please contact me at 301-415-1115.

Sincerely,

*/RA/*

Nicholas DiFrancesco, Project Manager  
Plant Licensing Branch III-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-374

Enclosures:

- 1. Amendment No. 192 to NPF-18
- 2. Safety Evaluation

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**ADAMS Accession No.: ML13050A637**

**\*by memo dated February 26, 2013**

OFFICE	LPL3-2/PM	LPL3-2/LA	DSS/SRXB/BC*	OGC - NLO	LPL3-2/BC(A)	LPL3-2/PM
NAME	NDiFrancesco (JWiebe for)	SRohrer	CJackson*	LSubin	JBowen	NDiFrancesco
DATE	02/26/13	02/21/13	02/26/13	02/27/13	02/27/13	02/27/13

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