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

January 28, 2011

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

SUBJECT: LASALLE COUNTY STATION, UNITS 1 AND 2, ISSUANCE OF AMENDMENTS CONCERNING SPENT FUEL NEUTRON ABSORBERS (TAC NOS. ME2376 AND ME2377)(RS-09-133)

Dear Mr. Pacilio:

The U.S. Nuclear Regulatory Commission (NRC, the Commission) has issued the enclosed Amendment No. 199 to Facility Operating License No. NPF-11 and Amendment No. 186 to Facility Operating License No. NPF-18 for the LaSalle County Station, Units 1 and 2, respectively. The amendments are in response to the Exelon Generation Company (the licensee, EGC or Exelon) application dated October 5, 2009, supplemented by letters dated June 10, November 23, December 14, and December 22, 2010, and January 11, 24, and 28, 2011.

The amendments requested changes to the Technical Specifications (TS) for LaSalle County Station (LSCS) Units 1 and 2, spent fuel pool (SFP) storage requirements to allow the use of NETCO-SNAP-IN inserts throughout the entire Unit 2 SFP. As concerns regarding the long-term crediting of BORAFLEX in the LaSalle SFPs have yet to be resolved, these amendments approve the use of the NETCO-SNAP-IN inserts, however these amendments also place license conditions related to the use of the nuclear criticality analysis provided and establish a three-tiered SFP BORAFLEX credit configuration. The license conditions are valid until October 28, 2011. After this date, credit for BORAFLEX is limited to a more restricted-tiered configuration until completion of the NETCO-SNAP-IN insert campaign. The licensee has committed to complete placement of the NETCO inserts by the end of 2014, and submittal of the first 10-year surveillance 60 days after completion.

A copy of the Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA/

Eva A. Brown, Senior Project Manager
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-373 and 50-374

Enclosures:
1. Amendment No. 199 to NPF-11
2. Amendment No. 186 to NPF-18
3. Safety Evaluation

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

EXELON GENERATION COMPANY, LLC

DOCKET NO. 50-373

LASALLE COUNTY STATION, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 199
License No. NPF-11

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 5, 2009 as supplemented by letters dated June 10, November 23, December 14, and December 22, 2010, and January 11, 24 and 28, 2011, 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-11 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. 199, 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 the date of its issuance and shall be implemented within 120 days after the end of Unit 2 refueling outage 13.

FOR THE NUCLEAR REGULATORY COMMISSION

Michael Mahoney FOR

Robert D. Carlson, 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: January 28, 2011

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. 186
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 5, 2009 as supplemented by letters dated June 10, November 23, December 14, and December 22, 2010, and January 11, 24 and 28, 2011, 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), 2.C.(30), 2.C.(31), 2.C.(32) and 2.C.(33) of the Facility Operating License No. NPF-18 is hereby amended to read as follows:

(30) Beginning 120 days after the LSCS Unit 2 refueling outage 13 (L2R13) and until October 28, 2011, the storage cells in the rack modules without NETCO-SNAP-IN® inserts will be placed into one of three categories: Unrestricted, Restricted and Unusable.

(a) Unrestricted will be cells whose minimum panel B^{10} areal density is greater than or equal to 0.0167 g/cm^2, Unrestricted cells may contain fuel assemblies up to the maximum reactivity identified in TS 4.3.1.1.d.

(b) Restricted will be cells whose minimum panel B^{10} areal density is between 0.0167 g/cm^2 and 0.0115 g/cm^2. Restricted cells will only contain LSCS Units 1 and 2 Cycle 1 General Electric (GE) and GE14 fuel assemblies.

(c) Unusable will be cells whose minimum panel B^{10} areal density is less than or equal to 0.0115 g/cm^2. Unusable cells will be administratively controlled to remain empty of any fuel assembly.

(31) After October 28, 2011, for the storage cells in the rack modules without NETCO-SNAP-IN® inserts in the LSCS Unit 2 SFP, the following categories will apply: Unrestricted, Restricted, and Unusable.

(a) Unrestricted will be cells whose minimum panel B^{10} areal density is greater than or equal to 0.0200 g/cm^2, Unrestricted cells may contain fuel assemblies up to the maximum reactivity identified in TS 4.3.1.1.d.

(b) Restricted will be cells whose minimum panel B^{10} areal density is between 0.0200 g/cm^2 and 0.0167 g/cm^2. Restricted cells will only contain LSCS Units 1 and 2 Cycle 1 GE and GE14 fuel assemblies.

(c) Unusable will be cells whose minimum panel B^{10} areal density is less than or equal to 0.0167 g/cm^2. Unusable cells will be administratively controlled to remain empty of any fuel assembly.

(32) To ensure the ongoing Boraflex degradation will not exceed the spent fuel pool criticality limits, Exelon shall complete loading all accessible storage rack cells in the LSCS Unit 2 spent fuel pool with NETCO-SNAP-IN® inserts no later than December 31, 2014.

(33) The methodology in AREVA NP Inc, Report No. ANP-2843(P) "LaSalle Unit 2 Nuclear Power Station Spent Fuel Storage Pool Criticality Safety Analysis with Neutron Absorbing Inserts and Without Boraflex," Revision 1, dated August 2009, as corrected by Attachment 3 to a letter dated June 10, 2010 from P. Simpson to the NRC, shall be used to perform required criticality calculations associated with the storage cells containing NETCO-SNAP-IN® inserts.

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 186, 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 the date of its issuance and shall be implemented within 120 days after the end of Unit 2 refueling outage 13.

FOR THE NUCLEAR REGULATORY COMMISSION

Michael Mahoney for R

Robert D. Carlson, 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: January 28, 2011

ATTACHMENT TO LICENSE AMENDMENT NOS. 199 AND 186

FACILITY OPERATING LICENSE NOS. NPF-11 AND NPF-18

DOCKET NOS. 50-373 AND 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	Insert
License NPF-11	License NPF-11
Page 3	Page 3
License NPF-18	License NPF-18
Page 3	Page 3
Page 8	Page 8
Page 9	Page 9
	Page 10
TSs	TSs
4.0-2	4.0-2
4.0-3	4.0-3
	4.0-4

(4) Exelon Generation Company, LLC, pursuant to the Act and 10 CFR Parts 30, 40, and 70, to receive, possess, and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and

(5) Exelon Generation Company, LLC, pursuant to the Act and 10 CFR Parts 30, 40, and 70, to 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.

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).

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 199, 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. 194 08/28/09 (3) DELETED

Am. 194 08/28/09 (4) DELETED

Am. 194 08/28/09 (5) DELETED

Am. 194 08/28/09 (6) DELETED

Am. 194 08/28/09 (7) DELETED

(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.

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. 186, 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 08/28/09 (3) DELETED

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

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

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

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

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

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

(c) The first performance of the periodic measurement of CRE pressure, Specification 5.5.15.d, shall be within 24 months, plus the 6 months allowed by SR 3.0.2, as measured from the date of the most recent successful pressure measurement test, or within 6 months if not performed previously. (30)

(30) Beginning 120 days after the LSCS Unit 2 refueling outage 13 (L2R13) and until October 28, 2011, the storage cells in the rack modules without NETCO-SNAP-IN® inserts will be placed into one of three categories: Unrestricted, Restricted and Unusable.

(a) Unrestricted will be cells whose minimum panel B^{10} areal density is greater than or equal to 0.0167 g/cm^2, Unrestricted cells may contain fuel assemblies up to the maximum reactivity identified in TS 4.3.1.1.d.

(b) Restricted will be cells whose minimum panel B^{10} areal density is between 0.0167 g/cm^2 and 0.0115 g/cm^2. Restricted cells will only contain LSCS Units 1 and 2 Cycle 1 General Electric (GE) and GE14 fuel assemblies.

(c) Unusable will be cells whose minimum panel B^{10} areal density is less than or equal to 0.0115 g/cm^2. Unusable cells will be administratively controlled to remain empty of any fuel assembly.

(31) After October 28, 2011, for the storage cells in the rack modules without NETCO-SNAP-IN® inserts in the LSCS Unit 2 SFP, the following categories will apply: Unrestricted, Restricted, and Unusable.

(a) Unrestricted will be cells whose minimum panel B^{10} areal density is greater than or equal to 0.0200 g/cm^2, Unrestricted cells may contain fuel assemblies up to the maximum reactivity identified in TS 4.3.1.1.d.

(b) Restricted will be cells whose minimum panel B^{10} areal density is between 0.0200 g/cm^2 and 0.0167 g/cm^2. Restricted cells will only contain LSCS Units 1 and 2 Cycle 1 GE and GE14 fuel assemblies.

(c) Unusable will be cells whose minimum panel B^{10} areal density is less than or equal to 0.0167 g/cm^2. Unusable cells will be administratively controlled to remain empty of any fuel assembly.

(32) To ensure the ongoing Boraflex degradation will not exceed the spent fuel pool criticality limits, Exelon shall complete loading all accessible storage rack cells in the LSCS Unit 2 spent fuel pool with NETCO-SNAP-IN® inserts no later than December 31, 2014.

(33) The methodology in AREVA NP Inc, Report No. ANP-2843(P) "LaSalle Unit 2 Nuclear Power Station Spent Fuel Storage Pool Criticality Safety Analysis with Neutron Absorbing Inserts and Without Boraflex," Revision 1, dated August 2009, as corrected by Attachment 3 to a letter dated June 10, 2010 from P. Simpson to the NRC, shall be used to perform required criticality calculations associated with the storage cells containing NETCO-SNAP-IN® inserts.

Am. 87 03/16/95 D. The facility requires exemptions from certain requirements of 10 CFR Part 50, 10 CFR Part 70, and 10 CFR Part 73. These include:

(a) Exemptions from certain requirements of Appendices G, H and J to 10 CFR Part 50, and to 10 CFR Part 73 are described in the Safety Evaluation Report and Supplement Numbers 1, 2, 3, and 5 to the Safety Evaluation Report.

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

(c) An exemption from the requirement of paragraph III.D of Appendix J to conduct the third Type A test of each ten-year service period when the plant is shutdown for the 10-year plant inservice inspections.

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

Am. 97 04/05/96 (e) An exemption was granted to remove the Main Steam Isolation Valves (MSIVs) from the acceptance criteria for the combined local leak rate test (Type B and C), as defined in the regulations of 10 CFR Part 50, Appendix J, Option B, Paragraph III.B. Exemption (e) is described in the safety evaluation accompanying Amendment No. 97 to this License.

These exemptions are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest. Therefore, these exemptions are hereby granted. The facility will operate, to the extent authorized herein, in conformity with the application, as amended, and the rules and regulations of the Commission (except as hereinafter exempted therefrom), and the provisions of the Act.

E. Before engaging in additional construction or operational activities which may result in a significant adverse environmental impact that was not evaluated or that is significantly greater than that evaluated in the Final Environmental Statement and its Addendum, the licensee shall provide a written notification to the Director of the Office of Nuclear Reactor Regulation and receive written approval from that office before proceeding with such activities.

Am. 164 06/14/06 F. Deleted

Am. 164 06/14/06 G. Deleted

H. The licensee shall have and maintain financial protection of such type and in such amounts as the Commission shall require in accordance with Section 170 of the Atomic Energy Act of 1954, as amended, to cover public liability claims.

I. This license is effective as of the date of issuance and shall expire at Midnight on December 16, 2023.

FOR THE NUCLEAR REGULATORY COMMISSION

Original signed by D.C. Eisenhut for

HAROLD R. DENTON, DIRECTOR
OFFICE OF NUCLEAR REACTOR REGULATION

Attachment/Appendices:
1. DELETED
2. DELETED
3. Appendix A – Technical Specifications (NUREG-1013)
4. Appendix B – Environmental Protection Plan

Date of Issuance: December 16, 1983

4.0 DESIGN FEATURES (continued)

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in either: (1) Section 9.1.2 of the UFSAR, or (2) AREVA NP Inc. Report No. ANP-2843(P), "LaSalle Unit 2 Nuclear Power Station Spent Fuel Storage Pool Criticality Safety Analysis with Neutron Absorbing Inserts and Without Boraflex," Revision 1, dated August 2009, for the Unit 2 spent fuel storage racks with rack inserts.

b. A nominal 6.26 inch center to center distance between fuel assemblies placed in the storage racks.

c. For Unit 2 only, a neutron absorbing rack insert shall be installed in spent fuel storage rack cells prior to loading fuel assemblies in cells that cannot otherwise maintain the requirements of 4.3.1.1.a. The neutron absorbing rack inserts shall have a minimum certified ^{10}B areal density greater than or equal to 0.0086 grams $^{10}B/cm^2$. The approved inserts are those described in Attachment 4 to the letter from P. Simpson to the NRC, dated October 5, 2009.

d. The combination of U-235 enrichment and gadolinia loading shall be limited to ensure fuel assemblies have a maximum k-infinity of 0.9185 for all lattices in the top of the assembly, a maximum k-infinity of 0.8869 for all lattices in the intermediate portion of the assembly, and a maximum k-infinity of 0.8843 for all lattices in the bottom of the assembly as determined at 4°C in the normal spent fuel pool in-rack configuration. The bottom, intermediate, and top zones are between 0"-96", 96"-126", and greater than 126" above the bottom of the active fuel.

(continued)

4.0 DESIGN FEATURES

4.3.1 Criticality (continued)

e. For Unit 2 only, at the interface between a non-insert rack module and an insert rack module of the spent fuel pool, the placement of inserts will be expanded one row and one column into the non-insert rack module as necessary to completely surround all assemblies in the insert rack module with four wings of an insert.

4.3.2 Drainage

The spent fuel storage pool is designed and shall be maintained to prevent inadvertent draining of the pool below elevation 819 ft.

4.3.3 Capacity

The spent fuel storage pool is designed and shall be maintained with a storage capacity limited to no more than 3986 fuel assemblies for Unit 1 and 4078 fuel assemblies for Unit 2.

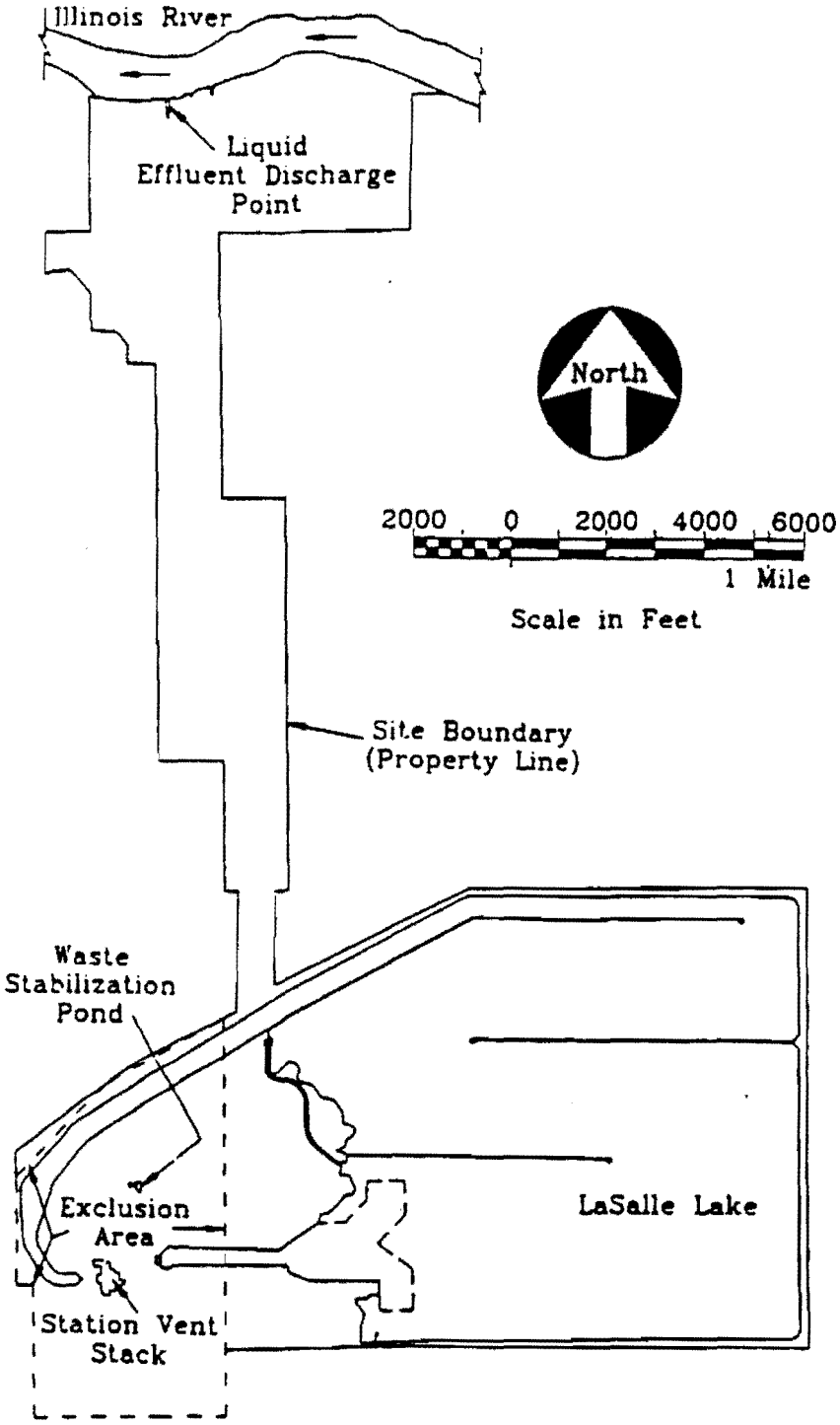

Figure 4.1-1 (Page 1 of 1)
Site and Exclusion Area Boundaries

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO

AMENDMENT NO. 199 TO FACILITY OPERATING LICENSE NO. NPF-11

AND

AMENDMENT NO. 186 TO FACILITY OPERATING LICENSE NO. NPF-18

EXELON GENERATION COMPANY, LLC

LASALLE COUNTY STATION, UNITS 1 AND 2

DOCKET NOS. 50-373 AND 50-374

1.0 INTRODUCTION

By letter dated October 5, 2009, supplemented by letters dated June 10, November 23, December 14, and December 22, 2010, and January 11, 24 and 28, 2011, Exelon Generation Company (EGC, Exelon or the licensee) requested changes to the Technical Specifications (TS) for LaSalle County Station (LSCS) Unit 1 and Unit 2 spent fuel pool (SFP) storage requirements. The request is required to accommodate degradation in the installed neutron absorber in the Unit 2 SFP. The Unit 1 SFP uses Boral, which does not have the degradation issues associated with BORAFLEX. Therefore, no inserts are proposed to be added to the Unit 1 SFP.

The June 10, November 23, December 14, and December 22, 2010, and January 11, 24, and 28, 2011 supplements, contained clarifying information and did not change the NRC staff's initial proposed finding of no significant hazards consideration.

2.0 REGULATORY EVALUATION

Title 10 to the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, Criterion 62, "Prevention of criticality in fuel storage and handling," as it relates to the prevention of criticality by physical systems or processes.

Section 50.68(b)(1) to 10 CFR requires:

> Plant procedures shall prohibit the handling and storage at any one time of more fuel assemblies than have been determined to be safely subcritical under the most adverse moderation conditions feasible by unborated water

Section 50.68(b)(4) to 10 CFR requires:

> If no credit for soluble boron is taken, the k-effective of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with unborated water. If credit is taken for soluble boron, the k-effective of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level, if flooded with borated water, and the k-effective must remain below 1.0 (subcritical), at a 95 percent probability, 95 percent confidence level, if flooded with unborated water.

Section 50.36(c)(4) to 10 CFR requires:

> Design features to be included are those features of the facility such as materials of construction and geometric arrangements, which, if altered or modified, would have a significant effect on safety and are not covered in categories described in paragraphs (c) (1), (2), and (3) of this section.

The LSCS Units 1 and 2 SFPs do not contain soluble boron. Therefore, the regulatory requirement is for the LSCS Units 1 and 2 SFPs effective neutron multiplication factor (k_{eff}) to remain less than or equal to 0.95, at a 95 percent probability, 95 (95/95) percent confidence level, if flooded with unborated water.

According to NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Section 9.1.2, "Spent Fuel Storage," the review should ensure that there are no potential mechanisms that will: (1) alter the dispersion of boron carbide (B_4C) in the neutron attenuation panels, and/or (2) cause physical distortion of the tubes retaining the stored fuel assemblies.

3.0 TECHNICAL EVALUATION

3.1 Rio Tinto Alcan Composite Material

The LSCS Unit 2 SFP currently relies on BORAFLEX as a neutron absorbing material. Degradation of BORAFLEX material results from irradiation of the silicon polymer matrix. Because of the ongoing degradation of the BORAFLEX, the licensee relies on a monitoring program to ensure sufficient neutron absorbing capabilities of the material. The licensee's long-term solution to the degradation of the BORAFLEX is the proposed use of NETCO SNAP IN® rack inserts constructed of Rio Tinto Alcan composite material. Once the proposed inserts have been installed the licensee will no longer need to credit the BORAFLEX for neutron attenuation in the criticality analysis and can therefore discontinue the BORAFLEX monitoring program.

The Rio Tinto Alcan composite uses AA1100 alloy as a metal matrix to retain boron carbide. This is the same alloy that is used in Boral neutron absorber materials. Unlike Boral, the Rio Tinto Alcan is manufactured by mixing boron carbide powder into molten aluminum. The composite material is then formed into a billet and hot-rolled into sheets that will form the final NETCO SNAP IN® inserts. The resulting material is a fully dense homogenous mixture of boron carbide particles embedded in AA1100 series aluminum. The manufacturing process is similar to that of Metamic material, which the NRC staff has approved for use in several SFPs at operating reactors.

3.1.1 Rio Tinto Alcan Composite Coupon Surveillance Program

Rio Tinto Alcan has not been previously approved for use in SFP applications. The material has been approved by the NRC for use in dry cask applications. The NRC staff has approved Metamic which is a similar aluminum boron carbide composite.

In Attachment 5 to the submittal dated October 5, 2009, the licensee provided NET-259-03, "Material Qualification of Alcan Composite for Spent Fuel Storage," Revision 5, which contained a Rio Tinto Alcan Coupon Surveillance Program. This program consists primarily of monitoring the physical properties of the absorber material by performing periodic physical inspection and neutron attenuation testing to confirm the ability of the material to perform its intended function.

3.1.1.1 Program Description

The purpose of the licensee's coupon surveillance program is to ensure the physical and chemical properties of the Rio Tinto Alcan composite material behave in a similar manner as that described in NETCO's simulated service performance and qualification testing of the material. The coupon program is intended to monitor how the neutron absorber material properties change over time under the radiation, chemical, and thermal environment found in the SFP. Additionally, this surveillance program is intended to provide a means to detect any significant degradation in a timely manner that will allow for implementation of corrective actions prior to the material losing its ability to perform its intended function.

3.1.2 Long-Term Surveillance Program

The licensee indicated that the long-term surveillance program will use coupon samples, made from the same material as used for rack construction, to monitor the performance of the neutron absorbing material. A total of 96 coupons will be suspended from a mounting tree that is placed in the SFP at the time of the initial rack insert installation. Each coupon will be examined prior to insertion in the SFP to determine an initial condition that will be compared to the coupons condition when it is removed from the pool after exposure. The coupons will be removed from the SFP, examined, and compared to the initial condition, on a prescribed schedule. In addition to dimensional and weight measurements, areal density testing will be performed to ensure that the boron content of the material is sufficient to perform its neutron attenuation function. Based on the proposed sampling schedule, there are a sufficient number of coupons to allow for over 80 years of surveillance. The licensee stated that the coupon tree will remain in the pool as long as the spent fuel storage racks continue to be used.

The coupon tree includes bent coupons to simulate stresses on the actual inserts, and bi-metallic coupons to simulate galvanic corrosion that may occur with stainless steel, inconel, and zircaloy in the SFP.

The long-term surveillance coupon types and objectives are described in Table 7-1 of Attachment 5 to the October 5, 2009, submittal with the frequency for long-term coupon testing is described in Table 7-4 of Attachment 5 and the acceptance criteria for long-term coupon surveillance program describe on page 23 of Attachment 1.

In addition to the coupon inspections described above, the licensee will also perform camera aided visual examinations on two rack inserts at the same frequency as the general coupon inspection schedule. The visual examinations will monitor for physical deformities such as blistering, pitting, and cracking. The licensee stated that the examinations will pay special attention to any edge or corner defects in the rack inserts.

3.1.3 Fast Start Coupon Surveillance

In addition to the long-term surveillance program, the licensee has already started "Fast Start" coupon surveillance program. This program consists of 24 coupons on a string (connected with stainless steel chain) that is suspended inside of a spent fuel storage rack cell and surrounded in all adjacent cells with freshly discharged fuel. The intent is to expose the Fast Start coupons to the maximum temperature and gamma irradiation. Two of the coupons will be removed approximately every 6 months and sent to a qualified laboratory for testing, inspection, and comparison to their pre-installation condition. The Fast Start coupons will provide early performance data on the Rio Tinto Alcan composite since the coupon string has been installed prior to rack insert installation.

3.1.4 Conclusion

Based on its review of the licensee's coupon sampling program and material qualification tests, the NRC staff concludes that the NETCO SNAP IN® rack inserts made from Rio Tinto Alcan composite neutron absorber are compatible with the environment of the Lasalle SFP. Also, the NRC staff finds the proposed surveillance program, which includes visual, physical and confirmatory tests, is capable of detecting potential degradation of the rack insert material that could impair its neutron absorption capability. Therefore, the NRC staff concludes that the use of Rio Tinto Alcan composite as a neutron absorber rack inserts in the Unit 2 SFP is acceptable.

3.2 SFP Criticality Analysis

The proposed change would eventually place NETCO SNAP IN® rack inserts made from Rio Tinto Alcan composite neutron absorber into all accessible cells. The licensee indicated that the inserts are intended to be installed on a module basis rather than a per cell basis. The inserts have a lower B^{10} areal density than the initial B^{10} areal density of the BORAFLEX panels. The insert B^{10} areal density used in nuclear criticality safety (NCS) analysis supporting the licensee's request is 0.0086 grams per centimeter square ($g/cm^{2)}$. Due to the lower areal density, the LSCS Unit 2 SFP would no longer be able to store fuel assemblies with the same reactivity as before.

LSCS Units 1 and 2 SFPs are connected by a double-gated transfer canal. Therefore LSCS has the ability to store fuel from either reactor in either SFP.

Exelon has proposed the following changes to the common LSCS Units 1 and 2 TS:

a. A revision to TS 4.3.1.1.a that captures the AREVA NP Inc, Report No. ANP-2843(P) "LaSalle Unit 2 Nuclear Power Station Spent Fuel Storage Pool Criticality Safety Analysis with Neutron Absorbing Inserts and Without Boraflex, " Revision 1, dated August 2009, to describe the allowance of uncertainties in analyses for the LSCS Unit 2 SFP.
b. A new TS 4.3.1.1.c that captures the minimum B^{10} areal density of the inserts,
c. A new TS 4.3.1.1.d to capture the maximum reactivity that may be stored in either SFP,
d. A new TS 4.3.1.1.e to require a row/column of inserts in modules adjacent to modules with inserts before the module with inserts can credit those inserts for reactivity control.

Because the licensee will continue to credit BORAFLEX for reactivity control in modules, which do not have a full complement of inserts, the licensee proposed the following tiered approach to the placement of fuel into the Unit 2 SFP:

a. Storage cells will be classified as Unusable, Restricted, or Unrestricted based on the degradation of adjacent BORAFLEX panels.
    - Unusable will be cells whose peak panel degradation is greater than 52.27 percent,
    - Restricted will be cells whose peak panel degradation is greater than 29.97 percent, but less than 52.27 percent,
    - Unrestricted will be cells whose peak panel degradation is less than or equal to 29.97 percent,
b. Unusable cells will be empty,
c. Restricted cells will only contain LSCS Units 1 and 2 Cycle 1 GE and GE14 fuel assemblies.
d. Unrestricted cells may contain fuel assemblies up to the maximum reactivity identified in TS 4.3.1.1.d.

3.2.1 Methodology

There is no generic methodology for performing SFP criticality analyses. In a letter dated August 19, 1998 [Agencywide Documents Access and Management System (ADAMS) Accession No Accession No. ML003728001], the NRC staff issued guidance for performing the review of SFP criticality analysis. This memorandum is known colloquially as the 'Kopp Letter,' after the author. The Kopp letter provides some guidance on several aspects of a criticality analysis. The guidance is germane to boiling water reactors and pressurized water reactors, borated and unborated SFPs.

The NCS analysis, ANP-2843(P) "LaSalle Unit 2 Nuclear Power Station Spent Fuel Storage Pool Criticality Safety Analysis with Neutron Absorbing Inserts and Without Boraflex," Revision 1 [ANP-2843(P)],supporting this submittal was provided by the licensee in Attachment 6 to the October 5, 2009, submittal. A publicly available version of this analysis was provided as Attachment 3 to the submittal. ANP-2843(P) determined k_{eff} to be 0.94 at a 95/95 percent confidence level, providing approximately 0.01 Δk_{eff} of reserved analytical margin to the regulatory limit of 0.95.

The methodology employed in ANP-2843(P), included:

- Depletion calculations are performed to demonstrate that at the point of peak reactivity acceptable margin is still present to regulatory requirements.
- A limiting fuel bundle design is constructed for analysis purposes by combining the most reactive lattices of various bundle designs that are currently present or expected to be present in the LaSalle SFP.
- A Reactivity Equivalent Beginning of Life (REBOL) bundle design was created using fresh UO_2 and no gadolinium in ATRIUM-10 lattices.
- Use of a 0.01 Δk_{eff} increase on the conversion from the depleted fuel to the REBOL.

3.2.2 Computer Code Validation

The licensee's NCS used both SCALE 4.4a and CASMO-4. ANP-2843(P) used the KENO V.a module and CSAS25 driver in the SCALE 4.4a code package with the 44 energy group cross-section library 44GROUPNDF5 for the spent fuel criticality analysis. The code validation is presented in Appendix C of ANP-2843(P). The licensee's code validation used NUREG/CR-6698, "Guide for Validation of Nuclear Criticality Safety Methodology," as guidance.

The validation of KENO V.a for this application was performed with a set of 100 critical experiments, including 11 experiments containing uranium-oxide/plutonium-oxide (MOX) fuel. These experiments cover a range of values in several key parameters to ensure that the safety case models are within the area of applicability of the validation suite.

KENO V.a was used to model the REBOL, which does not contain any plutonium. Therefore the use of MOX critical experiments to validate safety analysis appears to be inappropriate for this application. In a letter dated June 10, 2010, the licensee contends that it is acceptable to use the MOX critical experiments to validate safety analysis calculations that do not include any plutonium. The response has shown that, in this case, the inclusion of the MOX experiments did not affect the bias and bias uncertainty in a non-conservative way. Therefore, the use of MOX critical experiments to validate a safety analysis consisting of only uranium-oxide was acceptable but not relevant. The NRC staff notes that this may not always be the case.

Part of the validation is the trend analysis to determine if the bias and bias uncertainty exhibit any dependence of the parameters from the area of applicability. Inherent in the trend analysis is determining whether or not there is a valid trend. The null hypothesis can be either that a trend does not exist or that a trend does exist. The probability for rejecting this null hypothesis may also vary. The conservative approach is to determine the bias and bias uncertainty both assuming the lack of a trend and the presence of a trend. Those results can then be applied in a conservative manner. In the submittal the licensee contends that no trends existed. In a letter dated June 10, 2010, the licensee also considered the second approach, assuming that the trends were valid.

In Figures RAI-40.1 and RAI-40.2 of Attachment 3 of the June 10, 2010, supplement, the information provided appears to show that use of a lower tolerance limit is conservative compared to a lower tolerance band for systems with energy of average lethargy of neutrons causing fission (EALF) values between 0.1 and 2 electron-volts (eV) and for enrichments between 2.5 and 8 weight percent of Uranium-235 (wt % U^{235}). However, more than 5% of the

100 critical experiment k_{eff} values fall below what should be a 95/95 lower tolerance band. To further investigate the issue, the benchmark experiment k_{eff} results from ANP-2843(P) were used in USLSTATS calculations to confirm the trending analysis results shown in Figures RAI-40.1 and RAI-40.2 of Attachment 3 of the June 10, 2010, supplement.

For the EALF trend, contain in Figure 40.1 of the June 10, 2010, submittal, the confidence band limit (USL-1) ranged from 0.9835 to 0.9837 over the relevant EALF range of 0.19 to 0.26 eV. This is about 0.00140 Δk_{eff} lower than the k_L limit (0.9847) and about 0.00370 Δk_{eff} lower than the lower tolerance band values (~0.987) presented in the figure.

For the enrichment trend (Figure 40.2), the confidence band limit (USL-1) ranged from 0.9830 to 0.9833 over the relevant enrichment range of 2.66 to 3.05 wt % U^{235}. This is about 0.00140 Δk_{eff} lower than the k_L limit (0.9847) and about 0.00370 Δk_{eff} lower than the lower tolerance band values (~0.987) presented in the figure.

The discussion, provided in the June 10, 2010, supplement, claimed that the non-trending results conservatively bound the trending results may be based upon erroneous trending results. Subsequently, an alternative method (USLSTATS USL-1) was used to show that the non-trending results may be about 0.00150 Δk_{eff} non-conservative. Since the analysis retained approximately 0.01 Δk_{eff} of reserved analytical margin, there is enough margin to the 0.95 limit to cover a potential 0.00150 Δk_{eff} non-conservatism.

CASMO-4 is a multi-group, two-dimensional, transport theory code with an in-rack geometry option where typical storage rack geometries can be defined on an infinite lattice basis. ANP-2843(P) used the CASMO-4 code to deplete the fuel assembly lattices to determine the point of peak reactivity, determine the REBOL assembly design by comparing fuel assembly lattices in the SFP environment and geometry, and to determine the gadolinia manufacturing uncertainty. The library files used in the evaluation are the standard CASMO-4 70 group library based on ENDFB-IV. The licensee indicated that CASMO-4 was used for fuel depletion and relative reactivity comparisons in a manner that is consistent with AREVA's NRC approved CASMO-4/MICROBURN-B2 methodology contained in EMF-2158(P)(A) Revision 0, "Siemens Power Corporation Methodology for Boiling Water Reactors: Evaluation and Validation of CASMO-4/MICROBURN-B2," October 1999 [EMF-2158(P)(A)]. EMF-2158 (P)(A) is part of the LSCS list of approved methodologies in TS 5.6.5.

Since the CASMO-4 code is a two-dimensional code that models the storage rack in an infinite array, it cannot be used to provide a stand-alone benchmark of finite criticality experiments. Consequently, the evaluation in this appendix takes a different approach; it provides a code to code comparison of the CASMO-4 code to the SCALE 4.4a KENO V.a code. While ANP-2843(P) performed a code-to-code comparison between CASMO-4 and KENO V.a, those results were not used directly in the analysis. Instead the analysis increased the reactivity of the REBOL assembly relative to the limiting lattice determined by CASMO-4 by 0.01 Δkeff to accommodate the depletion uncertainty and code-to-code differences in modeling the REBOL assembly.

Based on the identified nonconservatisms being bounded by existing conservatisms, the NRC staff finds the code validation performed acceptable.

3.2.3 Spent Fuel Pool

3.2.3.1 Description of the Spent Fuel Pool

The Unit 2 SFP storage racks are high-density spent fuel storage racks consisting of 20 individual spent fuel storage racks/modules that have capacity for 4078 fuel assemblies and 38 special storage cells. The 4078 spent fuel storage cells consist of 4073 normal spent fuel storage cells and five defective fuel storage cells. The 38 special storage cells consist of 35 control rod storage cells (i.e., one rack of 18 and one rack of 17), and three control rod guide tube storage cells.

Each cell is a stainless steel box with a nominal inside dimension of 6.00 inches and a nominal wall thickness of 0.090 inches. The boxes are welded at the corners to form a module. On the outside of each box a double row of matching flat round raised areas are coined. The raised dimension of these locally formed areas on each box wall is half the thickness of the poison sheet. The space between each box is where the BORAFLEX neutron poison material is located. In the insert NCS analysis that space is modeled as SFP water.

The inserts are modeled as a chevron with wings covering two sides of the storage cell. The inserts have a minimum B^{10} areal density of 0.0086 g/cm^2 and a nominal thickness of 0.065 inches. The inserts will be in the storage cell with the fuel assembly, fuel assembly and flow channel, flow channel, control rods, and anything else the licensee stores in the cells. This raises the possibility of those items rubbing against the inserts and causing wear. The licensee's submittal and supplements acknowledge the potential for wear, but indicate no wear is expected over the lifetime of the inserts. However, in the June 10, 2010, the licensee indicated the intent to add an element to the insert surveillance program. Every 10 years an insert from a high use location will be removed and inspected for thickness along its length in a minimum of 10 locations. In the supplements the licensee provided additional information concerning the potential for wear and an estimate of how much wear would be tolerable. The licensee estimates that up to 8 mils of wear is tolerable. However, that estimate did not consider the minimum as-built B^{10} areal density, nor is it clear that it considered the uncertainty on the as-built B^{10} areal density. The NRC staff finds that if those are conservatively considered, the inserts will be unable to tolerate that much wear before the B^{10} areal density is below the minimum B^{10} areal density of 0.0086 g/cm^2 used in the NCS analysis. That coupled with the likelihood that this will be the first surveillance of this type of insert, the NRC staff requested the data and analysis of the first 10-year surveillance of the inserts be submitted to the NRC. The licensee committed in a letter dated January 24, 2011, to provide the surveillance report within 60 days of its completion.

3.2.3.1 Spent Fuel Pool Mechanical Uncertainties

The material and configuration of the SFP racks contributes to the reactivity; the material by providing a fixed neutron absorber and the configuration by controlling the fuel assembly spacing. The NRC staff has provided one method to address these uncertainties in the Kopp Letter.

The licensee determined SFP mechanical uncertainties for the following parameters: Insert Thickness, Cell Wall Thickness, and Storage Cell Pitch. In Attachment 3 to the June 10, 2010, on pages 59-60, Exelon discusses the addition of an uncertainty for Storage Cell Inside Dimension.

3.2.3.2 SFP Temperature Bias

The NRC guidance provided in the Kopp Letter states the criticality analysis should be done at the temperature corresponding to the highest reactivity. ANP-2843(P) indicates a sensitivity study was performed on temperature and the most reactive temperature was found to be 4 degrees Celsius (°C) . All subsequent k_{eff} calculations were performed at 4 °C, therefore no Temperature Bias is required.

3.2.4 Fuel Assembly

3.2.4.1 Selection of Bounding Fuel Assembly Design

A wide range of different fuel bundle designs have been used during operations at LSCS. Multiple designs from two different vendors have been used and are considered as part of this analysis. A description of the analysis and results of the screening to determine the bounding fuel assembly design is provided in Appendix B to ANP-2843(P). The licensee provided additional details on the screening process and results in a letter dated June 10, 2010. Based on the total information provided, the NRC staff finds the use of ATRIUM-10 lattices as bounding fuel design acceptable for this application.

3.2.4.2 Fuel Assembly Mechanical Tolerances

ANP-2843(P) included fuel assembly mechanical tolerances for fuel rod pitch, fuel enrichment, channel bulge, pellet diameter, clad diameter, and gadolinia concentration. Beginning on page 57 of Attachment 3 to the June 10, 2010, supplement, the licensee provided an additional uncertainty for gadolinia density and channel thickness.

3.2.5 Spent Fuel Characterization

For the SFP criticality analysis the fuel must be characterized appropriately. Characterization of fresh fuel is based primarily on Uranium-235 (U^{235}) enrichment and various manufacturing tolerances. The manufacturing tolerances are typically manifested as uncertainties, as discussed above, or are bounded by values used in the analysis. These tolerances and bounding values carry through to the spent fuel. The standard practice has been to treat the uncertainties as unaffected by the depletion. The characterization of spent fuel is more complex. Its characterization is based on the specifics of its initial conditions and its operational history in the reactor; that characterization has three main areas: a depletion uncertainty, the axial apportionment of the burnup, and the core operation that achieved that burnup.

For this analysis the criticality calculation is based on a REBOL fuel assembly, which is a fresh fuel assembly. The REBOL assembly represents the boiling-water reactor (BWR) fuel assembly at the point in its use when it has the peak reactivity. This point occurs when the majority of the gadolinia has been depleted and the reactivity of the fuel assembly is governed by the further U^{235} depletion. Therefore, in order for the REBOL assembly to be determined correctly the depleted state of the gadolinia bearing fuel assembly must be accurately portrayed. In establishing the REBOL assembly, the licensee has explicitly included the depletion uncertainty in 0.01 Δkeff increased reactivity of the REBOL assembly relative to the limiting lattice determined by CASMO-4. The licensee is modeling three lattices. The burnup on each lattice is sufficiently low that the use of a uniform apportionment of the burnup is reasonable. The primary core operating parameter for a BWR that affects the

determination of the point of peak reactivity is void history. The initial U^{235} enrichment and gadolinia loading are the primary assembly design parameters which impact the point of peak reactivity. In the June 10, 2010, supplements, the licensee provided additional information that demonstrated the acceptable application of the depletion parameters used in the depletion calculation. Based on the above and the aforementioned 0.01 Δk_{eff} increased reactivity of the REBOL assembly relative to the limiting lattice determined by CASMO-4, the NRC staff finds that the licensee has acceptably characterized the depleted fuel.

3.2.6 Criticality Analysis

For the general KENO V.a rack array calculations, an infinite array of fuel storage cells was assumed, using periodic boundary conditions in all three directions. The KENO V.a base model consists of a fuel assembly centered in the storage cell surrounded by SFP water and an insert in one corner with its 'wings' extending essentially all the way along the two walls. The cell wall is modeled at its nominal thickness and the BORAFLEX space is modeled at a half thickness as SFP water. The fuel assembly is an ATRIUM-10 REBOL assembly comprised of a 3.05 wt% U^{235} top zone (above 126"), a 2.72 wt% U^{235} intermediate zone (96" to 126"), and a 2.66 wt% U^{235} bottom zone (below 96"). The periodic boundary conditions effectively model an infinite array in the x and y direction and an infinite stack of fuel assemblies one on top of the other in the z direction.

ANP-2843(P) states,

> The array k-eff is highest when the assembly is centered in the available water space in the storage cell and the assembly orientation shown in Figure 4.2 is as limiting as the other 3 simple rotation possibilities.

As the ATRIUM-10 fuel assembly has an off center water hole, there is an asymmetry that may increase reactivity depending on the orientation of the water hole. ANP-2843(P) evaluated the four scenarios in which the water holes are all oriented in the same direction, and five scenarios where the water holes are not all oriented in the same direction. In the June 10, 2010, supplement, the licensee provided additional details concerning this portion of the analysis. While the reactivity of the four scenarios in which the water hole is oriented in the same direction evidently had similar reactivity, at least one of the five scenarios where the water holes are not all oriented in the same direction had a higher reactivity of approximately 0.001 Δk_{eff}, which the licensee has treated as an abnormal condition. However, as the licensee had not indicated there are any controls that would prescribe one combination or another, the NRC staff assumed that the combination resulting in the maximum k_{eff} is the normal case. Therefore the licensee's calculated k_{eff} should be increased by 0.001 Δk_{eff}. As nine scenarios are a limited set of the total possible combinations, it is possible that there is a combination with an even larger reactivity increase.

For abnormal conditions, the licensee also considered the misplacement of a fuel assembly alongside the storage racks, and a missing insert. In ANP-2843(P), the licensee determined the missing insert condition to be limiting with a 0.003 Δk_{eff} increase. In the June 10, 2010, supplement, the licensee considered scenarios that optimized the missing insert condition and determined that the 0.003 Δk_{eff} increase remained appropriate.

3.2.7 BORAFLEX Credit

The NRC approved license amendment 48 for LSCS Unit 2 to install the high density BORAFLEX storage racks on June 15, 1989, (ADAMS Accession No. ML021140803). The minimum B^{10} areal density modeled in the criticality analysis that supported that license amendment was 0.020 g/cm^2. The criticality analysis modeled a General Electric (GE) 8x8 fuel assembly with a U^{235} enrichment of 3.416 wt%. The criticality analysis calculated a k_{eff} of 0.9441.

BORAFLEX degradation in SFPs is a known phenomenon. On June 26, 1996, the NRC issued Generic Letter 96-04, "Boraflex Degradation in Spent Fuel Pool Storage Racks." Numerous BORAFLEX panels in the Unit 2 SFP have degraded below the 0.020 g/cm^2 B^{10} areal density modeled in the analysis of record (AOR) as approved in a letter dated June 15, 1989. The BORAFLEX degradation has led the licensee to declare numerous storage cells inoperable. BORAFLEX degradation is ongoing resulting in the continued loss of storage capacity. Eventually, all of the BORAFLEX will be gone.

In the November 23, 2010, supplement, the licensee provided some information concerning the current practices to account for BORAFLEX degradation and proposed actions to be taken until all of the inserts can be installed. The licensee states,

> The current criticality analysis for the most reactive fuel type in the Unit 2 SFP (i.e., ATRIUM-10) includes an assumed BORAFLEX™ panel thinning of 50 percent. This corresponds to an areal density of approximately 0.012 grams B^{10}/cm^2. Even with this amount of panel thinning, in-rack k_{eff} is demonstrated to be less than 0.95. Therefore, k_{eff} also remains less than 0.95 with areal densities between 0.012 and 0.020 grams B^{10}/cm^2.

Currently the licensee is declaring storage cells inoperable when the predicted degradation reaches 52.27 percent. Inoperable storage cells are administratively controlled to remain empty of any fuel assembly. Based on feedback from the NRC, the licensee proposed 120 days following its spring 2011 refueling outage (L2R13) and until the all of the inserts can be installed, the licensee proposed to place storage cells in the rack models without inserts into one of three categories: Unrestricted, Restricted and Unusable.

a. Unrestricted will be cells whose peak panel degradation is less than or equal to 29.97 percent, Unrestricted cells may contain fuel assemblies up to the maximum reactivity identified in TS 4.3.1.1.d.

b. Restricted will be cells whose peak panel degradation is greater than 29.97 percent, but less than 52.27 percent, Restricted cells will only contain LSCS Unit 1 and Unit 2 Cycle 1 GE and GE14 fuel assemblies.

c. Unusable will be cells whose peak panel degradation is greater than 52.27 percent, unusable cells will be administratively controlled to remain empty of any fuel assembly.

However, the current and proposed actions are evidently based on the 'current criticality analysis' mentioned in the November 23, 2010, supplement. The 'current criticality analysis' is obviously different than the analysis of record (AOR) approved in a letter dated June 15, 1989. The NRC has

not reviewed the 'current criticality analysis' for the LSCS Unit 2 SFP, and is therefore unable to determine until completion of the loading of the NETCO SNAP IN® rack inserts in December 2014, whether or not it demonstrates that k_{eff} is maintained less than or equal to 0.95, at a 95/95 percent confidence level as required by 10 CFR 50.68. There are several key aspects of a nuclear criticality safety analysis that need to be known before the NRC can reasonably conclude that k_{eff} is known at a 95/95 percent confidence level. Some of those aspects include:

- Calculation and application of biases and uncertainties,
- Criticality code validation,
- Characterization of the spent fuel including depletion codes and parameters,
- Modeling of the general and localized BORAFLEX degradation,
- Modeling of the remaining BORAFLEX, especially particle shelf shielding,
- Accident analysis especially fuel assembly misloading (a new accident at LSCS Unit 2) and the degraded BORAFLEX's condition and location following a seismic event.
- BORAFLEX degradation prediction and measurement accuracy and uncertainty.

In a letter dated December 22, 2010, the licensee's percentages are based on the nominal panel areal density of 0.0238g/cm^2. However, not all panels are at the nominal panel areal density. Some will be lower, perhaps significantly lower, perhaps as low as the 0.020 g/cm^2 used in the analysis of record. 52.27 percent degradation of an as-built areal density of 0.020 g/cm^2 will be much lower than 52.27 percent degradation of an as-built areal density of 0.0238 g/cm^2. Therefore the NRC staff finds it is more appropriate to control the availability of storage cells based on the actual areal density rather than a percentage of degradation from a nominal assumed for each panel. Given the proposed three-tiered approach and the NRC staff's outstanding concerns regarding the crediting of BORAFLEX, the NRC staff is proposing the following three-tiered SFP cell characterization be added as license condition (LC) 2.C(30):

> Beginning 120 days after the LSCS Unit 2 refueling outage 13 (L2R13) and until October 28, 2011, the storage cells in the rack modules without NETCO-SNAP-IN® inserts will be placed into one of three categories: Unrestricted, Restricted, and Unusable.
>
> a. Unrestricted will be cells whose minimum panel B^{10} areal density is greater than or equal to 0.0167 g/cm^2. Unrestricted cells may contain fuel assemblies up to the maximum reactivity identified in TS 4.3.1.1.d.
>
> b. Restricted will be cells whose minimum panel B^{10} areal density is between 0.0167 g/cm^2 and 0.0115 g/cm^2. Restricted cells will only contain LSCS Units 1 and 2 Cycle 1 General Electric (GE) and GE14 fuel assemblies.

c. Unusable will be cells whose minimum panel B^{10} areal density is less than or equal to 0.0115 g/cm^2. Unusable cells will be administratively controlled to remain empty of any fuel assembly.

The NRC staff recognizes that there was margin in the analysis of record that can be consumed to accommodate the BORAFLEX degradation. The above proposed LC should prove adequate to demonstrate k_{eff} is maintained less than or equal to 0.95, at a 95/95 percent confidence level until October 28, 2011. After October 28, 2011 the NRC staff has proposed that additional restrictions be placed on storage locations taking credit for BORAFLEX as part of LC 2.C(31):

> After October 28, 2011, for the storage cells in the rack modules without NETCO-SNAP-IN® inserts in the LSCS Unit 2 SFP, the following categories will apply: Unrestricted, Restricted, and Unusable.
>
> a. Unrestricted will be cells whose minimum panel B^{10} areal density is greater than or equal to 0.0200 g/cm^2. Unrestricted cells may contain fuel assemblies up to the maximum reactivity identified in TS 4.3.1.1.d.
>
> b. Restricted will be cells whose minimum panel B^{10} areal density is between 0.0200 g/cm^2 and 0.0167 g/cm^2. Restricted cells will only contain LSCS Units 1 and 2 Cycle 1 GE and GE14 fuel assemblies.
>
> c. Unusable will be cells whose minimum panel B^{10} areal density is less than or equal to 0.0167 g/cm^2. Unusable cells will be administratively controlled to remain empty of any fuel assembly.

The licensee has indicated that the Unit 2 SFP will be fully loaded with NETCO-SNAP-IN® rack inserts by December 31, 2014. Based on the existing concerns regarding crediting of BORAFLEX in the Unit 2 SFP, and the LCs proposed, the NRC staff finds that the quicker the SFP can be loaded, the less reliance is needed for the crediting of BORAFLEX. To address this concern, the NRC staff proposes the following be added as LC2.C(32):

> To ensure the ongoing Boraflex degradation will not exceed the spent fuel pool criticality limits, Exelon shall complete loading all accessible storage rack cells in the LSCS Unit 2 spent fuel pool with NETCO-SNAP-IN® inserts no later than December 31, 2014.

3.2.8 Analysis Observations

As the licensee does not take credit for soluble boron the regulatory requirement is taken from 10 CFR 50.68(b)(4) which requires, "... the k-effective of the spent fuel storage racks loaded with fuel of the maximum fuel assembly reactivity must not exceed 0.95, at a 95 percent probability, 95 percent confidence level." For Unit 2 SFP rack modules that contain the NETCO-SNAP-IN® inserts the licensee's analysis determined a k_{eff} of 0.94. With the additional items identified in this review, the NRC staff finds that a k_{eff} of 0.94250 is more reflective of the actual uncertainties in support of an estimated 95 percent probability, 95 percent confidence level. Since the requirement is for k_{eff} to not exceed 0.95 a 95/95 percent confidence level, the NRC staff finds that this margin provides

reasonable assurance that the Unit 2 SFP use of the described NETCO-SNAP-IN® inserts should support meeting the regulatory requirements.

The licensee corrected ANP-2843(P) as discussed previously and the corrections are reflected as LC2.C(33):

> The methodology in AREVA NP Inc, Report No. ANP-2843(P) "LaSalle Unit 2 Nuclear Power Station Spent Fuel Storage Pool Criticality Safety Analysis with Neutron Absorbing Inserts and Without Boraflex," Revision 1, dated August 2009, as corrected by Attachment 3 to a letter dated June 10, 2010 from P. Simpson to the NRC, shall be used to perform required criticality calculations associated with the storage cells containing NETCO-SNAP-IN® inserts.

For LSCS Unit 2 SFP rack modules that do not contain the NETCO-SNAP-IN® inserts the licensee continues to rely on BORAFLEX to control reactivity. A large number of BORAFLEX panels have degraded below the 0.020 g/cm^2 B^{10} areal density modeled in the AOR. The information provided regarding the licensee's analyses does not allow the NRC staff to have reasonable assurance that the BORAFLEX will be adequate to prevent inadvertent criticality in the SFP until completion of the NETCO-SNAP-IN® rack inserts into all cells by December 31, 2014.

3.3 Technical Conclusion

Based on the above, the NRC staff finds that the use of Rio Tinto Alcan composite as a neutron absorber rack inserts in the Unit 2 SFP is acceptable. The NRC staff notes that the analysis provided by the licensee was not sufficient to support the long-term crediting of BORAFLEX until completion of loading of the NETCO-SNAP-IN® rack inserts by December 31, 2014; therefore additional information will need to be provided. Therefore, the NRC finds that credit for BORAFLEX is acceptable until October 28, 2011, for the Unit 2 SFP given the above LCs.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change requirements with respect to the installation or use of the facilities components located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve 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 amendments involve no significant hazards consideration, and there has been no public comment on such finding (75 FR 463; January 5, 2010). Accordingly, the amendments meet 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 amendments.

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 amendments will not be inimical to the common defense and security or to the health and safety of the public.

7.0 REFERENCES

1. Exelon Generation Company, letter RS-09-133 from Patrick R. Simpson, Manager – Licensing, to USNRC document control desk, re: "LaSalle County Station Units 1 and 2 Facility Operating License Nos. NPF-11 and NPF-18, NRC Dockets No. 50-373 and 50-374, License Amendment Regarding the Use of Neutron Absorbing Inserts in Unit 2 Spent Fuel Pool Storage Racks," October 5, 2009. (ADAMS Accession No. ML092810279)

2. Exelon Generation Company, letter RS-10-102 from Patrick R. Simpson, Manager – Licensing, to USNRC document control desk, re: "LaSalle County Station Units 1 and 2 Facility Operating License Nos. NPF-11 and NPF-18, NRC Dockets No. 50-373 and 50-374, Additional Information Supporting License Amendment Request Regarding the Use of Neutron Absorbing Inserts in Unit 2 Spent Fuel Pool Storage Racks," June 10, 2010. (ADAMS Accession No. ML101650229)

3. Exelon Generation Company, letter RS-10-202 from Patrick R. Simpson, Manager – Licensing, to USNRC document control desk, re: "LaSalle County Station Units 1 and 2 Facility Operating License Nos. NPF-11 and NPF-18, NRC Dockets No. 50-373 and 50-374, Additional Information Supporting License Amendment Request Regarding the Use of Neutron Absorbing Inserts in Unit 2 Spent Fuel Pool Storage Racks," November 23, 2010. (ADAMS Accession No. ML103270566)

4. Exelon Generation Company, letter RS-10-210 from Jeffrey L. Hansen, Manager – Licensing, to USNRC document control desk, re: "LaSalle County Station Units 1 and 2 Facility Operating License Nos. NPF-11 and NPF-18, NRC Dockets No. 50-373 and 50-374, Additional Information Supporting License Amendment Request Regarding the Use of Neutron Absorbing

   Inserts in Unit 2 Spent Fuel Pool Storage Racks," December 14, 2010. (ADAMS Accession No. ML103490098)

5. Exelon Generation Company, letter RS-10-216 from David Gullott, Manager – Licensing, to USNRC document control desk, re: "LaSalle County Station Units 1 and 2 Facility Operating License Nos. NPF-11 and NPF-18, NRC Dockets No. 50-373 and 50-374, Additional Information Supporting License Amendment Request Regarding the Use of Neutron Absorbing Inserts in Unit 2 Spent Fuel Pool Storage Racks," December 22, 2010. (ADAMS Accession No. ML103570025)

6. NRC letter from Paul C. Shemanski, Acting Director, Project Directorate III-2, Division of Reactor Projects – III, IV, V and Special Projects, to Thomas J. Kovach, Nuclear Licensing Manager, Commonwealth Edison Company, "Issuance of Amendment No. 48 to Facility

Operating License NPF-18 LaSalle County Station, Unit 2 (TAC No. 62832)," June 15, 1989. (ADAMS Accession No. ML021140183)

7. NRC Memorandum from L. Kopp to T. Collins, Guidance on the Regulatory Requirements for Criticality Analysis of Fuel Storage at Light-Water Reactor Power Plants," August 19, 1998. (ADAMS Accession No. ML003728001)

8. NUREG/CR-6698, "Guide for Validation of Nuclear Criticality Safety Calculational Methodology," January, 2001 (ADAMS Accession No. ML010170125).

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

10. NRC Generic Letter 96-04, "Boraflex Degradation in Spent Fuel Pool Storage Racks," dated June 26, 1996 (ADAMS Accession No. ML031110008).

Principal Contributors: M. Yoder
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K. Wood

Date of issuance: January 28, 2011

A copy of the Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA/

Eva A. Brown, Senior Project Manager
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-373 and 50-374

Enclosures:
1. Amendment No. 199 to NPF-11
2. Amendment No. 186 to NPF-18
3. Safety Evaluation

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