



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

March 23, 2010

Mr. Charles G. Pardee  
President and Chief Nuclear Officer  
Exelon Nuclear  
4300 Winfield Road  
Warrenville, IL 60555

**SUBJECT: BRAIDWOOD STATION, UNITS 1 AND 2, AND BYRON STATION, UNIT NOS. 1  
AND 2 - ISSUANCE OF AMENDMENTS RE: DELETION OF E BAR  
DEFINITION AND REVISION TO REACTOR COOLANT SYSTEM SPECIFIC  
ACTIVITY TECHNICAL SPECIFICATION (TAC NOS. ME0206, ME0207,  
ME0208, AND ME0209)**

Dear Mr. Pardee:

The Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 162 to Facility Operating License No. NPF-72 and Amendment No. 162 to Facility Operating License No. NPF-77 for the Braidwood Station, Units 1 and 2 (Braidwood), and Amendment No. 167 to Facility Operating License No. NPF-37 and Amendment No. 167 to Facility Operating License No. NPF-66 for the Byron Station, Unit Nos. 1 and 2 (Byron), respectively.

The amendments are in response to your application dated December 4, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML083390706), as supplemented by letters dated February 17, 2009 (ADAMS Accession No. ML090480640), July 27, 2009 (ADAMS Accession No. ML092090437), December 4, 2009 (ADAMS Accession No. ML093410042), and January 29, 2010 (ADAMS Accession No. ML100320144). The amendments revise Technical Specifications (TSs) 1.1, "Definitions," and 3.4.16, "RCS [Reactor Coolant System] Specific Activity," and Surveillance Requirements 3.4.16.1, 3.4.16.2, and 3.4.16.3. The revisions replace the current TS 3.4.16 limit on RCS gross specific activity with a new limit on RCS noble gas-specific activity. The revisions adopt TS Task Force (TSTF) Change Traveler, TSTF-490, "Deletion of E Bar Definition and Revision to RCS Specific Activity Tech Spec [sic]," Revision 0.

C. Pardee

- 2 -

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,

A handwritten signature in black ink, appearing to read "Marshall J. David", with a large, stylized flourish at the end.

Marshall J. David, Senior Project Manager  
Plant Licensing Branch III-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-456, STN 50-457,  
STN 50-454, and STN 50-455

Enclosures:

1. Amendment No. 162 to NPF-72
2. Amendment No. 162 to NPF-77
3. Amendment No. 167 to NPF-37
4. Amendment No. 167 to NPF-66
5. Safety Evaluation

cc w/encls: Distribution via Listserv



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

EXELON GENERATION COMPANY, LLC

DOCKET NO. STN 50-456

BRAIDWOOD STATION, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 162  
License No. NPF-72

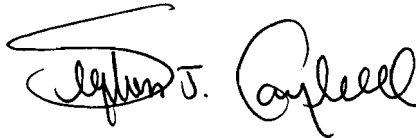
1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Exelon Generation Company, LLC (the licensee) dated December 4, 2008, as supplemented by letters dated February 17, 2009, July 27, 2009, December 4, 2009, and January 29, 2010, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and 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 rules and 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;
  - 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 Facility Operating License No. NPF-72 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A as revised through Amendment No. 162, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated into this 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 90 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in black ink, appearing to read "Stephen J. Campbell". The signature is fluid and cursive, with a large initial "S" and "C".

Stephen J. Campbell, 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: March 23, 2010



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

EXELON GENERATION COMPANY, LLC

DOCKET NO. STN 50-457

BRAIDWOOD STATION, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 162  
License No. NPF-77

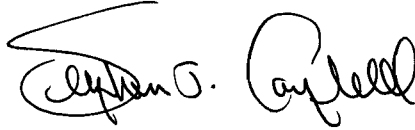
1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Exelon Generation Company, LLC (the licensee) dated December 4, 2008, as supplemented by letters dated February 17, 2009, July 27, 2009, December 4, 2009, and January 29, 2010, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and 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 rules and 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;
  - 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 Facility Operating License No. NPF-77 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A as revised through Amendment No. 162, and the Environmental Protection Plan contained in Appendix B, both of which are attached to License No. NPF-72, dated July 2, 1987, are hereby incorporated into this 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 90 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in black ink, appearing to read "Stephen J. Campbell". The signature is fluid and cursive, with a large initial "S" and "C".

Stephen J. Campbell, 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: March 23, 2010

ATTACHMENT TO LICENSE AMENDMENT NOS. 162 AND 162

FACILITY OPERATING LICENSE NOS. NPF-72 AND NPF-77

DOCKET NOS. STN 50-456 AND STN 50-457

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

Remove

License NPF-72  
License Page 3

License NPF-77  
License Page 3

TSs

1.1-3  
3.4.16-1  
3.4.16-2  
3.4.16-3  
3.4.16-4

Insert

License NPF-72  
License Page 3

License NPF-77  
License Page 3

TSs

1.1-3  
3.4.16-1  
3.4.16-2  
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## 1.1 Definitions

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DOSE EQUIVALENT I-131	DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries per gram) that alone would produce the same dose when inhaled as the combined activities of iodine isotopes I-131, I-132, I-133, I-134, and I-135 actually present. The determination of DOSE EQUIVALENT I-131 shall be performed using the Committed Effective Dose Equivalent (CEDE) dose conversion factors from Table 2.1 of EPA Federal Guidance Report No. 11, 1988, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion."
DOSE EQUIVALENT XE-133	DOSE EQUIVALENT XE-133 shall be that concentration of Xe-133 (microcuries per gram) that alone would produce the same acute dose to the whole body as the combined activities of noble gas nuclides Kr-85m, Kr-85, Kr-87, Kr-88, Xe-131m, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138 actually present. If a specific noble gas nuclide is not detected, it should be assumed to be present at the minimum detectable activity. The determination of DOSE EQUIVALENT XE-133 shall be performed using effective dose conversion factors for air submersion listed in Table III.1 of EPA Federal Guidance Report No. 12, 1993, "External Exposure to Radionuclides in Air, Water, and Soil."
ENGINEERED SAFETY FEATURE (ESF) RESPONSE TIME	The ESF RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its ESF actuation setpoint at the channel sensor until the ESF equipment is capable of performing its safety function (i.e., the valves travel to their required positions, pump discharge pressures reach their required values, etc.). Times shall include diesel generator starting and sequence loading delays, where applicable. The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured. In lieu of measurement, response time may be verified for selected components provided that the components and methodology for verification have been previously reviewed and approved by the NRC.



### 3.4 REACTOR COOLANT SYSTEM (RCS)

#### 3.4.16 RCS Specific Activity

LCO 3.4.16 RCS DOSE EQUIVALENT I-131 and DOSE EQUIVALENT XE-133 specific activity shall be within limits.

APPLICABILITY: MODES 1, 2, 3, and 4.

#### ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. DOSE EQUIVALENT I-131 not within limit.	-----NOTE----- LCO 3.0.4.c is applicable. -----	
	A.1 Verify DOSE EQUIVALENT I-131 $\leq 60 \mu\text{Ci/gm.}$	Once per 4 hours
	AND A.2 Restore DOSE EQUIVALENT I-131 specific activity to within limit.	48 hours
B. DOSE EQUIVALENT XE-133 not within limit.	-----NOTE----- LCO 3.0.4.c is applicable. -----	
	B.1 Restore DOSE EQUIVALENT XE-133 to within limit.	48 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition A or B not met.  <u>OR</u>  DOSE EQUIVALENT I-131 > 60 $\mu\text{Ci/gm}$ .	C.1 Be in MODE 3.	6 hours
	<u>AND</u>  C.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.16.1 Verify reactor coolant DOSE EQUIVALENT XE-133 specific activity $\leq 603 \mu\text{Ci/gm}$ .	7 days
SR 3.4.16.2 Verify reactor coolant DOSE EQUIVALENT I-131 specific activity $\leq 1.0 \mu\text{Ci/gm}$ .	14 days <u>AND</u> Between 2 and 6 hours after a THERMAL POWER change of $\geq 15\%$ RTP within a 1 hour period



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

EXELON GENERATION COMPANY, LLC

DOCKET NO. STN 50-454

BYRON STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 167  
License No. NPF-37

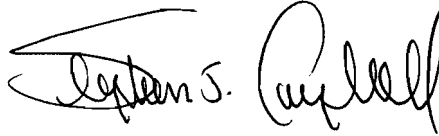
1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Exelon Generation Company, LLC (the licensee) dated December 4, 2008, as supplemented by letters dated February 17, 2009, July 27, 2009, December 4, 2009, and January 29, 2010, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and 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 rules and 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;
  - 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 Facility Operating License No. NPF-37 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A as revised through Amendment No.167, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated into this 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 90 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in black ink, appearing to read "Stephen J. Campbell", is written over a horizontal line.

Stephen J. Campbell, 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: March 23, 2010



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

EXELON GENERATION COMPANY, LLC

DOCKET NO. STN 50-455

BYRON STATION, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No.167  
License No. NPF-66

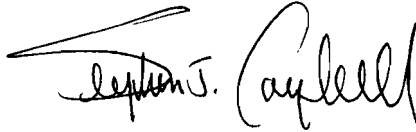
1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Exelon Generation Company, LLC (the licensee) dated December 4, 2008, as supplemented by letters dated February 17, 2009, July 27, 2009, December 4, 2009, and January 29, 2010, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and 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 rules and 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;
  - 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 Facility Operating License No. NPF-66 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A (NUREG 1113), as revised through Amendment No.167, and the Environmental Protection Plan contained in Appendix B, both of which are attached to License No. NPF-37, dated February 14, 1985, are hereby incorporated into this 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 90 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in black ink, appearing to read "Stephen J. Campbell", is written over a horizontal line.

Stephen J. Campbell, 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: March 23, 2010

ATTACHMENT TO LICENSE AMENDMENT NOS. 167 AND 167

FACILITY OPERATING LICENSE NOS. NPF-37 AND NPF-66

DOCKET NOS. STN 50-454 AND STN 50-455

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

Remove

License NPF-37  
License Page 3

License NPF-66  
License Page 3

TSs

1.1-3  
3.4.16-1  
3.4.16-2  
3.4.16-3  
3.4.16-4

Insert

License NPF-37  
License Page 3

License NPF-66  
License Page 3

TSs

1.1-3  
3.4.16-1  
3.4.16-2  
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- (4) 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) 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 the facility.
- C. The 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 3586.6 megawatts thermal (100 percent power) in accordance with the conditions specified herein.
  - (2) Technical Specifications

The Technical Specifications contained in Appendix A as revised through Amendment No. 167, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated into this license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.
  - (3) Deleted.
  - (4) Deleted.
  - (5) Deleted.
  - (6) The licensee shall implement and maintain in effect all provisions of the approved fire protection program as described in the licensee's Fire Protection Report, and as approved in the SER dated February 1987 through Supplement No. 8, subject to the following provision:

The licensee may make changes to the approved fire protection program without prior approval of the Commission only if those changes would not adversely affect the ability to achieve and maintain safe shutdown in the event of a fire.



- (3) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use at any time any byproduct, source and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;
  - (4) Pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess, and use in amounts are 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) 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 the facility.
- C. The license shall be deemed to contain and is subject to the conditions specified in the Commission's regulation 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 3586.6 megawatts thermal (100 percent rated power) in accordance with the conditions specified herein.
  - (2) Technical Specifications and Environmental Protection Plan  
  
The Technical Specifications contained in Appendix A (NUREG 1113), as revised through Amendment No. 167, and the Environmental Protection Plan contained in Appendix B, both of which are attached to License No. NPF-37, dated February 14, 1985, are hereby incorporated into this license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.
  - (3) Deleted.
  - (4) Deleted.
  - (5) Deleted.

## 1.1 Definitions

---

DOSE EQUIVALENT I-131	DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries per gram) that alone would produce the same dose when inhaled as the combined activities of iodine isotopes I-131, I-132, I-133, I-134, and I-135 actually present. The determination of DOSE EQUIVALENT I-131 shall be performed using the Committed Effective Dose Equivalent (CEDE) dose conversion factors from Table 2.1 of EPA Federal Guidance Report No. 11, 1988, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion."
DOSE EQUIVALENT XE-133	DOSE EQUIVALENT XE-133 shall be that concentration of Xe-133 (microcuries per gram) that alone would produce the same acute dose to the whole body as the combined activities of noble gas nuclides Kr-85m, Kr-85, Kr-87, Kr-88, Xe-131m, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138 actually present. If a specific noble gas nuclide is not detected, it should be assumed to be present at the minimum detectable activity. The determination of DOSE EQUIVALENT XE-133 shall be performed using effective dose conversion factors for air submersion listed in Table III.1 of EPA Federal Guidance Report No. 12, 1993, "External Exposure to Radionuclides in Air, Water, and Soil."
ENGINEERED SAFETY FEATURE (ESF) RESPONSE TIME	The ESF RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its ESF actuation setpoint at the channel sensor until the ESF equipment is capable of performing its safety function (i.e., the valves travel to their required positions, pump discharge pressures reach their required values, etc.). Times shall include diesel generator starting and sequence loading delays, where applicable. The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured. In lieu of measurement, response time may be verified for selected components provided that the components and methodology for verification have been previously reviewed and approved by the NRC.

### 3.4 REACTOR COOLANT SYSTEM (RCS)

#### 3.4.16 RCS Specific Activity

LCO 3.4.16 RCS DOSE EQUIVALENT I-131 and DOSE EQUIVALENT XE-133 specific activity shall be within limits.

APPLICABILITY: MODES 1, 2, 3, and 4.

#### ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. DOSE EQUIVALENT I-131 not within limit.	-----NOTE----- LCO 3.0.4.c is applicable. -----	
	A.1 Verify DOSE EQUIVALENT I-131 $\leq 60 \mu\text{Ci/gm.}$	Once per 4 hours
	<u>AND</u> A.2 Restore DOSE EQUIVALENT I-131 specific activity to within limit.	48 hours
B. DOSE EQUIVALENT XE-133 not within limit.	-----NOTE----- LCO 3.0.4.c is applicable. -----	
	B.1 Restore DOSE EQUIVALENT XE-133 to within limit.	48 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition A or B not met.  <u>OR</u>  DOSE EQUIVALENT I-131 > 60 $\mu\text{Ci/gm}$ .	C.1 Be in MODE 3.	6 hours
	<u>AND</u>  C.2 Be in MODE 5.	36 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.4.16.1 Verify reactor coolant DOSE EQUIVALENT XE-133 specific activity $\leq 603 \mu\text{Ci/gm}$ .	7 days
SR 3.4.16.2 Verify reactor coolant DOSE EQUIVALENT I-131 specific activity $\leq 1.0 \mu\text{Ci/gm}$ .	14 days <u>AND</u> Between 2 and 6 hours after a THERMAL POWER change of $\geq 15\%$ RTP within a 1 hour period



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATED TO AMENDMENT NO. 162 TO FACILITY OPERATING LICENSE NO. NPF-72,  
AMENDMENT NO. 162 TO FACILITY OPERATING LICENSE NO. NPF-77,  
AMENDMENT NO. 167 TO FACILITY OPERATING LICENSE NO. NPF-37,  
AND AMENDMENT NO. 167 TO FACILITY OPERATING LICENSE NO. NPF-66  
  
EXELON GENERATION COMPANY, LLC  
  
BRAIDWOOD STATION, UNITS 1 AND 2  
  
BYRON STATION, UNIT NOS. 1 AND 2  
  
DOCKET NOS. STN 50-456, STN 50-457,  
  
STN 50-454, AND STN 50-455

1.0 INTRODUCTION

By letter to the Nuclear Regulatory Commission (NRC, the Commission) dated December 4, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML083390706), as supplemented by letters dated February 17, 2009 (ADAMS Accession No. ML090480640), July 27, 2009 (ADAMS Accession No. ML092090437), December 4, 2009 (ADAMS Accession No. ML093410042), and January 29, 2010 (ADAMS Accession No. ML100320144), Exelon Generation Company, LLC (the licensee) submitted a license amendment request (LAR) for Braidwood Station, Units 1 and 2 (Braidwood), and Byron Station, Unit Nos. 1 and 2 (Byron). The LAR proposed to revise Technical Specifications (TSs) 1.1, "Definitions," and 3.4.16, "RCS [Reactor Coolant System] Specific Activity," and Surveillance Requirements (SRs) 3.4.16.1 and 3.4.16.3. The revisions would replace the current TS 3.4.16 limit on RCS gross specific activity with a new limit on RCS noble gas-specific activity. The revisions adopt TS Task Force (TSTF) Change Traveler, TSTF-490, "Deletion of E Bar Definition and Revision to RCS Specific Activity Tech Spec [sic]," Revision 0.

The supplemental letters, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change NRC staff's original proposed no significant hazards consideration determination published in an individual notice in the *Federal Register* on January 27, 2009 (74 FR 4771).

By letter dated September 13, 2005 (ADAMS Accession No. ML052630462), the TSTF submitted Change Traveler TSTF-490 for NRC staff review. TSTF-490 was noticed in the *Federal Register* on November 20, 2006 (71 FR 67170), for public comment. In a *Federal Register* notice dated March 15, 2007 (72 FR 12217), the NRC published a "Notice of Availability

Model Application Concerning Technical Specification Improvement Regarding Deletion of E Bar Definition and Revision to Reactor Coolant System Specific Activity Technical Specification Using the Consolidated Line Item Improvement Process." TSTF-490 involves changes to the Standard TS (STS, i.e., NUREG-1430, NUREG-1431, and NUREG-1432), Section 3.4.16, for RCS gross specific activity limits with the addition of a new limit for noble gas-specific activity. The noble gas-specific activity limit is based on a new dose equivalent Xe-133 (DEX) definition that replaces the current definition of E Bar or  $\bar{E}$  - average disintegration energy. In addition, the current dose equivalent I-131 (DEI) definition is revised to allow the use of additional thyroid dose conversion factors (DCFs).

## 2.0 REGULATORY EVALUATION

The NRC staff evaluated the impact of the proposed changes as they relate to the radiological consequences of affected design basis accidents (DBAs) that use the RCS inventory as the source term. The source term assumed in radiological analyses should be based on the activity associated with the projected fuel damage or the maximum RCS TS values, whichever maximizes the radiological consequences. The limits on RCS specific activity ensure that the offsite doses are appropriately limited for accidents that are based on releases from the RCS with no significant amount of fuel damage.

The steam generator tube rupture (SGTR) accident and the main steam line break (MSLB) accident typically do not result in fuel damage; therefore, the radiological consequence analyses are based on the release of primary coolant activity at maximum TS limits. For accidents that result in fuel damage, the additional dose contribution from the initial activity in the RCS is not normally evaluated and is considered to be insignificant in relation to the dose resulting from the release of fission products from the damaged fuel.

By letter dated September 8, 2006 (ADAMS Accession No. ML062340420), the Commission issued Amendment No. 147 to Byron and Amendment No. 140 to Braidwood to revise the TSs to incorporate a full-scope application of an alternative source term (AST) methodology in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.67(b)(2). As a result of the licensee using the AST in their dose consequence analyses, the NRC staff used the regulatory guidance provided in NUREG-0800, Standard Review Plan, Section 15.0.1, "Radiological Consequence Analyses Using Alternative Source Terms," Revision 0, July 2000, and Regulatory Guide (RG) 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors", July 2000, which provides the methodology and assumptions acceptable to the NRC staff for the evaluation of design basis radiological analyses using an AST. Specifically, the off-site dose criteria are 25 rem total effective dose equivalent (TEDE) at the exclusion area boundary for any 2-hour period following the onset of the postulated fission product release and 25 rem TEDE at the outer boundary of the low population zone for the duration of the postulated fission product release. In addition, 10 CFR 50.67(b)(2)(iii) requires that adequate radiation protection be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem TEDE for the duration of the accident.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Technical Evaluation of TSTF-490 TS Changes

##### 3.1.1 Revision to the Definition of DEI

The list of currently acceptable DCFs for use in the determination of DEI include the following:

- Table III of Technical Information Document (TID)-14844, Atomic Energy Commission (AEC), 1962, "Calculation of Distance Factors for Power and Test Reactor Sites."
- Table E-7 of RG 1.109, Revision 1, NRC, 1977.
- International Commission on Radiological Protection (ICRP) 30, 1979, page 192-212, Table titled "Committed Dose Equivalent in Target Organs or Tissues per Intake of Unit Activity."
- Committed Dose Equivalent (CDE) or Committed Effective Dose Equivalent (CEDE) dose conversion factors from Table 2.1 of Environmental Protection Agency (EPA) Federal Guidance Report No. 11 (FGR-11), 1988, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion."

The licensee's current definition allows DEI to be calculated using multiple DCFs from the above list. Byron and Braidwood are licensed to 10 CFR 50.67, "Accident Source Term", and the licensee proposed that the CEDE DCFs from Table 2.1 of FGR-11 will be used in the definition of DEI. Therefore, the new TS definition of DEI reads as follows:

DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries per gram) that alone would produce the same dose when inhaled as the combined activities of iodine isotopes I-131, I-132, I-133, I-134, and I-135 actually present. The determination of DOSE EQUIVALENT I-131 shall be performed using the Committed Effective Dose Equivalent (CEDE) dose conversion factors from Table 2.1 of EPA Federal Guidance Report No. 11, 1988, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion."

The NRC staff conducted a confirmatory analysis, using various sources of DCFs and the RCS concentration values from the licensee's AST submittal. The NRC staff's analysis confirmed that, for a given RCS concentration, use of the DCFs from FGR-11 will yield a conservative DEI value. In addition, maintaining the DEI value to the TS limit of 1 microcuries per gram ( $\mu\text{Ci/gm}$ ) will be conservative relative to the coolant concentrations used in the design basis dose consequence analyses for Byron and Braidwood.

##### 3.1.2 Deletion of the Definition of $\bar{E}$ and the Addition of a New Definition for DEX

The new definition for DEX is similar to the definition for DEI. The determination of DEX will be performed in a similar manner to that currently used in determining DEI, except that the calculation of DEX is based on the acute dose to the whole body and considers the noble gases Kr-85m, Kr-85, Kr-87, Kr-88, Xe-131m, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138, which

are significant in terms of contribution to whole body dose. Some noble gas isotopes are not included due to low concentration, short half life, or small DCF. The calculation of DEX will use the effective DCFs from Table III.1 of EPA Federal Guidance Report No. 12 (FGR-12), "External Exposure to Radionuclides in Air, Water, and Soil," 1993. Using this approach, the limit on the amount of noble gas activity in the primary coolant would not fluctuate with variations in the calculated values of  $\bar{E}$ . If a specified noble gas nuclide is not detected, the new definition states that it should be assumed that the nuclide is present at the minimum detectable activity. This will result in a conservative calculation of DEX.

When  $\bar{E}$  is determined using a design basis approach in which it is typically assumed to be 1.0 percent of the power is being generated by fuel rods having cladding defects and it is also assumed that there is no removal of fission gases from the letdown flow, the value of  $\bar{E}$  is dominated by Xe-133. The other nuclides have relatively small contributions. However, during normal plant operation, there are typically only a small amount of fuel clad defects and the radioactive nuclide inventory can become dominated by tritium and corrosion and/or activation products, resulting in the determination of a value of  $\bar{E}$  that is very different than would be calculated using the design basis approach. Because of this difference, the accident dose analyses become disconnected from plant operation and the limiting condition for operation (LCO) becomes essentially meaningless. It also results in a TS limit that can vary during operation as different values for  $\bar{E}$  are determined.

The proposed change will implement a LCO that is consistent with the whole body radiological consequence analyses, which are sensitive to the noble gas activity in the primary coolant but not to other non-gaseous activity currently captured in the  $\bar{E}$  definition. The current surveillance requirement (SR) 3.4.16.1 requires the licensee to verify reactor coolant gross specific activity  $\leq 100/\bar{E}$   $\mu\text{Ci/gm}$  every 7 days. The current  $\bar{E}$  definition includes radioisotopes that decay by the emission of both gamma and beta radiation. The current LCO 3.4.16.b would rarely, if ever, be entered for exceeding  $100/\bar{E}$   $\mu\text{Ci/gm}$  since the calculated value is very high (the denominator is very low) because beta emitters such as tritium are included in the determination, as required by the  $\bar{E}$  definition.

TS Section 1.1 definition for " $\bar{E}$  - AVERAGE DISINTEGRATION ENERGY" is deleted and replaced with a new definition "DOSE EQUIVALENT XE-133" which states:

DOSE EQUIVALENT XE-133 shall be that concentration of Xe-133 (microcuries per gram) that alone would produce the same acute dose to the whole body as the combined activities of noble gas nuclides Kr-85m, Kr-85, Kr-87, Kr-88, Xe-131m, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138 actually present. If a specific noble gas nuclide is not detected, it should be assumed to be present at the minimum detectable activity. The determination of DOSE EQUIVALENT XE-133 shall be performed using effective dose conversion factors for air submersion listed in Table III.1 of EPA Federal Guidance Report No. 12, 1993, "External Exposure to Radionuclides in Air, Water, and Soil."

The NRC staff concludes that the change incorporating the newly defined quantity DEX is acceptable from a radiological dose perspective since it will result in an LCO that more closely relates the non-iodine RCS activity limits to the dose consequence analyses, which form their bases. The licensee has proposed to use the TSTF-490 recommended DCFs of FGR-12 for the



calculation of DEX values. The NRC staff confirmed that use of FGR-12 DCFs will yield a conservative DEX value. The NRC staff also confirmed that the licensee's proposed value of 603  $\mu\text{Ci/gm}$  DEI accurately reflects the mix of nuclides used in the dose consequence analysis.

### 3.1.3 LCO 3.4.16

The current limiting indicators are identified in LCO 3.4.16.b. and SR 3.4.16.1 for gross non iodine-specific activity and in LCO 3.4.16.a. and SR 3.4.16.2 for iodine-specific activity. LCO 3.4.16 is modified to specify that iodine specific activity in terms of DEI and noble gas specific activity in terms of DEX shall be within limits. Specifically, the revised LCO states, "RCS DOSE EQUIVALENT I-131 and DOSE EQUIVALENT XE-133 specific activity shall be within limits." The actual limits on DEX ( $\leq 603 \mu\text{Ci/gm}$ ) and DEI ( $\leq 1 \mu\text{Ci/gm}$ ) are provided in revised SRs 3.4.16.1 and 3.4.16.2, respectively. As discussed above, the NRC staff finds these limits acceptable.

### 3.1.4 LCO 3.4.16 APPLICABILITY

The current APPLICABILITY for LCO 3.4.16 is: MODES 1 and 2, MODE 3 with RCS average temperature ( $T_{\text{avg}} \geq 500^\circ\text{F}$ ). The December 4, 2008, LAR proposed modifying the APPLICABILITY of LCO 3.4.16 to: MODES 1, 2, 3, and 4. However, in the LAR, NOTES for SRs 3.4.16.1 and 3.4.16.2 would not require the SRs to be performed in MODES 2, 3, and 4, thereby excluding sampling during plant conditions where LCO 3.4.16 may be exceeded (e.g., MODES 2, 3, and 4). Whereas after transient conditions (i.e., reactor trip, plant depressurization, shutdown or startup) that end in MODES 2, 3, and 4, the SR would not be required to be performed. Thus, LCO 3.4.16 could potentially be exceeded after plant transient or power changes; therefore, sampling in MODES 2, 3, and 4 is applicable. In addition, isotopic spiking and fuel failures are more likely during transient conditions than during steady state plant operations.

LCO 3.4.16.1 and LCO 3.4.16.2 are still required to be met during all MODES of Applicability (MODES 1, 2, 3, and 4) in accordance with SR 3.0.1, which states:

SRs shall be met during the MODES or other specified conditions in the Applicability for individual LCOs, unless otherwise stated in the SR. Failure to meet a Surveillance, whether such failure is experienced during the performance of the Surveillance or between performances of the Surveillance, shall be failure to meet the LCO. Failure to perform a Surveillance within the specified Frequency shall be failure to meet the LCO except as provided in SR 3.0.3.

In its supplements dated December 4, 2009, and January 29, 2010, the licensee retained the proposed APPLICABILITY of LCO 3.4.16 to MODES 1, 2, 3, and 4, and removed the limiting NOTES from proposed SRs 3.4.16.1 and 3.4.16.2 so that the surveillances will be required to be performed during all MODES 1, 2, 3, and 4. The NRC staff finds that this will ensure that the potential consequences of a MSLB or SGTR are bounded by the approved accident analysis, from which the LCO limits are derived.

### 3.1.5 TS 3.4.16.A

TS 3.4.16 CONDITION A is revised by replacing the DEI site specific limit "> 1.0  $\mu\text{Ci/gm}$ " with the words "not within limit" to be consistent with the revised TS 3.4.16 LCO format. The site specific DEI limit of  $\leq 1.0 \mu\text{Ci/gm}$  is contained in SR 3.4.16.2. This proposed format change will not alter current STS requirements and, as discussed previously, is acceptable from a radiological dose perspective.

TS 3.4.16 REQUIRED ACTION A.1 is revised to remove the reference to TS Figure 3.4.16-1 "Reactor Coolant DOSE EQUIVALENT I-131 Specific Activity Limit versus Percent of RATED THERMAL POWER [RTP]" and insert a limit of less than or equal to the site-specific DEI spiking limit of  $60 \mu\text{Ci/gm}$ . The curve contained in Figure 3.4.16-1 was provided by the AEC in a June 12, 1974, letter on the subject, "Proposed Standard Technical Specifications for Primary Coolant Activity." Radiological dose consequence analyses for SGTR and MSLB accidents that take into account the pre-accident iodine spike do not consider the elevated RCS iodine specific activities permitted by Figure 3.4.16-1 for operation at power levels below 80 percent RTP. Instead, the pre-accident iodine spike analyses assume a DEI concentration 60 times higher than the corresponding long term equilibrium value, which corresponds to the specific activity limit associated with 100 percent RTP operation. Therefore, the NRC staff finds it acceptable that TS 3.4.16 REQUIRED ACTION A.1 should be based on the short term site specific DEI spiking limit to be consistent with the assumptions contained in the radiological consequence analyses.

### 3.1.6 TS 3.4.16.B

TS 3.4.16 CONDITION B is replaced with a new CONDITION B for DEX not within limits. This change is made to be consistent with the change to the TS 3.4.16 LCO which requires the DEX specific activity to be within limits as discussed above in Section 3.1.3. The DEX limit is site-specific and the numerical value in units of  $\mu\text{Ci/gm}$  is contained in revised SR 3.4.16.1, as described below in Section 3.1.8. The site-specific limit of DEX in  $\mu\text{Ci/gm}$  is typically based on the maximum accident analysis RCS activity corresponding to 1 percent fuel clad defects with sufficient margin to accommodate the exclusion of those isotopes based on low concentration, short half life, or small dose conversion factors. The primary purpose of the TS 3.4.16 LCO on RCS specific activity and its associated conditions is to support the dose analyses for DBAs. The whole body dose is primarily dependent on the noble gas activity, not the non-gaseous activity captured in the current  $\bar{E}$  definition.

The COMPLETION TIME for revised TS 3.4.16 REQUIRED ACTION B.1 requires restoration of DEX to within limit in 48 hours. This is consistent with the COMPLETION TIME for current REQUIRED ACTION A.2 for DEI. The radiological consequences for the SGTR and the MSLB accidents demonstrate that the calculated thyroid doses are generally a greater percentage of the applicable acceptance criteria than the calculated whole body doses. It then follows that the COMPLETION TIME for noble gas activity being out of specification in the revised REQUIRED ACTION B.1 should be at least as great as the COMPLETION TIME for iodine specific activity being out of specification in current REQUIRED ACTION A.2. Therefore, the COMPLETION TIME of 48 hours for revised REQUIRED ACTION B.1 is acceptable from a radiological dose perspective. A NOTE is also included in the revised REQUIRED ACTION B.1 that states, "LCO 3.0.4.c is applicable." This NOTE would allow entry into a MODE or other specified condition in

the LCO APPLICABILITY when LCO 3.4.16 is not being met and is the same NOTE that is currently stated for REQUIRED ACTIONS A.1 and A.2. The proposed NOTE would allow entry into the applicable MODES from MODE 4 to MODE 1 (power operation) while the DEX limit is exceeded and the DEX is being restored to within its limit. The NRC staff finds this MODE change acceptable due to the significant conservatism incorporated into the DEX specific activity limit, the low probability of an event occurring which is limiting due to exceeding the DEX specific activity limit, and the ability to restore transient specific excursions while the plant remains at, or proceeds to power operation.

### 3.1.7 TS 3.4.16 CONDITION C

TS 3.4.16 CONDITION C is revised to remove the reference to gross specific activity and to acknowledge the changes to CONDITION B (DEX not within limit) if the REQUIRED ACTION and associated COMPLETION TIME of CONDITION B is not met. This is consistent with the changes made to CONDITION B, which now provide the same completion time for both components of RCS specific activity as discussed in the revision to CONDITION B. The revision to CONDITION C also replaces the limit on DEI from the deleted Figure 3.4.16-1, with a site-specific value of  $> 60 \mu\text{Ci/gm}$ . This change makes CONDITION C consistent with the changes made to TS 3.4.16 REQUIRED ACTION A.1.

The change to TS 3.4.16 REQUIRED ACTION C.1 requires the plant to be in MODE 3 within 6 hours and adds a new REQUIRED ACTION C.2 which requires the plant to be in MODE 5 within 36 hours. These changes are consistent with the changes made to the TS 3.4.16 APPLICABILITY. The revised LCO is applicable throughout all of MODES 1 through 4 to limit the potential radiological consequences of an SGTR or MSLB that may occur during these MODES. In MODE 5 with the RCS loops filled, the steam generators are not normally used for decay heat removal. In this mode, however, due to the reduced temperature of the RCS, the probability of a DBA involving the release of significant quantities of RCS inventory is greatly reduced. Therefore, monitoring of RCS specific activity is not required. In MODE 5 with the RCS loops not filled and in MODE 6, the steam generators are not used for decay heat removal, the RCS and steam generators are depressurized, and primary to secondary leakage is minimal. Therefore, the monitoring of RCS specific activity is not required.

A new TS 3.4.16 REQUIRED ACTION C.2 COMPLETION TIME of 36 hours is added for the plant to reach MODE 5. The NRC staff finds that this COMPLETION TIME is reasonable, based on operating experience, to reach MODE 5 from full power conditions in an orderly manner and without challenging plant systems, and that the value of 36 hours is consistent with other TS, which have a COMPLETION TIME to reach MODE 5.

### 3.1.8 SR 3.4.16.1 for DEX Surveillance

The change replaces the current SR 3.4.16.1 surveillance for RCS gross specific activity with a surveillance to verify that the site-specific reactor coolant DEX specific activity is  $\leq 603 \mu\text{Ci/gm}$ . This change provides a surveillance to ensure that the new LCO that DEX be within limits is met. The revised SR 3.4.16.1 requires performing a gamma isotopic analysis as a measure of the noble gas specific activity of the reactor coolant at least once every 7 days, which is the same frequency required under the current SR 3.4.16.1 for RCS gross non iodine-specific activity. This measurement is the sum of the degassed gamma activities and the gaseous gamma

activities in the sample taken. The surveillance provides an indication of any increase in the noble gas-specific activity. The results of the surveillance on DEX allow proper remedial action to be taken before reaching the LCO limit under normal operating conditions.

The previous surveillance required the licensee to verify reactor primary coolant gross specific activity to  $\leq 100/\bar{E}$   $\mu\text{Ci/gm}$ . In the LAR, the licensee is deleting the definition and reference to  $\bar{E}$ , the average disintegration energy, and adding a limit for primary coolant noble gas activity based on DOSE EQUIVALENT XE-133, and would take into account only the noble gas activity in the primary coolant. The revised SR 3.4.16.1 states, "Verify reactor coolant DOSE EQUIVALENT XE-133 specific activity  $\leq 603 \mu\text{Ci/gm}$ ."

As described in Sections 3.1.4 and 3.1.6 above, and in accordance with SR 3.0.1, LCO 3.4.16 is APPLICABLE in MODES 1, 2, 3, and 4. Therefore, SR 3.4.16.1 is also applicable in MODES 1, 2, 3, and 4. SR 3.4.16.1 is also affected by the inclusion of a NOTE in TS 3.4.16 REQUIRED ACTION B.1, which allows the use of the provisions of LCO 3.0.4.c. This allowance permits entry into the applicable MODE(S) while relying on the ACTIONS. This allowance is acceptable due to the significant conservatism incorporated into the specific activity limit, the low probability of an event which is limiting due to exceeding this limit, and the ability to restore transient specific activity excursions while the plant remains at, or proceeds to power operation. This allows entry into MODE 4, MODE 3, and MODE 2 prior to performing the surveillance. This allows the surveillance to be performed in any of those MODES, prior to entering MODE 1, similar to the current surveillance for DEI in SR 3.4.16.2.

#### 3.1.9 SR 3.4.16.2 for DEI Surveillance

As described in Section 3.1.4 above, and in accordance with SR 3.0.1, LCO 3.4.16 is applicable in MODES 1, 2, 3, and 4. Therefore, SR 3.4.16.2 is also applicable in MODES 1, 2, 3, and 4. Currently, a NOTE exists in SR 3.4.16.2 which reads, "Only required to be performed in MODE 1." In its December 4, 2009, response to a NRC staff request for additional information, and to be consistent with the applicability and requirements of SR 3.4.16.1, the licensee proposed to remove this NOTE from SR 3.4.16.2. Hence, the DEI Surveillance is required to be performed during all MODES of APPLICABILITY (i.e., MODES 1, 2, 3, and 4).

#### 3.1.10 Consistency of Site-Specific Limits and DCFs For DEX and DEI Surveillances

Consistent with the current and proposed revised definitions and limits for both DEX and DEI, and the DCFs used for the determination of DEI and DEX surveillances, the NRC staff verified that the site-specific limits for both DEI and DEX, the DCFs, and the RCS radioisotopic concentrations, are consistent with the current design basis dose analyses (SGTR and MSLB) for Bryon and Braidwood. The current definition of dose equivalent I-131 allows DEI to be calculated using multiple DCFs from the list provided in Section 3.1.1, and is based upon information presented in an application to incorporate full-scope implementation of AST methodology dated February 15, 2005 (ADAMS Accession No. ML050560102), as supplemented by letters dated November 28, 2005 (ADAMS Accession Nos. ML053330025 and ML053410195) and December 9, 2005 (ADAMS Accession Nos. ML060040046 and ML060040081), and January 27, 2006 (ADAMS Accession No. ML060300381), February 13, 2006 (ADAMS Accession No. ML060450176), March 17, 2006 (ADAMS Accession No. ML060790055), and July 14, 2006 (ADAMS Accession No. ML061950332), and approved in

Amendment No. 147 for Bryon and Amendment No. 140 for Braidwood, dated September 8, 2006 (ADAMS Accession No. ML062340420).

The acceptability for the pre-accident and concurrent iodine spike source terms, and the doses to be calculated using FGR-11, were also submitted and approved in the precedent documents stated above. In addition, RG 1.183 requires that the pre-accident and concurrent iodine spikes used in design basis analyses be based on the maximum value permitted by TS, which is 60  $\mu\text{Ci/gm}$  for Bryon and Braidwood. The Bryon and Braidwood MSLB and SGTR accidents are analyzed using the maximum RCS activity. DCFs from FGR-11 are used to calculate the TEDE consequences described using the guidance from RG 1.183, and the 1  $\mu\text{Ci/gm}$  DEI inventory.

The DCFs used by Bryon and Braidwood to determine dose from noble gases and the calculation of DEX are from FGR-12. DEX is that concentration of Xe-133 (in  $\mu\text{Ci/gm}$ ) that alone would produce the same acute dose to the whole body as the combined activities of noble gas nuclides Kr-85m, Kr-85, Kr-87, Kr-88, Xe-131m, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138 actually present. If a specific noble gas nuclide is not detected, it will be assumed to be present at the minimum detectable activity. Thus, Xe-131m is not present in the current design basis accident analysis source term. Its exclusion in the calculation of DEX is conservative since the limit will be lower and the actual surveillance will include either the actual concentration detected or the minimum detectable activity.

The NRC staff evaluated the licensee's LAR, as supplemented, regarding the RCS concentrations for noble gas isotopes, the calculation of the site specific limits on DEI and DEX, and how Bryon and Braidwood are maintaining consistency in regard to the current AST analyses. In its analyses, the licensee used primary coolant concentration values equivalent to the more limiting LCO of 1  $\mu\text{Ci/gm}$  DEI. A concentration value that is conservatively below the TS limit of 1  $\mu\text{Ci/gm}$  DEI, and the DEX limit of 603  $\mu\text{Ci/gm}$  was verified by the NRC staff. Therefore, the site-specific limits for both DEI and DEX, as described above in Sections 3.1.5, 3.1.6, and 3.1.7, and the DCFs used for the determination of DEI and DEX surveillances, as described above in Sections 3.1.1, 3.1.2, 3.1.8, and 3.1.9, are consistent with the current design basis dose analyses (SGTR and MSLB).

#### 3.1.11 SR 3.4.16.3 Deletion

The current SR 3.4.16.3, which requires the determination of  $\bar{E}$  is deleted. TS 3.4.16 LCO on RCS specific activity supports the dose analyses for DBAs, in which the whole body dose is primarily dependent on the noble gas concentration, not the non-gaseous activity currently captured in the  $\bar{E}$  definition. The NRC staff finds that, with the elimination of the LCO limit for RCS gross specific activity and the addition of the new LCO limit for noble gas specific activity, this SR to determine  $\bar{E}$  is no longer required.

### 3.2 Precedent

The TS developed for the Westinghouse AP600 and AP1000 advanced reactor designs incorporate an LCO for RCS DEX activity in place of the LCO on non-iodine gross specific activity based on  $\bar{E}$ . This approach was approved by the NRC staff for the AP600 in NUREG-1512, "Final Safety Evaluation Report Related to the Certification of the AP600 Standard Design, Docket No. 52-003," dated August 1998 and for the AP1000 in the NRC letter to

Westinghouse Electric Company dated September 13, 2004. In addition, the curve describing the maximum allowable iodine concentration during the 48-hour period of elevated activity as a function of power level was not included in the TS approved for the AP600 and AP1000 advanced reactor designs.

### 3.3 Conclusion

The NRC staff has reviewed the licensee's proposed changes in accordance with TSTF-490 to revise the definition of DEI, delete the definition of  $\bar{E}$ , add a new definition for DEX, revise LCO 3.4.16 to remove reference to gross specific activity and to include DEX, and revise the TS 3.4.16 CONDITIONS and REQUIRED ACTIONS, accordingly. In addition, the NRC staff has reviewed the change in the APPLICABILITY of LCO 3.4.16 to reflect the MODES during which the SGTR and MSLB accidents could be postulated to occur, the revision of SR 3.4.16.1 to verify DEX is within the prescribed limit, the revision of SR 3.4.16.2 to delete the existing NOTE, the consistency of site-specific limits and DCFs for DEI and DEX surveillances, and the deletion of SR 3.4.16.3.

As described above, the NRC staff reviewed the licensee's assumptions, inputs, and methods to assess the impact of the proposed changes to the RCS TS. Based on its review, the NRC staff determined there is reasonable assurance that the proposed changes will not impact the dose consequences of the applicable DBAs because the proposed changes limit the RCS noble gas and iodine specific activity to ensure consistency with the values assumed in the site-specific DBA radiological consequence analyses. Therefore, the proposed license amendment is acceptable with respect to the radiological dose consequences of the DBAs.

### 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 installation or use of a facility's components located within the restricted area, as defined in 10 CFR Part 20, or changes SRs. 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 (74 FR 4771; January 27, 2009). 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.

Principal Contributor: L. Benton, NRR

Date: March 23, 2010

C. Pardee

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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/

Marshall J. David, Senior Project Manager  
Plant Licensing Branch III-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket Nos. STN 50-456, STN 50-457,  
STN 50-454, and STN 50-455

Enclosures:

1. Amendment No. 162 to NPF-72
2. Amendment No. 162 to NPF-77
3. Amendment No. 167 to NPF-37
4. Amendment No. 167 to NPF-66
5. Safety Evaluation

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\*\*E-mail Date

NRR-058

OFFICE	LPL3-2/PM	LPL3-2/LA	DRA/AADB/BC	DIRS/ITSB/BC	OGC NLO w/comments	LPL3-2/BC
NAME	MDavid	BTully for THarris	TTate*	GWaig for RElliott**	BHarris	SCampbell
DATE	03/12/10	03/11/10	03/05/10	02/25/10	03/15/10	03/23/10

OFFICIAL RECORD COPY