



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

December 21, 2015

Mr. Bryan C. Hanson
Senior Vice President
Exelon Generation Company, LLC
President and Chief Nuclear Officer (CNO)
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 REGARDING INSTALLATION OF NEW LOW DEGRADED VOLTAGE RELAYS AND TIMERS ON THE 4.16 KV ENGINEERED SAFETY FEATURES (ESF) BUSES (CAC NOS. MF4051, MF4052, MF4053, AND MF4054)

Dear Mr. Hanson:

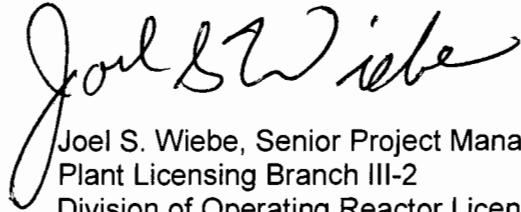
The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 188 to Facility Operating License No. NPF-72 and Amendment No. 188 to Facility Operating License No. NPF-77 for the, Braidwood Station, Units 1 and 2, respectively, and Amendment No. 195 to Renewed Facility Operating License No. NPF-37 and Amendment No. 195 to Renewed Facility Operating License No. NPF-66 for the Byron Station, Unit Nos. 1 and 2, respectively. The amendments are in response to your application dated April 24, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14120A039), as supplemented by letters dated April 30, 2015, and October 9, 2015 (ADAMS Accession Nos. ML15120A501 and ML15282A119, respectively).

B. Hanson

- 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 that reads "Joel S. Wiebe". The signature is written in a cursive style with a large, looping initial "J".

Joel S. Wiebe, 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. 188 to NPF-72
2. Amendment No. 188 to NPF-77
3. Amendment No. 195 to NPF-37
4. Amendment No. 195 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. 188
License No. NPF-72

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Exelon Generation Company, LLC (the licensee) dated April 24, 2014, as supplemented by letters dated April 30, 2015, and October 9, 2015, 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. 188, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated into 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 prior to MODE 4 following the Fall 2016 refueling outage (i.e., A1R19).

FOR THE NUCLEAR REGULATORY COMMISSION



Justin C. Poole, Acting Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical
Specifications and Facility Operating License

Date of Issuance: December 21, 2015



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. 188
License No. NPF-77

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Exelon Generation Company, LLC (the licensee) dated April 24, 2014, as supplemented by letters dated April 30, 2015, and October 9, 2015, 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:

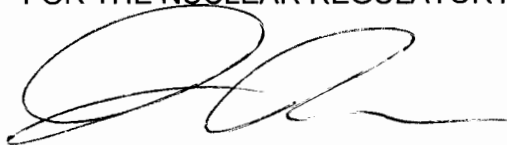
Enclosure 2

(2) Technical Specifications

The Technical Specifications contained in Appendix A as revised through Amendment No. 188 and the Environmental Protection Plan contained in Appendix B, both of which were 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 prior to MODE 4 following the Fall 2016 refueling outage (i.e., A1R19).

FOR THE NUCLEAR REGULATORY COMMISSION



Justin C. Poole, Acting Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical
Specifications and Facility Operating License

Date of Issuance: December 21, 2015

ATTACHMENT TO LICENSE AMENDMENT NOS. 188 AND 188

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 Appendix "A" Technical Specifications with the attached pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove

License NPF-72
Page 3

License NPF-77
Page 3

Insert

License NPF-72
Page 3

License NPF-77
Page 3

Interim pages: Use following implementation at Unit 2, prior to implementation at Unit 1.

TSs

3.3.5-1
--
3.3.5-2
--

TSs

3.3.5-1 (Unit 1)
3.3.5-1 (Unit 2)
3.3.5-2 (Unit 1)
3.3.5-2 (Unit 2)

Final pages: Use following implementation at both Units.

TSs

3.3.5-1 (Unit 1)
3.3.5-1 (Unit 2)
3.3.5-2 (Unit 1)
3.3.5-2 (Unit 2)

TSs

3.3.5-1 (Units 1 & 2)
--
3.3.5-2 (Units 1 & 2)
--

- (3) Exelon Generation Company, pursuant to the Act and 10 CFR Part 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) Exelon Generation Company, 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, 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 3645 megawatts thermal (100 percent rated power) in accordance with the conditions specified herein and other items identified in Attachment 1 to this license. The items identified in Attachment 1 to this license shall be completed as specified. Attachment 1 is hereby incorporated into this license.
 - (2) Technical Specifications

The Technical Specifications contained in Appendix A as revised through Amendment No. 188, and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated into the license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.
 - (3) Emergency Planning

In the event that the NRC finds that the lack of progress in completion of the procedures in the Federal Emergency Management Agency's final rule, 44 CFR Part 350, is an indication that a major substantive problem exists in achieving or maintaining an adequate state of emergency preparedness, the provisions of 10 CFR Section 50.54(s)(2) will apply.

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) 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 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 3645 megawatts thermal (100 percent rated power) in accordance with the conditions specified herein and other items identified in Attachment 1 to this license. The items identified in Attachment 1 to this license shall be completed as specified. Attachment 1 is hereby incorporated into this license.

(2) Technical Specifications

The Technical Specifications contained in Appendix A as revised through Amendment No. 188, and the Environmental Protection Plan contained in Appendix B, both of which were 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) Emergency Planning

In the event that the NRC finds that the lack of progress in completion of the procedures in the Federal Emergency Management Agency's final rule, 44 CFR Part 350, is an indication that a major substantive problem exists in achieving or maintaining an adequate state of emergency preparedness, the provisions of 10 CFR Section 50.54(s)(2) will apply.

3.3 INSTRUMENTATION

3.3.5 Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation

LCO 3.3.5 Two channels per bus of the loss of voltage Function and two channels per bus of the degraded voltage Function shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4;
When associated DG is required to be OPERABLE by LCO 3.8.2, "AC Sources-Shutdown."

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel on one or more buses inoperable.	A.1 -----NOTE----- For loss of voltage Function, the inoperable channel may be bypassed for up to 2 hours for surveillance testing of the other channel. ----- Place channel in trip.	1 hour
B. One or more Functions with two channels on one or more buses inoperable.	B.1 Restore one channel for the Function on the affected bus to OPERABLE status.	1 hour

(continued)

3.3 INSTRUMENTATION

3.3.5 Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation

LC0 3.3.5 Two channels per bus of the loss of voltage Function, two channels per bus of the degraded voltage Function and two channels per bus of the low degraded voltage Function shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4;
When associated DG is required to be OPERABLE by LC0 3.8.2, "AC Sources-Shutdown."

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel on one or more buses inoperable.	A.1 -----NOTE----- For loss of voltage Function, the inoperable channel may be bypassed for up to 2 hours for surveillance testing of the other channel. ----- Place channel in trip.	1 hour
B. One or more Functions with two channels on one or more buses inoperable.	B.1 Restore one channel for the Function on the affected bus to OPERABLE status.	1 hour

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time not met.	C.1 Enter applicable Condition(s) and Required Action(s) for the associated DG made inoperable by LOP DG start instrumentation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.3.5.1 -----NOTE----- Verification of relay setpoints not required. ----- Perform TADOT.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.2 Perform CHANNEL CALIBRATION with setpoint Allowable Value as follows: a. Loss of voltage Allowable Value ≥ 2730 V with a time delay of ≤ 1.9 seconds. b. Degraded voltage Allowable Value ≥ 3930 V with a time delay of 310 ± 30 seconds.	In accordance with the Surveillance Frequency Control Program

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time not met.	C.1 Enter applicable Condition(s) and Required Action(s) for the associated DG made inoperable by LOP DG start instrumentation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.3.5.1 -----NOTE----- Verification of relay setpoints not required. ----- Perform TADOT.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.2 Perform CHANNEL CALIBRATION with setpoint Allowable Value as follows: a. Loss of voltage Allowable Value ≥ 2730 V with a time delay of ≤ 1.9 seconds. b. Degraded voltage Allowable Value ≥ 3930 V with a time delay of 310 ± 30 seconds. c. Low degraded voltage Allowable Value ≥ 3196.4 V with a time delay of ≤ 3.5 seconds.	In accordance with the Surveillance Frequency Control Program

3.3 INSTRUMENTATION

3.3.5 Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation

LCO 3.3.5 Two channels per bus of the loss of voltage Function, two channels per bus of the degraded voltage Function and two channels per bus of the low degraded voltage Function shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4;
When associated DG is required to be OPERABLE by LCO 3.8.2, "AC Sources-Shutdown."

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel on one or more buses inoperable.	A.1 -----NOTE----- For loss of voltage Function, the inoperable channel may be bypassed for up to 2 hours for surveillance testing of the other channel. ----- Place channel in trip.	1 hour
B. One or more Functions with two channels on one or more buses inoperable.	B.1 Restore one channel for the Function on the affected bus to OPERABLE status.	1 hour

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time not met.	C.1 Enter applicable Condition(s) and Required Action(s) for the associated DG made inoperable by LOP DG start instrumentation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.3.5.1 -----NOTE----- Verification of relay setpoints not required. ----- Perform TADOT.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.2 Perform CHANNEL CALIBRATION with setpoint Allowable Value as follows: a. Loss of voltage Allowable Value ≥ 2730 V with a time delay of ≤ 1.9 seconds. b. Degraded voltage Allowable Value ≥ 3930 V with a time delay of 310 ± 30 seconds. c. Low degraded voltage Allowable Value ≥ 3196.4 V with a time delay of ≤ 3.5 seconds.	In accordance with the Surveillance Frequency Control Program



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 RENEWED FACILITY OPERATING LICENSE

Amendment No. 195
Renewed 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 April 24, 2014, as supplemented by letters dated April 30, 2015, and October 9, 2015, 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 Renewed 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. 195 and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated into this renewed 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 prior to MODE 4 following the Spring 2016 refueling outage (i.e., B2R19).

FOR THE NUCLEAR REGULATORY COMMISSION



Justin C. Poole, Acting Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical
Specifications and Renewed Facility Operating License

Date of Issuance: December 21, 2015



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 RENEWED FACILITY OPERATING LICENSE

Amendment No. 195
Renewed License No. NPF-66

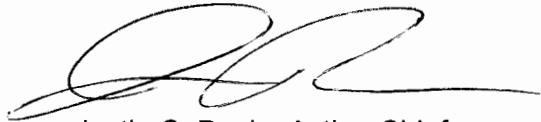
1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Exelon Generation Company, LLC (the licensee) dated April 24, 2014, as supplemented by letters dated April 30, 2015, and October 9, 2015, complies with the standards and requirements of the Atomic 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 Renewed 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. 195 and the Environmental Protection Plan contained in Appendix B, both of which were attached to Renewed License No. NPF-37, dated November 19, 2015, are hereby incorporated into this renewed 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 prior to MODE 4 following the Spring 2016 refueling outage (i.e., B2R19).

FOR THE NUCLEAR REGULATORY COMMISSION



Justin C. Poole, Acting Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical
Specifications and Renewed Facility Operating License

Date of Issuance: December 21, 2015

ATTACHMENT TO LICENSE AMENDMENT NOS. 195 AND 195
RENEWED FACILITY OPERATING LICENSE NOS. NPF-37 AND NPF-66
DOCKET NOS. STN 50-454 AND STN 50-455

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

Remove

License NPF-37
Page 3

License NPF-66
Page 3

Insert

License NPF-37
Page 3

License NPF-66
Page 3

Interim pages: Use following implementation at Unit 1, prior to implementation at Unit 2.

TSs

3.3.5-1
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3.3.5-2
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TSs

3.3.5-1 (Unit 1)
3.3.5-1 (Unit 2)
3.3.5-2 (Unit 1)
3.3.5-2 (Unit 2)

Final pages: Use following the implementation at both Units.

TSs

3.3.5-1 (Unit 1)
3.3.5-1 (Unit 2)
3.3.5-2 (Unit 1)
3.3.5-2 (Unit 2)

TSs

3.3.5-1 (Units 1 & 2)
--
3.3.5-2 (Units 1 & 2)
--

- (2) Pursuant to the Act and 10 CFR Part 70, to receive, possess and use at any time special nuclear material as reactor fuel, in accordance with the limitations for storage and amounts required for reactor operation, as described in the Updated Final Safety Analysis Report, as supplemented and amended;
- (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 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 renewed 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 3645 megawatts thermal (100 percent rated power) in accordance with the conditions specified herein.

(2) Technical Specifications

The Technical Specifications contained in Appendix A as revised through Amendment No. 195 and the Environmental Protection Plan contained in Appendix B, both of which are attached hereto, are hereby incorporated into this renewed license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

(3) Deleted.

(4) Deleted

- (2) Pursuant to the Act and 10 CFR Part 70, to receive; possess and use at any time special nuclear material as reactor fuel, in accordance with the limitations for storage and amounts required for reactor operation, as described in the Updated Final Safety Analysis Report, as supplemented and amended;
- (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 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 renewed 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 3645 megawatts thermal (100 percent rated power) in accordance with the conditions specified herein.

(2) Technical Specifications

The Technical Specifications contained in Appendix A (NUREG-1113), as revised through Amendment No. 195 and the Environmental Protection Plan contained in Appendix B, both of which were attached to Renewed License No. NPF-37, dated November 19, 2015, are hereby incorporated into this renewed license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

Renewed License No. NPF-66
Amendment No. 195

3.3 INSTRUMENTATION

3.3.5 Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation

LCO 3.3.5 Two channels per bus of the loss of voltage Function, two channels per bus of the degraded voltage Function and two channels per bus of the low degraded voltage Function shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4;
When associated DG is required to be OPERABLE by LCO 3.8.2, "AC Sources-Shutdown."

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel on one or more buses inoperable.	A.1 -----NOTE----- For loss of voltage Function, the inoperable channel may be bypassed for up to 2 hours for surveillance testing of the other channel. ----- Place channel in trip.	1 hour
B. One or more Functions with two channels on one or more buses inoperable.	B.1 Restore one channel for the Function on the affected bus to OPERABLE status.	1 hour

(continued)

3.3 INSTRUMENTATION

3.3.5 Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation

LCO 3.3.5 Two channels per bus of the loss of voltage Function and two channels per bus of the degraded voltage Function shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4;
When associated DG is required to be OPERABLE by LCO 3.8.2, "AC Sources-Shutdown."

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel on one or more buses inoperable.	A.1 -----NOTE----- For loss of voltage Function, the inoperable channel may be bypassed for up to 2 hours for surveillance testing of the other channel. ----- Place channel in trip.	1 hour
B. One or more Functions with two channels on one or more buses inoperable.	B.1 Restore one channel for the Function on the affected bus to OPERABLE status.	1 hour

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time not met.	C.1 Enter applicable Condition(s) and Required Action(s) for the associated DG made inoperable by LOP DG start instrumentation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.3.5.1 -----NOTE----- Verification of relay setpoints not required. ----- Perform TADOT.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.2 Perform CHANNEL CALIBRATION with setpoint Allowable Value as follows: a. Loss of voltage Allowable Value ≥ 2730 V with a time delay of ≤ 1.9 seconds. b. Degraded voltage Allowable Value ≥ 3793 V with a time delay of 310 ± 30 seconds. c. Low degraded voltage Allowable Value ≥ 3113.8 V with a time delay of ≤ 3.5 seconds.	In accordance with the Surveillance Frequency Control Program

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time not met.	C.1 Enter applicable Condition(s) and Required Action(s) for the associated DG made inoperable by LOP DG start instrumentation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.3.5.1 -----NOTE----- Verification of relay setpoints not required. ----- Perform TADOT.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.2 Perform CHANNEL CALIBRATION with setpoint Allowable Value as follows: a. Loss of voltage Allowable Value ≥ 2730 V with a time delay of ≤ 1.9 seconds. b. Degraded voltage Allowable Value ≥ 3793 V with a time delay of 310 ± 30 seconds.	In accordance with the Surveillance Frequency Control Program

3.3 INSTRUMENTATION

3.3.5 Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation

LCO 3.3.5 Two channels per bus of the loss of voltage Function, two channels per bus of the degraded voltage Function and two channels per bus of the low degraded voltage Function shall be OPERABLE.

APPLICABILITY: MODES 1, 2, 3, and 4;
When associated DG is required to be OPERABLE by LCO 3.8.2, "AC Sources-Shutdown."

ACTIONS

-----NOTE-----
Separate Condition entry is allowed for each Function.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more Functions with one channel on one or more buses inoperable.	A.1 -----NOTE----- For loss of voltage Function, the inoperable channel may be bypassed for up to 2 hours for surveillance testing of the other channel. ----- Place channel in trip.	1 hour
B. One or more Functions with two channels on one or more buses inoperable.	B.1 Restore one channel for the Function on the affected bus to OPERABLE status.	1 hour

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time not met.	C.1 Enter applicable Condition(s) and Required Action(s) for the associated DG made inoperable by LOP DG start instrumentation.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SR 3.3.5.1 -----NOTE----- Verification of relay setpoints not required. ----- Perform TADOT.	In accordance with the Surveillance Frequency Control Program
SR 3.3.5.2 Perform CHANNEL CALIBRATION with setpoint Allowable Value as follows: a. Loss of voltage Allowable Value ≥ 2730 V with a time delay of ≤ 1.9 seconds. b. Degraded voltage Allowable Value ≥ 3793 V with a time delay of 310 ± 30 seconds. c. Low degraded voltage Allowable Value ≥ 3113.8 V with a time delay of ≤ 3.5 seconds.	In accordance with the Surveillance Frequency Control Program



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 188 TO FACILITY OPERATING LICENSE NO. NPF-72,
AMENDMENT NO. 188 TO FACILITY OPERATING LICENSE NO. NPF-77,
AMENDMENT NO. 195 TO RENEWED FACILITY OPERATING LICENSE NO. NPF-37,
AND AMENDMENT NO. 195 TO RENEWED 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 application dated April 24, 2014 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14120A039), as supplemented by letters dated April 30, 2015, and October 9, 2015 (ADAMS Accession Nos. ML15120A501 and ML15282A119), Exelon Generation Company, LLC (the licensee) requested changes to the facility operating licenses for the Braidwood Station (Braidwood), Units 1 and 2, and the renewed facility operating licenses for the Byron Station (Byron), Unit Nos. 1 and 2. The supplemental letters dated April 30, 2015, and October 9, 2015, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the U.S. Nuclear Regulatory Commission (NRC or commission) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on September 2, 2014 (79 FR 52065).

The changes revised Technical Specifications (TS) 3.3.5, "Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation." Specifically, Limiting Condition of Operation (LCO) 3.3.5 was revised to add a new "low degraded voltage" Function; and the associated Surveillance Requirement (SR) 3.3.5.2 was revised to add a CHANNEL CALIBRATION to verify the specified values for the new low degraded voltage Allowable Value and time delay setting.

2.0 REGULATORY EVALUATION

2.1 System Description

The Byron and Braidwood Stations each consist of two main generating units designated as Unit 1 and Unit 2. The preferred power source is provided through the system auxiliary power transformers via a 345-kV switchyard ring bus. Two physically separate and electrically independent circuits are provided for each unit, one via the unit's assigned system auxiliary transformers and the other from the system auxiliary transformers of the other unit. Each unit of the Byron and Braidwood Stations has two emergency diesel generators (EDGs) that provide power to emergency 4.16 kilo Volt (kV) buses. The Cooper-Bessemer diesel engines have a continuous load rating of 5500 kilo Watts (kW).

There are two redundant and independent 4-kilo volt (kV) emergency buses and each has two levels of undervoltage protection: (1) LOP, and (2) degraded grid voltage. The relays are connected to the existing potential transformers on the bus.

The voltage and time setpoints are determined from an analysis of the voltage requirements of the safety-related loads and actual field measurements of bus voltages under various motor starting conditions. The approximate pickup voltage for the first level of protection is 70 percent of rated voltage. The setting for the second level of undervoltage protection is 92.5 percent of rated voltage at Byron and 95.8 percent at Braidwood. There is a 10-second time delay to avoid alarms on transients, and if the degraded voltage is not corrected, the bus automatically disconnects from the offsite power source 5 minutes after the alarm and connects to its onsite DG.

During a sustained degraded grid voltage condition, the subsequent occurrence of a safety injection signal immediately trips the offsite power supply to the 4.16 kV buses.

2.2 Description of Proposed Changes

2.2.1 Technical Specifications

The changes involve revising TS 3.3.5, "Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation." Specifically, LCO 3.3.5 would be revised to include a new "low degraded voltage" Function as follows:

TS 3.3.5. "Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation"

The current LCO 3.3.5 states the following:

LCO 3.3.5 Two channels per bus of the loss of voltage Function and two channels per bus of the degraded voltage Function shall be OPERABLE.

The proposed change would revise this LCO to include a new low degraded voltage Function as follows:

LCO 3.3.5 *Two channels per bus of the loss of voltage Function, two channels per bus of the degraded voltage Function and two channels per bus of the low degraded voltage Function shall be OPERABLE.*

SR 3.3.5.2 (CHANNEL CALIBRATION)

The current SR 3.3.5.2 states the following:

SR 3.3.5.2 *Perform CHANNEL CALIBRATION with setpoint Allowable Value as follows:*

- a. *Loss-of-voltage Allowable Value ≥ 2730 V with a time delay of ≤ 1.9 seconds.*
- b. *Degraded voltage Allowable Value $\geq [3930$ V- Braidwood; 3793 V- Byron] with a time delay of 310 ± 30 seconds.*

The proposed change would revise this SR to include a new Allowable Value and time delay for the low degraded voltage Function as follows:

SR 3.3.5.2 *Perform CHANNEL CALIBRATION with setpoint Allowable Value as follows:*

- a. *Loss of voltage Allowable Value ≥ 2730 V with a time delay of ≤ 1.9 seconds.*
- b. *Degraded voltage Allowable Value $\geq [3930$ V- Braidwood; 3793 V- Byron] with a time delay of 310 ± 30 seconds.*
- c. ***Low degraded voltage Allowable Value $\geq [3196.4$ V- Braidwood; 3113.8 V Byron] with a time delay of ≤ 3.5 seconds.***

2.3 Applicable Regulatory Requirements and Guidance

The NRC staff used the following regulatory requirements to review the LAR:

Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR) Appendix A, General Design Criterion (GDC) 17, "Electric power systems," requires, in part, that provisions be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the LOP generated by the nuclear power unit, the LOP from the transmission network, or the LOP from the onsite electric power supplies.

Part 50 of 10 CFR, Section 36, "Technical Specifications," requires that TSs shall be included by applicants for a license authorizing operation of a production or utilization facility.

10 CFR 50.36(c) requires that TSs include items in five specific categories related to station operation. These categories are: (1) safety limits, limiting safety system settings, and limiting control settings, (2) LCOs, (3) SRs, (4) design features, and (5) administrative controls. The proposed changes to TS, discussed in this safety evaluation, are within the LCOs and the SRs categories.

Additionally, 10 CFR 50.36(c)(3) requires that surveillance requirements relating to test, calibration, or inspection are to assure that the necessary quality of systems and components is maintained.

General Design Criterion (GDC) 13, "Instrumentation and Control," of Appendix A to 10 CFR Part 50 requires that instrumentation be provided to monitor variables and systems and that controls be provided to maintain these variables and systems within prescribed operating ranges.

GDC 20, "Protection System Functions," of Appendix A to 10 CFR Part 50 requires that the protection system be designed to initiate the operation of appropriate systems to ensure that specified acceptable fuel design limits are not exceeded.

The NRC staff also used the following documents for additional guidance for reviewing the license amendment request (LAR):

Regulatory Guide (RG) 1.105, Revision 3, "Setpoints for Safety-Related Instrumentation," dated December 1999 (ADAMS Accession No. ML993560062) describes a method that the NRC staff finds acceptable for use in complying with the NRC's regulations for ensuring that setpoints for safety-related instrumentation are initially within, and will remain within, the TS limits. RG 1.105 endorses Part I of Instrument Society of America Standard 67.04-1994, "Setpoints for Nuclear Safety-Related Instrumentation," subject to NRC staff clarifications. The staff used this guide to establish the adequacy of the licensee's setpoint calculation methodologies and the related plant surveillance procedures.

Regulatory Issue Summary (RIS) 2006-17, "NRC Staff Position on the Requirements of 10 CFR 50.36, "Technical Specifications," Regarding Limiting Safety System Settings During Periodic Testing and Calibration of Instrument Channels," dated August 24, 2006 (ADAMS Accession No. ML051810077), addresses requirements on limiting safety system settings that are assessed during the periodic testing and calibration of instrumentation.

Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (NUREG-0800), Branch Technical Position (BTP) PSB-1, "Adequacy of Station Electric Distribution System Voltages," Revision 0 (July 1981), (ADAMS Accession No. ML052350520), Section B.1.b, specifies that:

Two separate time delays shall be selected for the second level of undervoltage protection based on the following conditions:

1. The first time delay should be of a duration that established the existence of a sustained degraded voltage condition (i.e., something longer than a motor starting transient). Following this delay, an alarm in the control room should alert the operator to the degraded condition. The subsequent occurrence of a safety injection actuation signal should immediately separate the Class 1E distribution system from the offsite power system.
2. The second time delay should be of a limited duration such that the permanently connected Class 1E loads will not be damaged. Following this delay, if the operator has failed to restore adequate voltages, the Class 1E distribution system should be automatically separated from the offsite power system. Bases and justification must be provided in support of the actual delay chosen.

Section B.1.d. specifies that:

The technical specifications should include limiting conditions for operations, surveillance requirements, trip setpoints, and maximum and minimum allowable values for the first level of undervoltage protection (loss of offsite power) relays and the second level (degraded voltage) protection sensors and associated time delay devices.

3.0 TECHNICAL EVALUATION

The licensee stated in its letter dated April 24, 2014, that the Byron Station received a noncited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," for not having an appropriate analysis for the second level undervoltage (i.e., degraded voltage) relay timer setting, currently specified in SR 3.3.5.2, Item b. Specifically, Byron Station's analysis did not adequately confirm the ability of the 4.16 kV ESF bus safety-related loads to continue to operate for 5 minutes and 40 seconds (i.e., the maximum degraded voltage time delay period prior to being isolated from the normal off-site power source) without sustaining damage during a worst-case, nonaccident degraded voltage condition. Consequently, TS 3.3.5 was considered to be nonconservative. This issue is also applicable to Braidwood Station.

The licensee determined that a modification was necessary to resolve this violation. The modification adds new "low degraded voltage relays" (low graded voltage relays (LDVRs) and timers (i.e., a third level of undervoltage protection), with appropriate settings, on each engineered safety features (ESF) bus. The addition of the LDVRs will continue to allow the existing undervoltage protection circuitry to function as originally designed; i.e., the first-level "LOV" protection and the second level "degraded voltage" protection will remain in place and be unaffected by this change. The new relays and timers will ensure the safety-related connected loads will not be damaged by appropriately isolating the safety-related loads during a sustained degraded bus voltage event under non-accident conditions. The safety-related loads will then be re-sequenced back on to the 4.16 kV ESF buses as designed, powered by the EDG, and will continue to perform their design basis function.

The licensee stated that compliance with the intent of TS 3.3.5 is currently administratively controlled under the provisions of NRC the Administrative Letter 98-10, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant Safety" dated December 29, 1998 (ADAMS Accession No. ML031110108), to assure that plant safety is maintained at both Braidwood and Byron Stations.

Low Degraded Voltage Relays (LDVRs)

The NRC staff determined that the addition of the phrase, "and two channels per bus of the low degraded voltage Function shall be OPERABLE" to LCO 3.3.5, as shown in Section 2.2.1 above, is acceptable because the addition corrects the nonconservative TS by ensuring the safety-related connected loads will not be damaged by requiring equipment to be OPERABLE that isolates the safety-related loads during a sustained degraded bus voltage event under non-accident conditions.

Based on the above, the NRC staff determine that 10 CFR 50.36(c)(2) has been met.

In response to a request for additional information (RAI) dated October 23, 2014, concerning the LDVR settings, the licensee stated that while developing the response to the RAI, the licensee identified that some electrical parameters and recently added loads were not properly modeled in the calculations supporting the proposed TS changes. These issues prompted the licensee to revise the TS AVs and associated setpoints for the new degraded voltage function from those proposed in the LAR dated April 24, 2014.

The NRC staff reviewed a summary of the licensee's analysis provided in its April 30, 2015, supplement developed to establish the TS AV for the new LVDRs. The licensee identified the minimum voltage required to preclude motor stalling on the 4.16 kV buses. The licensee added 25 V to the minimum voltage, for conservatism, and determined the TS Allowable Value to be ≥ 3196.4 V, for Braidwood, Units 1 and 2, and ≥ 3113.8 V for Byron, Unit Nos. 1 and 2. The licensee determined that the LVDR time delay should be short enough to protect motors from tripping on overload and lockout (failure to restart) from prolonged exposure to low voltage. The licensee's analysis determined that the delay should be ≤ 3.5 seconds.

The NRC staff determined that adding:

Low degraded voltage Allowable Value $\geq [3196.4$ V for Braidwood; 3113.8 V for Byron] with a delay of ≤ 3.5 seconds.

As shown in Section 2.2.1 is acceptable because the required AVs ensure the motors on the electrical buses don't stall and perform the action fast enough to prevent the motors tripping on overload and lockout.

The proposed setpoint of the LDVRs is below the existing second-level degraded voltage relays (DVRs) and above the first level LOV relays on 4.16 kV ESF Buses 141, 142, 241, and 242 for both Byron and Braidwood Stations. The licensee's analysis concluded that the new LDVRs, will actuate prior to any safety-related motors stalling and thus satisfies the BTP PSB-1 acceptance criteria. The licensee reviewed the protective coordination of ESF loads for the worst-case operating and loading conditions and concluded that normally running safety-related motors will not trip and lock out during a degraded voltage condition during non-accident conditions.

In response to staff's questions concerning the basis for the analytical limit the licensee stated that the proposed AVs (see Section 2.2.1) will ensure that the safety-related loads will not be damaged by appropriately isolating the safety-related loads from the normal offsite power source during a sustained degraded bus voltage event under non-accident conditions. The licensee used a computer based alternating current power system analyses program for selection of the limiting breakdown torque and to determine the analytical limits, allowable values and associated setpoints to demonstrate that the equipment fed from all safety buses will not be damaged and will continue to operate satisfactorily. In addition, the motor control centers (MCCs) control power circuits will have adequate 'hold in' voltage for the starter coils and, therefore, the starters for operating MCCs loads will remain energized and the loads continue operating. The licensee provided vendor published data for the rated coil drop-out voltage (40-

60 percent of rated voltage). This range of drop out voltage is bounded by the minimum allowable voltage for the specific applications at the Byron and Braidwood Stations. The licensee's analyses also indicate that a momentary voltage dip lasting approximately 3 seconds to a value marginally above the LOV relay setpoint, with a recovery to the reset point of the LDVR, will not adversely impact any important to safety equipment which may be required to operate for more than 5 minutes. Based on the above, the staff finds the licensee's response acceptable.

In its response dated October 9, 2015, the licensee clarified that the analyses performed to support the LDVR setpoints demonstrated that any permanently connected load (i.e., any load that would be expected to be operating at the start of a degraded voltage condition) would continue to operate throughout the 340 second time delay without sustaining damage or actuating protective devices that would prevent the component from performing its intended safety function.

Based on the above, the NRC staff determined that the guidance in BTP PSB-1 is met because the second level undervoltage analysis now demonstrates that the safety-related loads continue to operate for 5 minutes and 40 seconds without sustaining damage.

The NRC staff determined that 10 CFR 50.36(c)(3) is met because SR 3.3.5.2 establishes AVs that ensure that the safety-related loads are available when needed.

The licensee stated in its April 30, 2015, letter that the associated setpoints for the proposed TS Allowable Values for the new low degraded voltage Function will be specified in the Technical Requirement Manual (TRM), Table T 2.0.b-1, "Engineered Safety Feature Actuation System Instrumentation Trip Setpoints." The setpoint values will be more conservative than the TS AVs and will be set at 78.0 percent (3244.2V) of nominal bus voltage for Braidwood and 76.0 percent (3160V) of nominal bus voltage for Byron.

In response to the NRC staff's question concerning the AVs and the Setpoint values, the licensee clarified that as part of the improved TSs conversion process to adopt NUREG-1431, the setpoints were relocated to the TRM. Relocation of these setpoints was consistent with the criteria stated in the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993 (58 FR 39132), which was subsequently codified by changes to 10 CFR 50.36, "Technical specifications," dated July 19, 1995 (60 FR 36953). However, the proposed AV and time delay for the LDVRs remain in the TS. Based on the above, the staff finds the licensee's response acceptable and consistent with the guidance in BTP PSB-1, B.1.d because the AVs are contained in TS and the setpoint values are contained in the TRM as allowed by 10 CFR 50.36.

LDVR Interaction with Existing LOVs and DVRs

In its letter dated April 24, 2014, the licensee states that the AVs and time delays for the existing LOV and DVRs remain the same. The licensee clarified in its supplemental information dated October 9, 2015, that the development of the setpoint is consistent with the discussion of DVR Setting Design Calculations provided in RIS 2011-12, "Adequacy of Station Electric Distribution System Voltages," Revision 1 (ADAMS Accession No. ML113050583).

Specifically, division specific degraded voltage analyses were performed for each safety-related distribution system at Byron and Braidwood Stations to determine the existing DVR setpoint and analytically demonstrate that adequate voltage exists for starting and running all safety-related equipment at or above the DVR setpoint value. The NRC staff finds consistency with RIS 2011-12 is an acceptable method for determining the relay settings.

In response to NRC staff questions concerning the existing DVR time delay under accident conditions, the licensee clarified that the time delay of 310 seconds is comprised of a 10-second time delay, integral to the DVR itself, and a separate 5-minute time delay device. The 10-second delay element is not a separate component and cannot be tested or replaced separately. As such, there is no separate 10-second time delay device associated with the 310-second time delay; and the 10-second time delay is not addressed separately in the TS. The staff finds this response acceptable because it satisfies the guidance provided in BTP PSB-1, Section B.1.b.1, for providing a short time delay and for providing surveillance requirements in accordance 10 CFR 50.36(c)(3).

The NRC staff requested confirmation on adequacy of DVR voltage setpoint and time delay of 340 seconds (for nonaccident condition) to ensure:

- a. safety-related loads will have adequate voltage to start and run
- b. protective devices will not actuate and
- c. none of the safety-related loads will be damaged.

In response, the licensee stated the following:

- The safety-related loads (i.e., motors) will not be damaged and it will not stall due to operation with reduced running torque.
- For 4.16 kV safety-related loads with electrical protective devices that require manual reset (e.g., lockout relays), the analysis verified that the protective devices will not actuate during operation at the LDVR minimum allowable voltage for 340 seconds except for the Main Control Room chiller compressors. The time-overcurrent primary pickup setting will be increased from 50 amps to 60 amps to address this issue. The calculation verified that the revised settings will adequately protect the main control room chiller compressors from overloads while also allowing them to continue operating under low degraded voltage conditions.
- For 4.16 kV safety-related loads with protective devices that will automatically reset following clearance of the overcurrent condition, the analysis assumed that the protective devices may trip during operation at the LDVR minimum allowable voltage during the 340-second time delay. Tripping of protective devices with an automatic reset is considered to be acceptable by the licensee since, once bus voltage has been restored to normal (e.g., from the EOG), the affected safety-related loads would be capable of restarting and performing their required design functions.
- For 480 V safety-related loads, the licensee's analysis verified that the protective devices will not actuate during operation at the LDVR minimum allowable voltage for 340 seconds.

- For any potential starting loads under low degraded voltage conditions, the licensee stated that the Byron Station and Braidwood Station low degraded voltage evaluations did not specifically analyze the potential starting of loads under low degraded voltage conditions. However, the licensee reviewed the consequence of some loads that could receive auto-start signals due to conditions other than an SIAS signal. For example, the Standby Component Cooling Water (CC) Pump could receive an automatic start signal on CC Pump low discharge pressure; and the Motor Driven Auxiliary Feedwater (AF) Pump could receive an automatic start signal on Reactor Coolant Pump bus undervoltage, Lo-Lo steam generator level, or an Anticipated Transient Without Scram (ATWS) signal. If either the CC Pump or the AF Pump were to attempt to start under low degraded voltage conditions, the load may trip; however, once the EDGs reenergize the ESF buses and restore normal bus voltage and auto reset the tripped loads, the safe shutdown sequencers would automatically start the CC Pump, the AF Pump, and the other required safe shutdown loads on each train.

In addition, the licensee's supplemental information dated October 9, 2015, indicated that for sustained degraded voltage condition (nonaccident) no other equipment including motor operated valves needed to be started. The NRC staff finds the response acceptable since the licensee's evaluation indicated that potential start of safety-related loads such as component cooling and auxiliary feed pumps will accomplish their required safety functions with the existing time delays for non-accident conditions without actuating their protective devices and none of the safety-related loads will be damaged.

Based on the above, the NRC staff finds that the addition of the LDVRs will not affect the existing LOV and DVRs.

Setpoint Evaluation

The NRC staff evaluated the licensee's submittals associated with this license amendment request. This evaluation was performed to accomplish the following objectives:

- Verify the licensee's setpoint calculation methods are adequate to assure that control and monitoring setpoints are established and maintained in a manner consistent with plant safety function requirements.
- Verify the licensee's setpoint calculation methods are adequate to assure with a high confidence level that required protective actions are initiated before the associated plant process parameters exceed their analytical limits.
- Confirm the proposed actions to be taken at established calibration intervals and operability determination methods are consistent with safety analysis assumptions and NRC guidance.

This license amendment establishes voltage AV setpoints for the new LDVRs that are below the existing second-level undervoltage relays and above the first-level LOV relays on the 4.16 kV ESF buses 141, 142, 241, and 242 are as follows:

- a. Byron, Unit Nos. 1 and 2 - Low degraded voltage AV \geq 3113.8 V with a time delay of \leq 3.5 seconds. The Analytical Limit (AL) was determined to be 3088.8V
- b. Braidwood, Units 1 and 2 - Low degraded voltage Allowable Value \geq 3196.4 V with a time delay of \leq 3.5 seconds. The AL was determined to be 3171.4V

The calculations used to determine the LDVR setpoints were provided as Attachment 4 (19-AN-29 revision 2B) for Braidwood and Attachment 5 (19-AN-28 revision 1B) for Byron (ADAMS Accession Nos. ML14120A040 and ML14120A041, respectively) of the LAR. These calculations use the square-root-of-the-sum-of-the-squares method of accounting for the following uncertainties to determine the channel uncertainty:

PT_error	=	Potential Transformer Tolerance
TDE	=	Time Delay Error
TNE	=	Total Negative Error for UV relay
TPE	=	Total Positive Error for UV relay
RA	=	Reference Accuracy

The NRC staff reviewed these calculations and observed they do not list individual instrument uncertainty factors other than the base instrument accuracy. Specifically, Sections 8.1.1.4 and 8.1.1.5 of Attachment 4 for Braidwood, and Sections 8.1.1.6 and 8.1.1.7 of Attachment 5 for Byron provide instrument uncertainty information which is based on basic instrument accuracy only. The NRC staff was unable to determine what uncertainty factors were included in the "Total Negative Error" and "Total Positive Error" terms used in the calculations. Consequently, the NRC issued an RAI to address these issues (ADAMS Accession No. ML14268A358).

In the response to this RAI (ADAMS Accession No. ML15120A501), the licensee revised the Braidwood calculation 19-AN-29 to Revision 002C, and the Byron calculation 19-AN-28 to Revision 001C. These two revised calculations were included in the RAI response letter as Attachments 4 and 5, respectively. In the revised calculations, the licensee noted the proposed TS AVs for the low DVRs for Byron and Braidwood were revised from the values listed in the LAR due to revisions to these calculations. The revised calculations also include terms used to determine the instrument total negative and positive error values as well as the calibration error. The following terms were included:

- Relay Temperature Effect
- Relay Control Voltage Effect
- Relay Reference Accuracy
- Calibration Instrument Error (i.e., measurement and test equipment)
- Relay Setting Tolerance

The NRC staff finds this calculation methodology acceptable for the independent variables considered in the instrument uncertainty calculation. The licensee provided justifications for selecting the parameters for each of the identified uncertainty factors for the low degraded voltage relays being added.

The NRC staff evaluated the Nominal settings for the Byron and Braidwood LDVR's. The staff found the Nominal Trip Set Point (NTSP) for Byron to be 1.48 percent to the AV level and 2.27

percent margin to the AL limit. Considering the total negative error value of the relay of 1.46 percent; the staff determined sufficient margin exists between the NTSP and the AL such that the relay safety function meets the performance criteria of RG 1.105.

The NRC staff found the NTSP for Braidwood to be 1.47 percent to the AV level and 2.24 percent margin to the AL limit. Considering the total negative error value of the relay of 1.46 percent; the staff determined sufficient margin exists between the NTSP and the AL such that the relay safety function meets the performance criteria of RG 1.105.

The NRC staff also confirmed adequate separation exists between the LDVR settings and the existing DVR and LOV relay settings such that LDVR operation will not interfere with either the degraded voltage or LOV functions.

To confirm incorporation of the LDVR's into the licensee's surveillance programs the NRC staff issued a second RAI (ADAMS Accession No. ML14268A358) to request information to demonstrate how the licensee will address surveillance test results exceeding As-Found and As-Left acceptance criteria for the new low degraded voltage safety function. In response to this RAI (ADAMS Accession No. ML15120A501), the licensee provided a description of how the Byron and Braidwood surveillance programs will be used to support monitoring of instrument operability during plant operation. The licensee noted when the as-found relay setting is found outside the acceptable tolerance band, an Issue Report will be written as part of the licensee corrective action program and the operations shift manager evaluates the relay to determine operability. Maintenance personnel will take actions to recalibrate the relays to a value within the As-Left setpoint tolerance band prior to returning the channel to service, as directed by site-specific Maintenance Procedures. There is a plant-specific program which verifies that the instrument channel functions as required by verifying the as-left and as-found settings are consistent with those established by the setpoint methodology. The setting tolerance band used by the licensee for surveillance testing is less than the square root of the sum of the squares of reference accuracy, measurement and test equipment, and readability uncertainties. The setting tolerance is included in the total loop uncertainty and the surveillance test acceptance criteria band for the as-found value includes the setting tolerance. The NRC staff thus determined this methodology to be consistent with the criteria outlined in RIS 2006-17 "NRC Staff Position on the Requirements of 10 CFR 50.36, "Technical Specifications," Regarding Limiting Safety System Settings during Periodic Testing and Calibration of Instrument Channels."

Based on the above, the NRC staff finds that the licensee has performed the setpoint calculations in conformance with the guidance criteria of RG 1.105, and RIS 2006-17. Based on meeting the guidance in RG 1.105 and RIS 2006-19, the staff further concludes the proposed TS changes meet the requirements of 10 CFR 50.36(c)(1)(ii)(A) as well as the 10 CFR 50, Appendix A, GDC listed in Section 2.0 and are therefore acceptable. Therefore, the NRC staff finds the proposed changes to LCO 3.3.5 and SR 3.3.5.2 to be acceptable.

Summary

The NRC staff determined that the AVs selected are adequate for the LDVRs to ensure that the Class 1 E distribution system remains connected to the offsite power system when adequate offsite voltage is available and motor starting transients and grid short disturbance are considered. The proposed time delay continues to provide equipment protection while preventing a premature separation from offsite power. There are no changes to the existing DVRs and LOVs voltage settings and time delays. Therefore, the AV changes continue to meet the accident analysis assumptions.

Based on the above, the NRC staff finds the proposed LDVR protection schemes provide reasonable assurance that the safety-related equipment will perform its intended safety functions during postulated grid conditions. The NRC staff also finds continued compliance with GDC 17 based on the provisions to provide safety-related load protection while minimizing the probability of losing electric power caused by premature separation from remaining power sources.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Illinois State official was notified on October 28, 2015, of the proposed issuance of the amendment. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (79 FR 52065; dated September 2, 2014). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that 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(s): RMathew
GMatharu

Date of issuance: December 21, 2015

B. Hanson

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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/

Joel S. Wiebe, 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. 188 to NPF-72
2. Amendment No. 188 to NPF-77
3. Amendment No. 195 to NPF-37
4. Amendment No. 195 to NPF-66
5. Safety Evaluation

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