November 19, 2003

Mr. John L. Skolds, President
Exelon Nuclear
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: ISSUANCE OF AMENDMENTS (TAC NOS. MB6569, MB6570, MB6571, AND MB6572)

Dear Mr. Skolds:

The U.S. Nuclear Regulatory Commission (Commission) has issued the enclosed Amendment No. 135 to Facility Operating License No. NPF-37 and Amendment No. 135 to Facility Operating License No. NPF-66 for the Byron Station, Unit Nos. 1 and 2, respectively, and Amendment No. 129 to Facility Operating License No. NPF-72 and Amendment No. 129 to Facility Operating License No. NPF-77 for the Braidwood Station, Unit Nos. 1 and 2, respectively. The amendments are in response to your application dated October 16, 2002, as supplemented by letters dated June 20, October 14, and November 7, 2003.

The amendments revise the completion time (CT) of Required Action A.1 of Technical Specification 3.8.7, “Inverters-Operating,” from the current 24 hours to 7 days for one inoperable instrument bus inverter.

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/***

Mahesh Chawla, Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

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

Enclosures:
1. Amendment No. 135 to NPF-37
2. Amendment No. 135 to NPF-66
3. Amendment No. 129 to NPF-72
4. Amendment No. 129 to NPF-77
5. Safety Evaluation

cc w/encls: See next page

November 19, 2003

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Sincerely,
***/RA/***
Mahesh Chawla, Project Manager, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

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

Enclosures:
1. Amendment No. 135 to NPF-37
2. Amendment No. 135 to NPF-66
3. Amendment No. 129 to NPF-72
4. Amendment No. 129 to NPF-77
5. Safety Evaluation

cc w/encls: See next page

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Byron/Braidwood Stations

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EXELON GENERATION COMPANY, LLC

DOCKET NO. STN 50-454

BYRON STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 135
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 October 16, 2002, as supplemented by letters dated June 20, October 14, and November 7, 2003, 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. 135 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 30 days of the date of issuance. As part of implementation, the Licensee shall describe, in the Updated Final Safety Analysis Report (UFSAR), the two compensatory actions to be taken when an instrument bus inverter is unavailable, which actions are identified in the Licensee's letter dated June 20, 2003, supplementing the application, and reviewed in the Staff's safety evaluation report dated November 19, 2003. This description shall be reflected in the next update of the UFSAR submitted to the NRC pursuant to 10 CFR 50.71(e).

FOR THE NUCLEAR REGULATORY COMMISSION

***/RA by DPickett for/***

Anthony J. Mendiola, Chief, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: November 19, 2003

EXELON GENERATION COMPANY, LLC

DOCKET NO. STN 50-455

BYRON STATION, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 135
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 October 16, 2002, as supplemented by letters dated June 20, October 14, and November 7, 2003, 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

The Technical Specifications contained in Appendix A (NUREG-1113), as revised through Amendment No. 135 and the Environmental Protection Plan contained in Appendix B, both of which were 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 30 days of the date of issuance. As part of implementation, the Licensee shall describe, in the Updated Final Safety Analysis Report (UFSAR), the two compensatory actions to be taken when an instrument bus inverter is unavailable, which actions are identified in the Licensee's letter dated June 20, 2003, supplementing the application, and reviewed in the Staff's safety evaluation report dated November 19, 2003. This description shall be reflected in the next update of the UFSAR submitted to the NRC pursuant to 10 CFR 50.71(e).

FOR THE NUCLEAR REGULATORY COMMISSION

***/RA by DPickett for/***

Anthony J. Mendiola, Chief, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: November 19, 2003

ATTACHMENT TO LICENSE AMENDMENT NOS. 135 AND 135

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

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

Replace the following page of the Appendix “A” Technical Specifications with the attached page. The revised page is identified by amendment number and contains marginal line indicating the area of changes.

| Remove Page | Insert Page |
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| 3.8.7-1 | 3.8.7-1 |

EXELON GENERATION COMPANY, LLC

DOCKET NO. STN 50-456

BRAIDWOOD STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 129
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 October 16, 2002, as supplemented by letters dated June 20, October 14, and November 7, 2003, 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. 129 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 30 days of the date of issuance. As part of implementation, the Licensee shall describe, in the Updated Final Safety Analysis Report (UFSAR), the two compensatory actions to be taken when an instrument bus inverter is unavailable, which actions are identified in the Licensee's letter dated June 20, 2003, supplementing the application, and reviewed in the Staff's safety evaluation report dated November 19, 2003. This description shall be reflected in the next update of the UFSAR submitted to the NRC pursuant to 10 CFR 50.71(e).

FOR THE NUCLEAR REGULATORY COMMISSION

***/RA by DPickett for/***

Anthony J. Mendiola, Chief, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: November 19, 2003

EXELON GENERATION COMPANY, LLC

DOCKET NO. STN 50-457

BRAIDWOOD STATION, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 129
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 October 16, 2002, as supplemented by letters dated June 20, October 14, and November 7, 2003, 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. 129 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 if its issuance and shall be implemented within 30 days of the date of issuance. As part of implementation, the Licensee shall describe, in the Updated Final Safety Analysis Report (UFSAR), the two compensatory actions to be taken when an instrument bus inverter is unavailable, which actions are identified in the Licensee's letter dated June 20, 2003, supplementing the application, and reviewed in the Staff's safety evaluation report dated November 19, 2003. This description shall be reflected in the next update of the UFSAR submitted to the NRC pursuant to 10 CFR 50.71(e).

FOR THE NUCLEAR REGULATORY COMMISSION

***/RA by DPickett for/***

Anthony J. Mendiola, Chief, Section 2
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: November 19, 2003

ATTACHMENT TO LICENSE AMENDMENT NOS. 129 AND 129

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

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

Replace the following page of the Appendix "A" Technical Specifications with the attached page. The revised page is identified by amendment number and contains marginal line indicating the area of changes.

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| 3.8.7-1 | 3.8.7-1 |

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 135 TO FACILITY OPERATING LICENSE NO. NPF-37,

AMENDMENT NO. 135 TO FACILITY OPERATING LICENSE NO. NPF-66,

AMENDMENT NO. 129 TO FACILITY OPERATING LICENSE NO. NPF-72,

AND AMENDMENT NO. 129 TO FACILITY OPERATING LICENSE NO. NPF-77

EXELON GENERATION COMPANY, LLC

BYRON STATION, UNIT NOS. 1 AND 2

BRAIDWOOD STATION, UNIT NOS. 1 AND 2

DOCKET NOS. STN 50-454, STN 50-455, STN 50-456 AND STN 50-457

## 1.0 INTRODUCTION

By application dated October 16, 2002, as supplemented by letters dated June 20, October 14, and November 7, 2003, Exelon Generating Company, LLC (the licensee) requested changes to the technical specifications (TS) for Units 1 and 2 of both Byron and Braidwood Stations. The supplements dated June 20, October 14, and November 7, 2003, provided additional information to clarify the application, did not expand the scope of the application as originally noticed, and did not change the staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on December 10, 2002 (67 FR 75874).

### 1.1 Proposed License Amendment

The proposed change would revise the completion time (CT) of Required Action A.1 of TS 3.8.7, "Inverters–Operating," from the current 24 hours to 7 days for one inoperable instrument bus inverter. The licensee stated that the proposed change provides greater operational flexibility in the scheduling and performance of online maintenance of an instrument bus inverter. The licensee further stated that the proposed change would improve instrument bus availability during shutdown modes or conditions and possibly avert an unplanned shutdown in the event that an inoperable inverter needs a longer maintenance or repair interval than currently allowed by the TS for Byron and Braidwood Stations, Units 1 and 2 (24 hours). In addition, the licensee noted that the current CT for restoration of an inoperable instrument bus inverter is insufficient to support the required maintenance and post-maintenance testing windows.

ENCLOSURE

## 2.0 REGULATORY EVALUATION

The staff finds that the licensee in Attachment A, Section F of its submittal identified some of the applicable regulatory requirements. The regulatory requirements which the staff considered in its review are listed below:

Section 50.36 of Title 10 of the *Code of Federal Regulations* (10 CFR) requires that all operating licenses for nuclear reactors must include the TS for the subject plant. Limiting conditions for operation (LCO), along with required CTs, are specified for each system that is included in the TS. The licensee submitted risk-informed information to support the proposed license amendment.

Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," dated November 2002, and RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," dated August 1998, provide specific guidance and acceptance criteria for assessing the nature and impact of licensing-basis changes, including proposed permanent TS changes in allowed outage times (AOTs) or CTs by considering engineering issues and applying risk insights. In addition, Chapter 16.1, "Risk-Informed Decisionmaking: Technical Specifications," of the Nuclear Regulatory Commission (NRC, the Commission) Standard Review Plan (SRP), NUREG-0800, describes acceptable approaches and guidelines in reviewing proposed TS modifications, including CT changes as part of risk-informed decisionmaking.

The Maintenance Rule, 10 CFR 50.65(a)(4), requires licensees to perform assessments before conducting maintenance activities on structures, systems, and components (SSCs) that are covered by the Maintenance Rule, and to manage any increase in risk that may result from the proposed activities. RG 1.182, "Assessing and Managing Risk Before Maintenance Activities at Nuclear Power Plants," dated May 2000, provides guidance on implementing the provisions of 10 CFR 50.65(a)(4). RG 1.174, Section 2.3, Element 3, "Define Implementation and Monitoring Program," states that monitoring that is in conformance with the Maintenance Rule can be used to satisfy Element 3 when the monitoring performed under the Maintenance Rule is sufficient for the SSCs affected by the risk-informed application.

General Design Criterion (GDC) 17, "Electric power systems," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50 requires, in part, that nuclear power plants have onsite and offsite electric power systems to permit the functioning of SSCs that are important to safety. The onsite power system is required to have sufficient independence, redundancy, and testability to perform its safety function, assuming a single failure. The offsite power system is required to supply power to the onsite electric distribution system by two physically independent circuits that are designed and located so as to minimize, to the extent practical, the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions. In addition, this criterion requires provisions to minimize the probability of losing electric power from the remaining electric power supplies as a result of loss of power from the unit, the offsite transmission network, or the onsite power supplies.

GDC-18, "Inspection and testing of electric power systems," requires that electric power systems that are important to safety must be designed to permit appropriate periodic inspection and testing.

The TS for Byron and Braidwood Stations, Units 1 and 2, currently require that an instrument bus must be re-energized within 2 hours (TS 3.8.9, "Distribution Systems-Operating") and an inoperable inverter must be restored within a CT of 24 hours (TS 3.8.7). The proposed license amendment would change the CT for restoring an inoperable inverter from 24 hours to 7 days.

## 3.0 TECHNICAL EVALUATION

### 3.1 Deterministic Evaluation

The purpose of the vital AC power system at Byron and Braidwood Stations, Units 1 and 2, is to provide a highly reliable source of 120 VAC power for safety-related instruments, logic, displays and equipment, including the reactor protection system (RPS) and engineered safety features actuation system (ESFAS). Each unit is equipped with four AC instrument buses, which are independently fed from an associated 125 VDC to 120 VAC single-phase AC static inverter. The inverters are normally powered from an AC source/rectifier or from the associated 125 VDC batteries. Should the 4.16 kV safety buses de-energize, the inverter would be automatically fed from its associated station battery, which provides an uninterruptible power source for the AC instrument buses. The AC instrument bus inverters are the preferred source of power for the AC instrument buses because of the stability and reliability they provide.

In addition, each instrument bus has a dedicated, safety-related interruptible constant voltage transformer (CVT), which is fed from the 480 VAC ESF bus that supplies power to the instrument bus in the event that an inverter fails or is down for maintenance. Upon loss of an inverter, the instrument bus is manually transferred to its CVT, which is an interruptible source of power. When the AC instrument bus is powered from its CVT, the bus and associated instrumentation and controls for the RPS and ESFAS rely on interruptible AC electrical sources (either offsite or onsite). A loss-of-offsite power (LOOP) with an inoperable instrument bus inverter (i.e., instrument bus being powered by its CVT) will result in a loss of power to the associated instrument bus.

The licensee in their submittal provided the following evaluation for extending the inverter CT:

> Since the CVT is powered from a 480 VAC ESF bus, upon a LOOP with an inoperable instrument bus inverter, power would be restored to the affected instrument bus once the associated emergency diesel generator (EDG) re-energized the 480 VAC ESF bus, and all instruments supplied by the instrument bus would be restored with no adverse impact to the units because no other instrument channels in the opposite train would be expected to be inoperable or in a tripped condition during this time, with the exception of routine surveillance. In order for the instrument bus to remain de-energized, the associated EDG would have to fail, there would have to be a failure to re-energize the 480 VAC ESF bus powering the CVT, or the CVT would have to fail to energize the instrument bus. In the event that the EDG failed (i.e., failed to re-energize the 480 VAC bus), power could still be established to the 480 VAC ESF bus by powering the 4 kV ESF bus from the opposite unit 4 kV ESF bus cross-tie breaker. In the event of a failure to re-energize the 480 VAC ESF bus or a CVT failure, the most significant impact on the unit is the failure of one train of ESF equipment to actuate. In this condition, the redundant train of ESF equipment will automatically actuate to mitigate the accident, and the affected unit would

remain within the bounds of the accident analyses. Since the probability of these events occurring simultaneously during a planned maintenance window is low, there is minimal safety impact due to the requested extended CT.

The initial conditions of the design-basis accident and transient analyses in the Byron and Braidwood Stations updated final safety analysis report, Chapter 6, "Engineered Safety Features," and Chapter 15, "Accident Analyses," assume ESF systems are operable. The AC instrument bus inverters are designed to provide the required capacity, capability, redundancy, and reliability to ensure the availability of necessary power to the RPS and ESFAS instrumentation and controls so that the fuel, reactor coolant system, and containment design limits are not exceeded.

The operability of the AC instrument bus inverters is consistent with the initial assumptions of the accident analyses and is based on meeting the design basis of the plants. This includes maintaining required AC instrument buses operable during accident conditions in the event of an assumed loss of all offsite AC power or all onsite AC power sources, and a worst case single failure.

Operable AC instrument bus inverters require the associated instrument bus to be powered by the instrument bus inverter with output voltage within tolerances, and power input to the instrument bus inverter from the associated 125 VDC battery. The power supply may be from an AC source via rectifier as long as the battery is connected as the uninterruptible power supply.

The staff concurs with the licensee's analysis in that there is reasonable assurance that the AC instrument bus will remain energized when an instrument bus inverter is removed from service, provided some compensatory measures, as described below, are taken when the instrument bus inverter is out-of-service. The compensatory measures arise from the staff's concern that with an inverter unavailable and the instrument bus being powered from the CVT, instrument power from that train is dependent on power from the EDG following a LOOP event. Entry into the extended inverter CT concurrent with EDG routine maintenance could have an impact on plant safety following a LOOP event in that a LOOP event could leave the instrument bus without power. In addition, an entry into the extended inverter CT, concurrent with planned maintenance on another RPS/ESFAS channel, could potentially result in that channel being in a tripped condition.

Because of those concerns, the staff requested the licensee to provide a description of compensatory measures that would be taken before the instrument bus inverter is taken out for service. In response to the staff's request, in letter dated June 20, 2003, the licensee stated that it recognizes that with an inverter unavailable and the instrument bus being powered by the CVT, instrument power for that train is dependent on power from the EDG following a LOOP event. Therefore, the licensee stated that the following compensatory actions will be taken when an instrument bus inverter is unavailable:

1. Entry into the extended inverter CT will not be planned concurrent with EDG maintenance.

2. Entry into the extended inverter CT will not be planned concurrent with planned maintenance on another RPS/ESFAS channel that could result in that channel being in a tripped condition.

In order to provide appropriate regulatory control over these compensatory actions, the amendment requires the licensee to describe these two compensatory actions in the Updated Final Safety Analysis Report (UFSAR). It also requires that these actions will be reflected in the next update of the UFSAR submitted to the NRC pursuant to 10 CFR 50.71(e). As a consequence, should the licensee seek to change these compensatory actions, the licensee would be required to evaluate the proposed changes in accordance with 10 CFR 50.59. The provisions of Section 50.59 provide adequate regulatory control over these two compensatory actions.

Regulatory Guide (RG) 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," states, in part, that "the change may be requested to reduce the unnecessary burdens in complying with current TS requirements, based on the operating history of the plant or industry in general." The staff requested the licensee to provide additional information regarding the licensee's history of performance experience with AC instrument bus inverters to date. In a letter dated June 20, 2003, the licensee responded that historically, the inverters at Byron and Braidwood have been out-of-service for approximately 2 to 3 days during outages for maintenance activities. The licensee also indicated that, as the inverters age, it is expected that additional maintenance activities will be needed, with major rebuilds of each inverter that would take a maximum of 4 to 7 days to perform corrective maintenance. In the initial request, the licensee requested the staff's approval of increasing the CT for instrument bus inverter inoperable for 14 days. The staff raised concerns regarding the requested 14 day CT. Following a number of discussions with the staff, the licensee determined that increasing the CT required for Action A.1 of TS 3.8.7 to 7 days would address the needs for Byron and Braidwood stations. Accordingly, the licensee revised the initial request to increase the CT from the current 24 hours to 7 days.

The staff examined the information provided by the licensee and the basis used to establish the current 24 hour limit for the completion time for repairing an inverter given the additional risk to which the unit is exposed because of the inverter inoperability. As discussed above, the licensee is requesting additional time in order to perform predictive and preventative maintenance activities during power operation. Industry operating experience supports the proposed change to a 7-day AOT for an inoperable instrument bus inverter. Therefore, the 7-day AOT reflects a reasonable time to effect restoration of an instrument bus inverter to operable status. Based on these considerations and the compensatory measures previously described, the staff concludes that an AOT extension from 24 hours to 7 days for an inoperable instrument bus inverter is acceptable.

3.2 Probabilistic Evaluation

The staff reviewed the submittal using the three-tiered approach referenced in RG 1.174, RG 1.177, and SRP Chapter 16.1. The first tier of the three-tiered approach includes assessing the risk impact of the proposed change in accordance with acceptance guidelines consistent with the Commission's Safety Goal Policy Statement, as documented in RG 1.174 and RG 1.177. Under the first tier, the staff assesses the impact on operational plant risk on the basis of the change in core damage frequency ($\Delta$CDF) and change in large early release frequency ($\Delta$LERF). In addition, under the first tier, the staff evaluates plant risk while

equipment covered by the proposed CT is out of service, as represented by the incremental conditional core damage probability (ICCDP) and incremental conditional large early release probability (ICLERP). Additionally, the staff pursuant to tier 1 should establish that the quality of the probabilistic risk assessment (PRA) is compatible with the safety implications of the proposed TS change and that the scope and level of the PRA are adequate to fully support the evaluation of the TS change. Cumulative risk of the requested TS change in light of past applications or additional applications under review are also considered along with uncertainty and sensitivity analysis with respect to the assumptions related to the proposed TS change.

The second tier involves identifying potential high-risk configurations that may exist if other equipment or systems (in addition to the equipment associated with the proposed change) were also taken out of service simultaneously, or subjected to concurrent testing. The purpose of the tier 2 evaluation is to ensure that appropriate restrictions will be in place to prevent the occurrence of such high-risk configurations.

The third tier establishes a risk management program for the overall configuration and confirms that risk insights are incorporated into the decisionmaking process before taking equipment out of service prior to or during the CT. The third tier provides additional assurance over the second tier by identifying risk-significant configurations that may be encountered over extended periods of plant operation. Licensees can implement the overall configuration risk management program (as referenced in RG 1.177) through application of 10 CFR 50.65(a)(4). Specifically, the rule requires that, before performing any maintenance activity, the licensee must assess and manage the potential risk increase that may result from a proposed maintenance activity. The following subsections describe each tier and the associated reviews.

3.2.1 Tier 1: PRA Capability and Insights

PRA Quality

The objective of the PRA quality review is to determine whether the PRAs for Byron and Braidwood Stations, Units 1 and 2, that were used in evaluating the proposed instrument bus inverter CT extension were of sufficient scope and detail. The staff reviewed the information provided in the proposed license amendment request, as well as the findings of the individual plant examination (IPE) for Byron and Braidwood Stations, Units 1 and 2, that the licensee submitted to the NRC on April 28, 1994, and June 30, 1994, respectively.

As a result of a request for additional information (RAI), the licensee subsequently submitted modified IPEs on March 27, 1997, for both stations. The NRC accepted the modified IPE for Byron Station by letter dated December 3, 1997, and for Braidwood Station by letter dated October 27, 1997, and noted that both IPEs were complete with regard to the information requested by Generic Letter (GL) 88-20, “Individual Plant Examination for Severe Accident Vulnerabilities–10 CFR 50.54(f),” dated November 23, 1988. One feature noted in the IPE review for both Byron and Braidwood Stations and applicable to the licensee’s proposed 14-day CT for the instrument bus inverters involved the cross-tie capability of the emergency AC buses. The principal insight stated in the review was that there are other situations for which the cross-tie is valuable (i.e., one bus de-energized and equipment on the other bus failed). The current PRA models for Byron and Braidwood Stations, Units 1 and 2, credit the cross-tie capability, which reduces the average CDF contribution from LOOP sequences (compared to the IPEs).

The staff reviewed the individual plant examination of external events (IPEEEs) for Units 1 and 2 of the Byron and Braidwood Stations with particular focus on information concerning the proposed instrument bus inverter CT. The licensee submitted the IPEEEs for Byron and Braidwood Stations on December 23, 1996, and June 27, 1997, respectively. The NRC accepted both IPEEEs by letters dated May 30, 2001. The staff concluded that the IPEEEs for both stations were complete with regard to the information requested by GL 88-20, and the IPEEE results were reasonable given the design, history, and operation of the plants. The staff noted the following observations as part of the IPEEE review:

- The staff evaluation report stated that for the seismic IPEEE analysis, both Byron and Braidwood stations are categorized as 0.3g focused-scope plants. The licensee's IPEEE safe shutdown equipment list identifying equipment and components was developed using the seismic margin assessment methodology developed by the Electric Power Research Institute. The licensee reported that each plant has a high confidence of low probability of failure of 0.3g or greater, because all equipment items were screened out for the review level earthquake of 0.3g, and all anchorage capacities of equipment exceeded 0.3g. Since the licensee used a seismic margin assessment methodology, no quantitative estimate of CDF contribution was provided, and the licensee did not define or identify any vulnerabilities in the IPEEE. An improvement documented from the IPEEE evaluations related to the instrument bus inverter CT request for both stations involved equipment that was moved or secured to prevent miscellaneous interactions. The list of affected equipment included switchgear, batteries, and inverters. Based on the above, the proposed inverter CT has negligible impact on seismic risk.

- The IPEEE fire risk assessment for both Byron and Braidwood Stations did not identify any potential vulnerabilities to fire risk scoping study issues and did not identify any fire related improvements. The majority of fire zones were screened out, but a few unscreened fire zones were postulated to produce a LOOP event which could impact the maintenance of the instrument bus inverter. For this to occur, the licensee stated that the fire would also have to fail the offsite power circuits and the remaining engineered safety feature (ESF) power division. The licensee stated that the probability of this combination of failures was judged to be insignificant. (Below the PRA quantification truncation limit of 1.0E-10/year). Thus, the proposed change in inverter CT should have a minimal effect on plant fire risk.

- For the IPEEE analysis for high winds, flood, and other (HFO) events, the licensee screened out HFO events. The licensee further determined that the impacts on CDF attributable to those events were insignificant for both stations and found no vulnerabilities with respect to HFO events. Therefore, HFO events are expected to have a negligible impact on the proposed 14-day instrument inverter CT.

The licensee stated that the current PRAs for Units 1 and 2 of Byron and Braidwood Stations were prepared by making major upgrades and updates to the original modified IPEs. The licensee also stated that aspects of the PRAs that were potentially sensitive to changes in inverter maintenance unavailability were adequate for the evaluation of the proposed inverter CTs. The PRAs included a model of the ESFAS and analysis of instrument bus inverter failure rates, maintenance unavailabilities, and common cause failure probabilities. Specific additions included in the PRA updates related to the proposed inverter CT extension were noted for

inverter common cause, plant-specific inverter failure rates, and the incorporation of detailed RPS and ESFAS models. The maintenance of the PRAs for both stations is controlled through established plant procedures.

The Byron PRA model underwent an industry peer review certification process using the Westinghouse Owners Group Peer Review Certification Guidelines in July 2000. The peer review for the Braidwood Station PRA was performed in August 1999. The licensee stated that a team of independent PRA experts from U.S. nuclear utility PRA groups and PRA consultant organizations carried out the peer review certifications. The licensee provided a summary of the peer review findings, observations, and dispositions that were applicable to the inverter CT request. The summary indicated that the facts and observations relevant to the proposed extended inverter CT were dispositioned and should not impact the implementation of the proposed vital bus inverter CT of 14 days.

Based on the above discussion, the staff concludes that the licensee adequately addressed the issue of PRA quality, and the PRAs are of sufficient scope and detail to estimate the risk measures associated with the proposed instrument bus inverter 14-day CT.

Cumulative Risk

The licensee evaluated the proposed instrument bus inverter CTs impact on previous submittals, including the risk-informed extended EDG CT submittal. No impact was noted for previous submittals. In addition, the licensee's review indicated that the EDG extended CT ΔCDF, ΔLERF, ΔICCDP, and ΔICLERP conclusions remain bounding, even considering the proposed inverter CT extensions.

The previous risk-informed In-Service Inspection program submittal conclusions also are not impacted by the proposed 14-day instrument bus inverter CT extension.

PRA Results

One approach to demonstrate that the risk impact of the proposed change is acceptable is to show that the licensing basis meets the key principles set forth in RG 1.174 for the proposed change. One of these principles is to show that when the proposed change results in an increase in CDF or risk, the increased risk should be small. In addition, the impact of the proposed change should be monitored using performance measurement strategies. RG 1.174 and RG 1.177 provide acceptance guidelines for meeting the above principles. Specifically, those guidelines include the change in ΔCDF, ΔLERF, ICCDP, and ICLERP. The risk metrics ICCDP and ICLERP suggested by RG 1.177 are used in addition to the metrics outlined in RG 1.174 for the evaluation of CTs because CTs are entered infrequently and are temporary in nature.

Based on the information provided by the licensee and assuming that the proposed CT of 14 days is used once per inverter per fuel cycle, the licensee's results for ΔCDF, ΔLERF, ICCDP, and ICLERP show a small change in risk for the proposed 14-day CT. Based on the response to the staff's RAI, the worst case inverter provided an estimated ΔCDF of 1.4E-7/year with an estimated ICCDP of 5.35E-9. The Level 2 analysis estimates for ΔLERF and ICLERP for the proposed 14-day instrument bus inverter CT were developed using the methodology in NUREG/CR-6595 entitled, "An Approach for Estimating the Frequencies of Various

Containment Failure Modes and Bypass Events," dated January 1999. The corresponding estimates of ΔLERF were 1.22E-8/year with an ICLERP of 4.69E-10. A comparison of the risk impacts for Units 1 and 2 of Byron and Braidwood Stations shows that the increases in ΔCDF and ΔLERF are within the RG 1.174 acceptance guideline of less than 1.0E-6 and 1.0E-7, respectively. The values for ICCDP and ICLERP are also within the RG 1.177 guidelines of less than 5.0E-7 and 5.0E-8, respectively.

PRA Uncertainty

As discussed in RG 1.174 and NUREG/CR-6141, "Handbook of Methods for Risk-Based Analyses of Technical Specifications," the licensee can perform sensitivity studies to provide additional insights into the uncertainties related to the proposed CT extension and demonstrate compliance with the guidelines and evaluate uncertainties related to modeling and completeness issues. The licensee's analysis indicated that the limiting case for the proposed inverter CT extension was the unavailability of the Braidwood Station Unit 2 inverter 214. The licensee stated that the risk increase is dominated by operator action associated with opening valves following a loss of 120 VAC power. The licensee performed a sensitivity study that assumed that the operator action would fail when the inverter was unavailable. The results of the analysis showed that ICCDP and ICLERP were the limiting values, but both were well within the acceptance guidelines for ICCDP and ICLERP given in RG 1.177.

In the evaluation of an extended inverter CT, the licensee did not adjust the common cause factors in the analysis. Instead, the licensee referenced a quantitative risk assessment performed as part of the Exelon Online Work Control procedure. Common cause failures are considered by work control procedures when the associated CT for the component is risk informed or where common cause has shown to be a significant contributor to risk. Although common cause factors were not adjusted in the inverter CT analysis, there is significant margin to the acceptance criteria given in RG 1.174 and RG 1.177 such that the adjustment of common cause factors would not be expected to significantly impact the licensee's analysis conclusions.

3.2.2 Tier 2 Avoidance of Risk-Significant Plant Configuration

The licensee evaluated the change in risk achievement worth (RAW) values for equipment modeled in the Byron and Braidwood Station PRA models. The licensee's review concluded that the maximum increase in RAW for individual components was approximately 7 percent and 9 percent for Units 1 and 2 of Byron and Braidwood Stations, respectively. No RAW values that were originally less than 2 exceeded this threshold value as a result of the proposed CT change. The licensee's evaluation also showed that there were no components that would result in a significant change in risk or require any maintenance restrictions when out of service concurrent with the inverter and consistent with the TS. Based on the licensee's analysis, no Tier 2 issues were identified and no compensatory measures were necessary with the proposed CT change to 14 days. However, LCO 3.0.3 must be entered if one or more additional inverters are inoperable. Increases in risk that may occur as a result of combinations of equipment out of service are to be managed under the licensee's configuration risk management program.

3.2.3 Tier 3 Risk-Informed Configuration Risk Management

RG 1.177 states that a licensee should develop a program to ensure that the risk impact of out-of-service equipment is appropriately evaluated before maintenance activity is performed. Based on the licensee's response to the staff's RAI, use of the full 14 day CT will be minimal. This is an assumed value for the risk assessment purposes.

The inverters are considered risk-significant, and their reliability and unavailability is monitored under 10 CFR 50.65(a)(2) to ensure that they meet their performance criterion. The licensee stated that inverter reliability and unavailability will be monitored to confirm that the extended inverter CT has not degraded inverter performance over time. Scheduling of maintenance and surveillance testing with an inverter out-of-service and its associated vital bus powered from the voltage-regulating transformer will be evaluated and controlled according to 10 CFR 50.65(a)(4).

Units 1 and 2 of both Byron and Braidwood Stations have implemented online work control procedures which call for an integrated review to identify risk-significant plant configurations prior to and during maintenance activities. Pursuant to its work control procedure, the licensee assesses risk based on the following evaluations:

- Maintenance activities that affect redundant and diverse SSCs that provide backup for the same function are minimized.

- The potential for planned activities to cause a plant transient is reviewed, and work on SSCs that are needed to mitigate the transient is avoided.

- Work is not scheduled if it is highly likely to exceed a TS CT requiring plant shutdown. For activities that are expected to exceed 50 percent of a TS AOT, compensatory measures and contingency plans are considered to minimize SSC unavailability and maximize SSC reliability.

- For Maintenance Rule high-risk-significant SSCs, the impact of the planned activity on the unavailability performance is evaluated.

- A quantitative risk assessment is performed to ensure that the activity does not pose an unacceptable risk. The risk results are classified by color, based on the increased risk of the activity. The quantitative evaluation uses a complete requantification of the PRA model for each configuration analyzed. The licensee currently uses the ORAM-Sentinel software package to perform the risk evaluations.

The licensee's online work control procedure is applicable to both planned maintenance activities and emergent conditions during plant operations. The licensee stated that the procedure considers equipment unavailability, operations, and weather conditions.

The staff finds that the licensee's program to control risk is capable of adequately assessing the activities being performed to ensure that high-risk plant configurations do not occur and/or compensatory actions are implemented if a high-risk plant configuration or condition should occur. As such, the licensee's program meets RG 1.177.

## 4.0 SUMMARY

The licensee originally requested a 14-day CT for the inverters out of service at Byron and Braidwood stations, and prepared its PRA based on a 14 day CT. While the licensee later revised its request to provide for a 7-day CT, there was no need to revise the PRA as the original analysis was conservative with respect to a 7-day CT. The staff, therefore, has applied the risk insights for a 14-day CT which are summarized below, to a 7-day CT.

The risk impact of the proposed 14-day CT for the inverters at Units 1 and 2 of the Byron and Braidwood Stations, as estimated by ΔCDF, ΔLERF, ICCDP, and ICLERP, is consistent with the acceptance guidelines specified in RG 1.174, RG 1.177, and staff guidance outlined in Chapter 16.1, "Risk-Informed Decisionmaking: Technical Specifications," of NUREG-0800. The staff finds that the risk analysis methodology and approach used by the licensee to estimate the risk impacts were reasonable and of sufficient quality. The Tier 2 evaluation did not identify any risk-significant plant equipment outage configurations needing TS, procedure, or compensatory measures, although the staff's deterministic evaluation indicated the need for limits on work on the EDGs and RPS/ESFAS channels when inverter maintenance is scheduled. The licensee's configuration risk management program under 10 CFR 50.65(a)(4) manages plant risk when an instrument bus inverter is taken out of service. Instrument bus inverter reliability and availability will also be monitored and assessed under the Maintenance Rule to confirm that performance continues to be consistent with the assumptions used in the analysis for extended inverter CTs.

Risk-informed license amendment requests are evaluated by the staff using traditional engineering analyses (deterministic approach) as well as consideration of the risk associated with any proposed change (PRA). The use of PRA technology should be used in a manner that complements the NRC's deterministic approach and supports the NRC's traditional defense-in-depth philosophy. The results of the PRA support the staff's deterministic evaluation of the requested 7-day inverter CT.

For the reasons set forth above, an increase in the CT for an inoperable instrument inverter from 24 hours to 7 days is acceptable.

## 5.0 STATE CONSULTATION

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

## 6.0 ENVIRONMENTAL CONSIDERATION

The amendments change 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 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 (67 FR 75874). 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.

## 7.0 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.

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