September 22, 2003

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

SUBJECT: BYRON STATION, UNITS 1 AND 2, ISSUANCE OF AMENDMENTS (TAC NOS. MB4853 and MB4854)

Dear Mr. Skolds:

The U.S. Nuclear Regulatory Commission (Commission) has issued the enclosed Amendment No. 134 to Facility Operating License No. NPF-37 and Amendment No. 134 to 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 19, 2002 and as supplemented by your letters dated September 9, 2002, January 3, and July 18, 2003.

The amendments would revise the surveillance frequency of the containment spray system nozzles from 10 years to "Following maintenance that could result in nozzle blockage, OR Following fluid flow through the nozzles."

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

Enclosures:
1. Amendment No. 134 to NPF-37
2. Amendment No. 134 to NPF-66
3. Safety Evaluation

cc w/encls: See next page

September 22, 2003

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**ADAMS Accession Number: ML03 (Package)**
**ADAMS Accession Number: ML032470096 (Amendment)**
**ADAMS Accession Number: ML03 (Technical Specifications)**

| OFFICE | PM:LPD3-2 | PM:LPD3-2 | LA:LPD3-2 | SC:SPSB | SC:RORP | OGC | SC:LPD3-2 |
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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. 134
License No. NPF-37

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 19, 2002, as supplemented by letters dated September 9, 2002, January 3, and July 18, 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. 134 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.

FOR THE NUCLEAR REGULATORY COMMISSION

***/RA/***

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: September 22, 2003

EXELON GENERATION COMPANY, LLC

DOCKET NO. STN 50-455

BYRON STATION, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 134
License No. NPF-66

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 19, 2002, as supplemented by letters dated September 9, 2002, January 3, and July 18, 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. 134 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.

FOR THE NUCLEAR REGULATORY COMMISSION

***/RA/***

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: September 22, 2003

ATTACHMENT TO LICENSE AMENDMENT NOS. 134 AND 134

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

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

Replace the following pages of the Appendix “A” Technical Specifications with the attached pages. The revised pages are identified by amendment number and contain marginal lines indicating the area of change.

| Remove Pages | Insert Pages |
| --- | --- |
| 3.6.6-3 | 3.6.6-3 |

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 134 TO FACILITY OPERATING LICENSE NO. NPF-37

AND AMENDMENT NO. 134 TO FACILITY OPERATING LICENSE NO. NPF-66

EXELON GENERATION COMPANY, LLC

BYRON STATION, UNIT NOS. 1 AND 2

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

## 1.0 INTRODUCTION

By application dated April 19, 2002, as supplemented by letters dated September 9, 2002, January 3, and July 18, 2003, Exelon Generating Company, LLC, the licensee, requested a revision to the Technical Specifications (TS) for the Byron Station, Units 1 and 2 (Byron) and Braidwood Station (Braidwood) Units 1 and 2. The supplements dated September 9, 2002, January 3, and July 18, 2003, provided additional information that clarified 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 June 11, 2002 (67 FR 40023).

The revision changes the testing frequency for the containment spray nozzle blockage test required by TS Section 3.6.6, "Containment Spray and Cooling Systems," Surveillance Requirement (SR) 3.6.6.8. The licensee proposes to revise the frequency for this test from "10 years" to "Following maintenance that could result in nozzle blockage OR Following fluid flow through the nozzles."

A number of foreign material incidents at Byron and Braidwood raised NRC staff concerns about the quality of the licensee's foreign material exclusion (FME) programs at these plants. This program is important with respect to the proposed technical specification change because a high quality, well-performed FME program provides assurance that no material can enter the containment spray system and block flow through the containment spray nozzles which are located high in the containment domes of both units. The licensee responded to the staff's questions and concerns with letters dated September 9, 2002, and January 3, 2003. These letters provided detailed accounts of the recent history of the FME programs at Byron and Braidwood and the steps the licensee has taken and will take to improve these programs. Because of the more benign situation at Braidwood, as indicated by the licensee's responses, the staff approved the proposed TS change in license amendment 126 for Braidwood Units 1 and 2, dated February 20, 2003. A July 18, 2003, licensee letter provides additional information related only to Byron foreign material exclusion issues.

## 2.0 REGULATORY EVALUATION

Pursuant to Part 50 of Title 10 of the *Code of Federal Regulations* (10 CFR)Appendix A contains General Design Criteria (GDC) for nuclear power reactors. In particular, General Design Criterion 40 requires testing of the Containment Heat Removal System. The containment spray system is included in the containment heat removal system.

The Westinghouse Standard Technical Specifications, Volume 1, Revision 2, dated June 2001, NUREG-1431, Surveillance Requirement (SR) 3.6.6.A.8 specifies a testing frequency of 10 years for the nozzle blockage test. While this is not a requirement, it has been the staff's and industry's current judgment of an acceptable frequency for this test and this is the frequency currently required by the Byron TS.

## 3.0 TECHNICAL EVALUATION

The Byron Station containment heat removal system consists of the reactor containment fan cooler system and the containment spray system. The containment spray system actuates automatically (on a High-3 containment pressure signal) or remote-manually from the control room. The containment spray system has several safety functions. It removes heat from the containment atmosphere following a design basis loss-of-coolant accident (LOCA) or main steam line break accident inside containment. This reduces the driving force for containment leakage and ensures the containment structural limits are not exceeded. The containment spray system also removes iodine and other radionuclides from the containment atmosphere following a LOCA.

The containment spray system is described in Section 6.5.2, "Containment Spray Systems," of the Byron/Braidwood Updated Final Safety Analysis Report (UFSAR). It consists of two independent 100% capacity trains with no common headers. The nozzles are made of corrosion resistant stainless steel and are of a swirl chamber design without any internal parts which could cause clogging. The system includes six spray headers, each with a different number of nozzles ranging from 39 nozzles in the Ring Header 1 to 120 nozzles in Ring Header 5. The riser pipes are 10 inches in diameter. The minimum area flow path in the containment spray system is the spray nozzle.

In the event of a High-3 containment pressure signal, the CS007A/B, CS010A/B and CS019A/B containment spray system valves will open immediately, if they are not already open. The CS007A/B valves are motor-operated containment isolation valves outside containment. They are the last motor-operated valves from the containment spray pumps before the riser piping to the spray headers. The CS010A/B valves are motor-operated valves in the lines from the containment spray pumps to the eductors. The CS019A/B valves are in the line from the NaOH tank to the eductors. The CS008A/B check valves are the containment isolation valves located inside containment.

Technical Specification SR 3.6.6.8 currently requires a test every 10 years to ensure that the containment spray system nozzles are not obstructed. The test is currently done, according to the licensee's April 19, 2002, letter, with the spray inlet valves closed. Hot air is blown through test connections downstream of the spray inlet valves and thermographs confirm flow from each nozzle. The current technical specification bases discuss the use of flowing low pressure air or smoke to detect blockage.

One postulated mode of blockage of the spray headers and nozzles is solid boric acid accumulation in the spray lines or nozzles due to evaporated borated water. The spray headers are maintained dry and are isolated from the water in the containment spray system by the normally closed containment isolation valves, CS007A/B. Since these valves are containment isolation valves, they are subject to local leakage rate testing in accordance with 10 CFR Part 50, Appendix J. In addition, the height of the water in the header upstream of the containment isolation valves corresponds to the water level in the refueling water storage tank (RWST), which is the initial borated water source for the containment spray system. Therefore, borated water cannot reach the spray nozzles without a containment spray system actuation.

Another possible blockage source is debris (foreign material) in the system. The licensee's April 19, 2002, letter states that "The current foreign material exclusion practices have been reviewed and judged sufficient to provide high confidence that debris will not be introduced during times when the CS [containment spray] system boundary is breached." The staff carefully reviewed this statement and requested additional supporting information from the licensee which was provided in letters dated September 9, 2002, January 3, and July 18, 2003.

Performance History at Byron

The licensee's September 9, 2002, and January 3, 2003 letters describe the past testing done to ensure that there is no debris in the system. As part of pre-operational testing, the containment spray system was tested at full flow from the refueling water storage tank (RWST) to the reactor cavity with a blind flange installed downstream of a tee connection in the discharge line between the vertical riser and the nozzles and a temporary line to the reactor cavity. The licensee then removed the blind flange and performed a pre-operational nozzle flow test using air. The licensee states in the September 9, 2002, letter that air flow was verified coming out of each nozzle. Subsequently, each unit was tested by blowing hot air through the risers. Unit 1 was tested in October 1991 and Unit 2 was tested in March 1992. A thermograph of each nozzle confirmed that there was no blockage. These were the last spray nozzle surveillance tests conducted at Byron.

License Amendment 82, dated April 10, 1996, approved the change to a ten-year containment spray nozzle flow surveillance test.

The licensee stated that since the last containment spray nozzle surveillance tests, there have been several system openings between the CS007A/B (outside) containment isolation valves and the spray nozzles. These consisted of:

- Replacement of a spectacle flange with a blind flange on the vertical riser of the containment spray header approximately 110 feet below the ring header and spray nozzles
- Local leak rate test (LLRT) of the motor operated containment isolation valves CS007A/B and CS008A/B containment isolation check valves
- Inspection of the CS008A/B containment isolation check valves
- Partial stroke test of the CS008A/B valves

Since the time of the last containment spray nozzle surveillance test in 1991 and 1992 until 2000, temporary covers were installed once the check valves CS008A/B were removed for inspection or rebuilding. When the valves were ready to be re-installed, the temporary covers were removed and a hold point was required for a Quality Control (QC) inspector to perform a cleanliness inspection. From 2000 to the present, the licensee states that, in addition to the above, foreign material exclusion requirements for the work area were addressed in pre-job briefings and inspections for system cleanliness are performed in accordance with the licensee's foreign material exclusion program. As stated in the letter from Exelon to NRC, dated July 18, 2003, the licensee reviewed work packages associated with replacing the spectacle flange from 1991 to the present and found that the proper checks were made on the procedures indicating that "internal cleanliness was maintained throughout the entire job." The licensee states that this indicates that the system was clear of any foreign material at the time the notation was made. Based on the licensee's records of all breaches of the containment spray system downstream of the CS007A/B containment isolation valves, the staff has confidence that the system has remained free of foreign material since the last spray nozzle surveillance tests.

In spite of the confidence in the cleanliness of the containment spray system downstream of containment isolation valves CS007A/B, there have been significant issues with the licensee's FME program in general. The licensee's January 3, 2003, letter identified 65 FME events between January 2001 and July 2002. None of these events involved the containment spray system. However, the licensee pointed out two previous incidents involving foreign material in the containment spray system. In January 1998, a turbine condenser tube cleaning brush was found lodged in the valve disc of the 1A eductor spray additive motor operated valve (1CS019A). In June 1999, a second turbine condenser cleaning brush was found in the 1C containment spray eductor test connection isolation valve. Both of these valves are upstream of the containment spray eductor. The second brush was not found immediately after the first brush was discovered because it was trapped between the top of the valve disc and the valve bonnet. The licensee concluded that due to the unique location of this brush it could not have migrated into the active portion of the containment spray system. The licensee hypothesizes that the brushes came from a hose used during the spray additive eductor flow verification surveillance test conducted in June 1997, which had previously been used for cleaning the turbine condenser. The licensee completed extensive containment spray system inspections due to these FME events, and concludes that there is high confidence that the Byron Station containment spray system is free of any foreign material. The details of these inspections are provided in the licensee's July 18, 2003 letter. NRC resident inspectors, as part of this review, conducted inspections of the licensee's work packages to ensure that no other foreign material was present. The licensee has included discussion of this event as part of Byron's FME training.

The surveillance under discussion would not have detected these brushes since it covers only the region downstream of the containment isolation valves and the brushes were upstream of the containment isolation valves.

The NRC staff asked the licensee to explain what steps would be taken to ensure that the FME program at Byron will be maintained at a level necessary to provide assurance that the containment spray nozzles will remain free from blockage during future maintenance or testing. The licensee's reply in the January 3, 2003, letter included the following corrective actions:

- Communicate roles and responsibilities listed in the licensee's foreign material exclusion procedure.

- Implement periodic assessments to check compliance with the requirements of the foreign material exclusion procedure.

- Fabricate, as necessary, portable foreign material exclusion (FME) carts to be used on job sites while performing work on open systems.

- Improve supervisory field presence to ensure that foreign material exclusion procedure requirements are being followed.

The licensee's July 18, 2003, letter listed additional steps which are more at the management and administrative level. The licensee established an FME "high impact team" to provide oversight and improve implementation. Some of the actions the high impact team has taken include presentation of expectations to plant personnel; development of enhanced training methods; procurement of enhanced FME tools; establishment of locations that provide ready access to FME tools; increased supervisory oversight to ensure that expectations are being met; establishment of FME followup reviews through self assessment and corrective action programs.

The staff considers these steps acceptable.

The licensee's July 18, 2003 letter addresses what steps would be taken if an FME issue were identified in the containment spray system that may impact nozzle performance. The licensee states that the actions would likely be similar to those taken in the 1998 and 1999 events involving the brushes in the containment spray system upstream of the containment isolation valves. An evaluation will determine if a re-performance of the containment spray nozzle surveillance test is warranted. The immediate actions and corrective actions would be tailored to the specific FME event. The licensee`further states:

> The station's corrective action program would be utilized to address a future FME issue. Upon identification of an issue, a condition report (CR) would be written. The CR would be screened by the operating shift manager for operability concerns and subsequently reviewed by the station's Management Review Committee (MRC). The MRC will ensure that appropriate follow-up action is taken for the resolution of the issue, e.g., completing an apparent cause evaluation or a formal root cause evaluation, and will concur with the priority assigned for completion of the evaluation. Corrective actions will be identified upon completion of the evaluation. In the case of an FME issue in the CS [containment spray] system, one of the potential corrective actions would be to perform the spray nozzle surveillance test. If a root cause evaluation is performed, the results would also be reviewed and approved by the MRC.

The staff finds these proposed actions to be acceptable.

With respect to flow through the nozzles, the licensee's April 19, 2002, letter states that there have been no containment spray system actuations at Byron. Therefore, blockage due to boron is not a concern.

The staff finds the proposed TS change to be acceptable for the following reasons: (1) it is unlikely that any foreign material has entered the containment spray system since the last surveillance test on each unit, (2) thorough inspection and flow testing was done of the containment spray system upstream of the containment isolation valves, and (3) the licensee has made reasonable efforts to improve the overall quality of the Byron FME program.

Industry Experience and Failure Mechanisms

Review of industry experience using the NRC's Sequence Coding and Search System for Licensee Event Reports indicates that spray systems of similar design are not susceptible to plugging. The staff reviewed industry experience and found that, with a few exceptions, once tested after construction, containment spray nozzles have not been subject to blockage. There have been several exceptions. In the case of one pressurized water reactor (PWR), a chemical added to the inner surface of a spray system pipe to eliminate corrosion detached and the loose material blocked some spray nozzles. Spray piping in PWRs, and Byron's in particular, is corrosion resistant; therefore, this failure mechanism is not applicable to Byron. The licensee for another PWR found debris, identified as construction debris, in the spray nozzle headers. The fraction of blockage was not significant and the sprays remained functional. The debris was found by visual observation, not by an air flow test.

A similar TS change for the Perry Nuclear Power Plant, Unit 1, was approved by Amendment 113 issued June 29, 2000, and for the Clinton Power Station, Unit 1, by Amendment 146 issued March 28, 2002.

## 3.1 Summary

As a result of reviewing the licensee's request to revise the testing frequency for the containment spray nozzles from "10 years" to "Following maintenance that could result in nozzle blockage OR Following fluid flow through the nozzles," and reviewing and assessing all the applicable information provided by the licensee, including information in the Byron UFSAR, and conducting inspections at Byron, the staff concludes that the design of the Byron containment spray systems, the past history of these spray systems, and the licensee's improved FME controls provide reasonable assurance that the potential for nozzle obstruction is acceptably low. The improved FME controls provide reasonable protection from the introduction of foreign materials into open piping during maintenance or testing and require post-maintenance verification of system cleanliness and freedom from foreign materials. In addition, review of industry-wide experience has not demonstrated any problem with the licensee's proposed change. Therefore, the staff finds the amendment request acceptable.

## 4.0 STATE CONSULTATION

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

## 5.0 ENVIRONMENTAL CONSIDERATION

The 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 40023). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

## 6.0 CONCLUSION

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

Principal Contributor: Richard Lobel

Date: September 22, 2003