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

June 29, 2016

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: BYRON STATION, UNIT NOS. 1 AND 2, AND BRAIDWOOD STATION, UNITS 1 AND 2 - REQUEST FOR USE OF ALTERNATIVE (CAC NOS. MF6079, MF6080, MF6081, AND MF6082)

Dear Mr. Hanson:

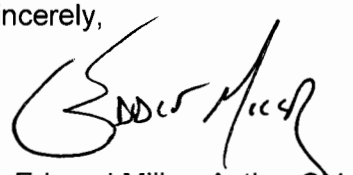
By letter dated April 6, 2015 (Agencywide Document and Management System (ADAMS) Accession No. ML15097A123), as supplemented by letters dated January 29, 2016 (ADAMS Accession No. ML16029A408), and April 11, 2016 (ADAMS Accession No. ML16102A375), Exelon Generation Company, LLC (the licensee) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for the use of alternatives to certain Institute of Electrical and Electronic Engineers (IEEE) Standard (Std,) 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations," guidance at Byron Station, Unit Nos. 1 and 2, and Braidwood Station, Units 1 and 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee requested to use the proposed alternative on the basis that the alternative provides an acceptable level of quality and safety.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation, that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(1). Specifically, the NRC staff has concluded the proposed alternative would provide an acceptable level of quality and safety without implementing the guidance of IEEE Std. 279-1971, Section 4.17, for single-failure criteria and manual system level initiation as they apply to the main steam isolation valve (MSIV) bypass valves. For each of the accident scenarios it has been demonstrated the existing application design of the MSIV bypass valves will have no impact on the consequences associated with the design basis accident scenarios. It is also concluded that the non-consistency with IEEE Std. 279-1971 does not affect the functional performance and reliability of the MSL isolation function. Therefore, the NRC staff authorizes the permanent use of the alternative at Byron Station, Unit Nos. 1 and 2, and Braidwood Station, Units 1 and 2

If you have any questions, please contact the Senior Project Manager, Joel S. Wiebe at 301-415-6606 or via e-mail at Joel.Wiebe@nrc.gov.

Sincerely,



G. Edward Miller, Acting Chief
Plant Licensing Branch 3-2
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

Enclosure:
Safety Evaluation

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ALTERNATIVE REGARDING

MAIN STEAM ISOLATION VALVE BYPASS VALVES

EXELON GENERATION COMPANY, LLC

BYRON STATION, UNIT NOS. 1 AND 2, AND BRAIDWOOD STATION, UNITS 1 AND 2

STN 50-456, STN 50-457, STN 50-454 and STN 50-455

1.0 INTRODUCTION

By letter dated April 6, 2015 (Agencywide Document and Management System (ADAMS) Accession No. ML15097A123), as supplemented by letters dated January 29, 2016 (ADAMS Accession No. ML16029A408), and April 11, 2016 (ADAMS Accession No. ML16102A375), Exelon Generation Company, LLC (the licensee) submitted a request to the U.S. Nuclear Regulatory Commission (NRC or Commission) for the use of alternatives to certain Institute of Electrical and Electronic Engineers (IEEE) Standard (Std.) 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations," guidance at Byron Station, Unit Nos. 1 and 2, and Braidwood Station, Units 1 and 2.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(1), the licensee requested to use the proposed alternative on the basis that the alternative provides an acceptable level of quality and safety.

Each unit at Bryon and Braidwood Stations is a Westinghouse design, four-loop pressurized water reactor with four steam generators and associated main steam lines (MSLs). Each steam line is equipped with an approximately 30-inch main steam isolation valve (MSIV) (i.e., 30-inch for steam lines A and D; 32-inch for steam lines B and C) and a four-inch MSIV bypass valve.

The MSIVs isolate steam flow from the secondary side of the steam generators (SGs) under normal and emergency conditions; specifically, following a high energy line break in the main steam piping. MSIV closure terminates flow from the unaffected SGs. Each MSIV is located in the MSL outside, but close to containment. The MSIVs are downstream from the main steam safety valves (MSSVs), to prevent isolation from the steam generators by MSIV closure. Closing the MSIVs isolates each steam generator from the others, and isolates the turbine, steam dump system, and other auxiliary steam supplies from the SGs. The MSIVs fail as is on loss of control or actuation power.

The MSIV bypass valves are air operated and fail closed on a loss of instrument air or loss of direct current power. At Bryon and Braidwood Stations, the MSIV bypass valves are used for a slow and controlled pressurization of the main steam piping and serve to warm up the main steam piping to avoid water hammer. Currently, these valves provide operational flexibility for performing the Trip Actuating Device Operational Test (TADOT) for the Steam Line Isolation Manual Initiation Function required by technical specification (TS) Surveillance Requirement 3.3.2.9. This test is performed during startup after a refueling outage and may currently be performed in MODES 2 (below the point of adding heat), 3, 4, 5 or 6. If the test is performed in MODES 2, 3, or 4, heat removal from the reactor coolant system (RCS) via the main steam system is required. Conducting this TADOT with the current system configuration will only close the MSIVs while the bypass valves remain open providing a steam flow/heat removal path to the condenser. Although these MSIV bypass valves are normally closed at power, they receive the same automatic closure signals as their associated MSIVs and MSIV bypass valves are also containment isolation valves.

The MSIVs close automatically on a main steam isolation signal generated by:

- Steam Line Low Pressure,
- Steam Line High Negative Rate, or
- High-high containment pressure.

In addition to the automatic closure signals noted above, the MSIVs and bypass valves may also be manually closed. There are four individual MSIV momentary control switches (one per loop). Also, four component level control switches for the MSIV bypass valves (one per loop) are mounted on the main control board. Each switch when actuated, will isolate its respective valve. In addition, there are two manual steam line isolation "system level" switches (i.e., each switch provides an "A" and "B" train signal). Operating either switch will close all four MSIVs; however, neither system level switch will close the MSIV bypass valves. The fact that the manual system level switches do not close the MSIV bypass valves is the subject of this proposed alternative.

The MSL isolation function is part of the engineered safety features actuation system (ESFAS) as noted in Braidwood and Byron combined Updated Final Safety Analysis Report (UFSAR) 7.3.1.1.1, "Function Initiation," Item f. The MSL isolation feature is used to prevent the continuous, uncontrolled blowdown of more than one SG and, thereby, prevent an uncontrolled RCS cooldown. Based on the MSIVs and MSIV bypass valves protection function, they are subject to the requirements of 10 CFR 50.55a (h)(2) which states that protection systems must meet the requirements of IEEE Std. 279. In addition, UFSAR Section 7.3.2.2, "Compliance with Standards and Design Criteria," specifically states: "The discussion given below shows that the engineered safety features actuation system [ESFAS] complies with IEEE Standard 279-1971..."

The licensee has discovered a non-conforming issue between the UFSAR and TS regarding the description of the MSL manual isolation function. UFSAR, Section 7.3.2.2.7, "Manual Initiation of Protective Actions," This description is consistent with the guidance noted in IEEE-279, Section 4.17, "Manual Initiation," which states: "The protection system shall include means for manual initiation of each protective action at the system level..." However, contrary to the UFSAR description, the information presented in the TS and TS Bases, (i.e., TS Table 3.3.2-1, "Engineered Safety Feature Actuation System Instrumentation," FUNCTION 4, "Steam Line

Isolation," the associated TS Bases, and the Bases for TS 3.7.2, "Main Steam Isolation Valves (MSIVs)"), indicates that the MSL manual isolation switches only close the MSIVs and not the bypass valves. The associated electrical prints also show that the isolation signals from the two system level manual switches only close the MSIVs and not the bypass valves. The Byron and Braidwood Stations configuration is identical.

This nonconforming issue was documented in the Braidwood and Byron Stations corrective action programs. In its letter dated April 6, 2015, the licensee stated that it concluded that the MSIV bypass valves remain operable as the actual plant configuration is consistent with the TS; however, the plant configuration is not consistent with IEEE Std. 279, specifically, Section 4.17; and, therefore, is considered nonconforming with the current licensing basis.

2.0 REGULATORY EVALUATION

2.1 Regulatory Requirements

10 CFR Part 50, "Domestic Licensing of Production Utilization Facilities," establishes the fundamental regulatory requirements. Specifically, 10 CFR 50.55a, "Codes and standards," paragraph (h)(2), states: "For nuclear power plants with construction permits issued after January 1, 1971, but before May 13, 1999, protection systems must meet the requirements stated in IEEE Std. 279-1968, 'Proposed IEEE Criteria for Nuclear Power Plant Protection Systems,' or the requirements in IEEE Std. 279-1971, 'Criteria for Protection Systems for Nuclear Power Generating Stations,' or the requirements in IEEE Std. 603-1991, 'Criteria for Safety Systems for Nuclear Power Generating Stations,' and the correction sheet dated January 30, 1995." The construction permits for the Braidwood and Byron Station units were issued on December 31, 1975.

10 CFR 50.55a(z), "Alternatives to codes and standards requirements," states: "Alternatives to the requirements of paragraphs (b) through (h) of this section or portions thereof may be used when authorized by the Director, Office of Nuclear Reactor Regulation, or Director, Office of New Reactors, as appropriate. A proposed alternative must be submitted and authorized prior to implementation. The applicant or licensee must demonstrate that:

> 10 CFR 50.55a(z)(1), "Acceptable level of quality and safety." The proposed alternative would provide an acceptable level of quality and safety. . ."

Appendix A to 10 CFR Part 50 provides General Design Criteria (GDC) that must be considered when developing principle design criteria for a water-cooled nuclear power plant. Section 3.1 of the Braidwood and Byron combined Updated Final Safety Analysis Report (UFSAR) discusses conformance with the GDC. The proposed alternative was evaluated against the following GDC, as incorporated into the Braidwood and the Byron licensing basis through the UFSAR:

> 10 CFR 50, Appendix A, GDC 21, "Protection system reliability and testability," in part, requires "Redundancy and independence designed into the protection system shall be sufficient to assure that (1) no single failure results in loss of the protection function."
>
> 10 CFR 50, Appendix A, GDC 22, "Protection system independence," in part, requires, "The protection system shall be designed to assure that the effects of natural

phenomena, and of normal operating, maintenance, testing, and postulated accident conditions on redundant channels do not result in loss of the protection function."

10 CFR 50, Appendix A, GDC Criterion 19, in part, requires:

A control room shall be provided from which actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain it in a safe condition under accident conditions, including loss-of-coolant accidents. Adequate radiation protection shall be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body, or its equivalent to any part of the body, for the duration of the accident. Equipment at appropriate locations outside the control room shall be provided (1) with a design capability for prompt hot shutdown of the reactor, including necessary instrumentation and controls to maintain the unit in a safe condition during hot shutdown, and (2) with a potential capability for subsequent cold shutdown of the reactor through the use of suitable procedures.

Applicants for and holders of construction permits and operating licenses under this part ... or holders of operating licenses using an alternative source term under 10 CFR 50.67, shall meet the requirements of this criterion, except that with regard to control room access and occupancy, adequate radiation protection shall be provided to ensure that radiation exposures shall not exceed 0.05 Sv (5 rem) total effective dose equivalent (TEDE) as defined in 10 CFR 50.2 for the duration of the accident.

The regulations in 10 CFR 50.67 state, in part:

(i) An individual located at any point on the boundary of the exclusion area for any 2-hour period following the onset of the postulated fission product release, would not receive a radiation dose in excess of 0.25 Sv [Sievert] (25 rem) total effective dose equivalent (TEDE), (ii) An individual located at any point on the outer boundary of the low population zone, who is exposed to the radioactive cloud resulting from the postulated fission product release (during the entire period of its passage), would not receive a radiation dose in excess of 0.25 Sv (25 rem) total effective dose equivalent (TEDE), and (iii) Adequate radiation protection is provided to permit access to and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 0.05 Sv (5 rem) total effective dose equivalent (TEDE) for the duration of the accident.

2.2 Regulatory Guidance

Regulatory Guide (RG) 1.62, "Manual Initiation of Protective Actions," issued October 1973 (ADAMS Accession No. ML003740216), describes an acceptable method that the NRC staff considers acceptable for complying with the agency's regulations for requirements of Section 4.17 of IEEE Std. 279-1971, which includes the means for manual initiation of protective actions.

RG 1.53, "Application of the Single Failure Criterion to Nuclear Power Plant Protection Systems," dated June, 1973 (ADAMS Accession No. ML003740182), describes an acceptable

method of complying with the Commission's requirements with respect to satisfying the single-failure criterion.

RGs 1.62 and 1.53 were subsequently updated, and, in part, recognizes IEEE Std. 603-1991 as the most current standard criteria for safety systems at nuclear power plants. The criteria in IEEE Std. 603-1991 is based upon a division level approach for manual isolation of protective actions. Whereas, IEEE Std. 279-1971, uses a system level approach for manual initiation of protective actions. However, the staff accepts the use of IEEE Std. 279-1971 (and associated criteria of the 1973 versions of the regulatory guidance) in this alternative request, because it is consistent with the current licensing basis of Byron and Braidwood Stations Therefore, the NRC staff reviewed the alternative request in the context of providing an acceptable level of quality and safety, as compared to Section 4.17 of the IEEE Std. 279-1971 (and associated 1973 versions).

IEEE Std. 279-1971, Criterion 4.17, "Manual Initiation," states, "The protection system shall include means for manual initiation of each protective action at the system level (i.e., reactor trip, containment isolation, safety injection, core spray, etc.). No single-failure, as defined by the note following Section 4.2, within the manual automatic, or common portions of the protection system shall prevent initiation of protective action by manual or automatic means. Manual initiation should depend upon the operation of a minimum of equipment."

Additionally, IEEE Std. 279-1971, Criterion 4.2, "Single Failure Criterion," states:

> "Any single failure within the protection system shall not prevent proper protective action at the system level when required.
>
> NOTE: "Single failure" includes such events as the shorting or open-circuiting or open-circuiting of power cables. It also includes single credible malfunctions or events that cause a number of consequential component, module, or channel failures. For example, the overheating of an amplifier module is a "single failure" even though several transistor failures result. Mechanical damage to a mode switch would be a "single failure" although several channels might become involved."

3.0 TECHNICAL EVALUATION

3.1 The Licensee's Alternative

The licensee requested to maintain the existing design of the MSIV bypass valves as an alternative to changing the design to be consistent with IEEE Std 279. In the existing design the MSIV bypass valves do not receive a manual isolation signal "at the system level," the requirements of IEEE Std. 279 and in RG 1.62 are not met. Also, the existing individual MSIV bypass valves manual control switches, located on the main control board, are single train switches such that a single-failure of a switch could prevent the manual initiation of the protective action (i.e., prevent closure of a MSIV bypass valve)."

3.2 NRC Staff Evaluation

3.2.1 Regulatory Guidance Evaluation

RG 1.62, "Manual Initiation of Protective Actions," describes a method acceptable to the NRC staff for specifically complying with the requirements of Section 4.17 of IEEE Std. 279-1971 and provides six NRC staff regulatory positions. These positions are methods acceptable to the NRC staff for meeting the Commission's regulations. In its request the licensee choose to address each of the positions for the determination of conformance with the NRC staff positions:

Regulatory Positions 1 and 2 of RG 1.62 manage characteristics to ensure the manual initiation of a protective action at system level perform all actions performed by automatic initiation. In its April 6, 2015 letter, the licensee stated "Since the MSIV bypass valves do not receive a manual isolation signal "at the system level," the requirements of IEEE Std. 279 and the guidance in RG 1.62 are not met." The NRC staff agrees if these two conditions of RG 1.62 cannot be met, then the design is not consistent with IEEE Std. 279-1971.

Regulatory Position 3 concerns the switches for manual initiation for protective action at the system level should be located in the control room and be easily accessible to the operator so that action can be taken in an expeditious manner. The licensee addressed this position in its January 29, 2016, letter for the two system level MSL manual isolation switches and the component level switches for the MSIV bypass valves. The licensee provided an overall layout of the Byron Station main control room (MCR) area. Pictures were provided of the actual controls and indications as well as their locations for all system level isolation switches and MSIV bypass valves. The NRC staff determined that the accessibility of the controls and indications are consistent with the guidance, although the guidance of Regulatory Position 3 is limited to the system level switches. Since the existing configuration does not have a system level switch for the MSIV bypass valves, the NRC staff concludes that Regulatory Position 3 is not met.

Regulatory Position 4 states: "The amount of equipment common to both manual and automatic initiation should be kept to a minimum." In its letter dated January 29, 2016, the licensee explained the sources of the automatic MSL isolation signal and the path of the manual component level control switch signal. In its letter dated April 11, 2016, the licensee stated that the manual position controllers, having a nonsafety-related power supply, can be used to close the MSIV bypass valve and are independent from the manual single valve control switches. However, since only one of the methods to manually close the MSIV bypass valves is powered from the safety-related power supply; compliance with the single-failure portion of the IEEE 279 requirement is not achieved. Regulatory Position 4 also states "it is preferable to limit such common equipment to the final actuation devices and the actuated equipment." In this case the MSIV bypass valves are end components common to both the manual and automatic closure signals. The NRC staff determined that this achieves the minimal equipment guidance which are common between the manual and automatic portions. However, Regulatory Position 4 states: "No single failure within the manual, automatic, or common portions of the protection system should prevent initiation of protective action by manual or automatic means." The bypass valves have their own individual manual switches in the MCR to close when required. These bypass valves have no other safety-related means of closing in lieu of these manual switches. Therefore, they are not single failure proof and the guidance of Regulatory Position 4 as well as the requirement of IEEE Std. 279-1971, Section 4.17, is not met.

Regulatory Position 5 stipulates: "Manual initiation should depend on the operation of a minimum of equipment consistent with positions 1, 2, 3 and 4 above." As discussed previously, the plant configuration does not conform to the Regulatory Positions 1, 2, 3 and 4 as identified by the NRC staff and noted above.

Regulatory Position 6 explains, in part, "Manual initiation of protection action should be so designed that once initiated, it will go to completion as required in Section 4.16 of IEEE Std. 279-1971." In its letter dated January 29, 2016, the licensee stated that the only action necessary is for the operator to turn the individual manual switch and confirm closure, which is identical to the actions upon receiving the automatic MSL isolation. The NRC staff agrees Regulatory Position 6 is met.

The NRC staff determined that the existing design is not consistent with IEEE Std. 279-1971 Section 4.17, because of the absence of protective action to manually close the MSIV bypass valves at the system level and not meeting the single failure criterion as stipulated by the staff positions in RG 1.62.

3.4 Design Basis Accident Review

In its letter dated January 29, 2016, the licensee provided a summary of the effects of one or more MSIV bypass valves failed open.

All analyzed steam line break scenarios, either inside or outside of containment, assume that one MSIV fails to close. Due to the relative line sizes (i.e., 30 inches for a MSIV and 4 inches for a MSIV bypass valve), failure of a MSIV bounds a failure of a MSIV bypass valve. Note that only one MSIV is assumed to fail open in any accident scenario. A specific analysis describing the consequences of a MSIV bypass valve is not documented in the UFSAR as the MSIV bypass valve consequences are bounded by the assumed MSIV failure consequences.

There are four design basis accidents where the MSIVs close on a main steam isolation signal. However, all these design basis accidents credit the automatic closure of the MSIVs and the associated bypass valves and do not credit manual closure of the MSIVs and the MSIV bypass valves. The mitigation of these design basis accidents is not adversely impacted by the proposed alternative since manual initiation of the MSIVs and associated bypass valves is not credited.

There is one design basis accident which credits manual initiation of the MSIVs and bypass valves; the steam generator tube rupture (SGTR) design basis accident. There are two major consequences as a result of the SGTR event: offsite dose case and the margin-to-overfill (MTO) case. For the offsite dose case, the most limiting single failure is for the power operated relief valves (PORV) on the ruptured SG to fail open in the current analysis of record (AOR). Therefore it is clear that the dose consequences of a failed open MSIV bypass valve also remains bounded by the current AOR. For the MTO case, similar to the offsite dose case, the analysis assumes the MSIV and the MSIV bypass valve, on the ruptured steam generator, are manually closed to isolate the SG. The MTO consequences of a failed open MSIV or MSIV bypass valve on the ruptured SG were specifically analyzed in the Byron/Braidwood SGTR MTO single-failure assessment. The analysis concluded that failure of one of the intact SG PORVs to open remains the bounding single failure.

Given the aforementioned considerations, the NRC staff concludes that the Design Basis Accident (DBA) analyses presented by the licensee demonstrates that use of a "system level" MSL manual isolation switches, inclusive of a modification to include control MSIV bypass valves, is bounded and would not be needed to successfully mitigate the consequences of a SGTR or steam line break scenarios.

3.5 Compliance with Applicable Regulatory Requirements

The licensees alternative request satisfies 10 CFR 50.55a(z), "Alternatives to codes and standards requirements," Item (1), "Acceptable level of quality and safety." The licensee requests to maintain the existing application design of the MSIV bypass valves as an alternative to not meeting all the requirements specified in IEEE Std. 279-1971 because a potential inability to manually initiate the MSIV bypass valve closure is bounded by DBA analysis. The NRC staff determined that the licensee provided the information and analyses, as described above, to demonstrate the alternative would provide an acceptable level of quality and safety.

The NRC staff also determined the approach complies with GDC 21 and GDC 22. The scope of the request for a permanent alternative to the requirements of IEEE Std. 279-1971 does not affect the automatic initiation and closure signal of the MSIVs and the MSIV bypass valves. Therefore, compliance with GDC 21 and GDC 22 is unchanged and no associated amendment to the license is needed.

The NRC staff concluded that the addition of the MSIV bypass valves to the system level manual isolation function would have an adverse effect on RCS temperature control during startup and testing. Specifically, this would result in all MSIVs and MSIV bypass valves closing during the TADOT test, completely isolating the heat removal path, causing RCS temperature control issues and probable steam relief through the steam generator PORVs.

The NRC staff reviewed the assumptions, inputs, and methods used by the licensee to assess the radiological consequences of DBAs to assess the use of the "system level" MSL valve bypass manual isolation switches to successfully mitigate the consequences. The NRC staff concludes that the licensee used methods of analysis and assumptions consistent with the regulatory requirements and guidance. The NRC staff compared the methodology applied by the licensee to the applicable dose guidelines and criteria. Based on that comparison, the NRC staff concludes that there is a reasonable assurance that the licensee's estimates of the exclusion area boundary, low population zone, and control room doses are not changed by the licensee's alternative. As a result the NRC staff concludes that compliance with 10 CFR 50.67 and, by extension 10 CFR Part 50, Appendix A, Criterion 19, is unchanged.

4.0 CONCLUSION

As set forth above, the NRC staff determines that based on the demonstration that the alternative does not impact the design basis accidents and that the single-failure of a MSIV bypass valve (4 inches) is bounded by the design basis assumed failure of a MSIV (30 inches), the proposed alternative provides an acceptable level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a. Therefore, the NRC staff authorizes the permanent use of the alternative at Byron Station, Unit Nos. 1 and 2, and Braidwood Station, Units 1 and 2

All other IEEE Std. 279-1971 guidance for which relief was not specifically requested and approved remain applicable.

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Date of issuance: June 29, 2016

If you have any questions, please contact the Senior Project Manager, Joel S. Wiebe at 301-415-6606 or via e-mail at Joel.Wiebe@nrc.gov.

Sincerely,

/RA/

G. Edward Miller, Acting Chief
Plant Licensing Branch 3-2
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

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