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

November 3, 2009

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

SUBJECT: DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3 - ALTERNATIVE TO NOZZLE-TO-VESSEL WELD AND INNER RADIUS EXAMINATIONS (TAC NOS. ME0882 AND ME0883)

Dear Mr. Pardee:

By letter dated March 13, 2009, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML090721084), Exelon Generation Company, LLC (EGC or the licensee), the licensee for Dresden Nuclear Power Station (DNPS), Units 2 and 3, submitted Relief Request I4R-16 to use an alternative to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI inspection requirements regarding examination of certain reactor pressure vessel nozzle-to-vessel welds and nozzle inner radii at DNPS, Units 2 and 3. The proposed alternative is in accordance with ASME Code Case N-702, "Alternative Requirements for Boiling-Water Reactor (BWR) Nozzle Inner Radius and Nozzle-to-Shell Welds."

The Nuclear Regulatory Commission (NRC) staff has reviewed the information provided by the licensee to support the request to authorize the use of the alternative. The NRC staff approved Boiling-Water Reactor Vessels Internal Project (BWRVIP) Report BWRVIP-108, "BWR Vessel and Internals Project, Technical Basis for the Reduction of Inspection Requirements for the Boiling-Water Reactor Nozzle-to-Vessel Shell Welds and Nozzle Inner Radii," published by the Electric Power Research Institute in a safety evaluation (SE) dated December 19, 2007 (ADAMS Accession No. ML073600374). The NRC staff has concluded that the licensee provided adequate information to satisfy the plant-specific requirements stated in the SE for the technical basis for the use of ASME Code Case N-702. The NRC staff also concluded that the proposed alternative provides an acceptable level of quality and safety. Although the requested duration is for the remainder of the fourth 10-year interval of the DNPS Inservice Inspection Program, use of ASME Code Case N-702 is authorized until such time as the code case is published in a future revision of Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1." At that time, if the licensee intends to continue implementing this code case, it must follow all of the provisions of ASME Code Case N-702, with conditions as specified in RG 1.147, and limitations as specified in Title 10 of the *Code of Federal Regulations*, Section 50.55a(b)(4), (b)(5) and (b)(6), if any. The NRC staff's SE is enclosed.

If you have any questions regarding this authorization, please contact Christopher Gratton at (301) 415-1055.

Sincerely,

Stephen Campbell, Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-237 and 50-249

Enclosure:
Safety Evaluation

cc w/encl: Distribution via ListServ

UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST I4R-16

ALTERNATIVE TO REACTOR PRESSURE VESSEL

NOZZLE-TO-VESSEL WELDS AND INNER RADIUS EXAMINATIONS

DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3

EXELON GENERATION COMPANY, LLC

DOCKET NOS. 50-237 AND 50-249

1.0 INTRODUCTION

By letter dated March 13, 2009 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML090721084), Exelon Generation Company, LLC (EGC, or the licensee) submitted a request for authorization to use an alternative to American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI inspection requirements regarding examination of certain reactor pressure vessel (RPV) nozzle-to-vessel welds and nozzle inner radii at Dresden Nuclear Power Station (DNPS), Units 2 and 3. The proposed alternative is in accordance with ASME Code Case N-702, "Alternative Requirements for Boiling-Water Reactor (BWR) Nozzle Inner Radius and Nozzle-to-Shell Welds." The technical basis for ASME Code Case N-702 was documented in an Electric Power Research Institute (EPRI) report for the Boiling-Water Reactor Vessel and Internals Project (BWRVIP) Report BWRVIP-108, "BWR Vessel and Internals Project, Technical Basis for the Reduction of Inspection Requirements for the Boiling-Water Reactor Nozzle-to-Vessel Shell Welds and Nozzle Inner Radii." The BWRVIP-108 report was approved by the Nuclear Regulatory Commission (NRC) staff in a safety evaluation (SE) dated December 19, 2007 (ADAMS Accession No. ML073600374)

The December 19, 2007, SE for the BWRVIP-108 report specified plant-specific requirements which must be met by applicants proposing to use this alternative. This submittal intended to demonstrate that the relevant DNPS, Units 2 and 3 RPV nozzle-to-vessel welds and their inner radii meet these plant-specific requirements so that the proposed alternative can be authorized.

2.0 REGULATORY EVALUATION

Inservice inspection (ISI) of ASME Code Class 1, 2, and 3 components is performed in accordance with Section XI of the ASME Code and applicable addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). The regulation at 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if: (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would

result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The regulations at 10 CFR 50.55a(g)(4) states further that ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except design and access provisions and preservice examination requirements, set forth in the ASME Code, Section XI to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The applicable ISI Code of Record for the fourth 10-year ISI interval for DNPS, Units 2 and 3, is the 1995 Edition, 1996 Addenda of ASME Code, Section XI.

For all RPV nozzle-to-vessel shell welds and nozzle inner radii, ASME Code, Section XI requires 100 percent inspection during each 10-year ISI interval. However, ASME Code Case N-702 proposes an alternative which reduces the inspection of RPV nozzle-to-vessel shell welds and nozzle inner radius areas from 100 percent to 25 percent of the nozzles for each nozzle type during each 10-year interval. As mentioned earlier, the NRC has approved the BWRVIP-108 report, which contains the technical basis supporting ASME Code Case N-702. The NRC staff's December 19, 2007, SE regarding the BWRVIP-108 report specified plant-specific requirements to be satisfied by applicants who propose to use ASME Code Case N-702.

3.0 TECHNICAL EVALUATION

The following plant-specific requirements are specified in the December 19, 2007, SE for the BWRVIP-108 report supporting use of the ASME Code Case N-702:

Each licensee should demonstrate the plant-specific applicability of the BWRVIP-108 report to their units in the relief request by showing that all the following general and nozzle-specific criteria are satisfied:

(1) the maximum RPV heatup/cooldown rate is limited to less than 115 °F per hour;

For recirculation inlet nozzles

(2) $(pr/t)/C_{RPV} < 1.15$

p = RPV normal operating pressure,
r = RPV inner radius,
t = RPV wall thickness, and
C_{RPV} = 19332...;

(3) $p(r_o^2 + r_i^2)/ (r_o^2 - r_i^2)]/C_{NOZZLE} < 1.15$

p = RPV normal operating pressure,
r_o = nozzle outer radius,
r_i = nozzle inner radius, and
C_{NOZZLE} = 1637...;

For recirculation outlet nozzles

(4) $(pr/t)/C_{RPV} < 1.15$

p = RPV normal operating pressure,
r = RPV inner radius,
t = RPV wall thickness, and
C_{RPV} = 16171...; and

(5) $[p(r_o^2 + r_i^2)/ (r_o^2 - r_i^2)]/C_{NOZZLE} < 1.15$

p = RPV normal operating pressure,
r_o = nozzle outer radius,
r_i = nozzle inner radius, and
C_{NOZZLE} = 1977....

The NRC staff required this plant-specific information to ensure that the probabilistic fracture mechanics (PFM) analysis documented in the BWRVIP-108 report applies to the RPV of the applicant's plant.

3.1 ASME Code Requirement for which Alternative is Requested

The licensee requested alternative to the following requirements of ASME Code, Section XI, 1995 Edition, 1996 Addenda:

> ASME Code Class 1 nozzle-to-vessel weld and nozzle inner radii examination requirements are delineated in Item Number B3.90, "Nozzle-to-Vessel Welds," and B3.100, "Nozzle Inside Radius Section." The required method of examination is volumetric. All nozzles with full penetration welds to the vessel shell (or head) and integrally cast nozzles are examined each interval.

3.2 Component(s) for which Alternative is Requested

Code Class:	1
Component Numbers:	N2, N3, N8, N18, N19, and N20 Nozzles (See licensees March 13, 2009, submittal (ADAMS Accession No. ML090721084) for complete list of nozzle identifications).
Examination Category:	B-D (Inspection Program B)
Item Number:	B3.90 and B3.100

3.3 Licensee's Proposed Alternative to the ASME Code

Pursuant to 10 CFR 50.55a(a)(3)(i), relief is requested from performing the required examinations on 100 percent of the nozzle assemblies identified in Tables 5-1 and 5-2 of the licensees March 13, 2009 submittal. As an alternative for all welds and inner radii identified in Tables 5-1 and 5-2, EGC proposes to examine a minimum of 25 percent of the DNPS, Unit 2 and Unit 3, nozzle-to-vessel welds and inner radius sections, including at least one nozzle from each system and nominal pipe size, in accordance with Code Case N-702.

3.4 Licensee's Bases for Use of the Proposed Alternative

EPRI report BWRVIP-108 was approved by the NRC staff in an SE dated December 19, 2007. Section 5.0, "Plant-Specific Applicability," of the SE indicates that each licensee who plans to request relief from the ASME Code, Section XI requirements for RPV nozzle-to-vessel shell welds and nozzle inner radius sections may reference the BWRVIP-108 report as the technical basis for the use of ASME Code Case N-702 as an alternative. However, each licensee should demonstrate the plant-specific applicability criteria from the BWRVIP-108 report to its units in the relief request by showing that all the general and nozzle-specific criteria addressed below are satisfied (the licensee provided the following plant-specific information in Enclosure 2 of its March 13, 2009, application).

Criterion 1: the maximum RPV heatup/cooldown rate is less than 115° F per hour.

DNPS Technical Specification 3.4.9, "RCS Pressure and Temperature (P/T) Limits," provides a limiting condition for operation. This heatup/cooldown rate is also described in the DNPS Updated Final Safety Analysis Report (UFSAR), Section 5.3.2, "Pressure-Temperature Limits," and UFSAR Table 5.1-1, "Reactor Coolant System Data."

Criteria 2 and 3: for recirculation inlet nozzles.

$(pr/t)/C_{RPV} < 1.15$; the calculation for the DNPS N2 Nozzle results in 1.065, which is less than 1.15.

$[p(r_o^2 + r_i^2)/(r_o^2 - r_i^2)]/C_{NOZZLE} < 1.15$; the calculation for the DNPS N2 Nozzle results in 0.972, which is less than 1.15.

Criteria 4 and 5: for recirculation outlet nozzles.

$(pr/t)/C_{RPV} < 1.15$; the calculation for the DNPS N1 Nozzle results in 1.273, which is higher than 1.15.

$[p(r_o^2 + r_i^2)/(r_o^2 - r_i^2)]/C_{NOZZLE} < 1.15$; the calculation for the DNPS N1 Nozzle results in 0.840, which is less than 1.15.

Based upon the above information, the licensee concluded that all DNPS RPV nozzle-to-vessel shell full penetration welds and nozzle inner radii sections, with the exception of the Recirculation Outlet Nozzles, meet the general and nozzle-specific criteria in BWRVIP-108, and therefore, Code Case N-702 is applicable.

3.5 NRC Staff Evaluation

Criteria for Applying the BWRVIP-108 Report

The NRC staff's December 19, 2007, SE for the BWRVIP-108 report specified five plant-specific criteria that licensees must meet to demonstrate that the BWRVIP-108 report results apply to a unit requesting to use Code Case N-702. The five criteria are related to the driving force of the PFM analyses for the recirculation inlet and outlet nozzles. It was stated in the December 19, 2007, SE that the nozzle material fracture toughness-related nil-ductility transition reference temperature (RT_{NDT}) values used in the PFM analyses were based on data from the entire fleet of BWR RPVs. Therefore, the BWRVIP-108 report's PFM analyses are bounding with respect to fracture resistance, and only the driving force of the underlying PFM analyses needs to be evaluated. It was also stated in the December 19, 2007, SE that, except for the RPV heatup/cooldown rate, the plant-specific criteria are for the recirculation inlet and outlet nozzles only, because the probabilities of failure, P(F|E)s, for other nozzles are an order of magnitude lower. The plant-specific heatup/cooldown rate that the NRC staff established in Criterion 1 is for normal operating conditions, which is limiting. Events with excursions of heatup/cooldown rates exceeding 115° F per hour are considered transients. According to the December 19, 2007, SE, the PFM results with a very severe low temperature over-pressure transient is not limiting, largely because the event frequency for that transient is $1x10^{-3}$ per reactor year, as opposed to the frequency of 1.0 per reactor year for the normal operating condition.

The licensee provided DNPS's plant-specific data and its evaluation of the five driving force factors, or ratios, against the criteria established in the December 19, 2007, SE. The information the licensee included in its application to address Criterion 1 did not include a specific heatup/cooldown rate. However, the licensee's Criterion 1 justification did refer to the DNPS technical specifications and the Updated Final Safety Analysis Report (UFSAR) for the heatup/cooldown rate. UFSAR Table 5.1-1 showed that the maximum heatup/cooldown rate is limited to 100° F in any 1-hour period, satisfying Criterion 1. Further, the NRC staff verified the licensee's evaluation which indicated that, except for the fourth criterion (related to recirculation outlet nozzles), all other criteria were satisfied. As a result, the reduced inspection requirements allowed under ASME Code Case N-702 do not apply to DNPS units' RPV recirculation outlet nozzles. The NRC staff agrees with the licensee's decision to exclude the recirculation outlet nozzles from the scope of this request based upon the licensee's evaluation. Considering that the driving force factor for the recirculation outlet nozzles (1.273) is only moderately higher than the plant-specific criterion (1.15) and the P(F|E)s for other RPV nozzles are an order of magnitude lower than the recirculation outlet nozzles, the NRC staff concluded that the licensee's proposed alternative for all DNPS RPV nozzles included in this application (see Section 3.2 of this SE) provides an acceptable level of quality and safety. It should be noted that RPV feedwater nozzles and control rod drive return line nozzles are outside the scope of ASME Code Case N-702 and are, accordingly, outside the scope of this application.

ASME Code Case N-702 permits a VT-1 (visual examination) of the nozzle inner radius without performing a sensitivity demonstration of detecting a 1-mil width wire or crack. This is not consistent with the NRC position established in Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," regarding ASME Code Case N-648-1, "Alternative Requirements for Inner Radius Examinations of Class 1 Reactor Vessel Nozzles." However, since the licensee stated in its application that it has no plans of using Code Case N-648-1, and volumetric examinations of all nozzle inner radii will be performed, the inconsistency between ASME Code Case N-702 and the NRC position regarding VT-1 examinations is not an issue for this application.

4.0 CONCLUSION

The NRC staff has reviewed the application regarding the licensee's evaluation of the five plant-specific criteria specified in the December 19, 2007, SE for the BWRVIP-108 report, which provides the technical bases for use of ASME Code Case N-702 to examine RPV nozzle-to-vessel welds and nozzle inner radii at DNPS, Units 2 and 3. Based on the evaluation in Section 3.5 of this SE, the NRC staff concluded that the licensee's proposed alternative pursuant to 10 CFR 50.55a(a)(3)(i), which applies to all DNPS RPV nozzles included in this application (see Section 3.2 of this SE), provides an acceptable level of quality and safety. It should be noted that the licensee's request did not include, and this SE does not approve, the application of ASME Code Case N-702 to the DNPS, Units 2 and 3 RPV recirculation outlet nozzles, RPV feedwater nozzles, and control rod drive return nozzles. Although the requested duration is the remainder of the fourth 10-year interval of the DNPS ISI program, use of ASME Code Case N-702 for the requested DNPS RPV nozzles is authorized until such time as the Code Case is published in a revision to RG 1.147. At that time, if the licensee intends to continue to implement the Code Case, the licensee must follow all provisions in ASME Code Case N-702 with conditions as specified in RG 1.147 and limitations as specified in 10 CFR 50.55a(b)(4), (b)(5) and (b)(6), if any.

All other requirements of the ASME Code, Sections III and XI, for which relief has not been specifically requested and approved, remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: S. Sheng, NRR

Date: November 3, 2009

If you have any questions regarding this authorization, please contact Christopher Gratton at (301) 415-1055.

Sincerely,

/RA/
Stephen Campbell, Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-237 and 50-249

Enclosure:
Safety Evaluation

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