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Exelon Nuclear

10 CFR 50.55a

RS-03-077

April 23, 2003

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington D.C. 20555-0001

Braidwood Station, Units 1 and 2
Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. 50-454 and 50-455

Subject: Proposed Alternative Method of Repair for the Control Rod Drive Mechanism Canopy Seal Weld

In accordance with 10 CFR 50.55a, "Codes and standards," paragraph (a)(3)(ii), Exelon Generation Company, LLC (EGC) is requesting NRC approval of a proposed alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 1989 Edition with no Addenda for the Braidwood and Byron Stations. The proposed alternative would permit the use of an alternative method of repair and nondestructive examination for control rod drive mechanism (CRDM) seal welds. The CRDM assemblies were designed and fabricated to the ASME B&PV Code, Section III, 1974 Edition through Summer, 1974 Addenda.

IWA-4000 of Section XI requires that repairs be performed in accordance with the owner's original construction Code of the component or system, or later editions and addenda of the Code. The canopy seal weld is described in Section III and a repair to this weld would require an excavation of the rejectable indication, subsequent surface examinations and re-welding. An alternative repair process exists that provides an acceptable level of quality and greatly reduces the occupational radiation dose exposure from the Code required repair method. Consequently, the required Code repair process for the CRDM canopy seal welds is considered a hardship without a compensating increase in the level of safety.

The alternative repair involves ASME Code Case N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping Section XI, Division 1." The Code case will be used as guidance for repair by weld overlay to provide a new leakage barrier. However, the repair material will be nickel based Alloy 52, instead of austenitic stainless steel. In lieu of a liquid penetrant examination (PT), a magnified visual inspection is proposed. By eliminating the requirement to excavate the rejectable indication and allowing a magnified visual inspection to be performed in lieu of a PT examination, an occupational radiation dose savings of 1.688 person-Rem is estimated.

EGC requests approval of this relief request by September 1, 2003 for use during examinations and potential repairs to be performed during the Braidwood Station, Unit 2 and Byron Station, Unit 1 upcoming fall outages and any future repairs to CRDM canopy seal welds should they become necessary during the second ten-year inservice inspection interval.

Should you have any questions concerning this matter, please contact Mr. Don Cecchett at (630) 657-2826.

Respectfully,

Kenneth A. Ainger for

Keith R. Jury
Director – Licensing
Mid-west Regional Operating Group

Attachments:
Attachment A – Braidwood Relief Request I2R-43, Revision 0
Attachment B – Byron Relief Request I2R-44, Revision 0

Attachment A
Braidwood Station
Relief Request I2R-43 Revision 0

Request for Relief from ASME Section XI Requirements for Repair/Replacement of Control Rod Drive Mechanism (CRDM) Canopy Seal Welds in Accordance with IWA-4000

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1. ASME CODE COMPONENT AFFECTED:

Reactor control rod drive mechanism (CRDM) canopy seal welds – Class 1 appurtenance to the reactor vessel.

2. APPLICABLE CODE EDITION AND ADDENDA:

The current Inservice Inspection program is based on the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, 1989 Edition with no Addenda. The CRDM assemblies were designed and fabricated to the ASME B&PV Code, Section III, 1974 Edition through Summer, 1974 Addenda.

3. APPLICABLE CODE REQUIREMENTS:

IWA-4000 of Section XI requires that repairs be performed in accordance with the owner's original construction Code of the component or system, or later editions and addenda of the Code. The canopy seal weld is described in Section III and a repair to this weld would require the following activities:

a. Excavation of the rejectable indications,
b. A surface examination of the excavated areas,
c. Re-welding and restoration to the original configuration and materials, and
d. Final surface examination.

4. REASON FOR THE REQUEST:

The principal issues leading to this request for relief are the excavation of the existing weld, the accompanying radiation dose received during the excavation and examination activities, and the weld material used for the repair or replacement.

Due to the nature of the flaw, the excavation of the leaking portion of the weld would necessitate a cavity that extends completely through wall. A liquid penetrant examination (PT) of this cavity is required to verify the removal of the rejectable flaw or to verify that the flaw is removed or reduced to an acceptable size. This PT examination would deposit the penetrant materials onto the inner surfaces of the component. This material would not be readily removable prior to re-welding due to the inaccessibility of the inside surface. The remaining penetrant material would introduce contaminants to the new weld metal and reduce the quality of the repair weld. The configuration of the canopy assembly would prevent the establishment and maintenance of an adequate back-purge during the welding process and would further reduce the quality of the repaired weld.

The CRDM canopy seal welds are located above the reactor vessel closure head, which is highly congested and subject to high radiation levels. The high radiological dose associated with strict compliance with these requirements would be contrary to the intent of the As Low As Reasonably Achievable (ALARA) radiological controls program. Most of the repair activities would be performed remotely using robotic equipment. This will reduce the radiation exposure to personnel involved in the welding process. However, the required excavation and PT examinations would necessitate hands-on access to the canopy weld and are estimated to result in a total occupational radiation dose of 1.688 person-Rem per CRDM canopy seal weld. The excavation and examinations are activities that would not be required if granted relief from these requirements and, thus, represent the estimated occupational radiation dose savings. This dose estimate is comprised of the following:

ACTIVITY	**DOSE (PERSON-REM)**
MANUAL EXCAVATION OF FLAW(S)	
Access/egress to perform the excavation (0.072 per trip, 1 trip required)	0.072
Performance of the excavation (total residence time of five minutes)	0.180
PT OF EXCAVATED AREA(S)	
Access/egress to perform the examination (0.072 per trip, 5 trips required)	0.359
Performance of the PT examination (total residence time of ten minutes)	0.359
FINAL PT OF NEW WELD	
Access/egress to perform the examination (0.072 per trip, 5 trips required)	0.359
Performance of the PT examination (total residence time of ten minutes)	0.359
TOTAL EXPOSURE FOR EXCAVATION AND SURFACE EXAMINATIONS	**1.688**
Dose estimate based on a recent survey performed on the Braidwood Station, Unit 1 head canopy area.	

IWA-4200 requires that the repair material conform to the original design specification or Section III. In this case, the replacement material would have the same resistance to stress corrosion cracking as the original material. Use of the original material does not guarantee that the repaired component will continue to maintain leakage integrity throughout the intended life of the item.

5. PROPOSED ALTERNATIVE AND BASIS FOR USE:

Braidwood Station requests relief from the requirements of IWA-4000 in accordance with 10 CFR 50.55a(a)(3)(ii) by proposing an alternative method of repair and nondestructive examination due to hardship and unusual difficulty without a compensating increase in quality or safety. Applicable portions of ASME Code Case N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping Section XI, Division 1," will be used as guidance for repair by weld overlay to provide a new leakage barrier. In lieu of performance of PT examinations of CRDM seal weld repairs or replacement, a 5X or better magnification visual examination will be performed after the welding is completed. In addition, Alloy 52 nickel-based weld repair material will be used rather than austenitic stainless steel as required by Code Case N-504-2.

Alloy 52 nickel-based weld repair material was selected for the repair rather than austenitic stainless steel because of its resistance to stress corrosion cracking. Consequently, the ferrite requirements of Code Case N-504-2 do not apply. The suitability of the replacement material has been evaluated and is determined to be compatible with the existing component and will provide a leakage barrier for the remainder of the intended life of the CRDM.

The alternative method of repair is being requested to facilitate contingency repair efforts during future outages within the second ten-year inservice inspection interval. The alternative nondestructive examination method is being requested to facilitate examination of either a repair or replacement of a CRDM canopy seal weld during the second ten-year inservice inspection interval.

Industry experience with failure analyses performed on leaking canopy seal welds removed from service at other plants has attributed the majority of the cases to transgranular stress corrosion cracking (SCC). The size of the opening where the leakage occurs has been extremely small, normally a few thousandths of an inch. The crack orientations vary, but often radiate outward such that a pinhole appears on the surface, as opposed to a long crack. The SCC results from exposure of a susceptible material to residual stress, which is often concentrated by weld discontinuities, and to a corrosive environment. A corrosive environment can form with water being trapped in the cavity behind the seal weld that is mixed with air initially in the cavity, resulting in a higher oxygen content than is in the bulk primary coolant.

Following the guidance of Code Case N-504-2, the CRDM canopy seal weld flaws will not be removed, but an analysis of the repaired weldment has been performed using Paragraph (g) of the Code Case as guidance to assure that the remaining flaw will not propagate unacceptably. The canopy seal weld is not a structural weld, nor a pressure-retaining weld, but provides a seal to prevent reactor coolant leakage if the mechanical joint leaks. The weld buildup is considered a repair in accordance with IWA-4110. Applicability of the original Code of construction or design specification is mandated because the weld is performed on an appurtenance to a pressure-retaining component. The alternative CRDM canopy seal weld repair uses a gas tungsten arc welding (GTAW) process controlled remotely.

A visual examination of the repaired/replaced weld will be performed using methods and personnel qualified to the standards of ASME VT-1 requirements. The visual examination will be performed using the welding equipment video camera with 5X or better magnification within several inches of the weld, qualified to ensure identification of flaws to assure an adequate margin of safety is maintained. The examination technique will be demonstrated to resolve a 0.001" thick wire against the surface of the weld. The repaired/replaced weld will be examined for quality of workmanship and discontinuities will be evaluated and dispositioned to ensure the adequacy of the new leakage barrier.

The automated GTAW weld repair and alternate VT-1 examination methods result in significantly lower radiation exposure because the equipment is remotely operated after setup. A post-maintenance pressure test (VT-2) at nominal temperature and pressure will be performed.

Repair/replacement activities, using the process described in this request for relief, shall be documented on the required NIS-2 forms. This request for relief will be identified on the NIS-2 forms in lieu of an adopted or invoked ASME Code Case. The repair documents will be reviewed by the Authorized Nuclear Inspector, and maintained in accordance with the requirements for archiving permanent plant records.

6. DURATION OF PROPOSED ALTERNATIVE:

This relief request will be implemented during the Braidwood Station, Units 1 and 2 Second Ten-Year Inservice Inspection Interval.

7. PRECEDENTS:

Similar relief requests have been granted to:

- Carolina Power and Light Company's Shearon Harris Nuclear Power Plant, by letter dated November 6, 1998

- Northern States Power's Prairie Island Nuclear Generating Station, by letter dated January 22, 1999

- Tennessee Valley Authority's (TVA) Watts Bar Nuclear Plant, by letter dated August 25, 1999

- TVA's Sequoyah Nuclear Plant, by letter dated September 12, 2000

- Pacific Gas & Electric's Diablo Canyon Power Plant, by letter dated June 5, 2001

- STP Nuclear Operating Company's South Texas Project Electric Generating Station, by letter dated November 5, 2002

Attachment B
Byron Station
Relief Request I2R-44 Revision 0

Request for Relief from ASME Section XI Requirements for Repair/Replacement of Control Rod Drive Mechanism (CRDM) Canopy Seal Welds in Accordance with IWA-4000

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1. ASME CODE COMPONENT AFFECTED:

Reactor control rod drive mechanism (CRDM) canopy seal welds – Class 1 appurtenance to the reactor vessel.

2. APPLICABLE CODE EDITION AND ADDENDA:

The current Inservice Inspection program is based on the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, 1989 Edition with no Addenda. The CRDM assemblies were designed and fabricated to the ASME B&PV Code, Section III, 1974 Edition through summer, 1974 Addenda.

3. APPLICABLE CODE REQUIREMENTS:

IWA-4000 of Section XI requires that repairs be performed in accordance with the owner's original construction Code of the component or system, or later editions and addenda of the Code. The canopy seal weld is described in Section III and a repair to this weld would require the following activities:

a. Excavation of the rejectable indications,
b. A surface examination of the excavated areas,
c. Re-welding and restoration to the original configuration and materials, and
d. Final surface examination.

4. REASON FOR THE REQUEST:

The principal issues leading to this request for relief are the excavation of the existing weld, the accompanying radiation dose received during the excavation and examination activities, and the weld material used for the repair or replacement.

Attachment B
Byron Station
Relief Request I2R-44 Revision 0

Due to the nature of the flaw, the excavation of the leaking portion of the weld would necessitate a cavity that extends completely through wall. A liquid penetrant examination (PT) of this cavity is required to verify the removal of the rejectable flaw or to verify that the flaw is removed or reduced to an acceptable size. This PT examination would deposit the penetrant materials onto the inner surfaces of the component. This material would not be readily removable prior to re-welding due to the inaccessibility of the inside surface. The remaining penetrant material would introduce contaminants to the new weld metal and reduce the quality of the repair weld. The configuration of the canopy assembly would prevent the establishment and maintenance of an adequate back-purge during the welding process and would further reduce the quality of the repaired weld.

The CRDM canopy seal welds are located above the reactor vessel closure head, which is highly congested and subject to high radiation levels. The high radiological dose associated with strict compliance with these requirements would be contrary to the intent of the As Low As Reasonably Achievable (ALARA) radiological controls program. Most of the repair activities would be performed remotely using robotic equipment. This will reduce the radiation exposure to personnel involved in the welding process. However, the required excavation and PT examinations would necessitate hands-on access to the canopy weld and are estimated to result in a total occupational radiation dose of 1.688 person-Rem per CRDM canopy seal weld. The excavation and PT examinations are activities that would not be required if granted relief from these requirements and, thus, represent the estimated occupational radiation dose savings. This dose estimate is comprised of the following:

ACTIVITY	**DOSE (PERSON-REM)**
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FINAL PT OF NEW WELD	
Access/egress to perform the examination (0.072 per trip, 5 trips required)	0.359
Performance of the PT examination (total residence time of ten minutes)	0.359
TOTAL EXPOSURE FOR EXCAVATION AND SURFACE EXAMINATIONS	**1.688**
Dose estimate based on a recent survey performed on the Braidwood Station, Unit 1 head canopy area. The Braidwood Station units are comparable to the Byron Station units.	

IWA-4200 requires that the repair material conform to the original design specification or Section III. In this case, the replacement material would have the same resistance to stress corrosion cracking as the original material. Use of the original material does not guarantee that the repaired component will continue to maintain leakage integrity throughout the intended life of the item.

5. PROPOSED ALTERNATIVE AND BASIS FOR USE:

Byron Station requests relief from the requirements of IWA-4000 in accordance with 10 CFR 50.55a(a)(3)(ii) by proposing an alternative method of repair and nondestructive examination due to hardship and unusual difficulty without a compensating increase in quality or safety. Applicable portions of ASME Code Case N-504-2, "Alternative Rules for Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping Section XI, Division 1," will be used as guidance for repair by weld overlay to provide a new leakage barrier. In lieu of performance of PT examinations of CRDM seal weld repairs or replacement, a 5X or better magnification visual examination will be performed after the welding is completed. In addition, Alloy 52 nickel-based weld repair material will be used rather than austenitic stainless steel as required by Code Case N-504-2.

Alloy 52 nickel-based weld repair material was selected rather than austenitic stainless steel for the repair because of its resistance to stress corrosion cracking. Consequently, the ferrite requirements of Code Case N-504-2 do not apply. The suitability of the replacement material has been evaluated and is determined to be compatible with the existing component and will provide a leakage barrier for the remainder of the intended life of the CRDM.

The alternative method of repair is being requested to facilitate contingency repair efforts during future outages within the second ten-year inservice inspection interval. The alternative nondestructive examination method is being requested to facilitate examination of either a repair or replacement of a CRDM canopy seal weld during the second ten-year inservice inspection interval.

Industry experience with failure analyses performed on leaking canopy seal welds removed from service at other plants has attributed the majority of the cases to transgranular stress corrosion cracking (SCC). The size of the opening where the leakage occurs has been extremely small, normally a few thousandths of an inch. The crack orientations vary, but often radiate outward such that a pinhole appears on the surface, as opposed to a long crack. The SCC results from exposure of a susceptible material to residual stress, which is often concentrated by weld discontinuities, and to a corrosive environment. A corrosive environment can form with water being trapped in the cavity behind the seal weld that is mixed with air initially in the cavity, resulting in a higher oxygen content than is in the bulk primary coolant.

Following the guidance of Code Case N-504-2, the CRDM canopy seal weld flaws will not be removed, but an analysis of the repaired weldment has been performed using Paragraph (g) of the Code Case as guidance to assure that the remaining flaw will not propagate unacceptably. The canopy seal weld is not a structural weld, nor a pressure-retaining weld, but provides a seal to prevent reactor coolant leakage if the mechanical joint leaks. The weld buildup is considered a repair in accordance with IWA-4110. Applicability of the original Code of construction or design specification is mandated because the weld is performed on an appurtenance to a pressure-retaining component. The alternative CRDM canopy seal weld repair uses a gas tungsten arc welding (GTAW) process controlled remotely.

A visual examination of the repaired/replaced weld will be performed using methods and personnel qualified to the standards of ASME VT-1 requirements. The visual examination will be performed using the welding equipment video camera with 5X or better magnification within several inches of the weld, qualified to ensure identification of flaws to assure an adequate margin of safety is maintained. The examination technique will be demonstrated to resolve a 0.001" thick wire against the surface of the weld. The repaired/replaced weld will be examined for quality of workmanship and discontinuities will be evaluated and dispositioned to ensure the adequacy of the new leakage barrier.

The automated GTAW weld repair and alternate VT-1 examination methods result in significantly lower radiation exposure because the equipment is remotely operated after setup. A post-maintenance pressure test (VT-2) at nominal temperature and pressure will be performed.

Repair/replacement activities, using the process described in this request for relief, shall be documented on the required NIS-2 forms. This request for relief will be identified on the NIS-2 forms in lieu of an adopted or invoked ASME Code Case. The repair documents will be reviewed by the Authorized Nuclear Inspector, and maintained in accordance with the requirements for archiving permanent plant records.

6. DURATION OF PROPOSED ALTERNATIVE:

This relief request will be implemented during the Byron Station Units 1 and 2 Second Ten-Year Inservice Inspection Interval.

7. PRECEDENTS:

Similar relief requests have been granted to:

- Carolina Power and Light Company's Shearon Harris Nuclear Power Plant, by letter dated November 6, 1998
- Northern States Power's Prairie Island Nuclear Generating Station, by letter dated January 22, 1999

- Tennessee Valley Authority's (TVA) Watts Bar Nuclear Plant, by letter dated August 25, 1999
- TVA's Sequoyah Nuclear Plant, by letter dated September 12, 2000
- Pacific Gas & Electric's Diablo Canyon Power Plant, by letter dated June 5, 2001
- STP Nuclear Operating Company's South Texas Project Electric Generating Station, by letter dated November 5, 2002