August 30, 2004

Mr. Joseph M. Solymossy
Site Vice President
Prairie Island Nuclear Generating Plant
Nuclear Management Company, LLC
1717 Wakonade Drive East
Welch, MN 55089

SUBJECT: PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2 - EVALUATION OF RELIEF REQUEST NO. 19, REVISION 0, THIRD 10-YEAR INSERVICE INSPECTION INTERVAL (TAC NOS. MC2543 AND MC2544)

Dear Mr. Solymossy:

By letter to the U.S. Nuclear Regulatory Commission (NRC) dated March 30, 2004, as supplemented by letter dated July 23, 2004, Nuclear Management Company (NMC) LLC, the licensee submitted a request for relief from Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (Code) for Prairie Island Nuclear Generating Plant (PINGP), Units 1 and 2. Specifically, NMC proposed to incorporate reduced ultrasonic examination volume requirements for Class 1 reactor pressure vessel (RPV) nozzle-to-vessel welds.

A request for additional information was sent to NMC via e-mail on May 26, 2004 (ADAMS Accession Number ML041730543). NMC provided the additional information in its supplement dated July 23, 2004. The NRC staff has evaluated the licensee's request for relief and has authorized the proposed alternative pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(i). The NRC staff's review concludes that the proposed reduction in ultrasonic examination volume requirements provides an acceptable level of quality and safety. Therefore, the requested relief is granted for PINGP's third 10-Year inservice inspection interval which ends on December 20, 2004. The use of Code Case N-613-1 is authorized until such time as the code case is published in a future version of regulatory guide (RG) 1.147. At that time, if the licensee intends to continue implementing this code case, it must follow all provisions of Code Case N-613-1 with limitations or conditions specified in RG 1.147, if any. The enclosed safety evaluation contains the basis for granting the requested relief.

Sincerely,

/RA/

L. Raghavan, Chief, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-282 and 50-306

Enclosure: Safety Evaluation

cc w/encls: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF, 10-YEAR INSERVICE INSPECTION INTERVAL

NUCLEAR MANAGEMENT COMPANY, LLC

PRAIRIE ISLAND NUCLEAR GENERATING PLANT, UNITS 1 AND 2

DOCKET NOS. 50-282 AND 50-306

1.0 INTRODUCTION

By letter to the U.S. Nuclear Regulatory Commission (NRC) dated March 30, 2004, as supplemented by letter dated July 23, 2004, Nuclear Management Company (NMC) LLC, the licensee submitted a request for relief from Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) under the provisions of TItle 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(i), for Prairie Island Nuclear Generating Plant (PINGP), Units 1 and 2. Specifically, NMC proposed to incorporate reduced ultrasonic examination volume requirements for ASME Code Class 1 reactor pressure vessel (RPV) nozzle-to-vessel welds.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), components (including supports) which are classified as ASME Code Class 1, 2, and 3 must meet the requirements, except the design and access provisions and the pre-service examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection [ISI] of Nuclear Power Plant Components," 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 120-month 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.

Inservice inspection of Class 1, 2, and 3 components is performed in accordance with Section XI of the ASME Code and applicable addenda as required by 10 CFR 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR50.55a(g)(6)(i). As stated in 10 CFR 50.55a(a)(3), proposed alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

ENCLOSURE

2.1 Regulatory Background

For PINGP, Units 1 and 2, the applicable inservice inspection ASME Code edition of record is the 1989 Edition of the ASME Code, Section XI. The proposed alternative is requested for the remainder of the third 10-Year inservice inspection interval.

3.0 TECHNICAL EVALUATION

3.1 ASME Code Components Affected

Code Class: Class 1

Code Edition: ASME Code Section XI, 1989 Edition

Examination Category: B-D

Item Number: B3.90, "Reactor Vessel Full Penetration Nozzle-to-Vessel Welds"

Component Numbers: Various, see Table 1

3.2 ASME Code Requirements

Pursuant to 10 CFR 50.55a(a)(3)(i), NMC is requesting relief from ASME, Section XI, Table IWB-2500-1, Examination Category B-D, Item B3.90 "Reactor Vessel Full Penetration Nozzle-to-Vessel Welds," examination requirement IWB-2500-7. Specifically, Figure IWB-2500-7(a) and (b) require examination of a distance of $t_s/2$ adjacent to the weld, where t_s equals the vessel wall thickness.

3.3 Licensee's Proposed Alternative to the ASME Code (as stated)

Pursuant to 10 CFR 50.55a(a)(3)(i), PINGP requests to implement an alternative to the volumetric ultrasonic (UT) requirements of ASME [Code] Section XI Table IWB-2500-1. ASME [Code] Section XI requires that a minimum volume of material a distance of one half (½) the reactor vessel shell thickness adjacent to the weld ($t_s/2$) be examined as demonstrated in Figures IWB-2500-7 (a) and (b). In lieu of the $t_s/2$ volume requirements of ASME [Code] Section XI, Figures IWB-2500-7 (a) and (b), PINGP proposes to reduce the examination volume next to the widest part of the weld from half of the vessel wall thickness to one-half (½) inch from the weld; as described in [ASME] Code Case N-613-1, Figures 1 and 2. As discussed below, this will provide an acceptable level of quality and safety.

3.4 Licensee's Bases for Alternative

In their March 30, 2004 submittal, the licensee provided the following basis for use:

> The required examination volume for the reactor pressure vessel (RPV) retaining nozzle-to-vessel welds extends far beyond the weld into the base material, and is unnecessarily large. This proposed alternative would re-define and limit the examination volume boundary to one-half (½) inch of base material on each side of the widest portion of the weld, removing from examination the base material

that was extensively examined during prior inspections, and is not considered in the high residual stress region associated with the weld. This reduction in base material examination volume will not affect the flaw detection capabilities in the weld and heat affected zone. The proposed reduction in examination volume is of the base material only.

Crack initiation during plant service in the examination volume excluded from the proposed reduced examination volume is highly unlikely because of the low stresses encountered in the base material outside of the heat affected zone of the weld. The stresses induced by the weld process are concentrated at or directly adjacent to the weld. Cracks, should they initiate, typically occur in the high-stressed areas of the weld. These high stress areas are bounded in the examination volume defined by ASME Code Case N-613-1. During previous examinations, both preservice and inservice, no indications exceeding the allowable flaw size of IWB-3500 were detected in the reactor vessel nozzle-to-shell examination volumes including the base material areas proposed for exclusion from examination in this request. The prior thorough examination of the base material and the proposed examination of the high-stressed areas of the weld provide an acceptable level of quality and safety.

The required examination of the welds shall consist of techniques and procedures qualified in accordance with ASME Code, Section XI, Appendix VIII, Supplements 4, 6 and 7.

From the nozzle bore, the weld and surrounding one-half (½) inch volume will be interrogated using techniques and procedures qualified in accordance with Appendix VIII, Supplement 7, as administered by the Performance Demonstration Initiative (PDI). In addition, the nozzle-to-shell examination volume is also accessible from the vessel inner diameter (ID) surface and will be examined in four orthogonal directions for the first 15 percent of weld thickness with respect to the vessel ID surface using Appendix VIII, Supplement 4 qualified techniques. The remaining 85 percent of weld volume accessible from the vessel ID surface will be examined in two opposing circumferential scanning directions using Appendix VIII, Supplement 6 qualified techniques to interrogate for transverse defects.

On May 26, 2004, the NRC staff issued a request for additional information (RAI) via e-mail on (ADAMS Accession Number ML041730543) to support the request for relief. The NRC staff requested that the licensee provide a supplemental diagram showing the proposed examination volume. The examination volume sketches, attached to the licensee's response to the RAI, depict specific nozzle-to-vessel weld configurations as taken from the fabrication drawings. Both PINGP, Unit 1 and 2, are dimensionally identical in this regard.

In response to the RAI, the licensee clarified that fully qualified Appendix VIII automated ultrasonic techniques applicable to the nozzle geometries will be performed from the nozzle bore and from the vessel shell inside diameter (ID) surface to accomplish the examination. NMC provided Table 1 which includes component numbers and description, nominal pipe diameters, and weldment material.

The staff inquired about the positive means of examination to be used to identify the weld extremities on repaired areas. NMC stated that a records check for PINGP, Units 1 and 2, RPV nozzles was conducted. The reactor vessel shop order files were reviewed to identify any deviations, which included all of the Procurement Advisory Releases and any associated Deviation Notice and Disposition Reports. The review found that none of the deviations identified involved repairs to the RPV primary nozzles. Review of the inservice inspections of these welds revealed no indication requiring repairs.

To ensure the extremities of the weld are included in the examination volume, NMC committed to conservatively add a margin of 0.5 inches to the scanning path of all transducers in all directions as allowed by component geometry.

The staff also requested that the licensee provide the technical basis to conclude that the portions of the base metal that would be excluded from examination by this relief request are not susceptible to service-induced degradation. In response, the licensee stated the following:

> The stresses in the nozzle-to-shell weld derive from two primary sources; operational stresses and weld residual stresses.
>
> The operational stresses derive from internal pressure in the vessel, and temperature changes which occur during operational transients. These stresses are limited by the design to ensure that ASME Code stress limits are met. Also, a fatigue analysis is required by [ASME Code] Section III to ensure that the component is unlikely to initiate flaws during operation from this source. The fatigue usage in the nozzle-to-shell weld region is typically less than 0.1, as compared to the [ASME] Code limit of 1.0.
>
> The total stresses in the nozzle-to-shell weld region are highest at the weld, and drop off as a function of the distance away from the weld. Stresses caused by welding are concentrated at and near the weld. The vessel is stress relieved through post-weld stress relief heat treatment. The weld residual stresses are significantly reduced, and those stresses that remain after the heat treatment decreases significantly as a function of distance from the weld boundary.
>
> Since operational and residual stresses are limited by the design requirements and the stress relief heat treatment, creation of flaws during plant service is unlikely due to the low stresses in the base metal away from the weld.
>
> The ASME Code inspection requirements are concentrated on the weld regions, because the welding process itself was thought to have a higher potential to result in cracks that the forging or plate rolling process used for the adjacent base metal. The only reason for including areas of the base metal in the examination volume was to ensure that the entire weld was included. The extent of the weld region for the [RPV] nozzle-to-shell weld region is very well known, since the fabrication process was very tightly controlled. The affected areas were previously examined in the previous two inspection intervals, with acceptable results, using the larger examination volume requirements specified in ASME [Code] Section XI.

> In summary, the stresses in the nozzle-to-shell region of the reactor vessel are all within the [ASME] Code allowable values, and the usage factor is small (less than ten percent of the [ASME Code] limit.) Therefore, the inspection requirements proposed in the relief request are sufficient to ensure that potential indications are found, and that the structural integrity of the reactor vessel is maintained.

4.0 STAFF EVALUATION

The licensee has requested relief from the examination volume requirements specified in Table IWB-2500-1 of the ASME Code, Section XI, pertaining to full penetration nozzles in the RPV. NMC proposed to use a reduced examination volume, extending to one-half (½) inch from each side of the widest part of the nozzle-to-vessel weld in lieu of an examination volume extending to a distance equal to one-half (½) the through-wall thickness from each side of the widest part of the nozzle-to-vessel weld.

The licensee provided supplemental information showing the specific configuration of the RPV nozzle-to-vessel welds as taken from the fabrication drawings with their revised examination volume, as well as a listing of all welds included within the scope of this relief request. All of the welds for which relief is requested have the same configuration of those shown in ASME Code Case N-613-1.

NMC will use automated ultrasonic techniques to examine the specified RPV nozzle-to-vessel welds from the nozzle bore and from the ID surface of the vessel shell. The first 15 percent of the weld thickness with respect to the vessel ID will be examined in four orthogonal directions. The remaining 85 percent of weld volume will be examined in two opposing circumferential scanning direction using ASME Code qualified techniques. This will allow for the extremities of the RPV nozzle-to-vessel welds to be precisely located, thereby assuring complete coverage of the modified examination volume on each side of the weld crown. Further, to ensure the extremities of the weld are included in the examination volume, the licensee committed to conservatively add a margin of 0.5 inches to the scanning path of all transducers in all directions as allowed by component geometry.

The acceptability of the reduced examination volume is based on prior full volumetric examinations of the welds and base metal, as well as the internal stress distribution near the weld. Previous examinations showed no indications exceeding the allowable limits of the preservice or inservice inspection criteria. Further, the creation of flaws in the volume excluded from the proposed reduced examination is unlikely because of the low stress in the base metal away from the weld. The stresses caused by welding are concentrated at, or near, the weld. Cracks, should they initiate, occur in the highly stressed areas of the weld. To provide adequate coverage, these high stress areas are to be included in the reduce examination volume proposed by NMC.

Based on the above, the NRC staff finds that the areas to be excluded from examination by the relief request have been found to be free of unacceptable flaws by previous examinations performed during inservice inspection and fabrication. The NRC staff has determined that the initiation of flaws in these regions is highly unlikely due to the lower weld-induced stresses. Therefore, the proposed alternative to reduce the UT examination volume to one-half (½) inch

from the widest part of the RPV nozzle-to-vessel weld on each side of the weld crown, will provide an acceptable level of quality and safety as required in 10 CFR 50.55a(a)(3)(i).

5.0 CONCLUSION

The NRC staff has reviewed the licensee's submittal and concludes that the proposed alternative will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the use of ASME Code Case N-613-1 for the remainder of the third 10-Year Interval (which ends on December 20, 2004) of the inservice inspection program at PINGP, Units 1 and 2. The use of the code case is authorized until such time as the code case is published in a future version of regulatory guide (RG) 1.147. At that time, if the licensee intends to continue implementing this code case, it must follow all provision of Code Case N-613-1 with limitations or conditions specified in RG 1.147 if any. All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Table 1
Nozzle-to-Vessel Welds within Scope of Request

Unit. No	ISI Summary Number	Component Identification	Component Description	Nominal Pipe Diameter	Weldment Material
1	301098	N-6	Inlet Nozzle to Vessel Weld Loop A	27.5"	Ferritic
1	301100	N-7	Outlet Nozzle to Vessel Weld Loop A	29"	Ferritic
1	301102	N-8	SI Nozzle to Vessel Weld Loop A	4"	Ferritic
1	302977	N-9	Inlet Nozzle to Vessel Weld Loop B	27.5"	Ferritic
1	302979	N-10	Outlet Nozzle To Vessel Weld Loop B	29"	Ferritic
1	302981	N-11	SI Nozzle To Vessel Weld Loop B	4"	Ferritic
2	501129	N-6	Inlet Nozzle to Vessel Weld Loop A	27.5"	Ferritic
2	505018	N-7	Outlet Nozzle to Vessel Weld Loop A	29"	Ferritic
2	500726	N-11	SI Nozzle to Vessel Weld Loop A	4"	Ferritic
2	501150	N-9	Inlet Nozzle to Vessel Weld Loop B	27.5"	Ferritic
2	505020	N-10	Outlet Nozzle to Vessel Weld Loop B	29"	Ferritic

Unit. No	ISI Summary Number	Component Identification	Component Description	Nominal Pipe Diameter	Weldment Material
2	500727	N-8	SI Nozzle to Vessel Weld Loop B	4"	Ferritic

Prairie Island Nuclear Generating Plant, Units 1 and 2

cc:

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