December 9, 2004

Mr. Randy K. Edington
Vice President-Nuclear and CNO
Nebraska Public Power District
P.O. Box 98
Brownville, NE 68321

SUBJECT: COOPER NUCLEAR STATION - RE: RISK INFORMED INSERVICE INSPECTION PROGRAM, RELIEF REQUEST RI-34 (TAC NO. MC2351)

Dear Mr. Edington:

By letter dated March 11, 2004, as supplemented by letters dated July 29 and August 26, 2004, Nebraska Public Power District (the licensee) submitted a request for approval of a Risk Informed Inservice Inspection (RI-ISI) Program as an alternative to existing American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI requirements for the selection and examination of Class 1 and Class 2 piping welds at the Cooper Nuclear Station (CNS).

Pursuant to the regulation at Section 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR), the NRC staff approves the licensee's RI-ISI Program. The proposed RI-ISI program relief request RI-34 provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the NRC staff authorizes the use of relief request RI-34 during the licensee's third ten-year inservice inspection interval for CNS. The NRC staff's safety evaluation for RI-34 is enclosed.

Sincerely,

/RA/

Michael K. Webb, Acting Chief, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-298

Enclosure: Safety Evaluation

cc w/encl: See next page

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DATE	11/29/04	11/29/04	11/22/04*	11/22/04*	12/7/04	12/8/04

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST NO. RI-34

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

DOCKET NO. 50-298

1.0 INTRODUCTION

By letter dated March 11, 2004 (Reference 1), as supplemented by letters dated July 29 and August 26, 2004 (References 2 and 3), Nebraska Public Power District (NPPD, the licensee) submitted relief request RI-34, which proposed a risk-informed inservice inspection (RI-ISI) program as an alternative to a portion of its current Inservice Inspection (ISI) program for Cooper Nuclear Station (CNS). The scope of the RI-ISI program would be limited only to the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1 and 2 piping, Examination Categories B-F, B-J, C-F-1, and C-F-2 welds.

The licensee's RI-ISI program was developed in accordance with the methodology contained in the Electric Power Research Institute (EPRI) Report TR-112657, Revision B-A (Reference 4), which was previously reviewed and approved by NRC staff. The licensee proposed the RI-ISI program as an alternative to the requirements in the ASME Code Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i). The licensee requested implementation of this alternative beginning with the final refueling outage of the third period of the third ten-year ISI interval at CNS.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements set forth in the Code to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulation at 10 CFR 50.55a(g) also states that ISI of the ASME Code, Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable addenda, except where specific written relief has been granted by the NRC. The objective of the ISI program, as described in Section XI of the ASME Code and applicable addenda, is to identify conditions (i.e., flaw indications) that are precursors to leaks and ruptures in the pressure boundary of these components that may impact plant safety.

The regulations also require that, during the first ten-year ISI interval and during subsequent intervals, the licensee's ISI program complies with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference into 10 CFR 50.55a(b) twelve months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. CNS is in the third interval. The applicable edition of Section XI of the ASME Code for CNS for this ten-year ISI interval is the 1989 Edition with no addenda.

According to 10 CFR 50.55a(a)(3), the NRC may authorize alternatives to the requirements of 10 CFR 50.55a(g), if an applicant demonstrates that the proposed alternatives would provide an acceptable level of quality and safety, or that the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Regulatory Guide (RG) 1.174 (Reference 5) defines the following safety principles that should be met in an acceptable RI-ISI program:

(1) The proposed change meets current regulations unless it is explicitly related to a requested exemption.
(2) The proposed change is consistent with the defense-in-depth philosophy.
(3) The proposed change maintains sufficient safety margins.
(4) When proposed changes result in an increase in risk, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement.
(5) The impact of the proposed change should be monitored using performance measurement strategies.

RG 1.178 (Reference 6) describes methods acceptable to the NRC staff for integrating insights from Probabilistic Risk Assessment (PRA) techniques with traditional engineering analyses into ISI programs for piping, and addresses risk-informed approaches that are consistent with the basic elements identified in Reference 5.

The licensee has proposed to use a RI-ISI program for ASME Class 1 and Class 2 piping (Examination Categories B-F, B-J, C-F-1, and C-F-2 welds) as an alternative to the ASME Code Section XI requirements. The licensee stated that this proposed program was developed using RI-ISI methodology described in Reference 4. The NRC staff's safety evaluation report (SER) dated October 28, 1999 (Reference 7), approving the methodology described in Reference 4, concluded that this methodology conforms to the guidance provided in References 5 and 6, and that no significant risk increase should be expected from the changes to the ISI program resulting from applying the methodology. The transmittal letter Reference 7 stated that an RI-ISI program, as described in Reference 4, utilizes a sound technical approach and will provide an acceptable level of quality and safety. It also stated that, pursuant to 10 CFR 50.55a, any RI-ISI program meeting the requirements of Reference 4 provides an acceptable alternative to the piping ISI requirements with regard to (1) the number of locations, (2) the locations of inspections, and (3) the methods of inspection.

Additionally, the staff used the guidance and acceptance criteria found in NUREG-0800, Section 3.9.8 (Reference 8) to evaluate the licensee's proposed RI-ISI program.

3.0 TECHNICAL EVALUATION OF RELIEF REQUEST RI-34

The Items for which Relief is Requested:

Code Classes:	1 and 2
References:	IWB-2500, IWC-2500, Table IWB-2500-1, Table IWC-2500-1
Examination Categories:	B-F, B-J, C-F-1, and C-F-2

Item Numbers: B5.10, B5.20, B5.130, B5.140, B9.10, B9.20, B9.30, B9.40, C5.50, and C5.80.
Description: Risk-Informed Inservice Inspection (RI-ISI)
Component Numbers: All Class 1 and 2 pressure retaining piping welds

Code Requirement:

ASME Section XI (1989 Edition), IWB-2500 (a) states:

> Components shall be examined and tested as specified in Table IWB-2500-1. The method of examination for the components and parts of the pressure retaining boundaries shall comply with those tabulated in Table IWB-2500-1 except where alternate examination methods are used that meet the requirements of IWA-2240.

Table IWB-2500-1, Categories B-F and B-J, requires 100 percent (%) and 25%, respectively, of the total number of non-exempt welds.

ASME Section XI (1989 Edition), IWC-2500 (a) states:

> Components shall be examined and pressure tested as specified in Table IWC-2500-1. The method of examination for the components and parts of the pressure retaining boundaries shall comply with those tabulated in Table IWC-2500-1, except where alternate examination methods are used that meet the requirements of IWA-2240.

Table IWC-2500-1, Categories C-F-1 and C-F-2, requires 7.5%, but not less than 28 welds to be selected for examination. Note: CNS does not have any Category C-F-1 welds.

In addition, both Tables (IWB-2500-1 and IWC-2500-1) reference figures that convey the examination volume for each configuration that could be encountered.

Licensee's Proposed Alternative (as stated in Reference 1):

> As an alternative to existing ASME Section XI requirements for piping weld selection and examination volumes, NPPD will implement the alternative RI-ISI program described in Enclosure 1 [of Reference 1].

Licensee's Basis for Relief (as stated in Reference 1):

> The scope for ASME Section XI Inservice Inspection (ISI) programs is largely based on deterministic results contained in design stress reports. These reports are normally very conservative and may not be an accurate representation of failure potential. Service experience has shown that failures are due to either corrosion or fatigue and typically occur in areas not included in the plant's ISI program. Consequently, nuclear plants are devoting significant resources to inspection programs that provide minimum benefit.
>
> As an alternative, significant industry attention has been devoted to the application of risk-informed selection criteria in order to determine the scope of ISI programs at nuclear power plants. Electric Power Research Institute (EPRI) studies indicate that the application of these techniques will allow operating nuclear plants to reduce the examination scope of current ISI programs by as much as 60% to 80%, significantly reduce costs, and continue to maintain high nuclear plant safety standards.

NPPD has applied the methodology of EPRI Topical Report TR-112657 in the development of the proposed CNS RI-ISI Program (see Enclosure 1 [of Reference 1]...). The RI-ISI application was also conducted in a manner consistent with ASME Code Case N-578, "Risk-Informed Requirements for Class 1, 2, and 3 Piping, Method B." The use of this methodology for the selection and subsequent examination of Class 1 and 2 piping welds will provide an acceptable level of quality and safety.

Relief is requested in accordance with 10 CFR 50.55a(a)(3)(i). The Nuclear Regulatory Commission has previously approved several RI-ISI Programs based on methodology contained in EPRI Topical Report TR-112657, Revision B-A. A similar RI-ISI submittal has been recently approved for Salem, Units 1 and 2.

3.1 Proposed Changes to the ISI Program

The scope of the proposed changes to the licensee's ISI program is limited to ASME Class 1 and Class 2 piping welds for the following Examination Categories: B-F for pressure retaining dissimilar metal welds in vessel nozzles, B-J for pressure retaining welds in piping, C-F-1 for pressure retaining welds in austenitic stainless steel or high alloy piping, and C-F-2 for pressure retaining welds in carbon or low alloy steel piping. The RI-ISI program is proposed as an alternative to the existing ISI requirements of the ASME Code Section XI.

The end result of the program changes is that the number and locations of non-destructive examination (NDE) inspections based on ASME Code Section XI requirements will be replaced by the number and locations of these inspections based on the RI-ISI guidelines. ASME Code requires, in part, that for each successive ten-year ISI interval, 100% of Category B-F welds and 25% of Category B-J welds for the Code Class 1 non-exempt piping be selected for volumetric and/or surface examination based on existing stress analyses and cumulative usage factors. For Category C-F welds in Class 2 piping, 7.5% of non-exempt welds are selected for volumetric and/or surface examination. The proposed RI-ISI program for CNS selects 57 of 650 Class 1 piping welds, and 4 of 930 Class 2 piping welds for NDE. The surface examinations required by ASME Code Section XI will be discontinued while system pressure tests and VT-2 visual examinations shall continue. These results are consistent with the concept that, by focusing inspections on the most safety-significant welds, the number of inspections can be reduced, while at the same time maintaining protection of public health and safety.

The licensee discussed the following augmented piping inspection programs in the proposed RI-ISI program:

Source Document	Subject	Status of Incorporation into Licensee RI-ISI Program
NUREG 0619	Feedwater Nozzle Cracking	The licensee indicates that this program will be unaffected by the proposed RI-ISI program.

Source Document	Subject	Status of Incorporation into Licensee RI-ISI Program
NUREG 0313; Generic Letter (GL) 88-01	Intergranular Stress Corrosion Cracking (IGSCC) in Boiling Water Reactors (BWRs)	Section 2.2 of Enclosure 1 of Reference 1 states: "The CNS is incorporating the guidance contained in BWR Vessel and Internals Project [VIP] Report No. BWRVIP-75. BWRVIP-75 provides alternative criteria to NRC Generic Letter 88-01 for the examination of welds susceptible to intergranular stress corrosion cracking (IGSCC). Both Generic Letter 88-01 and BWRVIP-75 specify examination extent and frequency requirements for austenitic stainless steel welds that are classified as Categories A through G, dependent upon their susceptibility to IGSCC. In accordance with EPRI TR-112657, piping welds identified as Category A are considered resistant to IGSCC and are assigned a low failure potential provided no other damage mechanisms are present. As such, the examination of welds identified as Category A inspection locations is subsumed by the RI-ISI Program. The existing plant augmented inspection program for the other piping welds susceptible to IGSCC at the CNS (the CRD [control rod drive] return line nozzle cap weld is classified as Category D) remains unaffected by the RI-ISI Program submittal."
GL 89-08	Flow Accelerated Corrosion (FAC)	Section 2.2 of Enclosure 1 of Reference 1 states: "The plant augmented inspection program for feedwater nozzle cracking per NUREG 0619 is implemented per the provisions provided in GE-NE-523-A71-0594 and the associated NRC Safety Evaluation. The feedwater nozzle-to-safe end weld locations are included in the scope of both the NUREG 0619 Program and the RI-ISI Program. The plant augmented inspection program requirements for these locations are not affected or changed by the RI-ISI Program."

The subsuming of Category A welds in GL 88-01 by the RI-ISI program is permitted in accordance with Reference 4, since Category A welds are considered resistant to IGSCC. Examinations associated with those augmented piping inspection programs which were not subsumed by the RI-ISI program will continue in accordance with those programs.

3.2 Engineering Analysis

In accordance with the guidance provided in References 5 and 6, the licensee provided the results of an engineering analysis of the proposed changes, using a combination of traditional engineering analysis and supporting insights from the PRA. The licensee performed an evaluation to determine susceptibility of components (i.e., a piping weld) to a particular degradation mechanism that may be a precursor to leak or rupture, and then performed an independent assessment of the consequence of a failure at that location. The results of this analysis assure that the proposed changes are consistent with the principles of defense-in-depth, because EPRI TR-112657 methodology requires that the population of welds with high consequences following failure will always have some weld locations inspected regardless of the failure potential. No changes to the evaluation of design-basis accidents in the final safety analysis report are being made by the RI-ISI process. Therefore, sufficient safety margins will be maintained.

3.2.1 Failure Potential

Piping systems within the scope of the RI-ISI program were divided into piping segments. Pipe segments are defined as lengths of pipe whose failure (anywhere within the pipe segment) would lead to the same consequence and which are exposed to the same degradation mechanisms. That is, some lengths of pipe whose failure would lead to the same consequence may be split into two or more segments when two or more regions are exposed to different degradation mechanisms. Reference 1 states that failure potential assessment, summarized in Table 3.3 of Reference 1, was accomplished utilizing industry failure history, plant specific failure history, and other relevant information using the guidance provided in Reference 4.

Section 3 of Reference 1 describes a proposed deviation to the EPRI RI-ISI methodology for assessing the potential for the thermal stratification, cycling, and striping (TASCS) degradation mechanism. Per Reference 3, the proposed methodology for assessing TASCS at CNS follows the guidance provided in EPRI letters dated February 28 and March 28, 2001 (Reference 9). The proposed methodology is consistent with the guidance in EPRI Technical Report TR-1000701, "Interim Thermal Fatigue Management Guideline (MRP-24)," dated January 2001.

In the proposed deviation, the licensee provided additional considerations for determining the potential for TASCS, including piping configuration and potential turbulence, low flow conditions, valve leakage, and heat transfer due to convection. The staff finds that these considerations are appropriate for determining the potential for TASCS. The licensee further stated in Reference 3 that it would incorporate applicable NRC-approved final guidance of MRP-24 into its RI-ISI program for assessing TASCS (Commitment 1). The staff finds this acceptable.

The staff observed that Table 3.3 of Reference 1 appeared to identify substantially fewer potential failure mechanisms in the systems at CNS than at similar BWRs. In Reference 3, the licensee provided a description of the RI-ISI program failure assessment process, indicating that it conducted a thorough review of the relevant plant documentation, including data, piping and instrumentation diagram, system flow diagrams, piping geometry, dimensions and materials, operating temperatures, descriptions of normal operating and upset conditions, operating procedures, water chemistry, and insulation specifications. The licensee stated that susceptibility to IGSCC was determined per GL 88-01, and susceptibility to FAC was determined per their FAC program documents.

The licensee summarized its comparison to several other BWRs in Reference 3. Key differences are as follows:

- In 1985, the licensee performed a major piping replacement project at CNS to address the IGSCC issue. All susceptible piping was replaced with piping of low carbon content, satisfying the IGSCC Category A criteria of GL 88-01. In addition, certain dissimilar metal nozzle-to-safe end welds at CNS have Alloy 182 buttering with Alloy 82 corrosion resistant cladding and Induction Heating Stress Improvement. Per NUREG-0313 Revision 2, Section 2.1.1(3), this configuration satisfies the criteria for Category A, whose welds are subsumed into the RI-ISI program. As a result, the CNS has far fewer IGSCC-susceptible welds than at similar plants.

- The licensee determined that it has a comparable number of locations susceptible to FAC and crevice corrosion, as compared to similar plants.
- Main steam and feedwater piping appear to be just as susceptible to thermal transients as at similar plants. However, the residual heat removal (RHR) system is not as susceptible, because RHR water, by procedure, is pre-heated prior to entering shutdown cooling operations, which minimizes the thermal transient that may affect other similar plants.
- Also, the feedwater system at CNS is not as susceptible to TASCS due to a high initial flow rate called out by their operating procedures.

The staff concurs that these differences, in particular the benefits of the IGSCC piping replacement project, provide a reasonable explanation for having a lower number of elements susceptible to degradation mechanisms at CNS than at similar plants.

The staff concludes that the licensee has met the guidelines in Reference 8 to confirm that a systematic process was used to identify the component's (i.e., pipe segments) susceptibility to common degradation mechanisms, and to categorize these degradation mechanisms into the appropriate degradation categories with respect to their potential to result in a postulated leak or rupture.

3.2.2 Consequence Analysis

The licensee stated that the consequences of pressure boundary failures were evaluated and ranked based on their impact on core damage and containment performance (isolation, bypass, and large early release). The licensee notes that the consequence evaluation included an assessment of shutdown and external events. Also, the licensee indicates that impact on the above measures due to both direct and indirect effects was considered. Specifically, in Reference 2, the licensee noted that, as part of this consequence analysis, it conducted an independent evaluation for spatial effects related to flooding, including plant walk-downs, in the areas where piping in the RI-ISI scope is found. No spatial dependencies were identified that were not previously identified during the Individual Plant Examination (IPE). The licensee reported no deviations from the approved consequence evaluation guidance provided in Reference 4. Therefore, the staff considers the consequence analysis performed by the licensee for this application to be acceptable.

3.2.3 Probabilistic Risk Assessment

As stated in Reference 1, the licensee used an updated version of the IPE model to evaluate the consequences of pipe rupture for the RI-ISI assessment. This version of the risk model, CNS PRA 1998, is comprised of a Level 1 PRA model, CNS PRA 1996b, and a Level 2 PRA model, developed in 1998. It addresses accidents initiated by internal events at full power, and containment response to these accidents.

Per Reference 2, the licensee noted that while the CNS PRA does not quantify the contribution to core damage frequency (CDF) from internal flooding, overall flooding risk has been qualitatively evaluated using a prior study of flooding risk at CNS documented in

NUREG/CR-4767 (Reference 10). That study identified several plant features that protect the plant in the event of flooding caused by pipe breaks.

In Reference 1, the licensee stated that the baseline CDF estimated from this PRA model is 1.3E-05/year and the baseline large early release frequency (LERF) estimated is 5.6E-07/year.

3.2.3.1 Staff/Industry Review of the Probabilistic Risk Assessment

The original CNS IPE was submitted to the NRC in March 1993. The IPE estimated a CDF of 7.97E-05/year. The SER of the IPE, dated May 18,1995, concluded that the IPE met the intent of GL 88-20, "Individual Plant Examination for Severe Accident Vulnerabilities." By Reference 2, the licensee confirmed that the staff did not identify any significant weaknesses with the IPE. The licensee stated in Reference 1 that the Level 1 model of the IPE was updated several times, leading to the CNS PRA 1996b model which supports this application. A BWR owner's group (BWROG) probablistic safety assessment (PSA) peer review/certification was performed in July 1997. In 1998, the above noted Level 2 PRA model was developed. In November 2001, a second BWROG PSA peer review/certification was performed. The licensee indicates that it is currently revising these models to address comments from both of the peer reviews. Following these model revisions, the licensee intends to update the quantified results of this application.

The licensee noted that the peer reviews/certifications concluded that the following changes would provide the greatest opportunities for improvement on a relative basis:

- Initiating Event Analysis - the licensee was urged to finalize their most recent draft initiating event analysis and to complete development of plant specific support system trip models.
- Data Analysis - the licensee should use the most recent operating data where available.
- Human Reliability Analysis (HRA) - use more recent methodology for the treatment of human action dependencies.

In Reference 1, the licensee concluded that none of these opportunities for improvement would impact the consequence rankings because the risk importance of the systems evaluated in the RI-ISI process is dominated by loss-of-coolant accident events. The staff finds the conclusions for the first two opportunities acceptable, on the basis that changes to support system failure-related initiating event frequencies do not impact pipe segment conditional core damage probability (CCDP) (and hence, their consequence ranking), and that equipment performance has been improving in recent years (lower failure probabilities), which should lead to lower CCDPs for pipe segments performing mitigative functions. Hence, it is unlikely that a transition to more recent equipment performance data would result in the elevation of a pipe segment's safety significance.

In Reference 2, the licensee indicated that it does not expect improvements in HRA methodology to impact the current consequence rankings, primarily because it anticipates that revised human-error probability (HEP) values will remain the same or smaller. This expectation supports the licensee's conclusion with regard to the third opportunity for improvement. The staff finds that, if the revised HEPs are less than or equal to the current HEPs, it is unlikely the consequence ranking of any pipe segment will increase.

The staff concludes that the licensee has adequately demonstrated that significant comments from the two industry peer reviews (there were no significant comments from the staff's review of the IPE) of the licensee's PRA, which have not yet been incorporated into the PRA, will not measurably affect this alternative RI-ISI application. The staff did not review the current PRA models to assess the accuracy of the quantitative estimates. The staff recognizes that the quantitative results of the PRA model are used as order of magnitude estimates to support the assignment of segments into three broad consequence categories. Inaccuracies in the models or in assumptions large enough to invalidate the broad categorizations developed to support the RI-ISI should have been identified during the staff's review of the IPE, and by the licensee's model update control program that included peer review/certification of the PRA model. Minor errors or inappropriate assumptions will affect only the consequence categorization of a few segments and will not invalidate the general results or conclusions.

3.2.3.2 Change in Risk

As required by Section 3.7 of Reference 4, the licensee evaluated the change in risk expected from replacing the current ISI program with the RI-ISI program. The calculations estimated the change in risk due to removing locations and adding locations to the inspection program.

The expected change in risk was quantitatively evaluated using the "Simplified Risk Quantification Method" described in Section 3.7 of Reference 4. For high consequence category segments, the licensee used the CCDP and conditional large early release probability (CLERP) based on the highest estimated CCDP and CLERP. For medium consequence category segments, bounding estimates of CCDP and CLERP were used. The licensee estimated the change in risk using bounding pipe failure rates from the EPRI methodology.

The licensee performed its bounding analysis with and without taking credit for an increased probability of detection (POD). The aggregate change in risk estimates are provided in the following table.

Change in CDF		**Change in LERF**	
With Increased POD	Without Increased POD	With Increased POD	Without Increased POD
1.26E-09/year	1.32E-09/year	1.26E-10/year	1.32E-10/year

The staff finds the licensee's process to evaluate and bound the potential change in risk reasonable, because it (1) accounts for the change in the number and location of elements inspected, (2) recognizes the differences in degradation mechanisms related to failure likelihood, and (3) considers the synergistic effects of multiple degradation mechanisms within the same piping segment. System level and aggregate estimates of the changes in CDF and LERF are less than the corresponding guideline values in Reference 4. The staff finds that re-distributing the welds to be inspected with consideration of the safety significance of the segments provides assurance that segments whose failure have a significant impact on plant risk receive an acceptable and often improved level of inspection. Therefore, the staff concludes that the implementation of the RI-ISI program, as described in Reference 1, will have a small impact on risk consistent with the guidelines of Reference 5.

3.2.4 Integrated Decisionmaking

The licensee used an integrated approach in defining the proposed RI-ISI program by considering in concert the traditional engineering analysis, the risk evaluation, the implementation of the RI-ISI program, and performance monitoring of piping degradation. This is consistent with the guidelines given in Reference 6.

3.2.4.1 Risk Characterization

The licensee stated in Reference 1 that pipe segments (and ultimately the elements within, which are defined as all having the same degradation susceptibility) are ranked in accordance with definitions given in Reference 4.

3.2.4.2 Selection of Element Population for Inspection

The licensee stated that the selection of elements to be examined was determined using the guidance provided in Reference 4, specifically noting Section 3.6.4.2 "ASME Code Case –578." The staff notes that most of the elements in the sampling population (i.e., Medium and High Risk) were Medium Risk Category 4 elements (i.e., no degradation mechanism, mostly due to the identification of few areas in the plant subject to degradation mechanisms). In Reference 3, the licensee stated that, per Risk Category 4 requirements, a 10% sampling of the inspection locations was selected for examination in each of the applicable systems. The licensee also stated that, within each system, the selections were distributed among representative structural discontinuities, factoring in worker exposure concerns and access considerations. The staff finds that these considerations are reasonably consistent with those given in Section 3.6.5.2 "ASME Code Case –578 Applications" of Reference 4.

The licensee provided additional details for elements susceptible to FAC or IGSCC degradation mechanisms as follows. For elements susceptible to FAC and other degradation mechanisms, the licensee indicates that a NDE for FAC would not adequately detect other degradation mechanisms identified by the RI-ISI program. Hence, no FAC examinations will be credited to satisfy RI-ISI selection requirements. Rather, inspection locations selected for RI-ISI purposes that are in the FAC Program will be subjected to an independent examination to satisfy the RI-ISI Program requirements.

The licensee selected, under the RI-ISI program, the only element (non-category A) at CNS susceptible to the IGSCC degradation mechanism, and credited the IGSCC augmented inspection program NDE as a RI-ISI program NDE[1]. The licensee stated in Table 3.6-1 of Reference 1 that the NDE of this weld was previously credited in the ASME Section XI ISI Program. In Reference 3, the licensee stated that the use of augmented inspection program examinations to meet EPRI TR-112657 selection requirements is described in a letter to the NRC from J. Knubel (New York Power Authority), dated May 8, 2000, "Revised Risk-Informed Inservice Inspection (RI-ISI) Program," and that this position was accepted by the NRC as documented on Page 4 of the RI-ISI Safety Evaluation "Risk-Informed Inservice Inspection Program, James A. Fitzpatrick Power Plant," dated September 12, 2000.

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[1]This is a CRD return line nozzle cap weld that is classified as Category D per the plant's GL 88-01 Program.

The staff believes that this process of taking credit for augmented inspection program NDEs is more consistent with the provisions of Code Case -560 (which explicitly permits such crediting), than with Code Case -578, as they are described in Reference 4. The staff considers the use of this provision of Code Case -560 (the crediting of augmented inspection program NDEs), along with the other provisions of Code Case -578, to be acceptable.

The licensee provided detailed information on the results of the evaluation in the following tables in Reference 1:

- Table 3.1 provides the number of segments and elements associated with each system in the ASME Class 1 and 2 scope.
- Table 3.4 identifies, on a per system basis, the number of segments, by risk category, from both perspectives of including and excluding FAC/IGSCC as RI-ISI degradation mechanisms.
- Table 3.5 provides, from the perspective of excluding FAC/IGSCC as a RI-ISI degradation mechanism, a listing of the number of elements, by system, in each category, as well as the number of locations selected for NDE.
- Table 3.6-1 provides the risk impact analysis results for each system.
- Tables 5.1 and 5.2 provide summaries comparing the number of inspections required under the 1989 ASME Code Section XI ISI program with the alternative RI-ISI program.)

The licensee reported that 8.8% of Class 1 piping welds were selected for RI-ISI NDEs. Section 3.6.4.2 of Reference 4 states that if the percentage of Class 1 piping locations selected for examination falls substantially below 10%, then the basis for selection needs to be investigated. The licensee provided the following information relative to having fewer than 10% of Class I welds selected for NDE:

- The sampling percentage for Class 1 piping locations includes both socket and non-socket welds. If only non-socket welded locations are considered, the percentage of Class 1 piping welds selected for examination increases to 11.3%.

- No FAC examinations are being credited to satisfy RI-ISI selection requirements. Hence, the above sampling percentage does not take credit for any inspection locations selected for examination per the plant's augmented inspection program for FAC beyond those selected per the RI-ISI process, which will be subjected to an independent examination to satisfy the RI-ISI Program requirements.

- The only non-Category A inspection location selected for examination per the plant's augmented inspection program for IGSCC (Category D) was also selected for RI-ISI purposes to satisfy Risk Category 4 selection requirements.

Based on the information provided by the licensee in Reference 1, the requirement in Reference 4 to perform NDE inspections on at least 25 percent of the locations in the high-risk region and 10% of the locations in the medium-risk region is met. With regard to having only 8.8% of the total ASME Class 1 welds selected for NDE, which is less than the guideline of 10% given in Section 3.6.4.2 of Reference 4, the staff considers this deviation acceptable based on the consideration that socket welds cannot be examined effectively by the volumetric method.

Based on the staff's review of the above tables (containing the results of element selection), the staff concludes that the element selection results are consistent with the described process and with EPRI TR-112657 guidelines. Hence, the licensee's selection of element locations, which includes consideration of degradation mechanisms in addition to those covered by augmented inspection programs, is judged to be acceptable.

3.2.4.3 Examination Methods

As noted in Section 2 of this safety evaluation, the objective of ISI is to identify conditions (i.e., flaw indications) that are precursors to leaks and ruptures in the pressure boundary that may impact plant safety. To meet this objective, the risk-informed location selection process, per Reference 4, employs an "inspection for cause" approach. To address this approach, Section 4 of Reference 4 provides guidelines for the areas and/or volumes to be inspected, as well as the examination method, acceptance standard, and evaluation standard for each degradation mechanism. Based on its review and acceptance of Reference 4, the staff concluded that these examination methods are appropriate, since they are selected based on specific degradation mechanisms, pipe sizes, and materials of concern. The licensee stated that Section 4 of Reference 4 was used as guidance in determining the examination methods and requirements for these locations.

The staff notes that a large percentage of the welds selected for NDE are in Category 4 (i.e., no known active degradation mechanisms). The licensee indicated in Reference 3 that the Category 4 welds will be inspected by volumetric examinations.

In Reference 3, the licensee indicated that Reference 4 recommends the use of an ultrasonic examination in order to identify evidence of crevice corrosion in areas of the reactor recirculation and core spray systems that are susceptible to this degradation mechanism, and provides guidance for various piping configurations and associated examination volumes. The licensee is in the process of developing examination techniques for crevice corrosion. The licensee indicated that it will ensure that the vendor's examination procedures and qualifications will result in a reliable detection of crevice corrosion prior to implementing these examinations in the field.

Based on these considerations, the staff concludes that the licensee's determination of examination methods is acceptable.

3.2.4.4 Relief Requests for Examination Locations and Methods

As required by Section 6.4 of Reference 4, the licensee has completed an evaluation of existing relief requests to determine if any should be withdrawn or modified due to changes that occur from implementing the RI-ISI program.

The licensee proposes to modify and/or withdraw the following relief requests:

- RR-08, Revision 0 - This was the replacement of sample expansion criteria from ASME Section XI IWB-2430 with that from GL 88-01. For the RI-ISI program, the licensee discussed sample expansion criteria in Section 3.5.1 of Reference 1, which is a reflection of ASME Section XI IWB-2430.

- RI-20, Revision 1 - This relief request relates to a partial surface examination of weld RVD-BF-14. This weld was selected for NDE under the RI-ISI program, but it will be volumetrically examined in the future. In Reference 1, the licensee stated that the need for continuing this relief request will depend upon the results of the first examination. In Reference 3, the licensee, in response to a staff Request for Additional Information (RAI), agreed this request will be withdrawn at the time of the RI-ISI program approval because it was originally applicable to a surface examination and is now no longer applicable. If the future volumetric examination cannot achieve the requisite coverage, a new relief request will be issued at that time.
- RI-22, Revision 0 - This relief request covers three welds previously volumetrically examined under ASME Section XI: FWA-BJ-81, RBS-BJ-6A, and RAS-BJ-10. The first two welds are not selected for NDE under the proposed RI-ISI program, but the last one remains selected. Hence, this Relief Request will remain outstanding, but modified to remove the two welds no longer receiving examinations under the RI-ISI program.

The licensee stated that for any examination location where greater than 90% volumetric coverage cannot be obtained, the process outlined in Reference 4 will be followed. The staff finds the licensee's proposed treatment of existing relief requests to be acceptable.

3.2.5 Implementation and Monitoring

Implementation and performance monitoring strategies require careful consideration by the licensee and are addressed in Element 3 of Reference 6 and Section 3.9.8 of Reference 8. The objective of Element 3 is to assess performance of the affected piping systems under the proposed RI-ISI program by utilizing monitoring strategies that confirm the assumptions and analyses used in the development of the RI-ISI program. Pursuant to 10 CFR 50.55a(a)(3)(i), a proposed alternative, in this case the implementation of the RI-ISI program, including inspection scope, examination methods, and methods of evaluation of examination results, must provide an acceptable level of quality and safety.

The licensee stated that, upon approval of the RI-ISI program, procedures that comply with EPRI TR-112657 guidelines will be prepared to implement and monitor the RI-ISI program. The licensee stated in Reference 1 that the applicable aspects of the ASME Code not affected by the proposed RI-ISI program would be retained.

The licensee indicated in Section 4 of Reference 1 that the RI-ISI program is a living program and its implementation will require feedback of new relevant information to ensure the appropriate identification of safety-significant piping locations. The licensee also stated that, as a minimum, risk ranking of piping segments will be reviewed and adjusted on an ASME period basis, and that significant changes may require more frequent adjustment as directed by NRC bulletin or generic letter requirements, or by industry and plant-specific feedback. This periodic review and adjustment of the risk-ranking of segments ensures that changes to the PRA that the licensee will make to incorporate the peer review results will also be incorporated into the RI-ISI program as necessary.

The licensee addressed additional examinations in Section 3.5.1 of Reference 1, which states that examinations performed that reveal flaws or relevant conditions exceeding the applicable acceptance standards shall be extended to include additional examinations. These additional examinations shall include piping structural elements with the same postulated failure mode and the same or higher failure potential. Additional examinations will be performed on these elements up to a number equivalent to the number of elements with the same postulated failure mode originally scheduled for that fuel cycle. If the additional required examinations reveal flaws or relevant conditions exceeding the acceptance standards, the examinations shall be further extended to include all elements subject to the same failure mechanism, throughout the scope of the program, during the same outage.

The staff finds the licensee's approach acceptable, since the additional examinations, if required, will be performed during the same outage in which the indications or relevant conditions are identified.

CNS has commenced the third period of the third ten-year ISI inspection interval, and is planning to complete the program activities of the third period during its refueling outage (RFO) 22, in the winter of 2005. The CNS RI-ISI program will be integrated into the third interval. The licensee will take credit for ASME Code Section XI ISIs performed during the first two periods and the completed portion of the third period of the third ten-year ISI interval. During these periods, 55% of the ASME Section XI examinations have been completed. To meet the ASME Section XI requirements, the licensee will examine 45% of the locations selected for RI-ISI during this upcoming RFO. The staff finds this acceptable because it is consistent with the guidance provided in the Reference 5. The staff's guidance in Reference 7 stated, in part, that the implementation of the RI-ISI program at any time within an inspection interval is acceptable as long as the examination schedules are consistent with the interval requirements contained in Article IWB-2000 of ASME Code Section XI, as applied to Inspection Program B.

In Attachment 1 of Reference 1, the licensee originally requested an Applicable Time Period beginning with the last outage of the third period of the third ten-year ISI interval, extending through the fourth ten-year ISI interval. In response to a staff RAI stating that such a time period is not consistent with current regulatory requirements (which require that the ISI program be updated every 10 years), the licensee restated in Reference 3 that the applicable time period will run from the last outage of the third period of the third ten-year ISI interval through the remainder of the third ten-year interval. The staff finds this Applicable Time Period acceptable.

The staff finds that the proposed process for RI-ISI program implementation, monitoring, feedback, and updating meets the guidelines given in Reference 5, which states that risk-informed applications should include performance monitoring and feedback provisions. Hence, the licensee's proposed process for program implementation, monitoring, feedback, and updating is judged to be acceptable.

4.0 CONCLUSIONS

Pursuant to 10 CFR 50.55a(a)(3)(i), alternatives to the requirements of 10 CFR 50.55a(g) may be used, when authorized by the NRC, if the licensee demonstrates that the proposed alternatives will provide an acceptable level of quality and safety. In this case, the licensee has proposed an alternative to use the risk-informed process described in NRC-approved EPRI TR-112657.

Reference 5 establishes requirements for risk-informed decisions involving a change to a plant's licensing basis. Reference 6 establishes requirements for risk-informed decisions involving alternatives to the requirements of 10 CFR 50.55a(g) (ISI program requirements), and its directive to follow the requirements of the ASME Code Section XI. Both References, taken together, define the elements of an integrated decisionmaking process that assesses the level of quality and safety embodied in a proposed change to the ISI program. EPRI TR-112657 RI-ISI methodology contains the necessary details for implementing this process. This methodology provides for a systematic identification of safety-significant pipe segments, for a determination of where inspections should occur within these segments (i.e., identification of locations), and for a determination of how these locations will be inspected. Such segments/locations are characterized as having either active degradation mechanisms, or failure which would be expected to result in a significant challenge to safety (either immediately by initiating an event or later on in response to an unrelated event), or both.

EPRI TR-112657 methodology also provides for implementation and performance monitoring strategies to insure a proper transition from the current ISI program, and to assure that changes in plant performance and new information from the industry and/or from the NRC is incorporated into the licensee's ISI program, as needed.

Other aspects of the licensee's ISI program, such as system pressure tests and visual examination of piping structural elements, will continue to be performed on all Class 1, 2, and 3 systems in accordance with ASME Code Section XI. This provides a measure of continued monitoring of areas that are being eliminated from the NDE portion of the ISI program. As required by EPRI TR-112657 methodology, the existing ASME Code performance measurement strategies will remain in place. In addition, EPRI TR-112657 methodology provides for increased inspection volumes for those locations that are included in the NDE portion of the program.

The staff concludes that the licensee's development of its RI-ISI program is consistent with the methodology described in Reference 4. The licensee proposed one deviation from this methodology, in that it will assess susceptibility of piping segments and elements at CNS to TASCS in accordance with the guidance in Reference 9. The staff finds that the considerations in this guideline are appropriate for determining the potential for TASCS. The staff also finds the licensee's commitment to incorporate the applicable NRC-approved final MRP-24 guidance into its RI-ISI application acceptable (Commitment 1).

The staff concludes that the licensee's proposed program, which is consistent with the methodology as described in Reference 4 with one acceptable deviation, will provide an acceptable level of quality and safety pursuant to 10 CFR 50.55a(a)(3)(i) for the proposed alternative to the piping ISI requirements with regard to (1) the number of locations, (2) the locations of inspections, and (3) the methods of inspection.

Hence, the staff concludes that the licensee's proposed RI-ISI program is an acceptable alternative to the current ISI program for Class 1 and Class 2 piping welds at CNS. Therefore, the proposed RI-ISI program is authorized for the remainder of the third ten-year ISI interval pursuant to 10 CFR 50.55a(a)(3)(i) on the basis that this alternative will provide an acceptable level of quality and safety.

5.0 COMMITMENT

In Attachment 3 to Reference 3, the licensee listed the following regulatory commitment to be completed within 12 months of NRC acceptance of MRP-24:

> CNS will incorporate the applicable NRC-approved final guidance of MRP-24 into the RI-ISI program for assessing TASCS.

The NRC staff finds that reasonable controls for the implementation and for subsequent evaluation of proposed changes pertaining to the above regulatory commitment are best provided by the licensee's administrative processes, including its commitment management program (See Regulatory Issue Summary 2000-017, "Managing Regulatory Commitments Made by Power Reactor Licensees to the NRC Staff"). The above regulatory commitment does not warrant the creation of a regulatory requirement (items requiring prior NRC approval of subsequent changes).

6.0 REFERENCES

1. Letter from S. B. Minahan (NPPD) to NRC, “Risk-Informed Inservice Inspection Program (Relief Request RI-34),” March 11, 2004. ADAMS Accession No. ML040760812.

2. Letter from R. K. Edington (NPPD) to NRC, “Response to Request for Additional Information Regarding Risk-Informed Relief Request RI-34,” July 29, 2004. ADAMS Accession No. ML042160125.

3. Letter from R. K. Edington (NPPD) to NRC, “Response to Request for Additional Information Regarding Risk-Informed Relief Request RI-34,” August 26, 2004. ADAMS Accession No. ML042450464.

4. EPRI TR-112657, Revision B-A, "Revised Risk-Informed Inservice Inspection Evaluation Procedure (PWRMRP-05)," Final Report, December 1999. ADAMS Accession No. ML013470102.

5. Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 1, November 2002. ADAMS Accession No. ML023240437.

6. Regulatory Guide 1.178, "An Approach for Plant-Specific Risk-Informed Decisionmaking for Inservice Inspection of Piping," Revision 1, September 2003. ADAMS Accession No. ML032510128.

7. Letter from NRC to G. L. Vine (EPRI), "Safety Evaluation Report Related to EPRI Risk-Informed Inservice Inspection Evaluation Procedure (EPRI TR-112657, Revision B, July 1999)," dated October 28, 1999. ADAMS Accession No. ML993190460.

8. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Section 3.9.8, "Risk-Informed Inservice Inspection of Piping," Revision 1, September 2003. ADAMS Accession No. ML032510135.

9. Letters from P. J. O'Regan (EPRI), "Extension of Risk-Informed Inservice Inspection (RI-ISI) Methodology," dated February 28 and March 28, 2001. ADAMS Accession Nos. ML010650169 and ML011070238 respectively.

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