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10 CFR 50.55a

NLS2008012
January 30, 2008

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

Subject: 10 CFR 50.55a Request Number RI-35, Revision 0
Cooper Nuclear Station, Docket No. 50-298, DPR-46

The purpose of this letter is to request that the Nuclear Regulatory Commission (NRC) authorize the Nebraska Public Power District (NPPD) to use an alternative to certain inservice inspection (ISI) code requirements for the Cooper Nuclear Station (CNS) pursuant to 10 CFR 50.55a(a)(3)(i). This request involves proposed alternatives to the dissimilar metal weld repair requirements of Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, including proposed alternatives related to Code Cases N-504-2, N-638-1, N-638-4, N-740, and Appendix VIII Supplement 11.

10 CFR 50.55a Request Number RI-35, Revision 0, is based upon restoring the structural integrity of the applicable dissimilar metal weld nozzle safe-end to nozzle weld joints and pipe to pipe joints by applying a full structural weld overlay over the weld joint. The need to perform weld overlay repair is contingent upon the results of examinations planned for Refueling Outage 24 (RE-24), currently scheduled to begin April 12, 2008. Once approved, RI-35 will be applicable to the Fourth Ten-year ISI interval, which commenced on March 1, 2006, and applies to the remaining portion of the current operating license. The applicable ASME Code for this interval is the 2001 Edition through the 2003 Addenda.

RI-35, Revision 0, including the basis and details of the request, is provided in the attachment.

NPPD requests approval of this request by April 12, 2008, in order to support weld repair work for RE-24 (currently scheduled to commence April 12, 2008). The need for this exigent review has been discussed with the NRC Cooper Project Manager.

Should you have any questions concerning this matter, please contact Dave Van Der Kamp, Licensing Manager, at (402) 825-2904.

Sincerely,

Stewart B. Minahan
Vice President - Nuclear and
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A047

/dm

Attachment

cc: U.S. Nuclear Regulatory Commission w/attachment
Regional Office - Region IV

Cooper Project Manager w/attachment
USNRC - NRR Project Directorate IV-1

Senior Resident Inspector w/attachment
USNRC - CNS

NPG Distribution w/o attachment

CNS Records w/attachment

10CFR 50.55a Request Number RI-35, Revision 0
Alternative Weld Overlay Repairs for Dissimilar Metal Welds Joining Nozzle to Safe-End, Nozzle to Control Rod Drive End Cap, and Piping Configurations

Cooper Nuclear Station
Docket No. 50-298, DPR-46

Proposed Alternative
in Accordance to 10CFR50.55a(a)(3)(i)

--Alternative Provides Acceptable Level of Quality and Safety--

Applicable Code Components Affected

Code Class: 1
Examination Categories: B-F, B-J, R-A
Item Numbers: B5.10, B9.11
Component Numbers:

CSA-BF-1x	10 inch Core Spray Nozzle N5A to Safe End Weld
CSB-BF-1x	10 inch Core Spray Nozzle N5B to Safe End Weld
RRA-BF-1	12 inch Reactor Recirc. Nozzle N2A to Safe End Weld
RRB-BF-1	12 inch Reactor Recirc. Inlet Nozzle N2B to Safe End Weld
RRC-BF-1	12 inch Reactor Recirc. Inlet Nozzle N2C to Safe End Weld
RRD-BF-1	12 inch Reactor Recirc. Inlet Nozzle N2D to Safe End Weld
RRE-BF-1	12 inch Reactor Recirc. Inlet Nozzle N2E to Safe End Weld
RRF-BF-1	12 inch Reactor Recirc. Inlet Nozzle N2F to Safe End Weld
RRG-BF-1	12 inch Reactor Recirc. Inlet Nozzle N2G to Safe End Weld
RRH-BF-1	12 inch Reactor Recirc. Inlet Nozzle N2H to Safe End Weld
RRJ-BF-1	12 inch Reactor Recirc. Inlet Nozzle N2J to Safe End Weld
RRK-BF-1	12 inch Reactor Recirc. Inlet Nozzle N2K to Safe End Weld
RAS-BF-1	29 inch Reactor Recirc. Outlet N1A Nozzle to Safe-end Weld
RBS-BF-1	29 inch Reactor Recirc. Outlet N1B Nozzle to Safe-end Weld
CSA-BF-4A	10 inch Core Spray Pipe to Pipe Weld A Loop
CSB-BF-4A	10 inch Core Spray Pipe to Pipe Weld B Loop
RAS-BF-12	20 inch Reactor Recirc. Elbow to Pipe weld
RCA-BF-1	5 inch Control Rod Drive Return Cap to Nozzle N9 Weld

Applicable Code Edition and Addenda

American Society of Mechanical Engineers (ASME) Code Section XI, 2001 Edition, 2003 Addenda

Applicable Code Requirement

IWA-4421(a) and IWA-4611.1(a) require removal of the detected flaw.

IWA-4610(a) requires that the area to be welded shall be pre-heated to 300°F minimum for gas tungsten arc welding (GTAW).

IWA-4610(a) also requires the use of thermocouples to monitor process temperatures.

IWA-4631(b) specifies the surface of the completed weld on the ferritic steel shall not exceed 100 square inches.

IWA-4633.2(c) specifies the first three layers of the weld shall be deposited with heat inputs within ±10% of that used in the procedure qualification test. Subsequent layers shall be deposited using heat input equal to or less than that used for layers beyond the third in the procedure qualification.

IWA-4633.2(c) also specifies that at least one layer of weld reinforcement shall be deposited and then this reinforcement shall be removed, to be substantially flush with the surface surrounding the weld.

Appendix VIII provides requirements for performance demonstration for ultrasonic examination systems. Supplement 11 provides qualification requirements for full structural overlaid wrought austenitic piping welds.

Reason for Request

Pursuant to 10 CFR 50.55a, "Codes and Standards," Paragraph (a)(3), relief is requested from the requirements of ASME Code Section XI requirements. The request is based upon restoring the structural integrity of the applicable dissimilar metal weld nozzle safe-end to nozzle weld joints, nozzle to control rod drive end cap weld joints, and pipe to pipe joints by applying a full structural weld overlay over the weld joint using technically sound welding practices and non-destructive examination (NDE), while limiting repair personnel exposure to the maximum extent practical. Currently, there exist no generically accepted Code approved criteria for a licensee to apply a full structural weld overlay to dissimilar metal welds involving nickel alloys such as Alloy 600, 82 and 182 at ambient temperature.

The following cited ASME Section XI articles identify the actions that would be required if a repair is performed in accordance with the Code without exception:

IWA-4421(a) and IWA-4611.1(a) require removal of the detected flaw. The repair cavity would extend through-wall since outer diameter (OD) removal would be required. Internal diameter (ID) removal of the indication and subsequent weld repair would be impractical due to the need to drain the vessel to perform the repair, and the resultant radiation levels would present unacceptable exposure burden.

IWA-4610(a) requires that the area to be welded shall be pre-heated to 300°F minimum for GTAW. Since the nozzle or pipe will remain full of water, establishing the 300°F minimum pre-heat temperature cannot be achieved.

IWA-4610(a) also requires the use of thermocouples to monitor process temperature. Due to the personnel exposure associated with the installation and removal of the thermocouples, the nozzle configuration, and because the nozzle will be full of water, a contact pyrometer will be used, in lieu of thermocouples, to provide equivalent temperature monitoring capabilities.

IWA-4631 (b) specifies the surface of the completed weld on the ferritic steel shall not exceed 100 square inches. Restoring the structural integrity with the weld overlay of the safe-end to nozzle weld or the end cap-to-nozzle weld will (in some instances) require welding on more than 100 square inches of surface on the low alloy steel base material.

IWA-4633.2(c) specifies the first three layers of the weld shall be deposited with heat inputs within ±10% of that used in the procedure qualification test. Subsequent layers shall be deposited using heat input equal to or less than that used for layers beyond the third in the procedure qualification. Code Case N-638-1 (Reference 3) allows for layers beyond the third to exceed the heat input provided it is in accordance with the procedure qualification records (PQRs).

IWA-4633.2(c) also specifies that at least one layer of weld reinforcement shall be deposited and then this reinforcement shall be removed, to be substantially flush with the surface surrounding the weld. The weld reinforcement will not be removed flush to the surface.

Appendix VIII provides requirements for performance demonstration for ultrasonic examination systems. Supplement 11 provides qualification requirements for full structural overlaid wrought austenitic piping welds. Appendix VIII, Supplement 11 cannot be implemented as written for ultrasonic examination of structural weld overlay repair.

Proposed Alternative and Basis for Use

A full structural weld overlay repair, which entirely replaces the original pressure boundary of the dissimilar metal weld, is proposed for the safe-end to nozzle, end cap to nozzle, and pipe to pipe weldments. The nozzle material is SA-508 Class 2 low alloy steel. The safe-end material is SA403-WP316 stainless steel. The control rod drive end cap material is Alloy 600. The existing weld material is Alloy 82, with Alloy 182 buttering. The pipe to pipe welds also are austenitic to ferritic dissimilar metal joints.

The full structural weld overlay will be designed consistent with the requirements of:

1) NUREG-0313, Revision 2 (Reference 6) (implemented by Generic Letter 88-01 (Reference 7)).

2) Code Case N-504-3 (Reference 2), "Alternative Rules for Repair of Classes 1, 2, and 3 Austenitic Stainless Steel Piping." Regulatory Guide 1.147, Revision 15 requires the following condition to be met when using Code Case N-504-3:

   "The provisions of Section XI, Non-Mandatory Appendix Q, "Weld Overlay Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping Weldments", must also be met."

   Cooper Nuclear Station will meet the associated requirements contained in non-mandatory Appendix Q, 2007 Edition (Reference 9).

3) Code Case N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature GTAW Temper Bead Technique," listed in Regulatory Guide 1.147, Revision 15 requires the following condition to be met when using Code Case N-638-1:

   "UT volumetric examinations shall be performed with personnel and procedures qualified for the repaired volume and qualified by demonstration using representative samples which contain construction type flaws. The acceptance criteria of NB-5330 in the 1998 Edition through 2000 Addenda of Section III apply to all flaws identified in the repair volume."

   Cooper Nuclear Station will implement this limitation.

4) Code Case N-638-4 (Reference 4), "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique, Section XI, Division 1."

5) IWB-3640, ASME Section XI 2001 Edition including Addenda through 2003 with Appendix C.

Welder Qualification and Welding Procedures-Use of Alloy 52M

All welders and welding operators will be qualified in accordance with ASME Section IX and any special requirements of ASME XI or applicable code cases. Qualified personnel under the vendor's welding program will perform the weld overlay repair.

A weld procedure specification utilizing machine GTAW (with cold wire feed) for welding SFA-5.14, ERNiCrFe-7A, UNS N06054, F-No. 43 (commercially known as Alloy 52M) will be used. This alloy has nominally 30% chromium, which is significantly greater than Alloy 82 (which nominally contains 20% chromium), and has been accepted by the Nuclear Regulatory Commission (NRC) in NUREG-0313, Revision 2 as a resistant material against intergranular stress corrosion cracking (IGSCC) in the BWR.

If repairs to the overlay are required, manual GTAW for welding SFA-5.14, ERNiCrFe-7A, UNS N06054, F-No. 43 (commercially known as Alloy 52M) will be used. In the unlikely event of a through-wall defect, UNS W86152, F No. 43 manual shield metal arc weld (SMAW) weld

rod (commercially known as Alloy 152) will be used to seal any defect if it is greater than 0.125 inch from the P-3 nozzle material before beginning the structural weld overlay using GTAW.

Welding Wire and Electrodes

A consumable nickel based welding wire, highly resistant to stress corrosion cracking (SCC), is selected as the weld overlay material. This material, Alloy 52M, contains a nominal 30 wt% Cr level that imparts excellent resistance to SCC. Where localized repairs are required, Alloy 52M will also be used.

Weld Overlay Design

The weld overlay will extend around the full circumference of the safe-end to nozzle, end cap to nozzle, or pipe to pipe weldment location in accordance with NUREG-0313, Revision 2, Code Case N-504-3 and Generic Letter 88-01. The overlay length will extend across the projected flaw intersection with the outer surface beyond the extreme axial boundaries of the flaw. The design thickness and length will be determined in accordance with the guidance provided in Code Case N-504-3 (paragraph f(1)) and ASME Section XI, paragraph IWB-3640, 2001 Edition including Addenda through 2003, and Appendix C for the evaluation methodology for flawed pipe. The overlay will completely cover the area of the flaw and other Alloy 182 or susceptible austenitic stainless steel material with the highly resistant Alloy 52M weld filler material. The overlay length conforms to the guidance of Code Case N-504-3, paragraph f(1), which satisfies the stress and load transfer requirements. A sketch of a typical weld overlay repair to a nozzle to safe-end joint is presented in Figure 1 at the end of this request.

In order to apply the necessary weld overlay geometry, it will be necessary to weld on the low alloy steel nozzle base material. A temper bead welding approach will be used for this purpose following the guidance of ASME Section XI Code Case N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique." This Code Case provides for fabricating machine GTAW temper bead weld repairs to P-No. 3 Group No.3 nozzle base material at ambient temperature. The temper bead approach was selected because temper bead welding is an acceptable alternative to the requirement for post-weld heat treatment (PWHT) of the heat-affected zone (HAZ) in welds on low alloy steel material. Also, the temper bead welding technique produces excellent toughness and ductility as demonstrated by welding procedure qualification in the HAZ of welds on low alloy steel materials, and, in this case, results in compressive residual stresses on the inside surface, which assists in inhibiting SCC. This approach provides a comprehensive weld overlay repair and increases the volume under the overlay that can be examined.

Pressure Testing

The completed repair shall be given a system leakage test in accordance with the CNS Section XI Repair/Replacement Program and in accordance with ASME Section XI, IWB-5220, 2001 Edition, 2003 Addenda. In the event an unexpected through wall defect is identified, either before or during the repair, the hydrostatic pressure test requirements defined in Code Case N-

504-3 will not be used since the requirements for the 2001 Edition, 2003 Addenda will be met for this repair activity.

Pre-heat and PWHT Requirements

Pre-heat and PWHT are typically required for welding on low alloy steel material. ASME Section III specifies PWHT on P-No. 3, Group No. 3, base materials unless temper bead welding is performed under limited restrictions (area and depth limits). ASME Section XI, 2001 Edition including Addenda through 2003, IWA-4610(a) specifies 300°F minimum pre-heat be used for temper bead welding. PWHT cannot be performed and the pre-heat requirements would necessitate draining the reactor pressure vessel (RPV) and a portion of the recirculation system piping. This would result in unacceptable radiation exposure of personnel. Therefore, consistent with ALARA practices and prudent utilization of outage personnel, the RPV will not be drained for this activity. The nozzle and connected piping will be full of water.

Basis for the Alternatives

IWA-4421(a) and IWA-4611.1(a) require removal of the detected flaw. The repair cavity would extend through wall since OD removal would be required. The ID is inaccessible due to the thermal sleeve. Therefore, the flaw will not be removed. Structural weld overlays covering flaws are permitted by Code Case N-504-3 provided the necessary weld overlay geometry is used.

IWA-4610(a) requires that the area to be welded shall be pre-heated to 300°F minimum for GTAW. Since the nozzle will remain full of water, establishing the 300°F minimum pre-heat temperature cannot be achieved. Code Case N-638-1, paragraph 1.0(b) provides for machine GTAW temper bead weld repairs to P-No. 3, Group No. 3, nozzle base material at ambient temperature. The ambient temperature temper bead approach was selected because temper bead welding supplants the requirement for PWHT of the HAZ in welds on low alloy steel material. Also, the temper bead welding technique produces excellent toughness and ductility, as demonstrated by welding procedure qualification, in the HAZ of welds on low alloy steel materials. Welding procedure qualifications have been successfully performed using Alloy 52M welds on P-No. 3, Group No.3, base material using the ambient temperature temper bead technique.

IWA-4610(a) also requires the use of thermocouples to monitor process temperatures. Due to the personnel exposure associated with the installation and removal of the thermocouples from the nozzle configuration, and because the water in the associated line will not be drained, thermocouples will not be used to verify that pre-heat and interpass temperature limits are met. In lieu of thermocouples, a contact pyrometer will be used to verify pre-heat temperature and interpass temperature compliance with the welding procedure surveillance (WPS) requirements. The use of a contact pyrometer provides equivalent temperature monitoring capabilities.

IWA-4631(b) specifies the surface of the completed weld on the ferritic steel shall not exceed 100 square inches. Restoring the structural integrity with the weld overlay of the safe-end to nozzle weld or control rod drive end cap to nozzle weld will (in some instances) require welding

on more than 100 square inches of surface on the low alloy steel base material. Recently approved ASME Section XI Code Cases N-638-4 paragraph 1.0(b) and N-740 (Reference 5) (Mandatory Appendix I) extend that limit to 500 square inches of surface on the low alloy steel base material. The NRC has accepted the increase on surface area to 500 square inches in at least one request as discussed in this document.

In addition, if the 100 square inch surface limit were maintained, the length of weld overlay extension on the nozzle base material would be severely limited on the nozzle side of the joint. This distance could be justified as sufficient to provide load redistribution from the weld overlay back into the nozzle without violating ASME III stress limits for primary local and bending stresses, and secondary and peak stresses for some of the joints. However, this length would not permit a complete ultrasonic test (UT) of the outer 25% of the nozzle and safe-end thickness as specified by Code Case N-504-3 for these nozzle to safe-end or nozzle to end cap configurations. The overlay may extend to the transition taper of the low alloy steel nozzle if this is necessary to provide adequate structural reinforcement and allow necessary NDE personnel access so that qualified UT of the required volume can be performed.

Code Case N-432-1 (Reference 1) allows temper bead welding on low alloy steel nozzles without limiting the temper bead weld surface area. The two additional conditions required by N-432-1, that are not required by Code Case N-638-1, are that temper bead welds have pre-heat applied and that the procedure qualification be performed on the same specification, type, grade, and class of material. As previously discussed, elevated pre-heat necessitates draining of the RPV and a portion of the recirculation system piping. This would result in unacceptable radiation exposure to personnel.

IWA-4633.2(c) specifies that the first three layers of the weld shall be deposited with heat inputs within ±10% of that used in the procedure qualification test. Subsequent layers shall be deposited using heat input equal to or less than that used for layers beyond the third in the procedure qualification. Code Case N-638-1 allows for layers beyond the third to exceed the heat input provided it is in accordance with the PQRs.

IWA-4633.2(c) also specifies that at least one layer of weld reinforcement shall be deposited and then this reinforcement shall be removed, to be substantially flush with the surface surrounding the weld. The weld overlay is austenitic and thus, there is no need to remove the final layer. Also, overlays, by definition, cannot be substantially flush with the surrounding surface. Overlays are permitted per Code Case N-504-3. The toe of the weld on the low alloy steel nozzle shoulder will be indexed between layers such that proper HAZ tempering will result.

Code Case N-638-1 is approved (with one limitation) for generic use in Regulatory Guide (RG) 1.147, Revision 15 and was developed for both similar and dissimilar metal welding using ambient temperature machine GTAW temper bead technique. The welding methodology of Code Case N-638-1 will be followed for the overlay, whenever welding within the 0.125-inch minimum distance from the low alloy steel nozzle base material.

Code Case N-504-3 is approved (with one limitation) for generic use in RG 1.147, Revision 15 and was developed for welding on and using austenitic stainless steel material. An alternate application for nickel-based and low alloy steel materials is proposed due to the specific configuration of this weldment. The weld overlay proposed is austenitic material having a mechanical behavior similar to austenitic stainless steel. It is also compatible with the existing weld and base materials.

The methodology of Code Case N-504-3 is to be followed, except for the following:

Code Case N-504-3 Requirement (b) requires the weld overlay shall be low carbon (0.035% maximum) austenitic stainless steel. A consumable welding wire highly resistant to SCC was selected for the overlay material. This material, designated as UNS N06054, F-No. 43, is a nickel based alloy weld filler material, commonly referred to as Alloy 52M and will be deposited using the machine GTAW process with cold wire feed. Alloy 52M contains about 30 wt% chromium, which imparts excellent corrosion resistance to the material. By comparison, Alloy 82 is identified as a SCC-resistant material in NUREG-0313, Revision 2 and contains nominally 20 wt% chromium, while Alloy 182 has a nominal chromium content of 15 wt%. With its significantly higher chromium content than Alloy 82, Alloy 52M provides an even higher level of resistance to SCC consistent with the requirements of the Code Case.

Exception to Code Case N-504-3, Requirement (h)

Code Case N-504-3, Requirement (h) specifies that a system hydrostatic test shall be performed in accordance with IWA-5000 if the flaw penetrates the pressure boundary. Leak testing in accordance with ASME Section XI (2001 Edition with the 2003 Addenda), IWA-5000, will be performed. Precedence for use of a leak test at normal operating temperature and pressure in lieu of a hydrostatic test has been set with Code Case N-416-1 that has been incorporated in ASME Section XI beginning in the 1998 Edition with the 1999 Addenda.

Exceptions to Code Case N-638-1 Paragraph 1.0(a)

Code Case N-638-1 paragraph 1.0(a) specifies that the maximum weld area on the finished surface shall be 100 square inches. Restoring the structural integrity with the weld overlay of the safe-end to nozzle weld will require welding on more than 100 square inches of surface on the low alloy steel base material. Recently approved ASME Section XI Code Cases N-638-4 paragraph 1.0(b) and N-740 (Mandatory Appendix I) extend that limit to 500 square inches of surface on the low alloy steel base material. The NRC has accepted the increase on surface area to 500 square inches in at least one request as discussed in this document.

As noted above, the ASME Code committees have recognized that the 100 square inches restriction on the surface area is unnecessarily limiting and Code Case N-638-4 has been issued to increase the surface area limit to 500 square inches. The supporting analysis for the code case is documented in Electric Power Research Institute (EPRI) Technical Report 1003616, "Additional Evaluations to Expand Repair Limits for Pressure Vessels and Nozzles,"

(Reference 8). This EPRI report has been used in several requests to expand the surface area limit (see discussion in "Precedents").

Exception to Code Case N-638-1 Paragraph 4.0(b)

Code Case N-638-1 Paragraph 4.0(b) specifies that the final weld surface and band area (1.5T width or 5 inches, whichever is less, per paragraph1.0 (d)) shall be examined using surface and ultrasonic methods when the completed weld has been at ambient temperature for at least 48 hours. Although the provisions of Code Case N-638-1 and N-740 require that the final post-weld examinations be performed after completion of welding, exception is taken to that provision. The 48 hour hold will begin following the completion of the third temper bead weld layer on the ferritic base metal, as provided in paragraph 4(a)(2) of Code Case N-638-4, which has been approved by the ASME Code Committee but has not yet received NRC endorsement. However, the NRC has approved the beginning of the 48 hour hold following completion of the third temper bead weld layer on the ferritic base metal in recent requests.

The UT shall be in accordance with ASME Section XI, Appendix I. Surface exams will be performed. IWA-4634 requires UT of the weld only. Any laminar flaws in the weld overlay will be evaluated in accordance with ASME Section XI Non-mandatory Appendix Q, Paragraph Q-4100, except, as allowed by IWB-3132.3, any flaws that exceed the acceptance standards of Table IWB-3510-1 are acceptable for continued service, without repair, if an analytical evaluation, performed in accordance with IWB-3600, meets the acceptance criteria of IWB-3600. Full UT of the 1.5T band will not be performed. The weld overlay will extend into the blend radius of the nozzle beyond the length required by Code Case N-504-3 for structural reinforcement. This extension onto the blend radius eliminates a stress riser on the nozzle and provides additional OD surface area for UT examination of the defect area. UT examination on the nozzle beyond the overlay will not provide any information regarding the area of the defect that required repair. Additionally, such UT would likely be unsatisfactory when applied to the nozzle blend radius, where the toe of the weld overlay resides. The UT return signal would be difficult to obtain and to interpret. Alternatively, surface examination will assure that no defects have been created at the toe of the weld overlay.

Exception to Code Case N-638-1 paragraph 4.0(c)

Code Case N-638-1 paragraph 4.0(c) specifies that the area from which weld-attached thermocouples have been removed shall be ground and examined using a surface examination method. Due to the personnel exposure associated with the installation and removal of the thermocouples, the nozzle configuration, and because the nozzle will be full of water, thermocouples will not be used to verify that the pre-heat and interpass temperature limits are met. In lieu of thermocouples, a contact pyrometer will be used to verify pre-heat temperature and interpass temperature compliance with the WPS requirements.

The use of overlay filler material that provides excellent resistance to SCC develops an effective barrier to flaw extension. Also, temper bead welding techniques produce excellent toughness and ductility in the weld HAZ low alloy steel materials, and in this case, results in compressive

residual stresses on the inside surface that help to inhibit further SCC. The design of the overlay for the safe-end to nozzle weldments and the control rod drive end cap to nozzle weldment uses methods that are standard in the industry. There are no new or different approaches in this overlay design which would be considered either first-of-a-kind or inconsistent with previous approaches. The overlay will be designed as a full structural overlay in accordance with Code Case N-504-3, except as noted above. The temper bead welding technique that will be implemented in accordance with Code Case N-638-1 will produce a tough, ductile, corrosion-resistant overlay.

Appendix VIII provides requirements for performance demonstration for ultrasonic examination systems. Supplement 11 provides qualification requirements for full structural overlaid wrought austenitic piping welds. Appendix VIII, Supplement 11 cannot be implemented as written for ultrasonic examination of structural weld overlay repair. Table 2 includes a discussion of the Performance Demonstration Initiative (PDI) Program alternatives and their bases with respect to Appendix VIII, Supplement 11 requirements.

Examination Requirements

NUREG-0313, Revision 2, and Code Case N-504-3, specify UT using methods and personnel qualified in accordance with ASME Section XI, Appendix I. The UT techniques to be used for the final post-weld examination have been qualified through the EPRI NDE Center, which satisfies the requirements of ASME Section XI, Appendix I. Furthermore, NUREG-0313 states that the UT is to be performed in accordance with the requirements of the applicable Edition and Addenda of ASME Section XI. ASME Section XI, 2001 Edition including Addenda through 2003 is the Code of Record for the current Cooper In-service Inspection Interval. Therefore, the acceptance criteria that will be used for the UT will be IWB-3130, "In-service Volumetric and Surface Examinations," and ASME Section XI (2007 Edition) Non-mandatory Appendix Q, "Weld Overlay Repair of Class 1, 2, and 3 Austenitic Stainless Steel Piping Weldments," as clarified under Exceptions to Code Case N-638-1 Paragraph 4.0(b).

Although the provisions of Code Case N-638-1 (paragraph 4.0(b)) and N-740 (paragraph a(3)) require that the final post-weld examinations be performed after completion of welding, exception is taken to that provision and the 48 hour hold will begin following the completion of the third temper bead weld layer on the ferritic base metal, as provided in paragraph 4(a)(2) of Code Case N-638-4, which has been approved by the ASME Code Committee but has not yet received NRC endorsement. Table 1 summarizes the examination requirements:

Table 1: Summary of Examination Requirements

Exam Description	Method	Technique	Reference
As found flaw detection	UT	PDI Qualified Implementing ASME Section XI, Appendix VIII, Supplement 10	IWB-3514.4
Pre-weld UT Thickness	UT	0°	N-504-3
Surface Prior to welding	PT	Color Contrast (Visible) Penetrant	IWA-4611.1(a) N504-2(c) N-638-1, 4.0(a)
Final Weld Overlay Surface	PT	Color Contrast (Visible) Penetrant	IWA-4634 N-504-3(j) N-638-1, 4.0(b)
Final Weld Overlay for Thickness	UT	0°	IWA-4634 N-504-3(j) N-638-1, 4.0(b)
Final Weld Overlay and outer 25% of the underlying wall thickness volumetric Pre-service	UT	PDI Qualified Implementing ASME Section XI, Appendix VIII Supplement 11 as allowed by this request.	IWA-4634 IWB-3514.4 N-504-3(j) N-638-1, 4.0(b) Appendix Q (2007 Edition)

PDI Program vs. Supplement 11

Relief is requested to allow closer spacing of flaws provided they didn't interfere with detection or discrimination. The existing specimens used to date for qualification to the Tri-party (NRC/Boiling Water Reactor Owners Group/EPRI) agreement have a flaw population density greater than allowed by the current Code requirements. These samples have been used successfully for all previous qualifications under the Tri-party agreement program. To facilitate their use and provide continuity from the Tri-party agreement program to Supplement 11, the PDI Program has merged the Tri-party test specimens into their weld overlay program.

Duration of Proposed Alternative

Cooper Nuclear Station is currently in its Fourth ten-year ISI interval, which began March 1, 2006. This interval will end concurrent with the expiration of Cooper Operating License on January 18, 2014. Consequently, the requested relief is for the remainder of the current operating license.

Precedents

As discussed above, the ASME Code committees have recognized that the 100 square inches restriction on the surface area is unnecessarily limiting and Code Case N-638-4 has been issued to increase the surface area limit to 500 square inches. The supporting analysis (Reference 8) for the code case has been used in several requests to expand the surface area limit and recently the NRC has approved previous request(s) that contain the 500 square inch surface area provision. For example, the request for Millstone Unit 3 was approved by the NRC in a letter dated May 3,

2007, and it included approval of 500 square inch surface area provision on the low alloy steel nozzle (ADAMS Accession # ML071210024, TAC # MD 3379).

Regarding the use of PDI in lieu of Supplement 11 requirements, NRC approved requests have been granted for several utilities that allow the use of the PDI Program for implementation of Appendix VIII, Supplement 11 requirements for the examination of piping welds with overlays.

The proposed repair activity is consistent with documented IGSCC in dissimilar metal welds that has been repaired using the weld overlay repair at other boiling water reactors, including Duane Arnold, Perry, Nine Mile Point-Unit 2, Susquehanna, Pilgrim and Hope Creek.

References

1. ASME Case N-432-1, "Repair Welding Using Automatic or Machine Gas Tungsten-Arc Welding (GTAW) Temper Bead Technique, Section XI, Division 1"

2. ASME Case N-504-3, "Alternative Rules for Repair of Classes 1, 2, and 3 Austenitic Stainless Steel Piping, Section XI, Division 1"

3. ASME Code Case N-638-1, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique, Section XI, Division 1"

4. ASME Code Case N-638-4, "Similar and Dissimilar Metal Welding Using Ambient Temperature Machine GTAW Temper Bead Technique, Section XI, Division 1"

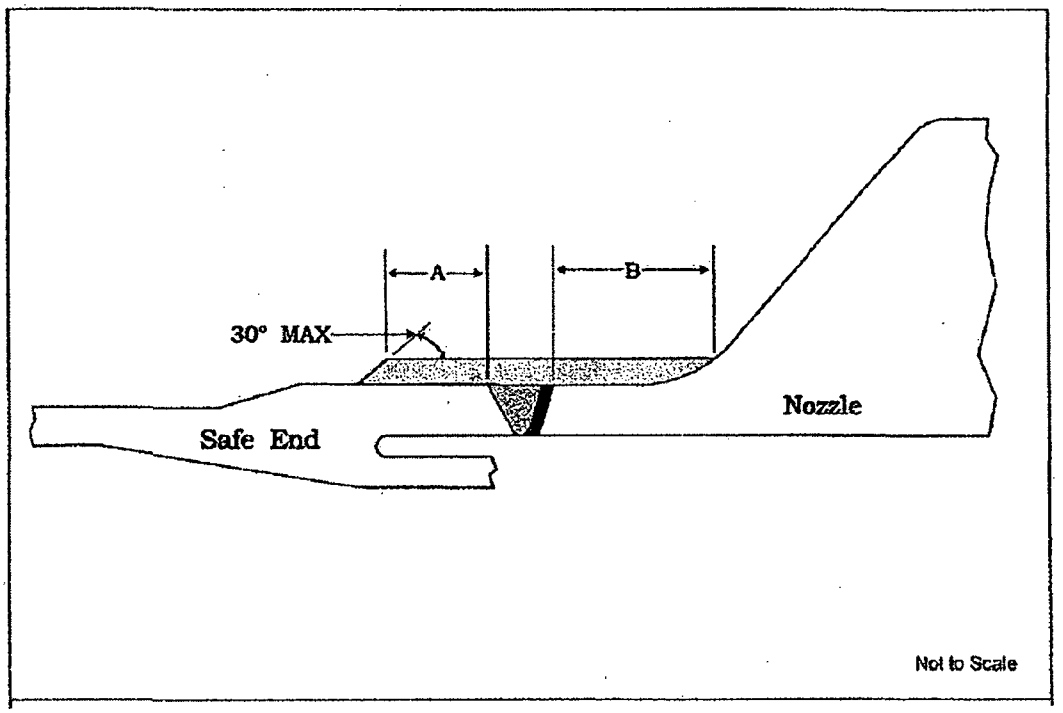
5. ASME Code Case N-740, "Dissimilar Metal Weld Overlay Repair of Class 1, 2, and 3 Items, Section XI, Division 1"

6. NUREG-0313 Revision 2, Date Published: January 1988

7. NRC Generic Letter 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," January 25, 1988, and Supplement 1, February 4, 1992

8. EPRI Technical Report 1003616, "Additional Evaluations to Expand Repair Limits for Pressure Vessels and Nozzles," March 2004

9. ASME Section XI, Nonmandatory Appendix Q, "Weld Overlay Repair of Classes 1, 2, and 3 Austenitic Stainless Steel Piping Weldments, 2007



Design Dimensions		
A	B	Thickness
2.0 inch	*Overlay to be gently blended into nozzle* to minimize stress concentration and to accommodate temper bead weld passes	0.500 inch

Figure 1
Typical Weld Overlay Repair Configuration for Recirculation System Nozzle to Safe End Joint

Table 2
PDI Program Modifications to Appendix VIII Supplement 11

Supplement 11-Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds	PDI Program: The Proposed Alternative to Supplement 11 Requirements
1.0 SPECIMEN REQUIREMENTS	
1.1 General. The specimen set shall conform to the following requirements.	
(b) The specimen set shall consist of at least three specimens having different nominal pipe diameters and overlay thicknesses. They shall include the minimum and maximum nominal pipe diameters for which the examination procedure is applicable. Pipe diameters within a range of 0.9 to 1.5 times a nominal diameter shall be considered equivalent. If the procedure is applicable to pipe diameters of 24 in. or larger, the specimen set must include at least one specimen 24 in. or larger but need not include the maximum diameter. The specimen set must include at least one specimen with overlay thickness within -0.1 in. to +0.25 in. of the maximum nominal overlay thickness for which the procedure is applicable.	**Alternative:** (b) The specimen set shall include specimens with overlays not thicker than 0.1 inch more than the minimum thickness, nor thinner than 0.25 inch of the maximum nominal overlay thickness for which the examination procedure is applicable. **Basis:** *To avoid confusion, the overlay thickness tolerance contained in the last sentence was reworded and the phrase "and the remainder shall be alternative flaws" was added to the next to last sentence in paragraph 1.1 (d)(1).*
(d) Flaw Conditions	
(1) Base metal flaws. All flaws must be cracks in or near the butt weld heat-affected zone, open to the inside surface, and extending at least 75% through the base metal wall. Flaws may extend 100% through the base metal and into the overlay material; in this case, intentional overlay fabrication flaws shall not interfere with ultrasonic detection or characterization of the cracking. Specimens containing IGSCC shall be used when available.	**Alternative:** (1) ... must be in or... intentional overlay fabrication flaws shall not interfere with ultrasonic detection or characterization of the base metal flaws. Specimens containing intergranular stress corrosion cracking shall be used when available. At least 70% of the flaws in the detection and sizing tests shall be cracks and the remainder shall be alternative flaws. Alternative flaw mechanisms, if used, shall provide crack-like reflective characteristics and shall be limited by the following: (a) The use of alternative flaws shall be limited to when the implantation of cracks produces spurious reflectors that are uncharacteristic of actual flaws. (b) Flaws shall be semi elliptical with a tip width of less than or equal to 0.002 inches. **Basis:** *This paragraph requires that all base metal flaws be cracks. Implanting a crack requires excavation of the base material on at least one side of the flaw. While this may be satisfactory for ferritic materials, it does not produce a useable axial flaw in austenitic materials because the sound beam, which normally passes only through base material, must now travel through weld material on at least one side, producing an unrealistic flaw response. To resolve this issue, the PDI program revised this paragraph to allow use of alternative flaw mechanisms under controlled conditions. For example, alternative flaws shall be limited to when implantation of cracks precludes obtaining an effective ultrasonic response, flaws shall be semi elliptical with a tip width of less than or equal to 0.002 inches, and at least 70% of the flaws in the detection and sizing test shall be cracks and the remainder shall be alternative flaws. To avoid confusion, the overlay thickness tolerance contained in paragraph 1.1(b) last sentence, was reworded and the phrase "and the remainder*

Table 2
PDI Program Modifications to Appendix VIII Supplement 11

Supplement 11-Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds	PDI Program: The Proposed Alternative to Supplement 11 Requirements
	shall be alternative flaws" was added to the next to last sentence. Paragraph 1.1(d)(1) includes the statement that intentional overlay fabrication flaws shall not interfere with ultrasonic detection or characterization of the base metal flaws.
(e) Detection Specimens	
(1) At least 20% but less than 40% of the flaws shall be oriented within ±20 deg. of the pipe axial direction. The remainder shall be oriented circumferentially. Flaws shall not be open to any surface to which the candidate has physical or visual access. The rules of IWA-3300 shall be used to determine whether closely spaced flaws should be treated as single or multiple flaws.	**Alternative:** (1) At least 20% but less than 40% of the base metal flaws shall be oriented within +/-20° of the pipe axial direction. The remainder shall be oriented circumferentially. Flaws shall not be open to any surface to which the candidate has physical or visual access. **Basis:** *The requirement for axially oriented overlay fabrication flaws was excluded from the PDI Program as an improbable scenario. Weld overlays are typically applied using automated GTA W techniques with the filler metal applied in a circumferential direction. Because resultant fabrication induced discontinuities would also be expected to have major dimensions oriented in the circumferential direction axial overlay fabrication flaws are unrealistic. The requirement for using IWA-3300 for proximity flaw evaluation was excluded; instead indication will be sized based on their individual merits .*
(2) Specimens shall be divided into base and over-lay grading units. Each specimen shall contain one or both types of grading units.	**Alternative:** (2) Specimens shall be divided into base metal and overlay fabrication grading units. Each specimen shall contain one or both types of grading units. Flaws shall not interfere with ultrasonic detection or characterization of other flaws. ***Basis:*** *Inclusion of "metal" and "fabrication" provides clarification. Flaw identification is improved by ensuring flaws are not masked by other flaws.*
(a)(1) A base grading unit shall include at least 3 in. of the length of the overlaid weld. The base grading unit includes the outer 25% of the overlaid weld and base metal on both sides. The base grading unit shall not include the inner 75% of the overlaid weld and base metal overlay material, or base metal-to-overlay interface	**Alternative:** (a)(1) A base metal grading unit includes the overlay material and the outer 25% of the original overlaid weld. The base metal grading unit shall extend circumferentially for at least 1 inch and shall start at the weld centerline and be wide enough in the axial direction to encompass one half of the original weld crown and a minimum of 0.50" of the adjacent base material. **Basis:** *The phrase "and base metal on both sides," was inadvertently included in the description of a base metal grading unit, The PDI program intentionally excludes this requirement because some of the qualification samples include flaws on both sides of the weld. To avoid confusion several instances of the term "cracks" or "cracking" were changed to the term "flaws" because of the use of alternative Flaw mechanisms. Modified to require that a base metal grading unit include at least1inch of the length of the overlaid weld, rather than 3 inches.*
(a)(2) When base metal cracking penetrates into the overlay material, the base grading unit shall include the overlay metal within 1 in. of the crack location. This	**Alternative:** (a)(2) When base metal flaws penetrate into the overlay material, the base metal grading unit shall not be used as part of any overlay fabrication

Table 2
PDI Program Modifications to Appendix VIII Supplement 11

Supplement 11-Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds	PDI Program: The Proposed Alternative to Supplement 11 Requirements
portion of the overlay material shall not be used as part of any overlay grading unit.	grading unit. **Basis:** *Substituted terms provide clarification and are consistent with 1d(1) above. The PDI program adjusts for this conservative change for excluding this type grading unit.*
(a)(3) When a base grading unit is designed to be unflawed, at least 1 in. of unflawed overlaid weld and base metal shall exist on either side of the base grading unit. The segment of weld length used in one base grading unit shall not be used in another base grading unit. Base grading units need not be uniformly spaced around the specimen.	**Alternative:** (a)(3) Sufficient unflawed overlaid weld and base metal shall exist on all sides of the grading unit to preclude interfering reflections from adjacent flaws. **Basis:** *Modified to require sufficient unflawed overlaid weld and base metal to exist on all sides of the grading unit to preclude interfering reflections from adjacent flaws, rather than the 1 inch requirement.*
(b)(1) An overlay grading unit shall include the overlay material and the base metal-to-overlay interface of at least 6 sq. in. The overlay grading unit shall be rectangular, with minimum dimensions of 2 in.	**Alternative:** (b)(1) An overlay fabrication grading unit shall include the overlay material and the base metal-to-overlay interface for a length of at least1 inch. **Basis:** *The PDI program reduces the base metal-to-overlay interface to at least 1 inch (in lieu of a minimum of 2 inches) and eliminates the minimum rectangular dimension. This criterion is necessary to allow use of existing examination specimens that were fabricated in order to meet NRC Generic Letter 88-01. This criterion may be more challenging than the ASME Code because of the variability associated with the shape of the grading unit.*
(b)(2) An overlay grading unit designed to be unflawed shall be surrounded by unflawed overlay material and unflawed base metal-to-overlay interface for at least 1 in. around its entire perimeter. The specific area used in one overlay grading unit shall not be used in another overlay grading unit. Overlay grading units need not be spaced uniformly about the specimen.	**Alternative:** (b)(2) Overlay fabrication grading units designed to be unflawed shall be separated by unflawed overlay material and unflawed base metal-to-overlay interface for at least 1 inch at both ends. Sufficient unflawed overlaid weld and base metal shall exist on both sides of the overlay fabrication grading unit to preclude interfering reflections from adjacent flaws. The specific area used in one overlay fabrication grading unit shall not be used in another overlay fabrication grading unit. Overlay fabrication grading units need not be spaced uniformly about the specimen. **Basis:** *Paragraph 1.1 (e)(2)(b)(2) states that overlay fabrication grading units designed to be unflawed shall be separated by unflawed overlay material and unflawed base metal-to-overlay interface for at least 1 inch at both ends, rather than around its entire perimeter.*
(b)(3) Detection sets shall be selected from Table VIII-S2-1. The minimum detection sample set is five flawed base grading units, ten unflawed base grading units, five flawed overlay grading units, and ten unflawed overlay grading units. For each type of grading unit, the set shall contain at least twice as many unflawed as flawed grading units.	**Alternative:**...base metal grading units, ten unflawed base metal grading units, five flawed overlay fabrication grading units, and ten unflawed overlay fabrication grading units. For each type of grading unit, the set shall contain at least twice as many unflawed as flawed grading units. For initial procedure qualification, detection sets shall include the equivalent of three personnel qualification sets. To qualify new values of essential variables, at least one personnel qualification set is required. **Basis:** *Clarified the guidance for initial procedure qualifications versus qualifying new values of essential variables.*
(f) Sizing Specimen	

Table 2
PDI Program Modifications to Appendix VIII Supplement 11

Supplement 11-Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds	PDI Program: The Proposed Alternative to Supplement 11 Requirements
(1) The minimum number of flaws shall be ten. At least 30% of the flaws shall be overlay fabrication flaws. At least 40% of the flaws shall be cracks open to the inside surface.	**Alternative:** (1) The...least 40% of the flaws shall be open to the inside surface. Sizing sets shall contain a distribution of flaw dimensions to assess sizing capabilities. For initial procedure qualification, sizing sets shall include the equivalent of three personnel qualification sets. To qualify new values of essential variables, at least one personnel qualification set is required. **Basis:** *Clarified the guidance for initial procedure qualifications versus qualifying new values of essential variables and is consistent with 1d(1) above.*
(3) Base metal cracking used for length sizing demonstrations shall be oriented circumferentially.	**Alternative:** (3) Base metal flaws used...circumferentially. **Basis:** *Clarified wording to be consistent with 1d(1) above.*
(4) Depth sizing specimen sets shall include at least two distinct locations where cracking in the base metal extends into the overlay material by at least 0.1 in. in the through-wall direction.	**Alternative:** (4) Depth sizing specimen sets shall include at least two distinct locations where a base metal flaw extends into the overlay material by at least 0.1 inch in the through-wall direction. **Basis:** *Clarified wording to be consistent with 1d(1) above.*
2.0 CONDUCT OF PERFORMANCE DEMONSTRATION	
The specimen inside surface and identification shall be concealed from the candidate. All examinations shall be completed prior to grading the results and presenting the results to the candidate. Divulgence of particular specimen results or candidate viewing of unmasked specimens after the performance demonstration is prohibited.	**Alternative:** The specimen ...prohibited. The overlay fabrication flaw test and the base metal flaw test may be performed separately. **Basis:** *Clarified wording to describe process.*
2.1 Detection Test.	
Flawed and unflawed grading units shall be randomly mixed. Although the boundaries of specific grading units shall not be revealed to the candidate, the candidate shall be made aware of the type or types of grading units (base or overlay) that are present for each specimen.	**Alternative:** Flawed...(base metal or overlay fabrication)...each specimen. **Basis:** *Clarified wording similar to 1(e)2 above.*
2.2 Length Sizing Test	
(d) For flaws in base grading units, the candidate shall estimate the length of that part of the flaw that is in the outer 25% of the base wall thickness.	**Alternative:** (d) For . . . base metal grading . . . base metal wall thickness. **Basis:** *Clarified wording for consistency.*
2.3 Depth Sizing Test.	
3.0 ACCEPTANCE CRITERIA	
3.1 Detection Acceptance Criteria	
Examination procedures, equipment, and personnel are qualified for detection when the results of the performance demonstration satisfy the acceptance criteria of Table VIII-S2-1 for both detection and false calls. The criteria shall be satisfied separately by the demonstration results for base grading units and for overlay grading units.	**Alternative:** Examination procedures are qualified for detection when: a. All flaws within the scope of the procedure are detected and the results of the performance demonstration satisfy the acceptance criteria of Table VIIIS2-1 for false calls. b. At least one successful personnel demonstration has been performed meeting the acceptance criteria defined in (c). c. Examination equipment and personnel are qualified for detection when the results of the performance demonstration satisfy the acceptance criteria of Table VIII-S2-1 for both detection and false calls.

Table 2
PDI Program Modifications to Appendix VIII Supplement 11

Supplement 11-Qualification Requirements for Full Structural Overlaid Wrought Austenitic Piping Welds	**PDI Program: The Proposed Alternative to Supplement 11 Requirements**
	d. The criteria in (b) and (c) shall be satisfied separately by the demonstration results for base metal grading units and for overlay fabrication grading units. **Basis:** *Clarified wording to better describe the difference between procedure qualification and equipment and personnel qualifications.*
3.2 Sizing Acceptance Criteria	
(a) The RMS error of the flaw length measurements, as compared to the true flaw lengths, is less than or equal to 0.75 inch. The length of base metal cracking is measured at the 75% through-base-metal position.	**Alternative:** (a) The...base metal flaws is...position. **Basis:** *Clarified wording to be consistent with 1d(1) above.*
(b) All extensions of base metal cracking into the overlay material by at least 0.1 inch are reported as being intrusions into the overlay material.	**Alternative:** This requirement is omitted. ***Basis:*** *The requirement for reporting all extensions of cracking into the overlay is omitted from the PDI Program because it is redundant to the RMS calculations performed in paragraph 3.2(c) and its presence adds confusion and ambiguity to depth sizing as required by paragraph 3.2(c). This also makes the weld overlay program consistent with the supplement 2 depth sizing criteria.*

ATTACHMENT 3 LIST OF REGULATORY COMMITMENTS©

Correspondence Number: NLS2008012

The following table identifies those actions committed to by Nebraska Public Power District (NPPD) in this document. Any other actions discussed in the submittal represent intended or planned actions by NPPD. They are described for information only and are not regulatory commitments. Please notify the Licensing Manager at Cooper Nuclear Station of any questions regarding this document or any associated regulatory commitments.

COMMITMENT	COMMITMENT NUMBER	COMMITTED DATE OR OUTAGE
None.	N/A	N/A