TECHNICAL LETTER REPORT
ON THIRD 10-YEAR INSERVICE INSPECTION INTERVAL
REQUESTS FOR RELIEF
FOR
NUCLEAR MANAGEMENT COMPANY, LLC
KEWAUNEE NUCLEAR POWER PLANT
DOCKET NO. 50-305

1.0 INTRODUCTION

By letter dated June 23, 2005, the licensee, Nuclear Management Company, LLC, submitted multiple requests for relief from requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, *Rules for Inservice Inspection of Nuclear Power Plant Components*. In response to a U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information, the licensee provided further information in a letter dated March 29, 2006. This request was submitted as part of the inservice inspection (ISI) program for the third 10-year inservice inspection (ISI) interval at Kewaunee Nuclear Power Plant (KNPP). The Pacific Northwest National Laboratory (PNNL) has evaluated the subject requests for relief in Section 3.0 of this report.

2.0 REGULATORY REQUIREMENTS

Inservice inspection (ISI) of the ASME Code Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME *Boiler and Pressure Vessel Code* (B&PV Code), and applicable addenda, as required by 10 CFR 50.55a(g), except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). The regulation at 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the U.S. Nuclear Regulatory Commission (NRC), if the licensee demonstrates that (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code, which was incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The ASME Code of record for the KNPP third 10-year interval inservice inspection, which began on June 16, 1994, is the 1989 Edition of Section XI, with no addenda.

3.0 TECHNICAL EVALUATION

The information provided by Nuclear Management Company, LLC in support of the requests for relief from ASME Code requirements has been evaluated and the bases for disposition are documented below. Based on the number and type of requests for relief included in the licensee's submittal, for purposes of clarity several were combined and grouped according to ASME Code Examination Category.

3.1 Request for Relief RR-G-7-04 (TAC MC7900), Examination Category B-A, Item B1.40, Pressure Retaining Welds in Reactor Vessel

ASME Code Requirement: Examination Category B-A, Item B1.40, requires volumetric and surface examination, as defined by Figure IWB-2500-5, of essentially 100% of the weld length of the reactor pressure vessel (RPV) closure head-to-flange weld. "Essentially 100%", as clarified by ASME Code Case N-460, is greater than 90% coverage of the examination volume, or surface area, as applicable.

Licensee's ASME Code Relief Request: In accordance with 10CFR50.55a(g)(5)(iii), the licensee requested relief from 100% volumetric examination coverage for RPV closure head-to-flange Weld RV-W12.

Licensee's Basis for Requesting Relief: (as stated)

To provide for access to the 23.0% of the head-to-flange Weld RV-W12 would require modification from the original design of the reactor vessel closure head and removal of the 3 welded lifting lugs. During the Fall 2004 refueling outage, Kewaunee Nuclear Power Plant replaced it's reactor vessel closure head. The replacement reactor vessel closure head was manufactured as a one piece forging. Thus a reactor vessel closure head-to-flange weld does not exist and ASME Boiler and Pressure Vessel Code Section XI, 1989 Edition Table IWB-2500-1 Examination Category B-A, Item No. B1.40 no longer applies.

Licensee's Proposed Alternative Examination (as stated):

No alternative Code required ultrasonic examination is available due to limited access. VT-2 examinations were performed during the 3rd interval as required by Code. Surface magnetic particle examinations were performed. During the Fall 2204 outage, KNPP replaced its reactor vessel closure head. The replacement was manufactured as a one-piece forging. Thus, a reactor vessel closure head-to-flange weld does not exist and the Code volumetric and surface examinations no longer apply.

Evaluation: The Code requires essentially 100% volumetric examination of RPV closure head-to-flange welds. The volumetric examinations must be performed by using several ultrasonic sound beams (at proper angles within the material), directed both perpendicular and parallel to the weld. *Ultrasonic scans* are applied from the outside surface of the component, from each side of the weld, and across the surface (crown) of the weld. The intent of these requirements is to increase the likelihood of flaw detection by interrogating the component with multiple sound fields to find potential service-induced degradation that may exist at various angular orientations relative to the weld and the heat-affected zone in the base material.

The component consists of an ASTM A-508-64, Class 2 forged ring (RPV bolting flange area) attached with a full penetration weld to an ASME SA-533, Class 1 forged, dome-shaped head. The cross-sectional geometry of the RPV closure head-to-flange Weld RV-W12 produces a high transition angle between the flange and the domed head. As illustrated in Figure 1, scanning from the flange side of the weld is severely limited due to location of the weld and the transition angle. In addition, the location of three closure head lifting lugs further restrict access for ultrasonic examination. For these reasons, the component configuration does not allow the licensee to obtain the full ASME Code-required volumetric coverage from both sides of the weld. However, the licensee obtained 77% volumetric coverage from the shell side of the weld. For the licensee to achieve 100% volumetric coverage, the RPV closure head would have to be redesigned and modified. This would place a significant burden on

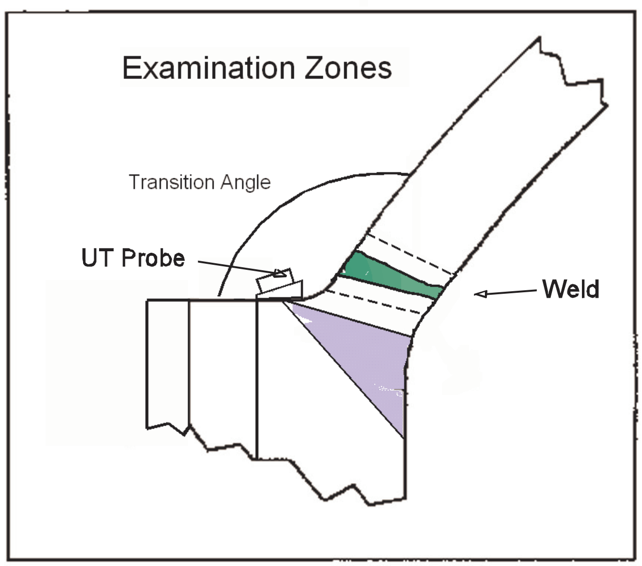

Figure 1 - Drawing depicting typical cross-sectional geometry of RPV closure head-to-flange weld.

the licensee, thus the Code-required 100% volumetric examination is impractical for Weld RV-W12.

The licensee replaced the subject reactor vessel closure head during the Fall of 2004. The replacement closure head was manufactured as a one piece forging and therefore a RPV closure head-to-flange weld no longer exists. During the period of time that the subject retired RPV closure head was inservice, it adequately performed its function as a pressure boundary component.

Based on the impracticality of volumetrically examining the RPV closure head-to-flange weld, along with the 77% volumetric coverage obtained, and considering the licensee has removed this component from service, it is recommended that, pursuant to 10 CFR 50.55a(g)(6)(i), relief be granted.

3.2 Request for Relief RR-G-7-71 (TAC MC7967), Examination Category B-A, Item B1.30, Pressure Retaining Welds in Reactor Vessel, Shell-to-Flange Weld RV-W1

ASME Code Requirement: Examination Category B-A, Item B1.30, requires essentially 100% volumetric examination, as defined by Figure IWB-2500-4, of the weld length of the reactor pressure vessel (RPV) shell-to-flange weld. "Essentially 100%", as clarified by ASME Code Case N-460, is greater than 90% coverage of the examination volume, or surface area, as applicable.

Licensee's ASME Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from 100% volumetric examination coverage for RPV lower shell-to-flange Weld RV-W1.

Licensee's Basis for Requesting Relief: (as stated)

25.56% (single side coverage) and 46.98% (two direction coverage) of the remote ultrasonic examination of the reactor vessel shell-to-flange Weld RV-W1 was inaccessible due to the flange-to-shell configuration thus restricting ultrasonic examination. To provide for access to the 25.56% (single side coverage) and 46.98% (two direction coverage) of the reactor vessel shell-to-flange Weld RV-W1 would require modification from the original design of the reactor vessel.

Licensee's Proposed Alternative Examination (as stated):

No alternative Code required ultrasonic examination is available due to the limited access.

Response to Request for Additional Information (as stated):

Remote automated ultrasonic examinations of RV-W1 included 45° longitudinal dual, 45° longitudinal and 45° shear from the reactor vessel ID, and manual ultrasonic examination of reactor vessel shell to flange weld RV-W1 included 0° longitudinal, 6° longitudinal, 12° longitudinal and 16° longitudinal from the reactor vessel flange surface. The reactor vessel flange material is A508-64 Class 2 carbon steel with stainless steel cladding.

The flange to shell weld RV-W1 was examined using ASME Boiler and Pressure Vessel Code Section XI Appendix VIII approved techniques to the extent practical considering the component geometry. Access is provided from the reactor vessel ID surface for automated examinations, and from the flange seal surface for manual examinations. The combination of automated and manual examinations produced coverage of 74.4% of the examination volume.

The limiting factor is the taper transition on the ID surface at the junction of the weld joint and the flange.

Other exam methodologies such as Phase Array and modified standard techniques such as using a single element full-vee path arrangement were evaluated and determined to be ineffective in providing any meaningful additional coverage. The problem is that the taper transition is curved with a 3-inch radius. This is a somewhat unique design for Westinghouse PWR vessel flange. The curved taper transition does not allow for proper contact of the transducers in either perpendicular or parallel scans. For parallel scans, scanning about the taper would result in a severe miss-orientation of the examination beam with respect to the volume. This is the biggest contributor to the coverage limitation. In perpendicular scans, a phase array probe would be limited and even shallow angle approaches would not reach the volumes of forging base metal surrounding the curved taper transition. Full-vee path techniques are not qualified to ASME Section XI Appendix VIII by any PWR vendor and may only increase coverage 3%-5%. The efficacy of this particular approach has not been proven by qualification, and it is the preference of DEK to apply only qualified automated exam techniques for the remote mechanized scans from the ID surface.

Evaluation: The ASME Code requires essentially 100% volumetric examination of RPV shell-to-flange Weld RV-W1. However, the configuration of the shell-to-flange weld prevents examining the full ASME Code-required weld volume. For the licensee to achieve full volumetric coverage requirements, the RPV would need to be redesigned and modified. This would place a significant burden on the licensee, thus the ASME Code-required 100% volumetric examinations are impractical.

As shown on the sketches and technical descriptions[1] provided by the licensee, approximately 63% (composite for single side and two-sided access) for the vessel shell to flange weld was examined due to access limitations caused by the taper transition between the forged flange and the upper RPV shell course. This geometry, which includes a 3-inch radius in the transition region, prevents making adequate transducer contact to place the corresponding ultrasonic beams into the correct weld volume from the taper side of the weld.

The ultrasonic examinations of the RPV shell-to-flange weld were conducted using personnel, equipment and procedures qualified in accordance with ASME Section XI, Appendix VIII, 1995 Edition with the 1996 Addenda as administered through the EPRI Performance Demonstration Initiative (PDI), which have shown high (approximately 90%) probability of detection levels. This has resulted in an increased reliability of inspections for weld configurations within the scope of PDI[2]. In addition, other pressure retaining shell welds in the RPV

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1. Sketches and technical descriptions provided by the licensee are not included in this report.

2. *Performance Demonstration - 25 Years of Progress*; L. Becker, Electric Power Research Institute, 3nd International Conference on NDE in Relation to Structural Integrity for Nuclear and Pressurized Components, November 14-16, 2001, Seville Spain.

were examined to the full extent of ASME Code requirements with no service induced flaws being detected.

While it is impractical for the licensee to meet the ASME Code-required 100% volumetric examination coverage, based on the limited examinations completed for the subject weld, and considering the full ASME Code volumetric examinations on other RPV shell welds, it is reasonable to conclude that significant degradation, if existing, would have been detected. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), it is recommended that relief be granted for RPV shell-to-flange Weld RV-W1.

3.3 <u>Request for Relief RR-G-7-73, Examination Category B-A, Item B1.21, Pressure Retaining Welds in Reactor Vessel, Lower Head Circumferential RV-W4</u>

Based on the NRC RAI, and the licensee's use of ASME Code Case N-460, the licensee elected to withdraw this request in the response dated March 29, 2006.

3.4 <u>Request for Relief RR-G-7-06 (TAC MC7902), Examination Category B-B, Item B2.11, Pressure Retaining Welds in Vessel Other than Reactor Vessels, Pressurizer Circumferential Head Welds</u>

Based on the NRC RAI, and the licensee's use of ASME Code Case N-460, the licensee elected to withdraw this request in the response dated March 29, 2006.

3.5 <u>Request for Relief RR-G-7-07 (TAC MC7903), Examination Category B-B, Item B2.12, Pressure Retaining Welds in Vessel Other than Reactor Vessels, Pressurizer Longitudinal Head Weld</u>

Based on the NRC RAI, and the licensee's use of ASME Code Case N-460, the licensee elected to withdraw this request in the response dated March 29, 2006.

3.6 <u>Requests for Relief for RR-G-7-20 (TAC7916) and RR-G-7-21 (TAC MC7917), Examination Category B-D, Item B3.90, Full Penetration Welded Nozzles in Vessels, Reactor Vessel Outlet Nozzle-to-Vessel Welds RV-W7 and RV-W10</u>

<u>ASME Code Requirement</u>: Examination Category B-D, Item B3.90, requires 100% volumetric examination, as defined in Figures IWB-2500-7(a) through (d), as applicable, of reactor pressure vessel (RPV) nozzle-to-vessel welds and adjacent base material during each inspection interval. The requirement for examining adjacent base metal extends a distance of one-half the vessel shell wall thickness from the widest part of the weld, on each side of the weld. ASME Code Case N-460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*, as an alternative approved for use by the NRC in Regulatory Guide 1.147, Revision 14, *Inservice Inspection Code Case Acceptability* (RG1.147), states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10%, i.e., greater than 90% examination coverage is obtained.

<u>Licensee's ASME Code Relief Request:</u> In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from 100% volumetric

examination coverage for RPV outlet nozzle-to-vessel Welds RV-W7 and RV-W10.

<u>Licensee's Basis for Requesting Relief: (as stated)</u>

2.84% of the remote ultrasonic perpendicular scan and 56.76% of the remote ultrasonic tangential scan of reactor vessel outlet nozzle-to-vessel Welds RV-W7and RV-W10 were inaccessible due to the outlet nozzle boss radius and the outlet nozzle boss, thus restricting ultrasonic examination. To provide for access to the 2.84% perpendicular scan and 56.76% of the tangential scan of reactor vessel outlet nozzle-to-vessel Welds RV-W7 and RV-W10 would require modification of the original design of reactor vessel outlet nozzle.

<u>Licensee's Proposed Alternative Examination (as stated):</u>

No alternative Code required ultrasonic examination is available due to the limited access.

<u>Response to Request for Additional Information (as stated):</u>

Remote automated ultrasonic examinations of reactor vessel outlet nozzle-to-vessel welds RV-W7 and RV-W10 included 0° longitudinal, 10° longitudinal, 30° longitudinal and 50° longitudinal from the nozzle bore and 45° shear, 60° shear, 0° longitudinal and 70° longitudinal from the reactor vessel shell. The reactor vessel nozzle material is A508-64 Class 2 carbon steel with stainless steel cladding.

ASME Code Section XI Appendix VIII Performance Demonstration For Ultrasonic Examination Systems did not apply to reactor vessel outlet nozzle to vessel weld RV-W7 or RV-W10 in 1995, as the examination was performed prior to the implementation of ASME Section XI Appendix VIII Supplement 7 Qualification Requirements For Nozzle To Vessel Weld on November 22, 2002.

It should be noted that, while similar limitations continued to be encountered, the reactor vessel outlet nozzle to vessel weld RV-W7 was further examined in fall 2004 to meet KPS fourth10-year interval inservice inspection program (June 16, 2004 - June 16, 2014). Examinations were performed to satisfy the requirements of ASME Boiler and Pressure Vessel Code Section XI 1998 Edition 2000 Addenda including Appendix VIII Supplement 7 Qualification Requirements For Nozzle To Vessel Weld. Due to inaccessibility because of component geometry, no other current volumetric examinations could be performed from the ID to reasonably increase the percentage examined.

<u>Evaluation</u>: The ASME Code requires volumetric examination of Class 1 full penetration welds of nozzles in the reactor pressure vessel (RPV). However, volumetric examination coverage, to the extent required by the ASME Code, for RPV outlet nozzle-to-vessel welds RV-W7 and RV-W10 cannot be performed due to a protusion at the nozzle inner radius which limits scanning to the shell side of the weld and the nozzle bore only. For the licensee to achieve the ASME

Code-required volumetric coverage, the inside geometry of the nozzles would need to be redesigned and modified. This would place a significant burden on the licensee, thus the ASME Code-required volumetric examinations are impractical.

As shown on the drawings and technical descriptions[3] provided by the licensee, approximately 70.2% composite volumetric coverage was obtained for each nozzle-to-shell Weld(s) RV-W7 and RV-W10. The composite coverage includes approximately 97% volumetric coverage for scans perpendicular to the weld, and approximately 43% volumetric coverage for scans parallel to the weld. The examinations were remotely performed using automated equipment from the inside diameter surface of the RPV. These nozzles are of a set-in design that includes a tapered extension, or nozzle boss area (as described by the licensee), that slightly protrudes beyond the RPV shell inside surface. This geometry does not allow 100% of the ASME Code-required volumes for tangential scans, or those with the ultrasonic beam directed parallel to the weld, to be completed. However, the licensee obtained substantial volumetric weld coverage from the inside shell side, and from the bore, of the nozzles with an automated inspection device having multiple angle beam transducers.

While the licensee may not have achieved complete examination coverage (for ultrasonic scans parallel to these welds) as required by the ASME Code, the ultrasonic examinations performed from the inside shell and nozzle bore of the carbon steel nozzle-to-vessel welds meet the inspection procedure guidelines documented in NUREG/CR-5068. Based on the examination coverage obtained, it is concluded that if significant service-induced degradation were occurring in the subject welds, there is reasonable assurance that evidence of it would be detected by the examinations that were performed. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), it is recommended that relief be granted.

3.7 Request for Relief RR-G-7-12 (TAC MC7908), Examination Category B-D, Item 3.140, Full Penetration Welded Nozzles in Vessels, Steam Generator 1A and 1B Nozzle Inside Radius Sections

ASME Code Requirement: Examination Category B-D, Item B3.140, requires 100% volumetric examination, as defined by Figure IWB-2500-7(a) through (d), as applicable, of Class 1 nozzle inside radius sections on the primary side of steam generators.

Licensee's ASME Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from 100% volumetric examination coverage for Steam Generator 1A nozzle inside radius sections SG-IR25 and SG-IR26, and Steam Generator 1B inside radius sections SG-IR-27 and SG-IR28.

Licensee's Basis for Relief Request (as stated):

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3 Drawings and technical descriptions provided by the licensee are not included in this report.

6.3% of each of the 4 nozzle inside radius sections SG-IR25, SG-IR26, SG-IR-27 and SG-IR28 were inaccessible due to the configuration of the steam generator nozzle inside radius section integrally welded attachment thus restricting ultrasonic examination. To provide for access to the [remaining] 6.3% of each nozzle inside radius section would require modification from the original design of the steam generators and integrally welded supports.

Licensee's Proposed Alternative Examination (as stated):

No alternative Code required ultrasonic examination is available due to the limited access.

Response to Request for Additional Information (as stated):

The steam generator 1A nozzle inside radius sections SG-IR25 and SG-IR26 and steam generator 1B nozzle inside radius sections SG-IR27 and SG-IR28 could not be examined due to the inability to place the 60° shear manual ultrasonic search unit on the inner radius for 2 circumferentially oriented scans:

a) of SG-IR25 due to integrally welded attachment SG-IA-23D
b) of SG-IR26 due to integrally welded attachment SG-IA-23B
c) of SG-IR27 due to integrally welded attachment SG-IB-23D
d) of SG-IR28 due to integrally welded attachment SG-IB-23B

Therefore, no cross sectional sketches of the weld indicating ultrasonic coverage could be obtained of the areas not scanned. There were no limitations for the third ultrasonic examination performed with a 38° shear circumferential scan. 6.3% of each nozzle inner radius could not be examined. Although not covered by ASME Code Case N-460, which addresses Class 1 and Class 2 welds, the percentage examined exceeded the 90% required by ASME Code Case N-460. The steam generator 1A and steam generator 1B nozzle inner radius are SA508 Class 3A carbon steel with stainless steel cladding.

Evaluation: The ASME Code requires 100% volumetric examination of the inside radius sections of Class 1 nozzle-to-shell welds. However, welded structural supports limit full access to examine the nozzle inside radius sections on primary coolant nozzles in Steam Generators 1A and 1B at KNPP. For the licensee to achieve full volumetric coverage requirements, the steam generator main supports would be required to be redesigned and modified. This would place a significant burden on the licensee, thus the ASME Code-required 100% volumetric examinations are impractical.

The licensee's sketches[4] indicate that integrally welded support pads SG-1A-23B and -23D, and SG-1B-23B and -23D, limit ultrasonic scan access for placement of transducers to examine the nozzle inside radius sections on Steam Generators 1A and 1B, respectively. However, the licensee obtained 92.7% volumetric coverage for each of the subject nozzle inside radius sections. This is a substantial level of examination coverage, and if the subject components were

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4 The sketches provide by the licensee are not included in this report.

welded volumes instead of base material, would have been acceptable per ASME Code Case N-460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*, as an alternative approved for use by the NRC in Regulatory Guide 1.147, Revision 14, *Inservice Inspection Code Case Acceptability* (RG1.147), and no further request for relief would be necessary. However, since the licensee interpreted ASME Code Case N-460 as being applicable to Class 1 and 2 welds only, RR-G-7-12 was submitted.

Based on the impracticality of examining 100% of the nozzle inside radius sections, and the high level of volumetric coverage obtained, it is reasonable to conclude that significant patterns of degradation, should they exist, would have been detected by the examinations performed. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), it is recommended that relief be granted.

3.8 Request for Relief RR-G-7-72 (TAC MC7968), Examination Category B-D, Item B3.90, Full Penetration Welded Nozzles in Vessels, Safety Injection Nozzle-to-Vessel Weld RV-W11

Based on the NRC RAI, and the licensee's use of ASME Code Case N-460, the licensee elected to withdraw this request in the response dated March 29, 2006.

3.9 Requests for Relief for RR-G-7-22 (TAC MC7918) and RR-G-7-23 (TAC MC7919), Examination Category B-F, Item B5.70, Pressure Retaining Dissimilar Metal Welds in Vessel Nozzles, Steam Generators 1A and 1B Nozzle-to-Safe End Butt Welds RC-W76DM, RC-77DM, RC-W78DM and RC-79DM

ASME Code Requirement: Examination Category B-F, Item B5.70, requires 100% volumetric and surface examination, as defined by Figure IWB-2500-8, of Class 1 nozzle-to-safe end butt welds greater than NPS 4-inches in diameter. ASME Code Case N-460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*, as an alternative approved for use by the NRC in Regulatory Guide 1.147, Revision 14, *Inservice Inspection Code Case Acceptability* (RG1.147), states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10%, i.e., greater than 90% examination coverage is obtained.

Licensee's ASME Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code requirement to examine 100% of the weld volume for the following Class 1 dissimilar metal nozzle-to-safe end welds:

Table 3.9 - Examination Category B-F Dissimilar Metal Welds in Vessel Nozzles

Component ID	Relief Request	Nozzle Type	Dissimilar Metal Weld	Coverage Obtained
Steam Generator 1A	RR-G-7-22	Hot Leg	RC-W76DM	61.9%

Table 3.9 - Examination Category B-F Dissimilar Metal Welds in Vessel Nozzles				
Component ID	Relief Request	Nozzle Type	Dissimilar Metal Weld	Coverage Obtained
		Cold Leg	RC-W77DM	61.9%
Steam Generator 1B	RR-G-7-23	Hot Leg	RC-W78DM	59.8%
		Cold Leg	RC-W79DM	59.8%

<u>Licensee's Basis for Relief Request</u> (as stated):

38.1% of the Steam Generator 1A nozzle to safe end butt welds RC-W76DM AND RC-W77DM were inaccessible due 'to the nozzle configuration thus restricting ultrasonic examination. To provide for access to the 38.1% of the Steam Generator 1A nozzle to safe end butt welds RC-W76DM and RC-W77DM would require modification of the design of Steam Generator 1A nozzles and reactor coolant pipe.

<u>Licensee's Proposed Alternative Examination (as stated):</u>

No alternative Code required ultrasonic examination is available due to the limited access. VT-2 and surface liquid penetrant examinations were performed as required by the Code. ASME Code, Section III radiography was performed as part of the KNPP steam generator replacement during the 2001 refueling outage.

<u>Response to Request for Additional Information (as stated):</u>

Portions of the weld area of steam generators 1A and 1B nozzle to safe end butt welds RC-W76DM, RC-W77DM, RC-W78DM and RC-W79DM could not be examined. These weld area portions could not be examined due to the inability to place the required 0°, 45°, and 60° longitudinal (axial and circumferential) manual ultrasonic transducers on the steam generator nozzle side or the safe end side due to the steam generator nozzle configuration. Therefore, no cross sectional sketches of the weld indicating ultrasonic coverage could be obtained for the areas not scanned. These dissimilar metal welds consist of: 1) Alloy 600 Weld with alloy 690 ID cladding to 2) Safe End of SA 336 Class F 316LN stainless steel and 3) Alloy 690 Weld to 4) SA508 Class 3A carbon steel steam generator nozzle.

Steam generator 1A nozzle to safe end butt welds RC-W76DM and RC-W77DM and steam generator 1B nozzle to safe end butt welds RC-W78DM and RC-W79DM were classified as fabrication welds. This classification is as defined in ASME Boiler and Pressure Vessel Code Section XI Code Case N-416-2 Alternate Pressure Test Requirement for Welded Repairs, Fabrication Welds for Replacement Parts and Piping Subassemblies, or Installation of Replacement Items by Welding Class 1, Class 2 and Class 3 Section XI, Division 1. Use of

ASME Code Case N-416-2 was approved for use at KPS by the Nuclear Regulatory Commission on February 9, 2001 TAC NO. MB0307. The fabrication of RC-W76DM, RC-W77DM, RC-W78DM and RC-W79DM was performed on site at KPS following the shipment of the steam generators from the manufacturer (Ansaldo-Energia). KPS, working with it's nondestructive examination vendor LMT Inc. developed an ultrasonic procedure using the latest available techniques in summer 2001 to examine the four nozzle to safe end butt welds to meet ASME Boiler and Pressure Vessel Code Section XI 1989 Edition Examination Volume Figure IWB-2500-8. The examination was only able to examine 61.9% of RC-W76DM and RC-W77DM and 59.75% of RC-W78DM and RC-W79DM. The main limitation was the inability to scan from the steam generator nozzle side due to the nozzle configuration, thus limiting the examination to a one side examination using 0°, 45° longitudinal and 60° longitudinal transducers. The required examination volumes when examined from the one side were 82.6% for welds RC-W76DM and RC-W77DM and 79.7% for welds RC-W78DM and RC-W79DM. There were no indications noted by ultrasonic examinations. Relief requests for RC-W76DM, RC-W77DM, RC-W78DM and RC-790DM to satisfy ASME Code requirements under 10 CFR 50.55a(a)(3)(i) or (ii) were included as part of the third 10-year limitation to examination relief requests.

Since the performance of these examinations in June 2001, ASME Boiler and Pressure Vessel Code Section XI has implemented requirements to perform Appendix VIII Supplement 10 Qualification Requirements For Dissimilar Metal Piping Welds. DEK, with their NDE vendor LMT Inc. and Electric Power and Research Institute (EPRI), developed a site specific procedure and specimen (NEP-15.45 Ultrasonic Examination of Steam Generator Primary Side Nozzle To Safe Ends For Inservice Inspection) to examine the KPS replacement steam generator nozzle to safe end butt welds RC-W76DM, RC-W77DM, RC-W78DM and RC-W79DM to meet Appendix VIII Supplement 10 Qualification Requirements For Dissimilar Metal Piping Welds. During the KPS 2004 refueling outage, an ultrasonic examination was performed on RC-W76DM to meet the KPS fourth 10-year interval program developed to ASME Boiler and Pressure Vessel Code Section XI 1998 Edition 2000 Addenda. Examination on RC-W76DM was performed to meet Appendix VIII Supplement 10 Qualification Requirements For Dissimilar Metal Piping Welds using the qualified procedure, specimen and personnel developed through the EPRI Performance Demonstration Initiative Program by DEK and LMT Inc. The examination of RC-W76DM using the newly developed technique examined 100% of the required ASME Boiler and Pressure Vessel Code Section XI IWB-2500-8 Volume. No indications were recorded. Since the configuration of the remaining three nozzle to safe end butt welds RC-W77DM, RC-W78DM and RC-W79DM are basically the same, DEK expects that performance of ultrasonic examination of these three remaining welds during the fourth 10-year interval (June 16, 2004 - June 16, 2014) will also be 100% examined.

Evaluation: The ASME Code requires 100% volumetric and surface examination of all Class 1 nozzle-to-safe end dissimilar metal welds NPS 4-inch or larger. In addition, the ASME Code requires that the volumetric examination be conducted from both sides of these circumferential nozzle-to-safe end dissimilar metal welds. However, 100% volumetric examination coverage from both sides of Welds RC-W76DM and RC-W77DM (Steam Generator 1A), and Welds RC-W78DM and RC-W79DM (Steam Generator 1B), could not be obtained due the outside surface geometry of the nozzle. For the licensee to achieve 100% volumetric coverage, the nozzles and welds would need to be redesigned and modified. This would place a significant burden on the licensee, thus the ASME Code-required 100% volumetric examination is impractical.

As shown on the sketches and technical descriptions[5] provided in the request, the licensee was able to obtain approximately 60% composite volumetric coverage for these dissimilar metal welds. In fact, the licensee's calculated coverage includes approximately 80% of the ASME Code-required volumes as scanned from the safe end side of the weld using 45 and 60 degree longitudinal waves. Scans could not be performed from the nozzle side due to the extreme outside surface taper of the nozzles. In addition, the licensee completed 100% of the ASME Code-required surface examinations on these welds with no limitations. No indications were observed during the volumetric or surface examinations.

It is concluded that, based on nozzle-to-safe end design, the ASME Code-required volumetric examination is impractical for the subject dissimilar metal welds. Based on the volumetric coverage obtained from the safe end side of the welds, in conjunction with the full surface examinations performed, if significant service-induced degradation were occurring in the subject welds, there is reasonable assurance that evidence of it would be detected by the examinations that were performed. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), it is recommended that relief be granted.

3.10 Request for Relief for RR-G-7-10 (TAC MC7906), Examination Category B-G-1, Item B6.180, Pressure Retaining Bolting Greater than 2-inch in Diameter, Reactor Coolant Pump 1A Main Flange Bolting RCP-B1 through RCP-B8, RCP-B9 and RCP-B11 through RCP-17

ASME Code Requirement: Examination Category B-G-1, Item B6.180, requires 100% volumetric examination, as defined by Figure IWB-2500-12, of Class 1 pump bolts and studs.

Licensee's ASME Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from 100% volumetric examination coverage of Reactor Coolant Pump 1A main closure flange Bolting RCP-B1 though RCP-B8, RCP-B9 and RCP-B11 through RCP-17.

Licensee's Basis for Relief Request (as stated):

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5 Sketches and technical descriptions provided by the licensee are not included in this report.

7.3% of each Reactor Coolant Pump 1A main flange bolt was inaccessible due to configuration of the bolts, thus restricting bore hole probe ultrasonic examination during the 1st and 2nd Period. To provide for access to the [remaining] 7.3 % of [the ASME-required volume] for each bolt would require modification from the original design of the reactor coolant pump main flange bolts.

Licensee's Proposed Alternative Examination: None. The licensee used a three-beam technique ultrasonic method for the first and second periods of the third interval. However, for the third period, a single zero-degree ASME Code Appendix VIII-qualified method was used with no limitations. This method will be applied for all future examinations.

Response to Request for Additional Information (as stated):

In order to achieve the necessary examination volume, three separate manual ultrasonic examinations were required: 1) 70° shear forward scan, 2) 70° shear reverse scan, and 3) 90° surface scan. The bolt drawings identify that the reactor coolant pump main flange bolting could not be examined due to the inability to place the manual ultrasonic 70° shear forward and 90° surface transducer probes completely through the in place bolting due to the bottom configuration, thus limiting the 90° surface examination and the 70° shear forward examination. There were no limitations for the required scan of 70° shear reverse manual ultrasonic. The reactor coolant pump main flange bolts are SA540 Grade B24 Class 4 carbon steel.

Note: Examinations of the reactor coolant pump 1A main flange bolting RCP-B10 and RCP-B18 through RCP-B24 during the third period of the third interval, were performed using the 0° head shot method per the requirements of ASME Boiler and Pressure Vessel Code Section XI, 1995 Edition, 1996 Addenda, Appendix VIII, Supplement 8, "Qualification Requirements For Bolts and Studs." These examinations revealed no indications and no limitations. Examinations of the reactor coolant pump 1A main flange bolting RCP-B1 through RCP-B8 during the first period of the fourth interval were performed using the 0° head shot method per the requirements of ASME Boiler and Pressure Vessel Code Section XI 1998 Edition 2000 Addenda Appendix VIII Supplement 8, "Qualification Requirements For Bolts and Studs." These examinations also revealed no indications and no limitations.

Evaluation: The ASME Code requires 100% volumetric examination of Class 1 bolts greater than 2-inches in diameter. However, the configuration of reactor coolant pump (RCP) main flange bolts at KNPP do not allow for ultrasonic methods deployed from the "heater hole" of the bolts to access the entire bolt length. In order to make the entire bolt length accessible for ultrasonic examination from these heater holes, the bolts would have to be re-designed and modified. This would place a significant burden on the licensee, thus the ASME Code-required volumetric examinations are impractical.

The RCP main flange closure bolts at KNPP are 4.3-inch diameter, 30.5-inch long SA540 carbon steel bolts designed with 0.75-inch diameter "heater hole" drilled though the bolt along the centerline. This heater hole allows for sufficient pre-load at operating temperature to be applied during the installation process. This design also makes it possible to volumetrically examine the bolt in-situ with ultrasonic transducers inserted into the heater hole. Typically, the entire examination volume over the length of the bolt can be accessed in this manner. However, the RCP bolts at KNNP are designed with a heater hole that tapers to a very small diameter for the bottom few inches of the bolt. This prevents placing the ultrasonic transducers into this region, and at KNPP, results in a limitation to two of the three ultrasonic methods applied for inspection.

During the first and second periods of the interval, the licensee used ultrasonic methods that included 70E forward and reverse scans and a 90E scan. The bolt configuration limited portions of the 70E forward and 90E scans. However, composite coverage for all scans resulted in 92.7% examination coverage for each RCP bolt. This is a substantial level of examination coverage, and if the subject components were welded volumes instead of bolting material, would have been acceptable per ASME Code Case N-460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*, as an alternative approved for use by the NRC in Regulatory Guide 1.147, Revision 14, *Inservice Inspection Code Case Acceptability* (RG1.147), and no further request for relief would be necessary. However, since the licensee interpreted ASME Code Case N-460 as being applicable to Class 1 and 2 welds only, RR-G-7-10 was submitted.

In addition, new ultrasonic 0E head shot methods, qualified in accordance with ASME Code, Appendix VIII, Supplement 8, have been recently applied for several of the bolts. The full ASME Code-required examination volumes are being completed with these new methods, and no recordable indications have been observed.

Based on the impracticality of examining the RCP main flange bolts with methods applied from the heater holes, and considering the substantial 92.7% coverage obtained, along with the licensee's application of new methods that result in no volumetric limitations, it is reasonable to conclude that significant degradation, should it exist, would have been detected. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), it is recommended that relief be granted.

3.11 <u>Requests for Relief for RR-G-7-08 (TAC7904), RR-G-7-09 (TAC MC7905), RR-G-7-13 (TAC MC7909), RR-G-7-14 (TAC MC7910), RR-G-7-15 (TAC 7911), RR-G-7-16 (TAC MC7912), and RR-G-7-64 (TAC MC7960), Examination Category C-A, Items C1.10, C1.20, and C1.30, Pressure Retaining Welds in Pressure Vessels</u>

<u>ASME Code Requirement:</u> Examination Category C-A, Items C1.10, C1.20, and C1.30, require essentially 100% volumetric examination, as defined by Figures IWC-2500-1 or -2, as applicable, of Class 2 circumferential shell, head, and tubesheet-to-shell welds in selected Class 2 pressure vessels. "Essentially

100%", as clarified by ASME Code Case N-460, is greater than 90% coverage of the examination volume, or surface area, as applicable.

Licensee's ASME Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the ASME Code volumetric requirement for the welds shown in Table 3.11 below.

Table 3.11 - Examination Category C-A Welds in Class 2 Pressure Vessels				
Component ID	Relief Request	ASME Item	Weld	Coverage Obtained
RHR Heat Exchanger AHRS1-1A	RR-G-7-8	C1.10	Shell circ. Weld AHRS1-W1	23%
RHR Heat Exchanger AHRS1-1A	RR-G-7-9	C1.20	Head circ. Weld AHRS1-W2	62.4%
Letdown Heat Exchanger	RR-G-7-13	C1.20	Head circ. Weld AHNR-W2	57%
Seal Water Injection Filter 1A	RR-G-7-14	C1.10	Shell circ. Weld AFS1-W1	32.9%
Seal Water Injection Filter 1A	RR-G-7-15	C1.20	Head circ. Weld AFS1-W2	64.2%
Steam Generator 1A	RR-G-7-16	C1.10	Shell circ. Weld SG-W2	88.9%
Regenerative Heat Exchanger	RR-G-7-64	C1.30	Tubesheet-to-shell circ. Weld ARG-W11	58.6%

Licensee's Basis for Relief Request: For the welds shown in Table 3.11, the licensee stated that geometries, locations, and/or adjacent structures limited access to perform the examinations to the extent required by the ASME Code. It was further stated that to provide access to increase the coverage(s) obtained would require modification from the original design of the component.

Licensee's Proposed Alternative Examination (as stated):

No alternative Code required ultrasonic examination is available due to the limited access.

Response to Request for Additional Information (as stated):

RHR Heat Exchanger AHRS1-1A
The weld area of AHRS1-W1 [shell circumferential weld], located at the intersection of integrally welded attachments AHRS1-SW1 and AHRS1-SW2, below the residual heat exchanger AHRS1-1A flange and above the 8 inch inlet

and outlet nozzles, could not be examined. This weld area could not be examined due to the inability to place portions of the required 0°, 45°, and 60° shear (axial scan and circumferential scan) manual ultrasonic transducers on circumferential weld AHRS1-W1 and the shell base metal. Therefore, no cross sectional sketches of the weld indicating ultrasonic coverage could be obtained of the areas not scanned. The limited access to weld AHRS1-W1 is due to; 1) the integrally welded attachments being bolted to the base support and covering the circumferential weld for 0°, 45°, and 60° shear (axial scan and circumferential scan), 2) the insertion of the 8 inch inlet and outlet nozzles with reinforcing plates into the shell for 0°, 45°, and 60° shear (axial scan and circumferential scan) and 3) the bolted flange connection for 0°, 45°, and 60° shear (axial scan and circumferential scan).

The weld area of residual heat exchanger 1A head circumferential weld AHRS1-W2 [head circumferential weld], located at the intersection of integrally welded attachments AHRS1-SW1 and AHRS1-SW2, below the 8-inch inlet and outlet nozzles, could not be examined. This area could not be examined due to the inability to place portions of the required 0°, 45°, and 60° shear (axial scan and circumferential scan) manual ultrasonic transducers on circumferential weld AHRS1-W2 and the shell base metal. Therefore, no cross sectional sketches of the weld indicating ultrasonic coverage could be obtained of the areas not scanned. The limited access for 0°, 45°, and 60° shear (axial scan and circumferential scan) is due to the integrally welded attachments being bolted to the base support and covering the circumferential weld, and the insertion of the 8-inch inlet and outlet nozzles with reinforcing plates into the shell.

Letdown Heat Exchanger

The weld area of AHNR-W2 [head circumferential weld] located at the intersection of integrally welded attachments AHNR-SW1 and AHNR-SW2, below the 2-inch inlet and outlet nozzles, could not be examined. This weld area could not be examined due to the inability to place portions of the required 0°, 45°, and 60° shear (axial scan and circumferential scan) manual ultrasonic transducers on circumferential weld AHNR-W2 and the shell base metal. Therefore, no cross sectional sketches of the weld indicating ultrasonic coverage could be obtained of the areas not scanned. The limited access for the required 0°, 45°, and 60° shear (axial scan and circumferential scan) is due to the integrally welded attachments being bolted to the base support and covering the circumferential weld, as well as the insertion of the 2-inch inlet and outlet nozzles with reinforcing plates into the shell. The letdown heat exchanger AHLD material is A240 TP304 stainless steel.

Seal Water Injection Filter 1A

The weld area of weld AFS1-W1 [shell circumferential weld], below the flange above the flange cover hinge plate, weld crown and above the nameplate, could not be examined. This weld area could not be examined due to the inability to place portions of the required 0°, 45° shear (axial scan and circumferential scan) and 60° shear (axial scan) manual ultrasonic transducers on circumferential weld AFS1-W1 and the shell base metal. Therefore, no cross sectional sketches of the weld indicating ultrasonic coverage could be obtained of the areas not scanned. The limited access is due to 1) the flange cover hinge plate being welded to seal water injection filter AFSI-1A shell for 45° shear axial scan and circumferential scan, 2) the name plate being welded to the seal water injection filter AFS1-1A shell for 45° shear axial scan, 3) the weld crown for the 45° shear axial scan and circumferential scan and, 4) the bolted flange connection for 45° shear axial scan and circumferential scan. The seal water injection filter AFS1-1A shell material is SA240 TP304 stainless steel.

The weld area of weld AFS1-W2 [head circumferential weld], at the intersection of integrally welded attachments AFS1-SW1, AFS1-SW2 and AFS1-SW3, and below the 2-inch inlet nozzle, could not be examined. This weld area could not be examined due to the inability to place portions of the required 0°, 45° shear (axial scan and circumferential scan) and 60° shear (axial scan) manual ultrasonic transducers on circumferential weld AFS1-W2 and the shell base metal. Therefore, no cross sectional sketches of the weld indicating ultrasonic coverage could be obtained of the areas not scanned. The limited access is attributed to the integrally welded attachments being welded to the seal water injection filter 1A shell and covering the circumferential weld for the 0°, 45° shear (axial scan and circumferential scan) and 60° shear (axial scan). Additionally, the limited access is attributed to the insertion of the 2-inch inlet nozzle into the shell for the 45° shear (axial scan and circumferential scan) and 60° shear (axial scan). The seal water injection filter AFS1-1A shell material is SA240 TP304 stainless steel.

Steam Generator 1A

The weld area of SG-W2 [shell circumferential weld], could not be examined. This weld area could not be examined due to an inability to place the required 0°, 45°, and 60° shear (axial scan and circumferential scan) manual ultrasonic transducers on circumferential shell weld SG-W2, the shell base material and the weld crown. Therefore, no cross sectional sketches of the weld indicating ultrasonic coverage could be obtained of the areas not scanned. The limited access is due to the integrally welded pads welded to the steam generator 1A shell for 0°, 45° shear (axial scan and circumferential scan) and 60° shear (axial scan) and the blended weld crown configuration for the 45° and 60° shear (axial scan and circumferential). The steam generator 1A circumferential shell is SA533 Grade A Class 1 carbon steel.

Regenerative Heat Exchanger

The weld area of ARG-W11 [tubesheet-to-shell circumferential weld] at the location of rigid support bracket ARG-S2 could not be examined. This weld area could not be examined due to an inability to place the required 0° and 45° longitudinal (axial and circumferential) manual ultrasonic transducers on circumferential weld ARG-W11 and the shell base metal. Therefore, no cross sectional sketches of the weld indicating ultrasonic coverage could be obtained for the areas not scanned. The limited access for the 45° longitudinal (axial and circumferential) is attributed to the rigid support bracket being bolted to the wall plate, welded stops (lug) around circumference of the regenerative heat exchanger and the difficulty in removing and replacing rigid support bracket in a 1–2 Rem per hour radiation field. The regenerative heat exchanger material consists of; shell, A351 CF8; tubesheet, A182 F304 stainless steel; and head, A240 TP304 stainless steel.

Evaluation: The ASME Code requires 100% volumetric examination of head, shell, and tubesheet-to-shell welds on selected Class 2 pressure vessels. However, the configuration of several of these components at KNPP preclude 100% examination. In order to increase coverage for the subject vessel welds, the components would have to be re-designed and modified. This would place a significant hardship on the licensee, thus the ASME Code-required volumetric examinations are impractical.

Based on the drawings and descriptions[6] of the subject welds, the licensee has shown that the design configurations limit volumetric examination, with a range of volumes from 23 to 89% being obtained (see Table 3.11). Specific causes of the limited volumetric examinations are briefly listed below:

RHR Heat Exchanger AHRS1-1A
Circumferential shell Weld AHRS1-W1 is a shell-to-bolted flange configuration which is only accessible from the shell side of the weld. In addition, the heat exchanger main integrally welded supports on either side of the heat exchanger, and the inlet and outlet nozzles located in close proximity to the weld, severely limit scans from the shell side. Thus, the licensee was only able to obtain approximately 23% volumetric coverage. Circumferential head Weld AHRS1-W2 is a shell-to-domed head design. This weld is accessible from each side, however, scans are severely limited due to the aforementioned welded supports and inlet/outlet nozzles. The licensee was able to obtain approximately 62% volumetric coverage of this weld.

Letdown Heat Exchanger
Circumferential head Weld AHNR-W2 is a shell-to-domed head design. This weld is accessible from each side, however, scans are severely limited due to integrally welded supports and inlet/outlet nozzles. The licensee was able to obtain approximately 57% volumetric coverage of this weld.

Seal Water Injection Filter 1A
Circumferential shell Weld AFS1-W1 is a shell-to-bolted flange configuration which is only accessible from the shell side of the weld. In addition, the weld crown build-up, a flange cover hinge plate, and equipment identification plate limit scans from the shell side. The licensee was able to obtain approximately 33% volumetric coverage of this weld. Circumferential head Weld AFS1-W2 is a shell-to-domed head design. This weld is accessible from each side, however,

6 Drawings and physical descriptions provided by the licensee are not included in this report.

scans are severely limited due to three integrally welded support legs and a 2-inch diameter inlet nozzle located in close proximity to the weld. The licensee was able to obtain approximately 64% volumetric coverage of this weld.

Steam Generator 1A
Circumferential shell Weld SG-W2 is located at the upper transition zone-to-shell. This weld is accessible from each side, however, scans are limited due to integrally welded support pads, and the blended weld crown geometry which restrict scanning access in these areas. The licensee was able to obtain approximately 89% volumetric coverage of this weld.

Regenerative Heat Exchanger
Ultrasonic scans on circumferential tubesheet-to-shell Weld ARG-W11 are limited due to the pipe support clamp and welded stops around circumference of heat exchanger. Scans could only be performed from one side of this weld. However, the licensee obtained approximately 59% volumetric coverage of this weld.

As discussed above, the licensee obtained a limited, but meaningful amount of volumetric coverage on the subject Class 2 vessel welds. Other pressure-retaining welds on these vessels were examined to the full extent of ASME Code requirements, and all components received the ASME Code-required VT-2 visual examination. No rejectable indications were observed during any of the examinations performed.

Based on the impracticality of examining the subject welds to the extent required by ASME Code, and considering the volumetric coverage(s) obtained on these and similar Class 2 vessel welds, it is reasonable to conclude that significant patterns of degradation, should they exist, would have been detected. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), it is recommended that the requests for relief for the welds listed above be granted.

3.12 <u>Request for Relief RR-G-7-05 (TAC MC7901), Examination Category C-A, Item C1.20, Pressure Retaining Welds in Pressure Vessels, Welds on Charging Pump Pulsation Dampeners</u>

Based on the NRC RAI, and the licensee's use of ASME Code Case N-460, the licensee elected to withdraw this request in the response dated March 29, 2006.

3.13 <u>Request for Relief RR-G-7-11 (TAC MC7907), Examination Category C-A, Item C1.20, Pressure Retaining Welds in Pressure Vessels, Circumferential Head Weld on Regenerative Heat Exchanger</u>

Based on the NRC RAI, and the licensee's use of ASME Code Case N-460, the licensee elected to withdraw this request in the response dated March 29, 2006.

3.14 Request for Relief RR-G-7-17 (TAC MC7913), Examination Category C-A, Item C1.10, Pressure Retaining Welds in Pressure Vessels, Steam Generator 1B Shell Circumferential Weld

Based on the NRC RAI, and the licensee's use of ASME Code Case N-460, the licensee elected to withdraw this request in the response dated March 29, 2006.

3.15 Request for Relief RR-G-7-18 (TAC MC7914), Examination Category C-A, Item C1.20, Pressure Retaining Welds in Pressure Vessels, Steam Generator 1B Head Circumferential Weld

Based on the NRC RAI, and the licensee's use of ASME Code Case N-460, the licensee elected to withdraw this request in the response dated March 29, 2006.

3.16 Request for Relief RR-G-7-19 (TAC MC7915), Examination Category C-A, Item C1.30, Pressure Retaining Welds in Pressure Vessels, Steam Generator 1A and 1B Tubesheet-to-Shell Circumferential Welds

Based on the NRC RAI, and the licensee's use of ASME Code Case N-460, the licensee elected to withdraw this request in the response dated March 29, 2006.

3.17 Request for Reliefs RR-G-7-01, (TAC MC7997), RR-G-7-02 (TAC MC7998), and RR-G-7-03 (TAC MC7999), Examination Category C-C, Items C3.10 and C3.30, Integral Attachments for Vessels, Piping, Pumps, and Valves

ASME Code Requirement: Examination Category C-C, Items C3.10 and C3.30, require 100% surface examination, as defined by IWC-2500-5, of the welds and adjacent base material for integrally welded support attachments on Class 2 pressure vessels and pumps, respectively. ASME Code Case N-460, *Alternative Examination Coverage for Class 1 and Class 2 Welds*, as an alternative approved for use by the NRC in Regulatory Guide 1.147, Revision 14, *Inservice Inspection Code Case Acceptability* (RG1.147), states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 weld is acceptable provided that the reduction is less than 10%, i.e., greater than 90% examination coverage is obtained.

Licensee's ASME Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from examining 100% of the ASME Code-required inspection surfaces shown in Figures IWC-2500-5(a) through (d), as applicable, for integral attachment support welds in Table 3.X.

Table 3.X - Examination Category C-C Integral Attachment Support Welds

Component ID	Relief Request	Attachment Weld	ASME Item	Coverage Obtained
RHR Heat Exchanger AHRS1-1A	RR-G-7-01	AHRS1-SW1 AHRS1-SW2	C3.10	79.3%

Table 3.X - Examination Category C-C Integral Attachment Support Welds				
Component ID	Relief Request	Attachment Weld	ASME Item	Coverage Obtained
Safety Injection Pump APSI-1A	RR-G-7-02	APSI-1A-S1 APSI-1A-S3 APSI-1A-S4	C3.30	85.4%
Safety Injection Pump APSI-1B	RR-G-7-02	APSI-1B-S1 APSI-1B-S2 APSI-1B-S4	C3.30	85.4%
Safety Injection Pump APSI-1A	RR-G-7-03	APSI-1A-S2	C3.30	83%
Safety Injection Pump APSI-1B	RR-G-7-03	APSI-1B-S3	C3.30	83%

Licensee's Basis for Relief Request: The licensee stated that a limited portion (see Table 3.1) of each integrally welded attachment was inaccessible for surface examination based on the close proximity of the attachment to the subject component.

Licensee's Proposed Alternative Examination: The licensee stated that no alternative ASME Code-required surface examinations were available due to limited access. VT-2 and VT-3 examinations were performed during the 3rd interval as required by ASME Code.

Response to Request for Additional Information (as stated):

Integrally welded attachments AHRS1-SW1 and AHRS1-SW2 [on residual heat exchanger AHRS-1A] could not be examined due to the physical inability to perform proper surface cleaning and to apply liquid penetrant. These restrictions are related to component geometry. The limited access is due to the integrally welded attachment being bolted to the base support. The residual heat exchanger AHRS1-1A shell material is A240 TP304 stainless steel, and the integrally welded attachment material is A285 Grade C carbon steel. Other surface examination methods (e.g., magnetic particle) would not be practical and could not reasonably increase the examination coverage, as the surface to be examined is stainless steel. VT-2 and VT-3 examinations were performed as required by ASME Boiler and Pressure Vessel Code Section XI 1989 Edition.

The weld area located at the bottom portion of integrally welded attachments APSI-1A-S1, APSI-1A-S3, APSI-1A-S4, APSI-1B-S1, APSI-1B-S2, and APSI-1B-S4 [on safety injection pumps APSI-1A and APSI-1B] could not be examined due to the physical inability to perform proper surface cleaning and limited use of the magnetic particle Y-6 yoke for establishing a magnetic field and applying magnetic particle powder.

These restrictions are related to component geometry. The limited access is due to the integrally welded attachment being bolted to the base support. The safety injection pump casing is ASTM A266 Class 1 carbon steel, and the safety injection pump welded attachments are A216 WC A carbon steel. Other surface examination methods (liquid penetrant) would not be practical and could not reasonably increase the examination coverage, as the surface to be examined would still be limited by the integrally welded attachment being bolted to the base support. VT-2 and VT-3 examinations were performed as required by ASME Boiler and Pressure Vessel Code Section XI 1989 Edition.

The weld area located at the bottom portion of safety injection pump APSI-1A integrally welded attachment APSI-1A-S2 and safety injection pump APSI-1B integrally welded attachment APSI-1B-S3 could not be examined due to the physical inability to perform proper surface cleaning and limited use of the magnetic particle Y-6 yoke for establishing a magnetic field and applying magnetic particle powder. These restrictions are related to component geometry. The limited access is due to the integrally welded attachment being bolted to the base support. The safety injection pump casing is ASTM A266 Class 1 carbon steel and the safety injection pump welded attachments are A216 WC A carbon steel. The safety injection pumps are normally in standby condition and are normally operated during surveillance procedures. Since the integrally welded attachments are located on the external surface of the pump and are not subjected to known degradation mechanisms except during surveillance testing, inservice degradation is not expected. Other current surface examination methods (liquid penetrant) would not be practical and could not reasonably increase the examination coverage, as the surface to be examined would still be limited by the integrally welded attachment being bolted to the base support. VT-2 and VT-3 examinations were performed as required by ASME Boiler and Pressure Vessel Code Section XI 1989 Edition.

<u>Evaluation:</u> The ASME Code requires that 100% surface examinations of the entire weld and adjacent base material of integral attachment support welds be examined for selected Class 2 pressure retaining vessels and pumps. The licensee has requested relief from examining 100% of the ASME Code-required surfaces, as shown in Figures IWC-2550-5(a) through (d), as applicable, for several integral attachments on the Residual Heat Removal (RHR) heat exchanger and safety injection pumps, based on the design geometries of the components.

These integrally attached supports are made of carbon steel and provide primary support for the RHR heat exchanger and safety injection pumps. The supports are welded to the pressure-retaining boundary of the subject vessel/pumps and bolted to either an in-bed plate in the concrete floor, or to other non-ASME support members. Based on the drawings and photographs[7] provided by the licensee, it has been shown that ASME Code 100% surface examination

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7 The drawings, descriptions, or photographs submitted by the licensee are not included in this report.

requirements are impractical due to the design and location of these supports. Access to the lower portions of the welds, and those in close contact with the vessel/pumps, are inaccessible for successful application of ASME Code surface methods. In order to increase the reported coverages (see Table 3.1), the components would require redesign and modification. Therefore, it is impractical to perform the ASME Code-required examinations on the subject integral attachment welds. However, the licensee has obtained a significant amount of surface examination coverage ranging from 79 to 85% of the ASME Code-required areas. In addition, no rejectable indications were observed in the examinations completed.

Based on the impracticality of meeting the ASME Code surface examination requirements, and considering the coverage that was obtained, it is reasonable to conclude that any significant patterns of degradation, if existing, would have been detected. Therefore, pursuant to 10 CFR 50.55a(g)(6)(I), it is recommended that relief be granted for the integral attachment support welds listed above.

4.0 CONCLUSIONS

PNNL has reviewed the licensee's submittal and concludes that the ASME Code examination coverage requirements are impractical for the subject welds listed in the following requests for relief:

RR-G-7-1	RR-G-7-8	RR-G-7-13	RR-G-7-20	RR-G-7-64
RR-G-7-2	RR-G-7-9	RR-G-7-14	RR-G-7-21	RR-G-7-71
RR-G-7-3	RR-G-7-10	RR-G-7-15	RR-G-7-22	
RR-G-7-4	RR-G-7-12	RR-G-7-16	RR-G-7-23	

Based on the coverages obtained, if significant service-induced degradation were occurring, there is reasonable assurance that evidence of it would be detected by the examinations that were performed. Therefore, for these requests, it is recommended that relief be granted, pursuant to 10 CFR 50.55a(g)(6)(i), for the third inspection interval at Kewaunee Nuclear Power Plant.

Based on the NRC Request for Additional Information (RAI), the licensee withdrew the following requests for relief, because ASME Code Case N-460 had been adopted at KNPP and greater than 90% coverage was obtained:

RR-G-7-5	RR-G-7-11	RR-G-7-19
RR-G-7-6	RR-G-7-17	RR-G-7-72
RR-G-7-7	RR-G-7-18	RR-G-7-73

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TABLE 1
SUMMARY OF RELIEF REQUESTS

Relief Request Number	PNNL TLR Sec.	System or Component	Exam. Category	Item No.	Volume or Area to be Examined	Required Method	Licensee Proposed Alternative	Relief Request Disposition
RR-G-7-1	3.17	Integrally Welded Attachments	C-C	C3.10	100% of the integral attachment welds on RHR heat exchanger AHRS1-1A	Surface	None. Use obtained 79.3% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-2	3.17	Integrally Welded Attachments	C-C	C3.30	100% of the integral attachment welds on safety injection pumps APSI-1A and -1B	Surface	None. Use obtained 85.4% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-3	3.17	Integrally Welded Attachments	C-C	C3.30	100% of integral attachment welds on safety injection pumps APSI-1A and -1B	Surface	None. Use obtained 83% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-4	3.1	RPV Closure Head Flange	B-A	B1.40	100% of head-to-flange weld	Volumetric and Surface	None. Use obtained 77% examination coverage. Head has been replaced.	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-5	3.12	Charging Pump Pulsation Dampeners	C-A	C.120	100% of head circumferential welds	Volumetric	N/A	Withdrawn by licensee in March 29, 2006 letter
RR-G-7-6	3.4	PZR Head Welds	B-B	B2.11	100% of circumferential shell-to-head welds	Volumetric	N/A	Withdrawn by licensee in March 29, 2006 letter
RR-G-7-7	3.5	PZR Head Welds	B-B	B2.12	100% of longitudinal head welds	Volumetric	N/A	Withdrawn by licensee in March 29, 2006 letter
RR-G-7-8	3.11	Class 2 Pressure Vessels	C-A	C1.10	100% of shell circumferential weld on RHR heat exchanger AHRS1-1A	Volumetric	None. Use obtained 23% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-9	3.11	Class 2 Pressure Vessels	C-A	C1.20	100% of head circumferential weld on RHR heat exchanger AHRS1-1A	Volumetric	None. Use obtained 62.4% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-10	3.10	RCP Bolting	B-G-1	B6.180	100% of bolting on RCP 1A	Volumetric	None. Use obtained 92.7% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-11	3.13	Class 2 Pressure Vessels	C-A	C1.20	100% of head circumferential head weld on regenerative heat exchanger	Volumetric	N/A	Withdrawn by licensee in March 29, 2006 letter

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Relief Request Number	PNNL TLR Sec.	System or Component	Exam. Category	Item No.	Volume or Area to be Examined	Required Method	Licensee Proposed Alternative	Relief Request Disposition
RR-G-7-12	3.7	Steam Generator Nozzles	B-D	B3.140	100% of inner radius sections on steam generators 1A and 1B nozzles	Volumetric	None. Use obtained 93.7% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-13	3.11	Class 2 Pressure Vessels	C-A	C1.20	100% of head circumferential weld on letdown heat exchanger	Volumetric	None. Use obtained 57% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-14	3.11	Class 2 Pressure Vessels	C-A	C1.10	100% of shell circumferential weld on seal water injection filter 1A	Volumetric	None. Use obtained 32.9% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-15	3.11	Class 2 Pressure Vessels	C-A	C1.20	100% of head circumferential weld on seal water injection filter 1A	Volumetric	None. Use obtained 64.2% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-16	3.11	Class 2 Pressure Vessels	C-A	C1.10	100% of shell circumferential weld on steam generator 1A	Volumetric	None. Use obtained 88.9% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-17	3.14	Class 2 Pressure Vessels	C-A	C1.10	100% of shell circumferential weld on steam generator 1B	Volumetric	N/A	Withdrawn by licensee in March 29, 2006 letter
RR-G-7-18	3.15	Class 2 Pressure Vessels	C-A	C1.20	100% of head circumferential weld on steam generator 1B	Volumetric	N'A	Withdrawn by licensee in March 29, 2006 letter
RR-G-7-19	3.16	Class 2 Pressure Vessels	C-A	C1.30	100% of tubesheet-to-shell circumferential weld on steam generators 1A and 1B	Volumetric	N/A	Withdrawn by licensee in March 29, 2006 letter
RR-G-7-20	3.6	RPV Nozzle Welds	B-D	B3.90	100% of nozzle-to-shell weld RV-W7	Volumetric	None. Use obtained 70.2% composite examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-21	3.6	RPV Nozzle Welds	B-D	B3.90	100% of nozzle-to-shell weld RV-W10	Volumetric	None. Use obtained 70.2% composite examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-22	3.9	SG Nozzle-to-Pipe Welds	B-F	B5.70	100% of dissimilar metal welds in steam generator 1A	Volumetric and Surface	None. Use obtained 61.9% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-23	3.9	SG Nozzle-to-Pipe Welds	B-F	B5.70	100% of dissimilar metal welds in steam generator 1B	Volumetric and Surface	None. Use obtained 59.8% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-64	3.11	Class 2 Pressure Vessels	C-A	C1.30	100% of tubesheet-to-shell circumferential weld on regenerative heat exchanger	Volumetric	None. Use obtained 58.6% examination coverage	Granted 10 CFR 50.55a(g)(6)(i)

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RR-G-7-71	3.2	RPV Shell Weld	B-A	B1.30	100% of shell-to-flange weld RV-W1	Volumetric	None. Use obtained 63% composite examination coverage	Granted 10 CFR 50.55a(g)(6)(i)
RR-G-7-72	3.8	RPV Nozzle Weld	B-D	B3.90	100% of nozzle-to-shell weld RV-W11	Volumetric	N/A	Withdrawn by licensee in March 29, 2006 letter
RR-G-7-73	3.3	RPV Lower Head Weld	B-A	B1.21	100% of lower head-to-shell weld RV-W4	Volumetric	N/A	Withdrawn by licensee in March 29, 2006 letter