OCONEE NUCLEAR POWER STATION, UNIT 1
Third 10-Year ISI Interval

TABLE 1
SUMMARY OF RELIEF REQUESTS

Relief Request Number	PNNL TLR RR Sec.	System or Component	Exam. Category	Item No.	Volume or Area to be Examined	Required Method	Licensee Proposed Alternative	Relief Request Disposition
02-004 (Part A)	3.1	Reactor Pressure Vessel Shell	B-A	B1.11 B1.21	100% of full penetration lower shell-to-head ring Weld 1-RPV-WR34 and lower head ring-to-cap Weld 1-RPV-WR35.	Volumetric	Use achieved volumetric coverage	Granted 10CFR50.55a(g)(6)(i)
02-004 (Part B)	3.2	Reactor Pressure Vessel Nozzles	B-D	B3.90 B3.100	100% of full penetration outlet nozzle-to-vessel Weld RPV-WR13 and RPV-WR13A; and core flood nozzle-to-vessel Welds 1-RPV-WR54 and 1-RPV-WR54A (includes inner radius)	Volumetric	Use achieved volumetric coverage	Granted 10CFR50.55a(g)(6)(i)
02-004 (Part C)	3.3	Reactor Pressure Vessel Nozzles	B-F	B5.10	100% of full penetration dissimilar metal Welds 1-RPV-WR53 and 1-RPV-WR53A	Volumetric and Surface	Use achieved volumetric and surface coverage	Authorized 10CFR50.55a(a)(3)(ii)
02-004 (Part D)	3.4	Reactor Coolant Piping	B-J	B9.11	100% of full penetration safe end-to-pipe Welds 1-53A-02-43L and 1-53A-01-1L	Volumetric and Surface	Use achieved volumetric and surface coverage	Authorized 10CFR50.55a(a)(3)(ii)
02-005 (Part A)	3.5	Steam Generator Nozzles	B-D	B3.130 B3.140	100% of full penetration nozzle-to-vessel Welds 1-SGA-WG25 and 1-SGB-WG25 (includes inner radius)	Volumetric	Use achieved volumetric coverage	Granted 10CFR50.55a(g)(6)(i)
02-005 (Part B)	3.6	Letdown Cooling Vessel	B-D	B3.150	100% of pull penetration Welds LDCB-IN-VI and 1-LDCB-OUT-V2	Volumetric	Use achieved volumetric coverage	Granted 10CFR50.55a(g)(6)(i)
02-005 (Part C)	3.7	Reactor Pressure Vessel	B-G-1	B6.40	100% of the flange threaded areas, 1-RPV-LIGAMENTS	Volumetric	Use achieved volumetric coverage	Authorized 10CFR50.55a(a)(3)(ii)
02-005 (Part D)	3.8	Piping Welds	C-F-1	C5.11 C5.21	100% of high alloy piping Welds 1LP-128-80, 1HP-192-15, 1-51A-01-91A, 1HP324-118B, 1-51A-01-32AA, 1HP-393-127A, 1-51A-02-34B, 1HP-193-12, 1HP-70-11, 1-51A-01-103A	Volumetric and surface	Use achieved volumetric and surface coverage	Granted 10CFR50.55a(g)(6)(i)

ENCLOSURE 2

TECHNICAL LETTER REPORT
ON THE THIRD 10-YEAR INTERVAL INSERVICE INSPECTION
REQUESTS FOR RELIEF NOS. 02-004 and 02-005
FOR
DUKE POWER COMPANY
OCONEE NUCLEAR STATION, UNIT 1
DOCKET NUMBER: 50-269

1.0 INTRODUCTION

By separate letters dated July 29, 2002, the licensee, Duke Power Company, submitted Requests for Relief 02-004 and 02-005, seeking relief from the 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 an NRC Request for Additional Information (RAI), the licensee revised the requests and provided further information in a letter dated May 15, 2003. These requests are for the third 10-year inservice inspection (ISI) interval at Oconee Nuclear Station, Unit 1 (Oconee 1). Pacific Northwest National Laboratory (PNNL) has evaluated the revised requests for relief and supporting information submitted by the licensee in the following sections.

2.0 REGULATORY REQUIREMENTS

Inservice inspection 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 code of record for the Oconee 1 third 10-year interval inservice inspection program, which began on July 15, 1994, is the 1989 Edition of Section XI of the ASME Boiler and Pressure Vessel Code, with no addenda.

3.0 TECHNICAL EVALUATION

The information provide by Duke Power Company in support of the requests for relief from Code requirements has been evaluated and the bases for disposition are documented below. This evaluation report includes both Relief Request 02-004 and 02-005, which were originally submitted under separate letters dated July 29, 2002. For clarity, the request has been evaluated in several parts.

3.1 Request for Relief 02-004 (Part A), Examination Category B-A, Items B1.11 and B1.21, Pressure Retaining Welds in Reactor Vessel

Code Requirement: Examination Category B-A, Items B1.11 and B1.21, require essentially 100% volumetric examination, as defined by Figures IWB-2500-1 and IWB-2500-3, of the length of Class 1 full penetration reactor pressure vessel (RPV) circumferential shell and head welds, respectively. "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 Code Relief Request: In accordance with 10CFR50.55a(g)(5)(iii), the licensee requested relief from the 100% volumetric examination coverage requirement for RPV lower shell-to-head ring Weld 1-RPV-WR34 and lower head ring-to-cap Weld 1-RPV-WR35.

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

During the ultrasonic examination of welds 1-RPV-WR34 and 1-RPV-WR35, 100% coverage of the required examination volume could not be obtained. The examination coverage was limited to 36% and 42% respectively. Limitations were caused by the core guide lugs & flow stabilizers for WR34 and incore nozzles & flow stabilizers for WR35 that restrict the scanning surface. The percentage of coverage reported represents the aggregate coverage. In order to achieve more coverage the core guide lugs, incore nozzles and flow stabilizers would have to be moved to allow greater access for scanning, which is impractical.

[The licensee provided the following additional general information in regards to justification for all Examination Category Items included in Relief Request 02-004:]

Duke Energy will use pressure testing and VT-2 visual examination to complement the limited examination coverage. The Code requires (reference Table IWB-2500-1, item numbers B15.10 and B15.50) that a system leakage test be performed after each refueling outage for Class 1. Additionally a system hydrostatic test (reference Table IWB-2500-1, item numbers B15.11 and B15.51) is required once during each 10-year inspection interval. These tests require a VT-2 visual examination for evidence of leakage. This testing provides adequate assurance of pressure boundary integrity.

Duke Energy will use VT-3 visual examination to complement the limited examination coverage. The Code requires (reference Table IWB-2500-1, item number B13.10) that a VT-3 examination be performed after the first refueling outage and subsequent refueling outages at approximately 3 year periods. During the first and second periods

of an interval a VT-3 examination is performed on areas above and below the reactor core that are made accessible for examination by removal of components during normal refueling outages. During the third period of an interval the VT-3 examination is performed on all of the reactor vessel interior surfaces at the same time that the automated UT exams are performed on the reactor vessel welds. This examination provides adequate assurance of pressure boundary integrity.

In addition to the above Code required examinations (volumetric, pressure test, and VT-3), there are other activities which provide a high level of confidence that, in the unlikely case that leakage did occur through these welds, it would be detected and isolated. Specifically, leakage from these welds would be detected by monitoring of the Reactor Coolant System (RCS), which is performed once each shift under procedure PT/1,2,3/A/0600/10, "RCS Leakage." This RCS leakage monitoring is a requirement of Technical Specification 3.4.13, "Reactor Coolant System Leakage." Leakage is also evaluated in accordance with this Technical Specification. The leakage could also be detected through several other methods. One is the RCS mass balance calculation. A second is the Reactor Building air particulate monitor. This monitor is sensitive to low leak rates; the iodine monitor, gaseous monitor and area monitor are capable of detecting any fission products in the coolant and will make these monitors sensitive to coolant leakage. A third is the level indicator in the Reactor Building normal sump. A fourth is a loss of level in the Letdown Storage Tank.

Due to the design of the reactor vessel and location of the core guide lugs, flow stabilizers, outlet nozzle boss, flow restrictors and inlet nozzles and air in the top of some of the nozzles; it is not feasible to obtain the examination coverage required for all of the welds listed in this request for relief. Duke Energy has examined the welds/components referenced in this request to the maximum extent possible utilizing the latest in examination techniques and equipment. These welds were rigorously inspected by volumetric NDE methods during construction and verified to be free from unacceptable fabrication defects. Based on the portions and results of the required volumetric and visual examinations performed during this outage, it's our opinion that this combination of examinations provides a reasonable assurance of component integrity. Thus, an acceptable level of quality and safety will have been achieved and allowing relief from the aforementioned Code requirements will not endanger public health and safety.

Licensee's Proposed Alternative Examination (as stated):

The scheduled 10-year code examination was performed on the referenced area/weld and it resulted in the noted limited coverage of the required ultrasonic volume. No additional examinations are planned for the area/weld during the current inspection interval.

Evaluation: The Code requires essentially 100% volumetric examination of Class 1 full penetration reactor pressure vessel (RPV) circumferential shell and head welds. However, 100% volumetric examination coverage for RPV lower shell-to-head ring Weld 1-RPV-WR34 and lower head ring-to-cap Weld 1-RPV-WR35 is not possible. The vessel core guide lugs and flow stabilizers limit the scanning coverage for Weld 1-RPV-WR34, and incore nozzles and flow stabilizers limit scanning coverage for

Weld 1-RPV-WR35. For the licensee to achieve 100% volumetric coverage, the reactor pressure vessel would need to be redesigned and modified. This would place a significant burden on the licensee, thus the Code-required 100% volumetric examinations are impractical.

As shown on the sketches and technical descriptions[1] provided by the licensee, approximately 36% (Weld 1-RPV-WR34) and 42% (Weld 1-RPV-WR35) coverage of the required examination volume was obtained. The core guide lugs, incore nozzles and flow stabilizers limit scanning access for the subject welds. The ultrasonic examination of welds 1-RPV-WR34 and 1-RPV-WR35 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). Personnel, equipment and procedures qualified through the EPRI PDI program 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.

Other pressure retaining shell welds in the RPV were examined to the full extent of Code requirements with no service induced flaws being detected. While it is impractical for the licensee to meet the Code-required 100% volumetric examination coverage, the limited examinations that have been completed for the subject welds, in conjunction with highly reliable examinations on other RPV shell welds, should detect any general patterns of degradation that may occur in the areas examined, providing reasonable assurance of the continued structural integrity of the RPV shell. Therefore, pursuant to 10CFR50.55a(g)(6)(i), it is recommended that relief be granted.

3.2 Request for Relief 02-004 (Part B), Examination Category B-D, Items B3.90 and B3.100, Full Penetration Welded Nozzles in Vessels

Code Requirement: Examination Category B-D, Item B3.90 requires 100% volumetric examination, as defined by Figure IWB-2500-7, of Class 1 full penetration RPV nozzle-to-vessel welds. Item 3.100 requires 100% volumetric examination, as defined by Figure IWB-2500-7, of the inner radius section for each RPV nozzle. Code Case N-460, as an alternative approved for use by the NRC Staff, 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 Code Relief Request: In accordance with 10CFR50.55a(g)(5)(iii), the licensee requested relief from the Code requirement to complete 100% coverage of the examination volume described in Figure IWB-2500-7 for the RPV nozzle-to-shell welds and inner radius sections listed in Table 1.0 below.

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

Table 1.0 - ASME Category B-D Welds		
Area/Weld Number	Area or Weld Configuration	Volumetric Percentage Completed
1-RPV-WR13	Reactor Vessel Outlet Nozzle-to-Vessel Weld @ 90°	Item No. B3.90 82% Volume Coverage
1-RPV-WR13A	Reactor Vessel Outlet Nozzle-to-Vessel Weld @ 270°	Item No. B3.90 82% Volume Coverage
1-RPV-WR54	Reactor Vessel Core Flood Nozzle-to-Vessel Weld @ 0°	Item No. B3.90 81% Volume Coverage
1-RPV-WR54A	Reactor Vessel Core Flood Nozzle-to-Vessel Weld @ 180°	Item No. B3.90 81% Volume Coverage
1-RPV-WR54	Reactor Vessel Core Flood Nozzle Inside Radius @ 0°	Item No. B3.100 52% Volume Coverage
1-RPV-WR54A	Reactor Vessel Core Flood Nozzle Inside Radius @ 180°	Item No. B3.100 52% Volume Coverage

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

During the ultrasonic examination of welds 1-RPV-WR13 and 1-RPV-WR13A, 100% coverage of the required examination volume could not be obtained. The examination coverage was limited to 82%. Limitations were caused by the outlet nozzle boss that restricts the scanning surface. The percentage of coverage reported represents the aggregate coverage. In order to achieve more coverage, the outlet nozzle boss would have to be moved to allow greater access for scanning, which is impractical.

During the ultrasonic examination of welds 1-RPV-WR54 and 1-RPV-WR54A, 100% coverage of the required examination volume could not be obtained. The examination coverage was limited to 81% of the required volume from one side of the weld. Limitations were caused by the flange taper and inlet nozzles that restrict the scanning surface. The percentage of coverage reported represents the aggregate coverage. In order to achieve more coverage, the inlet nozzles would have to be moved and the taper on the flange would have to be redesigned to allow greater access for scanning, which is impractical. In addition, because of the proximity of the flow restrictors no scanning was performed from the nozzle I.D. (0% examination coverage). In order to achieve more coverage. The flow restrictor would have to be moved to allow access for scanning, which is impractical.

During the ultrasonic examination of inside radius sections 1-RPV-WR54 and 1-RPV-WR54A, 100% coverage of the required examination volume could not be obtained. The examination coverage was limited to 52%. Limitations were caused by the flow restrictor that prevents scanning the surface. The percentage of coverage reported represents the aggregate coverage. In order to achieve more coverage, the flow

restrictor would have to be moved to allow greater access for scanning, which is impractical.

[See additional licensee-submitted general information previously shown in 3.1 of this report.]

Licensee's Proposed Alternative Examination (as stated):

The scheduled 10-year code examination was performed on the referenced area/weld and it resulted in the noted limited coverage of the required ultrasonic volume. No additional examinations are planned for the area/weld during the current inspection interval.

Evaluation: The Code requires 100% volumetric examination of Class 1 full penetration nozzle-to-vessel welds and inner radius sections for each RPV nozzle. However, the specific design of the reactor outlet and core flood nozzles limits access for examination of these welds so that 100% of the required coverage cannot be obtained. For the licensee to achieve 100% volumetric coverage, the subject nozzles would have to be redesigned and modified. This would place a significant burden on the licensee, thus the Code-required 100% volumetric examinations are impractical.

As shown on the sketches and technical descriptions[2] provided by the licensee, the examinations of nozzle welds 1-RPV-WR13 and 1-RPV-WR13A (90 and 270 degrees) are limited by the outlet nozzle boss that restricts the scanning surface. The examinations of nozzle welds 1-RPV-WR54 and 1-RPV-WR54A are limited by the flange taper and inlet nozzles that restrict scanning. However, the licensee was able to obtain a substantial amount (82% and 81%, respectively) of the Code-required examination volume for these welds.

The Code-required inspection volume of the inside radius sections of nozzle-to-vessel welds 1-RPV-WR54 and 1-RPV-WR54A could not be examined due to the proximity of flow restrictors inside the nozzle that do not permit scanning from the inner surface. The licensee was able to examine 52% of the required examination volume for these inside radius sections.

The examinations performed by the licensee did not detect any recordable indications and there is no history of failures for these welds. While the licensee cannot meet the Code-required 100% volumetric examination coverage, the examinations completed should detect any general patterns of degradation that may occur in the areas examined, providing reasonable assurance of the continued structural integrity of these welds. Therefore, pursuant to 10CFR50.55a(g)(6)(i), it is recommended that relief be granted.

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

3.3 Request for Relief 02-004 (Part C), Examination Category B-F, Item B5.10, Pressure Retaining Dissimilar Metal Welds in Vessel Nozzles

Code Requirement: Examination Category B-F, Item B5.10, requires 100% volumetric and surface examination, as defined in Figure IWB-2500-8, of Class 1 nozzle-to-safe end welds greater than NPS 4-inches in diameter. Code Case N-460, as an alternative approved for use by the NRC Staff, states that a reduction in examination coverage due to part geometry or interference for any Class 1 and 2 welds is acceptable provided that the reduction is less than 10%, i.e., greater than 90% examination coverage is obtained.

Licensee's Code Relief Request: In accordance with 10CFR 50.55a(g)(5)(iii), the licensee requested relief from the Code requirement to examine 100% of the Code-required weld volume for Class 1 dissimilar metal nozzle-to-safe end Welds 1-RPV-WR53 and 1-RPV-WR53A.

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

During the ultrasonic examination of welds 1-RPV-WR53 and 1-RPV-WR53A, 100% coverage of the required examination volume could not be obtained. The examination coverage was limited to 86% and 81%, respectively. Limitations were caused by air at the top of [the] nozzle that prevents the transducer from making contact for scanning the surface. The percentage of coverage reported represents the aggregate coverage. In order to achieve more coverage, the reactor coolant pumps would have to be in operation to permit reactor coolant flow which would remove the air at the top of the nozzle, which is impractical.

[See additional licensee-submitted general information previously shown in Part A of this report.]

Licensee's Proposed Alternative Examination (as stated):

The scheduled 10-year code examination was performed on the referenced area/weld and it resulted in the noted limited coverage of the required ultrasonic volume. No additional examinations are planned for the area/weld during the current inspection interval.

Evaluation: The Code requires 100% volumetric examination of the subject RPV nozzle-to-safe end welds from two beam path directions and 100% outside surface examination. The NRC granted the licensee approval to use an alternative ultrasonic examination performed from the inside diameter in lieu of the outside surface examination requirements prescribed in Section XI for reactor vessel nozzle-to-pipe welds. NRC Approval is documented in a Safety Evaluation Report dated November 15, 1995. As an alternative, the licensee has proposed to use the reduced volumetric coverage that was obtained during these examinations.

During the examination of core flood nozzle-to-safe end Welds 1-RPV-WR53 and 1-RPV-WR53A, the licensee discovered that air had become entrapped at the top of the subject core flood nozzles. The trapped air resulted in limited examinations near the top of the nozzles due to an inability to couple the ultrasonic transducers to the inside

surface. The licensee made two attempts to evacuate the air but was unsuccessful because air was reintroduced and the licensee could not determine the source of the air. Similar problems with eliminating trapped air in small diameter piping have occurred in other RPV examinations. An alternative for achieving more examination coverage would have been for the licensee to manually examine the nozzle from the outside surface. Accessing the subject nozzle welds from the outside diameter is physically possible, however, the licensee stated that such an examination would result in approximately 80-140 man-rem in exposure resulting from supporting activities associated with this type of examination. The activities include preparation of the core flood nozzles for examination, removing the refueling canal seal plate, providing shielding, removing insulation and conducting the examination.

The licensee completed a significant percentage (81 to 86%) of the required volumetric examinations for the subject welds. The licensee did not record any indications in the portions of the nozzle welds that were examined. In addition, 100% of the Code-required volumetric examinations were obtained from other Category B-F dissimilar welds in the reactor coolant system. Exposing inspection personnel to 80 to 140 man-rem of radiation for an increase of less than 10% in examination volume coverage is not warranted and would result in a hardship without a compensating increase in quality or safety.

The same limitations (trapped air) as described above prevented the licensee from achieving 100% of the alternative volumetric examination (in lieu of surface) from the inside diameter of the nozzle. However, the licensee completed a significant percentage of the alternative volumetric examination from the inside surface for the subject welds. Any existing patterns of degradation that may occur on these welds should be detected by the limited examinations performed by the licensee. The licensee could meet the Code requirements by examining these welds from the outside surface, however, as shown in the discussion above, this would result in a significant hardship.

Based on the examination limitations caused by the trapped air in the subject nozzles, and considering the significant levels of volumetric coverage obtained, requiring the licensee to make small increases (less than 10%) in coverage from the outside surface of the component would result in a hardship with no compensating increase in quality or safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that the licensee's alternative be authorized.

3.4 Request for Relief 02-004 (Part D), Examination Category B-J, Item B9.11, Pressure Retaining Welds in Piping

Code Requirement: Examination Category B-J, Item B9.11, requires essentially 100% volumetric and surface examination, as defined in Figure IWB-2500-8, of the length of Class 1 piping welds greater than NPS 4-inches in diameter. "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 Code Relief Request: In accordance with 10CFR50.55a(g)(5)(iii), the licensee requested relief from the Code requirements to perform 100% coverage of the examination volumes for nozzle safe end-to-pipe Welds 1-53A-02-43L and 1-53-A-01-1L

and is proposing volumetric examination from the inside surface in-lieu of the Code-required surface examination.

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

During the ultrasonic examination of welds 1-53A-02-43L and 1-53A-01-1L, 100% coverage of the required examination volume could not be obtained. The examination coverage was limited to 76% and 83% respectively. Limitations were caused by air at the top of nozzle that prevents the transducer from making contact for scanning the surface. The percentage of coverage reported represents the aggregate coverage. In order to achieve more coverage, the reactor coolant pumps would have to be in operation to permit reactor coolant flow which would remove the air at the top of the nozzle, which is impractical.

[See additional licensee-submitted general information previously shown in Part A of this report.]

Licensee's Proposed Alternative Examination (as stated):

The scheduled 10-year code examination was performed on the referenced area/weld and it resulted in the noted limited coverage of the required ultrasonic volume. No additional examinations are planned for the area/weld during the current inspection interval.

Evaluation: The Code requires 100% volumetric examination of the subject reactor pressure vessel nozzle safe end-to-pipe welds from two beam path directions and 100% outside surface examination. The NRC granted the licensee approval to use an alternative ultrasonic examination performed from the inside diameter in lieu of the outside surface examination requirements prescribed in Section XI for reactor vessel nozzle to pipe welds. NRC Approval is documented in a Safety Evaluation Report dated November 15, 1995. As an alternative, the licensee has proposed to use the reduced volumetric coverage that was obtained during these examinations.

During the ultrasonic examination of nozzle safe end-to-pipe welds 1-53A-02-43L and 1-53A-01-1L, the licensee discovered that air had become entrapped at the top of the subject welds. The trapped air resulted in limited examinations near the top of the nozzles due to an inability to couple the ultrasonic transducers to the inside surface. The licensee made two attempts to evacuate the air but was unsuccessful because air was reintroduced and the licensee could not determine the source of the air. Similar problems with eliminating trapped air in small diameter piping have occurred in other RPV examinations. An alternative for achieving more examination coverage would have been for the licensee to manually examine the nozzle from the outside surface. Accessing the subject nozzle welds from the outside diameter is physically possible, however, the licensee stated that such an examination would result in approximately 80-140 man-rem in exposure resulting from supporting activities associated with this type of examination. The activities include preparation of the nozzle safe end-to-pipe welds for examination, removing the refueling canal seal plate, providing shielding, removing insulation and conducting the examination.

The licensee completed a significant percentage (76% to 83%) of the required volumetric examinations for the subject welds. The licensee did not record any indications in the portions of the nozzle welds that were examined. In addition, 100% of the Code-required volumetric examinations were obtained from other Category B-J dissimilar welds in the reactor coolant system. Exposing inspection personnel to 80 to 140 man-rem of radiation for an increase of less than 15% in examination volume coverage is not warranted and would result in a hardship without a compensating increase in quality or safety.

The same limitations (trapped air) as described above prevented the licensee from achieving 100% of the alternative volumetric examination (in lieu of surface) from the inside diameter of the pipe. However, the licensee completed a significant percentage of the alternative volumetric examination from the inside surface for the subject welds. Any existing patterns of degradation that may occur on these welds should be detected by the limited examinations performed by the licensee. The licensee could meet the Code requirements by examining these welds from the outside surface, however, as shown in the discussion above, this would result in a significant hardship.

Based on the examination limitations caused by the trapped air in the subject nozzle safe end-to-pipe welds, and considering the significant levels of volumetric coverage obtained, requiring the licensee to make small increases (less than 15%) in coverage from the outside surface of the component would result in a hardship with no compensating increase in quality or safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that the licensee's alternative be authorized. The licensee should make every effort to eliminate entrapped air during the next inspection of these components.

3.5 Request for Relief 02-005 (Part A), Examination Category B-D, Items B3.130 and B3.140, Full Penetration Welded Nozzles in Vessels

Code Requirement: Examination Category B-D, Item B3.130 requires 100% volumetric examination, as defined by Figure IWB-2500-7, of Class 1 full penetration steam generator nozzle-to-vessel welds. Item 3.140 requires essentially 100% volumetric examination, as defined by Figure IWB-2500-7, of the inner radius section for each steam generator nozzle. Code Case N-460, as an alternative approved for use by the NRC Staff, 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 Code Relief Request: In accordance with 10CFR50.55a(g)(5)(iii), the licensee requested relief from the Code requirement to complete 100% coverage of the examination volume described in Figure IWB-2500-7 for the steam generator nozzle-to-shell welds and inner radius sections listed Table 2 below.

Table 2.0 - ASME Category B-D Welds		
Area/Weld Number	Area or Weld Configuration	Volumetric Percentage Completed
1-SGA-WG25	Steam Generator 1A Nozzle-to-Vessel Weld	Item No. B3.130 58% Volume Coverage
1-SGB-WG25	Steam Generator 1B Nozzle-to-Vessel Weld	Item No. B3.130 58% Volume Coverage
1-SGA-WG25	Steam Generator 1A Nozzle Inside Radius Section	Item No. B3.140 70% Volume Coverage
1-SGB-WG25	Steam Generator 1B Nozzle Inside Radius Section	Item No. B3.140 70% Volume Coverage

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

During the ultrasonic examination of welds 1-SGA-WG25 & 1-SGB-WG25, 100% coverage of the required examination volume could not be obtained. The examination coverage was limited to 57.98%. The examination was performed in accordance with the requirements of ASME Section V, Article 4 as amended by ASME Section XI, Appendix I. Scanning was performed from three directions, parallel and perpendicular to the welds from the vessel head side using 45°and 60° shear wave beams and straight beam search units. Scanning was limited from the nozzle side due to the tapered geometry. The percentage of coverage reported represents the aggregate coverage obtained by all scans over the full length of the weld. The 45° and 60° scans parallel to the welds covered 50% of the weld metal and 100% of the base material on the head side from one direction. The 45° and 60° scans perpendicular to the weld covered 37% of the base material on the nozzle side of the weld from one direction, 100% of the base material on the vessel head side of the weld from one direction and 97% of the weld metal from one direction. In order to achieve more coverage the nozzle would have to be re-designed to allow scanning from both sides of the weld, which is impractical. There were no recordable indications found during the inspection of these welds.

Inner Radii:

During the ultrasonic examination of the inside radius sections associated with both nozzle to vessel welds, 1-SGA-WG25 & 1-SGB-WG25, 100% coverage of the required examination volume could not be obtained. The examination coverage was limited to 70.21%. The examination was performed in accordance with the requirements of ASME Section V, Article 4 as amended by ASME Section XI, Appendix I. There were no recordable indications found during the inspection of these inner radii.

[The licensee provided the following additional general information in regards to justification for all Examination Category Items included in Relief Request 02-005:]

Duke Energy Corporation will use pressure testing and VT-2 visual examination to complement the limited coverage. The Code requires (reference Table IWB-2500-1,

item numbers B15.50, B15.30 and item number B 15.40) that a system leakage test be performed after each refueling outage for Class 1. Additionally, a system hydrostatic test (reference Table IWB-2500-1, Item numbers B 15.51, B 15.31 and Item number B 15.41) is required once during each 10-year inspection interval. These tests require a VT-2 visual examination for evidence of leakage. [For] the above Code required examinations (volumetric and pressure test), there are other activities which provide a high level of confidence that, in the unlikely case that leakage did occur through these areas/welds, it would be detected and isolated. Specifically, leakage from these areas/welds would be detected by monitoring of the Reactor Coolant System (RCS) inventory, which is performed once each shift under procedure PT/1,2,3/A/0600/10, "RCS Leakage". This RCS leakage monitoring is a requirement of Technical Specification 3.4.13, "Reactor Coolant System Leakage". Leakage is also evaluated in accordance with this Technical Specification. The leakage could be detected through several methods. One is the RCS mass balance calculation. A second is the Reactor Building air particulate monitor. This monitor is sensitive to low leak rates. The iodine monitor, gaseous monitor and area monitor are capable of detecting any fission products in the coolant and will make these monitors sensitive to coolant leakage.

A third is the level indicator in the Reactor Building normal sump. A fourth is a loss of level in the Letdown Storage Tank. Duke Energy Corporation has examined the welds/components referenced in this request to the maximum extent possible, utilizing the latest in examination techniques and equipment. The welds/components identified in Section I of this request were rigorously inspected by volumetric NDE methods during construction and verified to be free from unacceptable fabrication defects. Based on the coverage and results of the required volumetric exams during this outage, the additional pressure testing (VT-2) exams, and the various methods for leakage detection, it's our opinion that this combination of examinations provides a reasonable assurance of component integrity.

Licensee's Proposed Alternative Examination (as stated):

The scheduled 10-year code examination was performed on the referenced area/weld and it resulted in the noted limited coverage of the required ultrasonic volume. No additional examinations are planned for the area/weld during the current inspection interval.

Evaluation: The Code requires 100% volumetric coverage of steam generator nozzle-to-vessel Welds 1-SGA-WG25 and 1-SGB-WG25, and the associated nozzle inside radius sections. However, the component outside surface geometry restricts access to a single side of the welds, preventing scanning the welds from four directions. Thus, 100% of the weld cannot be examined from both sides of the weld, as required by Code. For the licensee to achieve 100% volumetric coverage, the subject nozzles would have to be redesigned and modified. This would place a significant burden on the licensee, therefore the Code-required 100% volumetric examinations, performed from both sides of the weld, is impractical.

The subject steam generator nozzle-to-vessel welds are fabricated from SA 508 carbon steel, are 48-inches in diameter with a wall thickness of 8-inches, and are clad with stainless steel on the inner surface. As shown on the sketches and technical

descriptions[3] provided by the licensee, approximately 58% of the required examination volume was obtained for steam generator nozzle-to-vessel Welds 1-SGA-WG25 and 1-SGB-WG25. However, the coverage achieved by the licensee includes greater than 97% of the Code-required examination volume using 45 and 60 degree ultrasonic beam angles from a single (vessel) side of the weld. Scanning from the nozzle side of the weld was severely limited due to the nozzle taper.

For the accompanying nozzle inside radius sections, approximately 70% of the required Code examination volume was inspected. The nozzle inner radii were examined from the vessel shell in two opposing directions using 60 and 70 degree shear wave beam angles. The search units were skewed from the nozzle centerline in order to provide a 45 degree intercept angle between the sound beam and any flaws oriented in the axial/radial plane within the required examination volume.

The inspections performed by the licensee examined the subject weld to the maximum extent practical given the limitations of component geometry and would be expected to detect any significant degradation that might be present, providing reasonable assurance of the continued structural integrity of this weld. Additionally, the licensee has indicated that the steam generator for Oconee will be replaced during the fall of 2003 resulting in the removal of these welds from the ISI program. Therefore, pursuant to 10 CFR 50.55a(g)(6)(i), it is recommended that relief be granted.

3.6 Request for Relief 02-005 (Part B), Examination Category B-D, Items B3.150, Full Penetration Welded Nozzles in Vessels

Code Requirement: Examination Category B-D, Item B3.150 requires 100% volumetric examination, as defined by Figure IWB-2500-7(a), of Class 1 full penetration nozzle-to-vessel welds. Code Case N-460, as an alternative approved for use by the NRC Staff, 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 Code Relief Request: In accordance with 10CFR50.55a(g)(5)(iii), the licensee requested relief from the Code requirement to complete 100% coverage of the examination volume for the high pressure injection system, letdown cooler 1B nozzle-to-channel body Welds 1-LDCB-IN-V1 and 1-LDCB-OUT-V2.

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

During the ultrasonic examination of Welds 1-LDCB-IN-VI and 1-LDCB-OUT-V2, 100% coverage of the required examination volume could not be obtained. The examination coverage was limited to 27.48%. Although these welds are classified as Category B-D the actual configuration is similar to a pipe branch connection. The percentage of coverage reported represents the aggregate coverage from all scans performed on the weld and base material. The examination was performed from both the vessel shell side and the nozzle side of the weld. The 45° and 60° beam angles directed perpendicular to

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

the weld covered 88.24% of the base material examination volume. The axial scans with 45° beams covered 37.46% of the examination volume including the weld and base material in two opposite directions. In order to achieve more coverage, the nozzle would have to be re-designed to allow additional scanning from both sides of the weld, and across the width of the weld, which is impractical. There were no recordable indications found during the inspection of these welds. In order to examine similar metal stainless steel welds, refracted longitudinal wave and refracted shear wave search units are [required to be] used. The refracted longitudinal wave search units have an inherent limitation in that the useful portion of the sound beam lies in the first beam path leg between the transducer and the inside surface of the component. Beam paths beyond the inside surface of the component cannot be used to extend the examination coverage through the weld because of mode conversion that occurs at the inside surface. However, refracted longitudinal wave search units have better penetration through stainless steel weld metal than shear wave search units. When calibrating in accordance with ASME Section XI, Appendix III and using refracted longitudinal wave there is not enough sound energy available to establish a distance-amplitude-correction curve beyond the inside surface notch located in the basic calibration block.

Licensee's Proposed Alternative Examination (as stated):

The scheduled 10-year code examination was performed on the referenced area/weld and it resulted in the noted limited coverage of the required ultrasonic volume. No additional examinations are planned for the area/weld during the current inspection interval.

Evaluation: The Code requires 100% volumetric examination of Examination Category B-D full penetration nozzle-to-vessel welds on heat exchangers. The subject letdown cooler inlet and outlet nozzle-to-channel body welds could not be examined to the full extent required by the Code due to the outside surface geometry of the heat exchanger. For the licensee to achieve 100% volumetric coverage of this weld from two beam directions would require that the nozzle be completely redesigned and modified. This would place a significant burden on the licensee; therefore, the Code-required 100% volumetric examinations are impractical.

The design of the letdown heat exchangers contains a tapered nozzle that does not permit scanning from the nozzle side of the weld. As shown on the sketches[4] provided by the licensee, an aggregate coverage of approximately 27% of the required examination volume was obtained. The licensee used both shear wave and refracted longitudinal wave transducers to maximize the coverage of the required inspection volume. The shear and longitudinal wave examination with 45 and 60 degree sound beams directed perpendicular to the weld resulted in 88% of the required examination volume from the vessel side of the weld. In recent round-robin trials[5] longitudinal wave techniques were shown to provide better detection results when examinations required that the ultrasonic beam pass through the austenitic weld metal.

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

5. NUREG/CR Report CR-4908 "Ultrasonic Inspection Reliability for Intergranular Stress Corrosion Cracks" and NUREG/CR Report CR-5068 "Piping Inspection Round Robin.

While the licensee cannot meet the Code-required 100% volumetric examination requirement from two beam path directions, the licensee has examined the subject welds to the maximum extent possible given the nozzle geometry. In addition, industry experience has not shown any failure experience for these welds. The limited examination performed by the licensee should detect any structurally significant patterns of degradation that may occur, providing reasonable assurance of the continued integrity of the inlet and outlet nozzle-to-channel body welds 1-LDCB-IN-V1 and 1-LDCB-OUT-V2. Therefore, pursuant to 10CFR50.55a(g)(6)(i), it is recommended that relief be granted.

3.7 Request for Relief 02-005 (Part C), Examination Category B-G-1, Item B6.40, Pressure Retaining Bolting Greater than 2 inches - Reactor Vessel Threads in Flange

Code Requirement: Examination Category B-G-1, Item B6.40, requires 100% volumetric examination of the flange threads, as defined by Figure IWB-2500-12, of Class 1 pressure retaining bolting components greater than 2-inches in diameter.

Licensee's Code Relief Request: In accordance with 10CFR50.55a(g)(5)(iii), the licensee requested relief from the Code requirement to complete 100% coverage of the examination volume.

Licensee's Basis for Relief (as stated):

During the ultrasonic examination of 1-RPV-LIGAMENTS, 100% coverage of the required examination volume could not be obtained. The examination coverage was limited to 84.52%. Limitations are caused by the clad area at each stud hole that causes the search unit to lift off the scanning surface. The percentage of coverage reported represents the aggregate coverage. In order to achieve more coverage the flange would have to be re-designed to allow for scanning, which is impractical.

Licensee's Proposed Alternative Examination (as stated):

The scheduled 10-year code examination was performed on the referenced area/weld and it resulted in the noted limited coverage of the required ultrasonic volume. No additional examinations are planned for the area/weld during the current inspection interval.

Evaluation: The Code requires 100% volumetric examination of the threaded areas, including a portion of the ligaments, on the RPV shell-to-closure head flange. The reactor vessel threads, designated as 1-RPV-LIGAMENTS, could not be examined to the full extent required by the Code due to the presence of cladding on portions of the flange at each stud hole. To achieve more coverage the cladding around each stud hole would need to be altered or removed to allow better coupling for the ultrasonic search unit. This would place a significant burden on the licensee.

As shown by the sketches included in the submittal, the licensee was able to obtain significant coverage of approximately 84% of the required examination volume. The reactor vessel flange threads are examined using a 0-degree, longitudinal beam search unit to detect potential cracking that may originate at the root of the threads. The entire

Code-required volume could not be examined because of the presence of cladding around a portion of each stud hole. The reactor pressure vessel is clad with stainless steel to help maintain the water chemistry of reactor coolant. A small portion of the flange scanning surface nearest the interior of the vessel is clad. The clad-to-carbon steel interface area causes the search unit used to examine the threaded stud hole in the flange to lose coupling ("lift off"), thus a small percentage of the threaded flange cannot be examined as required by Code. Removing, or altering (grinding flush) portions of the cladding on the RPV flange is possible, however, this would result in significant radiation exposure to personnel.

The examinations performed by the licensee should detect any structurally significant patterns of degradation that may occur, providing reasonable assurance of the continued integrity of the 1-RPV-LIGAMENT threads in the stud holes. Based on the significant levels of volumetric coverage obtained, requiring the licensee to make small increases (less than 15%) in coverage by removing or altering the cladding on the RPV flange would result in a hardship with no compensating increase in quality or safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), it is recommended that the licensee's alternative be authorized.

3.8 Request for Relief 02-005 (Part D), Examination Category C-F-1, Item C5.11 and Item C5.21, Pressure Retaining Welds in High Alloy Steel

Code Requirement: Examination Category C-F-1, Item C5.11 and C5.21 require 100% volumetric and surface examinations, as defined by Figure IWC-2500-7, of selected austenitic stainless steel or high alloy piping welds. Code Case N-460, as an alternative approved for use by the NRC Staff, 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 Code Relief Request: In accordance with 10 CFR 50.55a(g)(5)(iii), the licensee requested relief from the Code-required volumetric examinations of the high and low alloy piping welds shown in Table 3.

Table 3 - Examination Category C-F-1 Welds

Code Item	Weld ID	Weld Type
C5.11	1LP-128-80	Reducer to Valve
C5.21	1HP-192-15	Pipe to Flange
C5.21	1-51A-01-91A	Pipe to Valve
C5.21	1HP324-118B	Tee to Valve
C5.21	1-51A-01-32AA	Pipe to Valve
C5.21	1HP-393-127A	Pipe to Valve
C5.21	1-51A-02-34B	Elbow to Valve

Table 3 - Examination Category C-F-1 Welds		
Code Item	Weld ID	Weld Type
C5.21	1HP-193-12	Tee to Valve
C5.21	1HP-70-11	Expansion Joint to Elbow
C5.21	1-51A-01-103A	Pipe to Valve

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

The licensee provided the information shown in Table 4.0 describing the limitations for the volumetric examinations.

Table 4 - Examination Limitations		
Weld ID	Limitation	% Coverage
1LP-128-80	Single sided access caused by the proximity of the valve taper.	59.74% UT 100% PT
1HP-192-15	Single sided access caused by the proximity of the flange.	60.99% UT 100% PT
1-51A-01-91A	Single sided access caused by the proximity of the valve taper.	60.84% UT 100% PT
1HP324-118B	Single sided access caused by the proximity of the valve taper.	61.54% UT 100% PT
1-51A-01-32AA	Single sided access caused by the proximity of the valve taper.	60.39% UT 100% PT
1HP-393-127A	Single sided access caused by the proximity of the valve taper.	59.31% UT 100% PT
1-51A-02-34B	Single sided access caused by the proximity of the valve taper.	61.30% UT 100% PT
1HP-193-12	Single sided access caused by the proximity of the valve taper,.	59.37% UT 100% PT
1HP-70-11	Single sided access caused by the proximity of the expansion joint.	56.22% UT 100% PT
1-51A-01-103A	Single sided access caused by the proximity of the valve taper.	60.71% UT 100% PT

Licensee's Proposed Alternative Examination (as stated):

The scheduled 10-year code examination was performed on the referenced area/weld and it resulted in the noted limited coverage of the required ultrasonic volume. No additional examinations are planned for the area/weld during the current inspection interval.

Evaluation: The Code requires 100% volumetric and surface examination of the subject pressure retaining high alloy piping welds. However, as shown in Table 3, complete examinations are restricted by component configurations (e.g., pipe-to-valve or elbow-to-pipe). These conditions make compliance with Code-required volumetric examinations impractical to perform for these welds. To achieve greater examination coverage, substantial portions of the piping runs would need to be redesigned. Imposition of this requirement would create a significant burden on the licensee, therefore, the Code-required examinations are impractical.

Drawings and descriptions[6] included in the licensee's submittal clearly show that examinations of the subject welds have been performed to the extent practical, with the licensee obtaining substantial volumetric examination coverages (from approximately 56% to 61% aggregate), and 100% of the Code-required surface examinations for these welds (see Table 4). The volumetric examinations performed include 100% of the weld metal and far-side base metal examined with a 60 degree refracted longitudinal beam in a direction perpendicular to the weld, and 100% of the near-side base metal with a 60 degree shear wave oriented perpendicular to the weld.

For all the welds in this request for relief, severe limitations caused by the component configurations prevent the necessary access to achieve additional examination coverages. The limitations for these restricted examinations cannot be overcome without redesigning the subject piping welds, or adjacent components, and portions of the associated piping systems. No problems or reportable indications have been detected during any of these examinations. The examinations performed by the licensee should detect any significant patterns of degradation in the areas examined, thus the examinations performed by the licensee provide reasonable assurance of continued structural integrity for these welds. Based on the impracticality of examining the subject welds, and the volumetric and surface coverages obtained, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i).

4.0 CONCLUSIONS

PNNL staff have reviewed the licensee's submittal and conclude that the Code examination coverage requirements are impractical for the subject welds listed in Request for Relief No. 02-004, Parts A and B and Request for Relief No. 02-005, Parts A, B, and D. Further, reasonable assurance of the structural integrity of the subject components has been provided by the examinations that were performed. Therefore, for these parts of the requests, it is recommended that relief be granted pursuant to 10 CFR 50.55a(g)(6)(i) for the third inspection interval at Oconee 1.

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

For Requests for Relief 02-004, Parts C and D and 02-005, Part C, it has been shown that compliance with the Code requirements would result in a hardship or unusual difficulty with no compensating increase in quality or safety. The alternatives proposed by the licensee provide reasonable assurance of the continued structural integrity of the subject welds. Therefore, for these portions of the requests, it is recommended that the alternative be authorize pursuant to 10 CFR 50.55a(a)(3)(ii) for the third 10-year ISI interval.