

August 15, 2002

Mr. J. A. Stall
Senior Vice President, Nuclear and
Chief Nuclear Officer
Florida Power and Light Company
P.O. Box 14000
Juno Beach, Florida 33408-0420

SUBJECT: SAFETY EVALUATION FOR TURKEY POINT UNITS 3 AND 4 — RELIEF
REQUEST 25 CONCERNING INSERVICE INSPECTION REQUIREMENTS
FOR THE CLASS 1 REACTOR PRESSURE VESSEL NOZZLES
(TAC NOS. MB5031 AND 5032)

Dear Mr. Stall:

By a letter dated May 6, 2002, as supplemented by a letter dated July 1, 2002, Florida Power and Light (FPL) submitted a request for relief from the inservice inspection (ISI) requirements specified in American Society of Mechanical Engineers Code, Section XI, for the Class 1 Reactor Pressure Vessel (RPV) nozzle inner radius sections for the RPV and the RPV head. In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i), your request proposes an enhanced remote visual examination capable of a 1-mil (0.001 inch) wire resolution as an alternative to the required volumetric examination for nozzles where plant configuration is such that visual examination may be performed on essentially 100 percent of the inner radius.

Based on our review of your submittals, we have concluded that the proposed alternative provides an acceptable level of quality and safety, and, therefore, it is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the remainder of the third 10-year ISI interval at Turkey Point Unit 3, which began February 22, 1994, and ends February 21, 2004, and for the remainder of the third 10-year ISI interval at Turkey Point Unit 4, which began April 15, 1994, and ends April 14, 2004.

Sincerely,

/RA/

Kahtan N. Jabbour, Acting Chief, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-250 and 50-251

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

INSERVICE INSPECTION PROGRAM

RELIEF REQUEST NO. 25

FLORIDA POWER AND LIGHT

TURKEY POINT NUCLEAR PLANT UNITS 3 AND 4

DOCKET NOS. 50-250 AND 251

1.0 INTRODUCTION

By a letter dated May 6, 2002, and as supplemented July 1, 2002, Florida Power and Light (FPL) submitted a request for relief from the inservice inspection (ISI) requirements specified in American Society of Mechanical Engineers (ASME) Code, Section XI, for the Class 1 Reactor Pressure Vessel (RPV) nozzle inner radius sections. In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(a)(3)(i), your Relief Request Number 25 proposes an enhanced remote visual examination capable of a 1-mil (0.001 inch) wire resolution as an alternative to the required volumetric examination for nozzles where plant configuration is such that visual examination may be performed on essentially 100 percent of the inner radius. The subject relief request is for the remainder of the third 10-year ISI interval at Turkey Point Unit 3, which began February 22, 1994, and ends February 21, 2004, and for the remainder of the third 10-year ISI interval at Turkey Point Unit 4, which began April 15, 1994, and ends April 14, 2004.

2.0 APPLICABLE 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

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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 Turkey Point Units 3 and 4 third 10-year ISI intervals is the 1989 Edition of the ASME B&PV Code.

3.0 RELIEF REQUEST NO. 25

3.1 Component Function/Description

ASME Code Class: Class 1

System: Reactor Coolant System (RCS)

Components: Reactor Pressure Vessel (RPV) 3 Inlet (Cold Leg) and 3 Outlet (Hot Leg) Nozzles

The following table specifically identifies the inner radii examinations for which relief is requested.

Unit 3	Unit 4
3-DI-A-IRS - Inlet Nozzle Inner Radius	4-DI-A-IRS - Inlet Nozzle Inner Radius
3-DO-A-IRS - Outlet Nozzle Inner Radius	4-DO-A-IRS - Outlet Nozzle Inner Radius
3-DI-B-IRS - Inlet Nozzle Inner Radius	4-DI-B-IRS - Inlet Nozzle Inner Radius
3-DO-B-IRS - Outlet Nozzle Inner Radius	4-DO-B-IRS - Outlet Nozzle Inner Radius
3-DI-C-IRS - Inlet Nozzle Inner Radius	4-DI-C-IRS - Inlet Nozzle Inner Radius
3-DO-C-IRS - Outlet Nozzle Inner Radius	4-DO-C-IRS - Outlet Nozzle Inner Radius

3.2 Code Requirements for Which Relief is Requested

Rules for Inservice Inspection of Nuclear Power Plant Components, ASME Section XI, 1989 Edition, Table IWB-2500-1, Examination Category B-D, Full Penetration Welds of Nozzles in Vessels – Inspection Program B, Code Item B3.100, Reactor Vessel Nozzle Inner Radius Sections, Figure IWB-2500-7 (a) and (b), surfaces M-N requires an ultrasonic test (UT). Relief is requested from the requirements to perform the volumetric examination of the inner nozzle radii for the nozzles listed in Section 3.1 above.

3.3 Licensee's Proposed Alternative (from submittals)

1. In lieu of the UT examination requirements of ASME Section XI Table IWB-2500-1, Examination Category B-D, Item B3.100, a visual examination, VT-1, shall be performed. The resolution capability of a .001 inch wire will be substituted in lieu of the Code required resolution for the examinations. FPL will utilize the acceptance criteria of Table IWB-3512-1 of the 1989 Edition of Section XI for the examination. When applying Table IWB-3512-1 criteria, the crack depth will be assumed to be equal to one-half the measured crack length.

2. Periodic System Pressure Tests per Category B-P, Table IWB-2500-1

3.4 Licensee's Bases for Alternative (as stated)

A "White Paper – ISI-99-26" was submitted to the NRC staff by the ASME, Boiler & Pressure Vessel Code, Subcommittee In-service Inspection, - Section XI for the elimination of RPV Nozzle Inside Radius examinations. The Westinghouse Owners Group developed this study and presented the results to the NRC staff in the May 9, 2000 meeting. According to the NRC's summary of the meeting, the staff indicated that an UT examination could be replaced by visual examination, VT-1, for the proposed RPV nozzle inspections on the basis that surveillance is maintained and a visual examination, VT-1, is performed. This examination is superior to the current requirement of the VT-3.

The requirement for the UT examination of the nozzle inner radius regions has been in effect for inspections for many years. However, there have been no inspection findings in any of the reactor vessel nozzles inner radius regions. The original requirement was included because of a cracking event in a non-nuclear vessel, which occurred near the time when the ASME Section XI inspection requirements were being established. As per the "White Paper-ISI-99-26," the failure probability is extremely low under the plant operating conditions and elimination of the RPV nozzle inner radius inspection is not expected to result in a significant increase in risk.

The original requirement, as instituted in the early 1970's, was based on very limited experience in operating nuclear plants. After more than 25 years of operation (over 1000 reactor years), no cracking incidents of any kind have been found in these vessel nozzle inner radius regions. The "White Paper-ISI-99-26" concluded that it is advisable therefore to eliminate this (UT examination) requirement.

The implementation of this relief request will provide to FPL the additional benefits of:

- Reducing the personnel radiation exposure consistent with FPL's ALARA [as low as reasonably achievable] program, and
- Reducing the on-vessel examination time by as much as 6 hours, which will result in significant cost savings.

At Turkey Point Units 3 and 4, all nozzle forgings were nondestructively examined during fabrication and have been examined twice during service using ultrasonic techniques specific to the nozzle configuration. There have been no inspection findings and no flaws have been detected at Turkey Point in any of the previous RCS RPV nozzle inner radius sections examinations. Additionally, there have been no service related cracking discovered in any of the PWR [pressurized-water reactor] fleet plant nozzles (Reference 3).

For FPL's Turkey Point Units 3 and 4, there is no significant thermal cycling during operation. As identified in Reference 3, the only mechanism of damage that can be envisioned for the nozzle inner radius is fatigue. Fracture toughness tests performed at Oak Ridge National Laboratories indicate there is a large flaw tolerance for nozzle inner radius regions. Even if flaw propagation was assumed, test results indicated a leak before break scenario would occur, which would not result in a significant increase in core damage frequency. Additionally, pressure testing continues to be performed and, during plant operation the containment is monitored for changes in unidentified leakage. From a risk perspective, the failure probability is extremely low under the plant operating conditions and elimination of the RPV nozzle inner radius inspection is not expected to result in a significant increase in risk. Therefore, there is no need to perform volumetric examination of any nozzles. Reference 3 was submitted to the NRC Staff by the ASME, Boiler & Pressure Vessel Code, Subcommittee In-service Inspection, Section XI. The Staff indicated that Reference 3 supports the conclusion that the UT examination could be replaced by Visual examination, VT-1, for the proposed RPV nozzle inspections on the basis that surveillance is maintained and a Visual examination, VT-1, is performed.

Florida Power & Light believes the application of a visual examination alternative for the listed nozzle inner radius sections ensures an acceptable level of quality and safety. FPL proposes to perform the VT-1 with the resolution demonstration of a 0.001 inch wire in lieu of the code required resolution demonstration (1/32 inch line). Qualified VT-1 personnel using a remote underwater camera with magnification and lighting sufficient to resolve a 0.001 inch wire will perform the examination of the nozzle inner radius sections. The resolution of the system will be demonstrated prior to performing the examinations.

The visual examination will cover the same inspection surface as specified for the UT examination (Reference Figure IWB-2500-7 (a) and (b), surface M-N). The Inservice examinations of the RCS RPV nozzle inner radius sections are performed subsequent to the removal of internals components, thereby removing all limiting conditions that would preclude complete examination coverage of the examination area. Therefore 100% coverage is expected to be achieved.

The implementation of this relief request will provide FPL the additional benefits of reducing the personnel radiation exposure and reducing on-vessel examination time by as much as 6 hours. During the previous ultrasonic examinations, scanning heads were required to be removed from the RPV by personnel standing on the refueling cavity bridge and replaced.

The remote Visual examination of the nozzle inner radius sections will be performed in conjunction with the code required 10-year Inservice Inspection of the RPV, thereby eliminating the need for personnel to perform equipment changes during the performance of the nozzle inner radius examinations. The performance of this visual examination uses the reactor water as a shield and

the camera is not removed until all visuals for the ISI examinations are complete. This is consistent with FPL's ALARA program

3.5 Evaluation

In the mid 1970s, fatigue-initiated cracking was discovered in the nozzle inner radius section of feedwater nozzles at 18 boiling-water reactors. UT did not reveal the presence of these cracks, which prompted the NRC to prepare NUREG-0619, which modified inspection requirements for these components.

In NUREG-0619, the NRC staff concluded that UT of the vessel nozzle inner radius section involves complex geometries, long examination metal paths, and inherent UT beam spread, scatter, and attenuation. During the intervening years, improvements in UT technologies were introduced (e.g., computer modeling, tip diffraction, and phased array scanning), which improved the quality of the examination for this component. However, the area remains difficult to examine completely.

The NRC staff finds that even with vessel examinations using improved nondestructive examination technology from the outside surface, the complex geometry of the RPV nozzle inner radius sections prevents complete UT coverage. The licensee proposed to perform an enhanced VT-1 visual examination with essentially 100-percent coverage of the examination area in lieu of the UT. This coverage is possible based on the licensee's intention to remove internal components allowing for an obstructed field to perform the examinations upon. The resolution sensitivity for this remote in-vessel exam will be established using a 1-mil diameter wire.

The primary degradation mode in RPV nozzles is thermal fatigue, which produces hairline surface indications at the nozzle inner radius section. Using high-magnification cameras with a 1-mil resolution, it is highly unlikely that the licensee would not detect such flaws. The staff has determined that the high-resolution image from the camera may be used in lieu of UT of the inner nozzle radius and will provide adequate assurance of structural integrity.

The licensee indicated in their submittal, that their alternative examination "is similar to the examination alternative proposed in ASME Section XI Code Case N-648." The staff recognizes that there was a typographical error in this code case and, therefore, has assumed that Table IWB-3512-1 would be more appropriate if followed using an aspect ratio of 0.50 and surface flaw depth of 2.5 percent for calculating the flaw acceptance criteria. Also the code case fails to address cracks tighter than 0.03125" which accounts for the need for examination using a 1-mil resolution. The conservatism in the allowable flaw length specified provides for an extension of the crack that is not visible using the alternative method, but would be if the licensee was using the UT method. In the licensee's submittal, they indicated their intention to use the flaw acceptance criteria specified in ASME Section XI Table IWB-3512-1.

Based on the above, the licensee's ability to demonstrate equipment and operator qualification to a 1-mil resolution during the examinations and a reasonable flaw acceptance criteria based on Table IWB-3512-1, the NRC staff has determined that there is reasonable assurance that the licensee's proposal to use enhanced remote visual examination for the RPV nozzle inner radius sections will result in an acceptable level of quality and safety.

3.6 Conclusion

Based on the information provided in the licensee's submittal, the NRC staff has determined that the proposed alternative in Relief Request 25, as described in Section 3.3 above, provides an acceptable level of quality and safety, and, therefore, it is authorized pursuant to 10 CFR 50.55a(a)(3)(i) for the remainder of the third 10-year ISI intervals at Turkey Point Unit 3, which began February 22, 1994, and ends February 21, 2004, and for the remainder of the third 10-year ISI interval at Turkey Point Unit 4, which began April 15, 1994, and ends April 14, 2004. This authorization is limited to those components described in Section 3.1 above.

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Date: August 15, 2002

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