

February 15, 2002

Mr. Michael Kansler
Senior Vice President and
Chief Operating Officer
Entergy Nuclear Operations, Inc.
440 Hamilton Avenue
White Plains, NY 10601

SUBJECT: INDIAN POINT NUCLEAR GENERATING UNIT NO. 2 - EXEMPTION FROM
THE REQUIREMENTS OF 10 CFR PART 50, SECTION 50.60(a) - (TAC NO.
MB2420)

Dear Mr. Kansler:

The Commission has approved the enclosed exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.60(a), for the Indian Point Nuclear Generating Unit No. 2 (IP2). This action is in response to an application by the Consolidated Edison Company of New York, Inc. (Con Edison), the former licensee of IP2, for an exemption dated July 16, 2001. On September 6, 2001, Con Edison's interest in the license was transferred to Entergy Nuclear Operations, Inc. (ENO). By letter dated September 20, 2001, ENO requested that the U.S. Nuclear Regulatory Commission (NRC) continue to review and act on all requests before the Commission which had been submitted before the transfer. Accordingly, the NRC staff has acted upon the request. The exemption request of July 16, 2001, was supplemented by ENO on January 11, 2002.

The exemption would permit the use of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI Code Case N-640, "Alternative Requirement Fracture Toughness for Development of P-T Limit Curves for ASME Section XI Division I," and ASME Code, Section XI Code Case N-588, "Alternative to Reference Flaw Orientation of Appendix G for Circumferential Welds in Reactor Vessels, Section XI, Division I," in lieu of 10 CFR, Part 50, Appendix G, paragraph I.

A copy of the exemption has been forwarded to the Office of the Federal Register for publication.

Sincerely,

/RA by JMunday for PMilano/

Patrick D. Milano, Sr. Project Manager, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-247

Enclosure: Exemption

cc w/encl: See next page

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ENTERGY NUCLEAR OPERATIONS, INC.
INDIAN POINT NUCLEAR GENERATING UNIT NO. 2
DOCKET NO. 50-247
EXEMPTION

1.0 BACKGROUND

The Entergy Nuclear Operations, Inc. (ENO or the licensee) is the holder of Facility Operating License No. DPR-26 which authorizes operation of the Indian Point Nuclear Generating Unit No. 2 (IP2). The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of a pressurized-water reactor located in Westchester County in the State of New York.

2.0 PURPOSE

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Appendix G, requires that the Reactor Coolant System (RCS) Pressure-Temperature (P-T) limits for an operating plant be at least as conservative as those that would be generated if the method of Appendix G to Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code) (Appendix G to the Code) were applied.

In summary, this action is in response to an application by the Consolidated Edison Company of New York, Inc.(Con Edison), the former licensee of IP2, for an exemption dated July 16, 2001. On September 6, 2001, Con Edison's interest in the license was transferred to

Entergy Nuclear Operations, Inc. (ENO). By letter dated September 20, 2001, ENO requested that the NRC continue to review and act on all requests before the Commission which had been submitted before the transfer. Accordingly, the NRC staff has acted upon the request. The exemption request of July 16, 2001, was supplemented by ENO on January 11, 2002. The exemption would permit the use of the ASME Code, Section XI Code Case N-640, "Alternative Requirement Fracture Toughness for Development of P-T Limit Curves for ASME Section XI Division I," and ASME Code, Section XI Code Case N-588, "Alternative to Reference Flaw Orientation of Appendix G for Circumferential Welds in Reactor Vessels, Section XI, Division I," in lieu of 10 CFR Part 50, Appendix G, paragraph I.

2.1 Code Case N-588

The requested exemption would allow use of ASME Code Case N-588 to determine stress intensity factors for postulated flaws and postulated flaw orientation for circumferential welds.

10 CFR Part 50, Appendix G requires that Article G-2120 of ASME Code, Section XI, Appendix G, be used to determine the maximum postulated defects in reactor pressure vessels (RPV) for the P-T limits. These limits are determined for normal operation and test conditions. Article G-2120 specifies in part, that the postulated defect be in the surface of the RPV material and normal (i.e., perpendicular) to the direction of maximum stress. ASME Code, Section XI, Appendix G, also provides a methodology for determining the stress intensity factors for a maximum postulated defect normal to the maximum stress. The purpose of this article is, in part, to ensure the prevention of non-ductile fractures by providing procedures to identify the most limiting postulated fractures to be considered in the development of P-T limits. Code Case N-588 provides relief from the Appendix G requirements, in terms of calculating P-T limits, by revising the Article G-2120 reference flaw orientation for circumferential welds in RPVs. The reference flaw is a postulated flaw that accounts for the possibility of a prior existing

defect that may have gone undetected during the fabrication process. Thus, the intended application of a reference flaw is to account for defects that could physically exist within the geometry of the weldment. The current ASME Section XI, Appendix G approach mandates the consideration of an axial reference flaw in circumferential welds for purposes of calculating the P-T limits. Postulating the Appendix G reference flaw in a circumferential weld is physically unrealistic and overly conservative, because the length of the flaw is 1.5 times the RPV wall thickness, which is much longer than the width of circumferential welds. The possibility that an axial flaw may extend from a circumferential weld into a plate or axial weld is already adequately covered by the requirement that defects be postulated in plates/forgings and axial welds.

The fabrication of RPVs for nuclear power plant operation involved precise welding procedures and controls designed to optimize the resulting weld microstructure and to provide the required material properties. These controls were also designed to minimize defects that could be introduced into the weld during the fabrication process. Industry experience with the repair of weld indications found during pre-service inspection, in-service non-destructive examinations, and data taken from destructive examination of actual RPV welds, confirms that any remaining defects are small and do not cross transverse to the weld bead. Therefore, any postulated defects introduced during the fabrication process, and not detected during subsequent non-destructive examinations, would only be expected to be oriented in the direction of weld fabrication. For circumferential welds this indicates a postulated defect with a circumferential orientation. ASME Code Case N-588 addresses this issue by allowing consideration of maximum postulated defects oriented circumferentially in circumferential welds. ASME Code Case N-588 also provides appropriate procedures for determining the stress intensity factors for use in developing RPV P-T limits per ASME Code, Section XI, Appendix G procedures. The procedures allowed by ASME Code Case N-588 are conservative

and provide a margin of safety in the development of RPV P-T operating and pressure test limits that will prevent non-ductile fracture of the RPV.

The proposed P-T limits include restrictions on allowable operating conditions and equipment operability requirements to ensure that operating conditions are consistent with the assumptions of the accident analysis. Specifically, reactor coolant system pressure and temperature must be maintained within the heatup and cooldown rate dependent P-T limits specified in TS Section 3.1.B, "Heatup and Cooldown."

2.2 Code Case N-640

The requested exemption would allow use of ASME Code Case N-640 in conjunction with ASME Code Section XI, Appendix G to determine the P-T limits for the RPV. Code Case N-640 permits the use of an alternate reference fracture toughness (K_{Ic} fracture toughness curve instead of K_{Ia} fracture toughness curve) for reactor vessel materials in determining the P-T limits. Because use of the K_{Ic} fracture toughness curve results in the calculation of less conservative P-T limits than the methodology currently required by 10 CFR Part 50, Appendix G, an exemption to apply the Code Case would be required by 10 CFR 50.60.

The licensee proposed to revise the P-T limits for IP2, using the K_{Ic} fracture toughness curve, in lieu of the K_{Ia} fracture toughness curve, as the lower bound for fracture toughness.

Use of the K_{Ic} curve in determining the lower bound fracture toughness in the development of P-T operating limit curves is more technically correct than the K_{Ia} curve because the rate of loading during a heatup or cooldown is slow and is more representative of a static condition than a dynamic condition. The K_{Ic} curve appropriately implements the use of static initiation fracture toughness behavior to evaluate the controlled heatup and cooldown process of a reactor vessel. The staff has required use of the initial conservatism of the K_{Ia} curve since 1974 when the curve was codified. This initial conservatism was necessary due to the limited knowledge of RPV materials. Since 1974, additional knowledge has been gained about RPV

materials, which demonstrates that the lower bound on fracture toughness provided by the K_{Ia} curve is well beyond the margin of safety required to protect the public health and safety from potential RPV failure. Additionally, P-T curves based on the K_{Ic} curve will enhance overall plant safety by opening the operating window, with the greatest safety benefit in the region of low-temperature operations.

In summary, the ASME Section XI, Appendix G, procedure was conservatively developed based on the level of knowledge existing in 1974 concerning RPV materials and the estimated effects of operation. Since 1974, the level of knowledge about these topics has been greatly expanded.

3.0 DISCUSSION

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50, when (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. Special circumstances are present whenever, according to 10 CFR 50.12(a)(2)(ii), "Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule."

Code Case N-588

The first of these exemption requests would allow ENO to apply ASME Code Case N-588 as the basis for determining the most limiting material in the IP2 RPV. Code Case N-588 is applicable only for reactor vessels that have a circumferential weld as the most limiting material in the beltline region of the RPV. The Code Case methods allow licensees to apply the lower tensile stresses associated with a circumferential crack postulated in the circumferential weld, and thus allow the licensee to use the next most limiting base metal or axial weld material

in the RPV as the basis for evaluating the vessel. Since the IP2 RPV is currently limited by circumferential shell weld for the 1/4T location, this Code Case is applicable to the evaluation of the IP2 RPV.

The staff has determined that Entergy has provided sufficient technical bases for using the methods of Code Case N-588 for the calculation of the P-T limits for the IP2 reactor coolant pressure boundary (RCPB). The staff has also determined that application of Code Case N-588 to the P-T limit calculations will continue to serve the purpose in 10 CFR Part 50, Appendix G, for protecting the structural integrity of the IP2 RPV and RCPB. In this case, since strict compliance with the requirements of 10 CFR Part 50, Appendix G, is not necessary to serve the underlying purpose of the regulation, the staff concludes that application of Code Case N-588 to the P-T limit calculations meets the special circumstance provisions stated in 10 CFR 50.12(a)(2)(ii), for granting this exemption to the regulation.

Code Case N-640

Entergy has requested, pursuant to 10 CFR 50.60(b), an exemption to use ASME Code Case N-640 as the basis for establishing the P-T limit curves. Appendix G to 10 CFR Part 50 has required use of the initial conservatism of the K_{Ia} equation since 1974 when the equation was codified. This initial conservatism was necessary due to the limited knowledge of RPV materials. Since 1974, the industry has gained additional knowledge about RPV materials, which demonstrates that the lower bound on fracture toughness provided by the K_{Ic} equation is well beyond the margin of safety required to protect the public health and safety from potential RPV failure. In addition, the RPV P-T operating window is defined by the P-T operating and test limit curves developed in accordance with the ASME Code, Section XI, Appendix G, procedure.

The ASME Working Group on Operating Plant Criteria (WGOPC) has concluded that application of Code Case N-640 to plant P-T limits is still sufficient to ensure the structural integrity of RPVs during plant operations. The staff has concurred with ASME's determination.

The staff has concluded that application of Code Case N-640 would not significantly reduce the safety margins required by 10 CFR Part 50, Appendix G. The staff also concluded that relaxation of the requirements of Appendix G to the Code by application of Code Case N-640 is acceptable and would maintain, pursuant to 10 CFR 50.12(a)(2)(ii), the underlying purpose of the NRC regulations to ensure an acceptable margin of safety for the IP2 RPV and RCPB. Therefore, the staff concludes that Code Case N-640 is acceptable for application to the IP2 P-T limits.

The staff examined the licensee's rationale to support the exemption requests and concluded that ENO has provided sufficient technical bases for using the methods of Code Cases N-588 and N-640 in the calculation of the P-T limits for IP2. The staff has also concluded that application of Code Case N-588 and Code Case N-640 to the P-T limit calculations will continue to serve the purpose in 10 CFR Part 50, Appendix G, for protecting the structural integrity of the IP2 RPV and reactor coolant pressure boundary. In this case, since strict compliance with requirements of 10 CFR 50.60(a) and 10 CFR Part 50, Appendix G, is not necessary to serve the overall intent of the regulations, the staff concludes that application of the Code Cases N-588 and N-640 to the P-T limit calculations meets the special circumstance provisions in 10 CFR 50.12(a)(2)(ii), for granting exemptions to the regulations, and that, pursuant to 10 CFR 50.12(a)(1), the granting of these exemptions is authorized by law, will not present undue risk to the public health and safety, and is consistent with the common defense and security. The staff, therefore, considers granting exemptions to 10 CFR 50.60(a) and 10 CFR Part 50, Appendix G, to allow ENO to use Code Cases N-588 and N-640 as the part of the bases for generating the P-T limit curves for IP2 is appropriate.

4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not present an undue risk to the public health and safety,

and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants ENO an exemption from the requirements of 10 CFR 50.60(a) and 10 CFR Part 50, Appendix G, for the calculation of P-T limits for IP2. The licensee shall use the methods Code Cases N-588 and N-640 in calculation of the P-T limits for IP2.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment (67 FR 7206).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 15th day of February 2002.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

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